Predictors of trajectories of psychotic-like experiences in children and adolescents

Jahn, Nina

Awarding institution:
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SYSTEMATIC REVIEW

EMPIRICAL PROJECT

SERVICE EVALUATION PROJECT

Nina Jahn

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Volume Contents

Systematic Review

Predictors of trajectories of psychotic-like experiences in children and adolescents.

Supervised by

Dr. Suzanne Jolley, Institute of Psychiatry, Psychology and Neuroscience

and

Dr. Catherine Stewart, Institute of Psychiatry, Psychology and Neuroscience

TABLE OF CONTENTS

Abstract

In an effort to reduce mental health burden, there has been increasing interest in identifying candidate early indicators of future mental illness, in order to intervene early to reduce risk, prior to the development of a clinical mental health condition. Childhood psychotic-like, or unusual experiences (PLEs) appear to be one such indicator: they are associated with increased risk of a range of adverse mental health outcomes and their persistence and increasing severity characterise a trajectory towards the development of an at-risk mental state and, potentially, clinical psychosis. Psychological intervention is recommended when such experiences are distressing and/or impacting on the young person's functioning. However, as PLEs in themselves, even when distressing, are both common in the general population, and likely to remit over time, effective psychological intervention needs to target the factors that drive persistence and increasing severity. While many studies have identified biosocial correlates of the presence of PLEs, the literature on the psychosocial factors that could form targets of intervention is less prominent. The current review was designed to synthesise the existing literature, with a view to informing the development of psychological interventions, and to identifying the gaps in the current evidence base and the most useful direction for, and the design of, future research.

Introduction

Developmental Genesis of psychosis and the need for early intervention

Rutter, Kim-Cohen and Maughan (2006) posit that a developmental perspective on the genesis of mental disorder has become mainstream, underpinning a revolution in research and theoretical approaches regarding continuities and discontinuities between psychopathology in childhood and adulthood. Numerous high quality longitudinal cohort studies have now investigated early behavioural, psychological and neurological manifestations of disorders and the mechanisms that underlie such early manifestations and the factors that mitigate their potential trajectory to adult psychopathology.

Schizophrenia has traditionally been regarded as a disorder beginning in late adolescence/early adult life. However retrospective research over the past few decades has shown that those who later developed the disorder were more likely than controls to show social, emotional and behavioural (Baum and Walker, 1995; Welham et al., 2004) and neurodevelopmental (Cornblatt, Obuchowski, Roberts, Pollack and Erlenmeyer-Kimling, 1999) problems and subclinical psychotic-like symptoms (Kaymaz et al., 2012; Rubio, Sanjuan, Florez-Salamanca and Cuesta, 2012) in childhood. Further investigations into the brain changes associated with psychosis have shown that those at familial risk of psychosis show similar changes to those who have developed the disorder (Lawrie, McIntosh, Hall, Owens and Johnstone, 2008) and that those who go on to develop psychosis show alterations in brain structure and functionality prior to onset of overt symptoms (Jung, Jang, Byun, An and Kwon, 2010; Pantelis et al., 2007; Smieskova et al., 2010; Wood et al., 2008).

It is likely that such neurodevelopmental impairments, and their behavioural expression, reflect a combination of both early manifestations of a genetic liability or psychotic phenotype and the effects of some independent environmental risk factors, such as prenatal insults to the developing foetus, and early life adversity (Rutter et al., 2006; Van Winkel, Stefanis and Myin-Germeys, 2008). It follows that one trajectory to psychosis may be developmental and that

multiple genetic, epigenetic and environmental factors interact synergistically in the trajectory to psychosis (Collip, Myin-Germeys, and Van Os, 2008; Van Os, Linscott, Myin-Germeys, Delespaul & Krabbendam, 2009).

If the genesis of psychosis can occur on a trajectory, prevention at a time point as early as possible is pivotal to disrupt the likely complex interactive processes that are at play on the trajectory to disorder. What follows is the need to identify (behavioural and neurological) markers of an underlying vulnerability to pathology with high predictive value to identify target groups for preventative intervention, together with those factors that predict an unfavourable trajectory (risk factors) and those that predict favourable trajectories (protective factors) given underlying vulnerability. Such research should inform the development of intervention strategies. However, predictors can potentially be both markers and risk factors, i.e. emotional problems in childhood could be a behavioural manifestation of a psychosis proneness phenotype and also might be causative in the trajectory towards increasing pathology (Collip et al., 2008).

Psychotic like experiences and persistence as marker for underlying psychosis vulnerability

One possible marker of an underlying psychosis phenotype is the subclinical expression of positive psychotic like experiences (Collip et al., 2008; Cougnard et al., 2007; Dominguez et al., 2011). Psychotic like experiences (PLEs) are experiences that are phenomenologically similar to (positive) symptoms of psychosis (i.e. perceptual abnormalities, delusions of reference, persecution or grandeur or bizarre beliefs, such as being under the control of a special power) but are attenuated and occur in the absence of frank psychosis (Wigman, van Winkel et al., 2011).

The psychosis proneness persistence impairment model is based on the assumption that the type of distribution expected for disorders of multifactorial interactive etiology is continuous (Johns & Van Os, 2001; Linscott and van Os, 2010; Van Os et al., 2009) and that psychosis

hence exists on a spectrum from no symptoms, to expression of symptoms on a subclinical level to impairment (Dominguez et al., 2009). This model postulates that transitory psychotic experiences are manifestations of a psychotic phenotype but that additional exposure to environmental risk leads to persistence of such experiences for a subgroup of individuals and for some to impairment (Cougnard et al., 2007).

General population studies have shown that prevalence rates for PLEs are relatively high, both in adult (Kelleher and Cannon, 2011) and child and youth populations (Kelleher et al. 2012; Scott, Martin, William, Sawyer, Clark and McGrath, 2009). In a recent review of 19 population studies, Kelleher et al. (2012) found that the median prevalence rate of PLEs in children aged 9 to 12 years was 17% and among adolescents aged 13 to 18 years was 7.5 %. Although the presence of PLEs in non-clinical samples is associated with risk of psychotic disorders, incident PLEs appear to be a relatively common and benign or at least neutral childhood experience and for the majority of children these experiences do not persist over time (Dhossche et al., 2002; Dominguez et al., 2011; Hanssen, Bak, Bijl, Vollebergh & Os, 2005) and do not lead to transition to psychosis. Hence their positive predictive value is low (Dhossche et al., 2002; Dominguez et al., 2011; Hanssen et al., 2005; Poulton et al., 2000; Welham et al., 2009), and so is their predictive specificity as they are also associated with the onset of other psychiatric illnesses (Dhossche et al., 2002; Van Rossum, Lieb, Wittchen & van Os, 2011; Varghese et al., 2011).

Linscott and Van Os (2013), reported that across 61 cohorts they reviewed, including child and adult samples, 20 % of those who report PLEs go on to develop persistent PLEs and 80 % remit over time. Persistent PLEs in child and adolescent populations have been linked to later psychopathology and need for care (Dominguez et al., 2011; Kaymaz et al. 2012; Rubio et al. 2012). Dominguez et al. (2011) found in a ten year longitudinal 'Early Developmental Stages of Psychopathology' (EDSP) general population cohort that persistence of PLEs over three separate time points predicted transition to clinical psychosis in a dose response fashion. Of all cases of clinical psychosis established at T3 over a third were predicted by subclinical PLEs at all time points and over a fifth by reporting subclinical psychotic-like experiences at

least twice (follow up from T0 to T3). The authors concluded that a significant proportion of psychotic disorder may be conceptualized as the 'rare poor outcome of a common developmental phenotype characterized by persistence of psychometrically detectable subclinical psychotic experiences' (p. 84).

Consequently, incident PLEs can serve as markers for a possible psychosis phenotype by which subgroups of the population for early intervention can be identified. Targets for intervention would be those additional factors that lead to persistence and those that lead to impairment, given persistence.

Risk factors for PLEs and Psychosis

If schizophrenia and PLEs are expressions of the same phenotype it is to be expected that the same or similar factors influence their occurrence (Van Os et al., 2008). Environmental risk factors such as prenatal stress/malnutrition/infection/hypoxia, paternal age, developmental trauma, urbanicity, cannabis, ethnic minority group and social fragmentation have been shown to be associated with an increased risk for schizophrenia and psychotic symptoms, which relate to the geographical variation in incidence and prevalence (Collip et al. 2008). Similar risk factors have been found to be implicated in the expression of subclinical psychosis in both adults and children (Linscott and van Os, 2013; Scott et al., 2009; Van Os et al., 2008). Although compelling support for the phenomenological and temporal continuity between PLEs and psychotic disorder has been found, no markers and risk factors to date have been identified that are either necessary or sufficient for the emergence of later psychosis (Linscott and Van Os, 2013).

Collip et al. (2008), point out that an important theoretical challenge is to identify plausible underlying common or distinct mechanisms of such diverse risk factors. They postulate that the extreme diversity of environmental influences associated with psychosis are unlikely to be linked to as many underlying mechanisms and that environmental exposures may induce

psychological or physiological alterations that can be traced to a final common pathway of cognitive biases and or altered biological processes.

The process of sensitisation is a proposed mechanism by which proximal risk factors exert their influence on the development of psychosis. Sensitisation refers to the observation that individuals repeatedly exposed to environmental stressors may develop increasingly greater responses to such stressors over time, finally resulting in lasting changes in response amplitude. With regards to environmental risk factors such as trauma, ethnic minority group and social fragmentation, sensitisation is proposed to manifest on a cognitive level as a 'social defeat' effect leading to subsequent attribution biases (external, persecutory, grandiose) as a coping response (delusions -as – defence theory) (Bjorkqvist, 2001; Trower and Chadwick, 1995). On an affective level early life stressors such as childhood trauma give rise to lasting emotional and psychotic reactivity, manifesting behaviourally as an exaggerated affective response to minor stresses. At a biological level the final common pathway of the factors involved in the trajectory to psychosis is proposed to be dopamine dysregulation (Collip et al., 2008).

Cougnard et al. (2007), propose that to identify those factors that are causally linked (through a process of sensitisation) to the development of psychosis one needs to examine at the population level which factors lead to 1) an increased rate of persistence of PLEs (indicating lasting sensitisation) and 2) the subsequent increased rate of transition to clinical psychotic disorder.

Disentangling complexity

Interactions between genes, the environment and emerging psychopathology are likely to be complex and interactive and there might be bidirectional gene environment and environment psychopathology interactions (Collip et al., 2008). For example genetic liability to psychosis might potentially influence environmental factors, such as cannabis use (self-medication hypothesis) and environmental factors might influence gene expression through epigenetic

effects (Rutten and Mill, 2009). It is also conceivable that subclinical psychopathology brought on by early genetic and environmental risk can lead to further increases in environmental risk (i.e. experiences of PLEs and paranoia could increase bullying, which further affects sensitisation).

Additionally, it is possible that there is not one final common pathway to psychosis, but rather that latent subgroups of psychosis exist with distinct trajectories, influenced by distinct risk factors and mechanisms (Boks, Leask, Vermunt and Kahn, 2007).

Conclusions and Aims of the Systematic Review

In conclusion, incident PLEs might be a proxy marker for an underlying psychosis proneness phenotype, whilst persistence of PLEs might indicate increased sensitisation resulting from complex interactions of multiple risk factors.

Two recent systematic reviews have examined PLEs in child and adolescent samples. Rubio et al. (2012), investigated the longitudinal course of hallucinatory experiences during late childhood and adolescence and their relationship to psychotic disorders and found a considerable turnover of incident-discontinuing cases, with most cases discontinuing in the short term and a subset evidencing risk for persistence or transition to psychosis. Linscott and Van Os (2013), investigated prevalence of incidence, persistence and psychotic disorder outcome for both adults and children. However, neither review aimed to investigate the risk factors and mechanisms related to persistence.

The aim of this systematic review is to review the literature on longitudinal studies examining psychosocial predictors of PLE trajectories in children over time in order to identify:

1) those psychological and social risk factors that predict PLE trajectories over time including both
    a) those factors that are causally linked to PLE persistence or increase (increased sensitisation), and
    b) those factors that are causally linked to PLE remission;
2) the interactive relationship between risk factors and the bidirectional relationship between PLE trajectories and predictors ; and
3) the identification of latent subgroups of trajectories characterised by distinct risk factors and mechanisms.

Methods

Search strategy

The initial search was conducted using the following databases using the Ovid search engine: PsycINFO (1806 to December 2016), MEDLINE (R) (1946 to December 2016), EMBASE (1974 to January 2016). The following search strategy was used:

'Young people' OR Youth* OR Adolescen* OR Teen* OR Child* OR 'Young person*'

AND

Psychotic* OR Psychosis OR PLE OR PLEs OR 'Out- of-the- ordinary' OR 'Unusual experience*' OR

'Unusual belief* OR Delus* OR Hallucinat* OR 'Negative symptom*' OR 'Positive symptom*' OR

Paranoi* OR PLIKS OR BLIPS OR Grandios* OR Prodrom* OR Schizotyp*

AND

Longitudinal* OR Trajector* OR prospective

Searches were limited to 'human' studies and 'english language' in the PsycINFO, MEDLINE, and EMBASE databases, searches were limited to 'all child (0 to 18 years)' and 'humans' in MEDLINE, to 'childhood <birth to 12 years>' OR 'adolescence <13 to 17 years>', and 'followup study' OR 'longitudinal study' OR 'prospective study' in PsycINFO and to 'humans' and 'child <unspecified age> OR adolescent <13 to 17 years>' in EMBASE. Searches were carried out in December 2015.

Duplicates were removed, and titles and abstracts manually screened for eligibility. Papers that did not meet the inclusion criteria were rejected and full text articles were retrieved for potentially eligible studies. The reference lists of the final 18 selected studies and relevant review articles were searched manually for additional studies, and 1 further study was identified during this process.

Selection criteria

Articles were included in the review if they met the below stated criteria:

a) Longitudinal or prospective design
b) Published in a peer reviewed journal
c) English language
d) The study measures PLEs at T1 and PLEs, prodromal state or psychotic disorder at a later time point.
e) PLE measure includes assessment of unusual perceptual experiences and or unusual beliefs.
f) At T1 the sample population consisted of children or a mixed sample of children and young adults. The age range at T1 must include children aged 18 or below.
g) The study specifically analyses trajectories or controls for PLEs at T1 in analyses
h) The study reports psychosocial predictors or correlates of PLE trajectories, which have been taken prior to the final PLE measure. Risk factors/correlates must be informative with regards to trajectories of PLEs (i.e. their persistence over time) not solely development/incidence of PLEs.
i) 'Psychosocial' predictors or correlates are defined as intrapsychic, interpersonal or environmental factors that are not thought to directly influence the trajectory of PLEs through biological means (i.e. cannabis, birth complications etc.)
j) Clinical and non-clinical population; i.e. help seeking and non-help seeking, but excluding studies that specifically recruited samples with established psychotic disorders, or samples known to be at risk of developing a psychotic disorder, i.e. stated to be at familial risk; clinical ultra-high risk, high risk or prodromal.
k) Not intervention studies, unless the mechanisms targeted through intervention were clearly stated and measured.

The researcher (NJ) assessed the relevance of articles against criteria. Inter-rater reliability of study selection was assessed through verification of the selection decision by the first

supervisor SJ. 10 papers (including some screened out at the abstract stage, some screened out at the full text stage and some included) were rated by SJ. There was disagreement regarding the selection of one paper, which was resolved after discussion

Quality assessment

Each paper was quality assessed using a modified version of the EPHPP (Effective Public Health Practice Project, 2007) Quality Assessment Tool for Quantitative Studies (see Appendices D, E and F). The EPHPP was selected because its domains of observation were appropriate for observational studies and it has been found to have very good reliability in terms of the overall quality rating (Armijo-Olivo, Stiles, Hagen, Biondo & Cummings, 2012).

Studies were assessed across eight domains of which two were assessed as in the original EPHPP ('representativeness of the sample', 'withdrawals and dropouts') four were adapted from the EPHPP ('reliability and validity of measurement tools', 'study design', 'methodological or statistical control of confounding factors', and 'suitability of analyses') and two were added ('PLE measure verification' and **'**consideration of missing data and dropouts'). Those domains adapted and added are described in more detail below.

'Validity and reliability' were assessed separately for PLE and predictor measures, according to EPHPP ratings, and another global rating was also derived. The 'study design' domain was tailored to longitudinal studies of PLEs in child populations and was assessed on three criteria: 1) rationale provided for developmental stage of sample. 2) rationale provided for the duration of follow-up and 3) information on and/or exclusion of those participants with diagnosed childhood schizophrenia or those at ultra-high risk at baseline (based on quality domains used by Rubio et al., 2012). 'Methodological or statistical control of confounding factors' was assessed on the basis of whether a rationale was provided for inclusion or exclusion of confounders. 'Suitability of analysis' was assessed on the basis of whether power was discussed, adjustments had been made for multiple testing and analyses were appropriate to the question and modelled as much of the data as possible. 'PLE measure verification' was

rated on whether validity was verified by interview or by exclusion of those whose PLEs occurred solely in the context of fever or on waking or falling asleep (Kelleher, Harley, Murtagh, & Cannon, 2011). Reporting of adequate consideration of missing data and or dropouts resulted on higher scores on this domain.

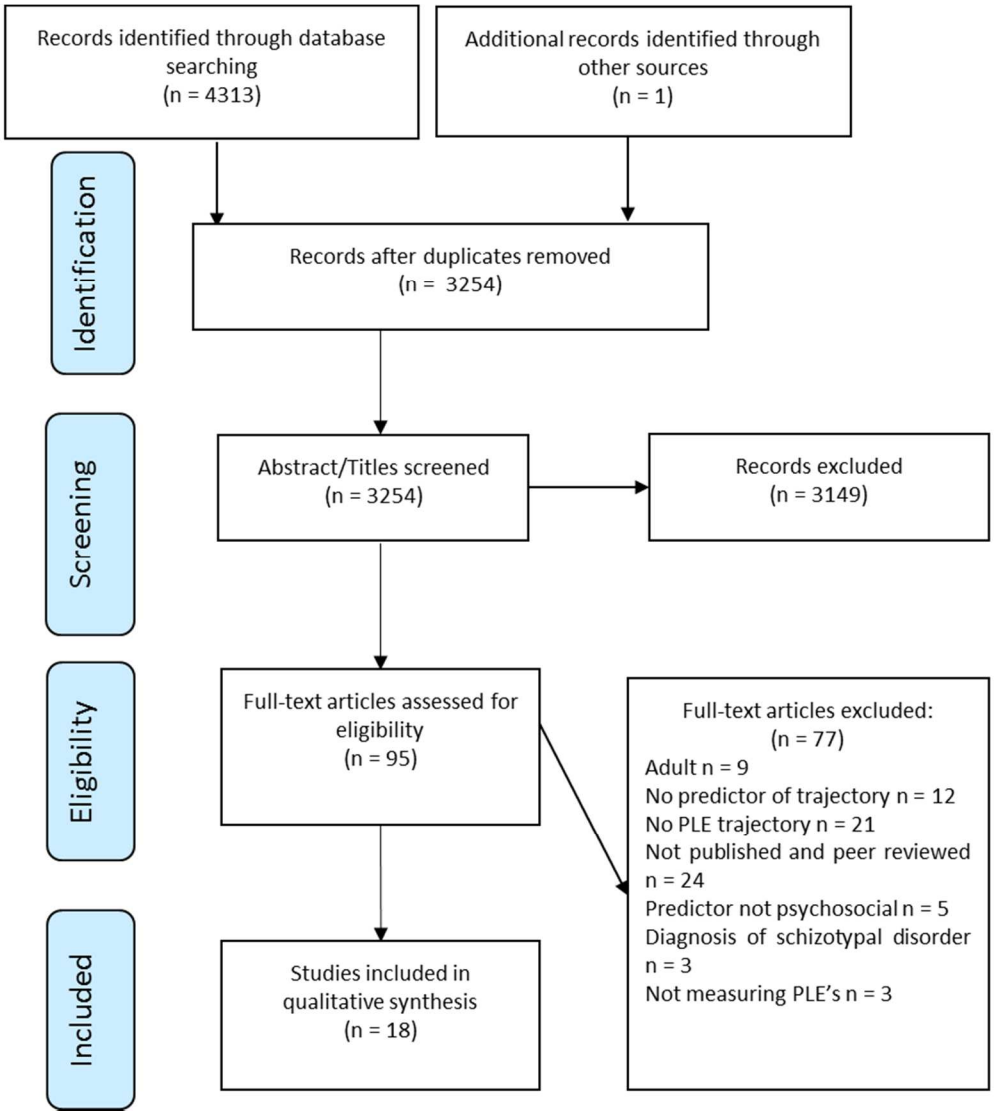
Studies received a quality score for each domain ranging from one to three (1: strong, 2: medium and 3: weak). The rating key used for each domain is described in Appendix D. An overall quality rating was given based on scores on the domains 'selection bias', 'study design', 'confounders', 'data collection method' and 'withdrawals and dropouts'. These are five out of the six domains used by the EPHPP to compute the overall rating (the domain 'blinding' was deemed irrelevant for the studies assessed). A 'strong' overall rating was given when there was no weak ratings across any domain. A 'moderate/acceptable' rating was given when one domain was deemed 'weak'. A 'weak' overall rating was given when two or more domains were rated as weak. Another idiosyncratic quality score was computed substituting the 'confounders' domain for the 'appropriateness of analysis' domain. The rationale was that 'appropriateness of analysis' was deemed of great importance for assessing quality. Additionally, almost all studies were rated as 'weak' in the domain 'confounders' due to stricter quality criteria used in the modified question as opposed to the EPHPP (i.e. rationale given as opposed to 'at least 60 % of relevant confounders controlled for'), which made it harder to see differences in quality in the overall rating.

Results

Search results

The search identified 3254 papers after duplicates were removed. Figure 1 shows the process of the systematic search. 1 additional study was identified through hand searching reference lists. A total of 18 papers were identified for review, comprising 9 distinct samples.

Figure 1.PRISMA (2009) flow diagram of systematic review process



Study characteristics

Eighteen studies from ten separate samples that met above criteria for inclusion in the review. Two studies were derived from an Australian general population sample recruited from secondary schools (Collip et al., 2013; Lin et al., 2011), two studies reported on a UK General Population sample from secondary schools in Greater London (Mackie, Castellanos-Ryan, & Conrod, 2011; Mackie et al., 2013), four studies on the Avon Longitudinal Study of Parents and Children (ALSPAC) (Sullivan et al., 2014; Thapar et al., 2012; Thompson et al., 2014; Wolke, Lereya, Fisher, Lewis, & Zammit, 2014) three studies on the sample from the German Early Developmental Stages of Psychopathology (EDSP) cohort (Cougnard et al., 2007; Spauwen, Krabbendam, Lieb, Wittchen, & Van Os, 2006; Van der Werf et al., 2011) and two studies reporting on the Dutch 'Tracking Adolescent Individual Lives' (TRAILS) cohort (Wigman et al., 2012; Wigman, Van Winkel et al., 2011). Studies from the same sample were included if they used different predictors. Characteristics of these studies, including the country, cohort name and or description, sample size across time points, average age at baseline, percentage of female gender, length of follow-up, and PLE measure can be found in Table 1. Information pertaining to the analysis including analytic method, a description of the final trajectory model, predictors and measures of predictors and results can be found in Table 2.

All studies used general population samples, with the exception of Escher, Romme, Buiks, Delespaul, and van Os (2002) who recruited a sample of young people hearing voices and Wigman, Lin et al. (2011) who investigated a sample of help seeking youth referred to a public mental health program (Orygen Youth Health). Additionally Mackie et al. (2011) examined a subsample of a UK general population study who scored high or low on four personality risk factors. Length of follow-up ranged from one to ten years. The number of time points at which PLEs were assessed, to determine the trajectory for analysis, ranged from two to four (Mackie et al., 2011; Mackie et al., 2013, Thapar et al., 2012). Initial sample size ranged from 80 participants to 7387 (Escher et al., 2002 and Thapar et al., 2012, respectively). Studies were conducted in Europe (UK, Netherlands, Germany and Ireland) and Australia and New

Zealand. All studies included information on both male and female participants. The mean age and age range (if reported) at baseline was below 18 for all but five studies; the three studies reporting data on the EDSP which sampled children and young people aged 14 -24 with a mean age of 18.3 at baseline (sampling the youngest group, 14-15, at twice the rate of those aged 16 -21 who were sampled at twice the rate as those aged 22 -24) and two further studies, with a mean of 17.7 (range 15 -24) at baseline (Wigman, Lin et al., 2011) and a mean age of 18 at baseline (Goodwin, Fergusson, & Horwood, 2004). The youngest age at which PLEs were measured was 11.1 years (TRAILS cohort, Wigman, Van Winkel et al., 2011; Wigman et al. 2012).

Table 1. Sample characteristics and PLE outcome measures

Study	Country, Cohort name Sample Characteristic	Age in years (unless otherwise stated) at baseline PLE measure	% Female at baseline	Length of follow-up, # of time points (if reported)	Original cohort size, sample size by time points, and sample size included in analysis	Analysed for purpose	1. Baseline PLE measure 2. PLE measure at other time points if different from baseline
Escher et al., (2002)	Netherlands, population of children hearing voices, 50% receiving professional care, self-referral	Mean: 12.9 (SD = 3.1 , range: 8 - 19)	53.8 %	3 years, 4 time points in total	T0: 80 T1: 75 T2: 43 T3: 60	Analysed for purpose: PLEs at all time points, predictors at preceding time points	3 delusions items from the BPRS: suspiciousness, unusual thought content, grandiosity
Goodwin et al., (2004)	New Zealand, Christchurch Health and Development Study, longitudinal study of unselected birth cohort, Gen. Pop.	Mean: 18	49.8%	Yearly follow up from birth, up to age 16, and again at age 18 and 21	Total sample at birth: 1265 Analysis: 1053	Analysed for purpose: data on panic attacks and PLEs available at 18 and 21.	Psychoticism: 10 items from paranoid ideation subscale of SCL -90-R
De Loore et al. (2007)	Netherlands, National Survey, Gen. Pop.	Mean = 13.7 (SD = .081, range: 12 -17)	34%	Regular total population screening: 201 000 dutch children, PLEs measured at 2 time points, over 2 year period.	Analysis: N = 1129	Analysed for purpose: children with PLE measure completed at both time points, psychosocial, predictors measured at T1.	3 items derived from the DISC -C
Scott et al. (2009)	Australia, birth cohort 'Mater- University of Queensland study of pregnancy,' Gen. Pop.	Mean: 14 years	52.8 % (of sample included in analysis)	21 years, 4 time points in total, PLEs measured at T3 and T4 over 7 year period	Sample at birth: 7223 T1, 6 months: 7223 T2, Age 5: 5259 T3, Age 14: 5185 T4, Age 21: 3801 Analysis: 3617	Analysed for purpose: PLE measured at T3 and T4, predictors measured at T3	1. 2 items related to hallucinations at T3 (YSR) 2. PDI at T4
Wigman, Lin et al. (2011) Australia	Australia, Orygen Youth Health public mental health program, help- seeking sample	Mean: 17.7 (SD = 2.6, range: 15 -24)	58%	2 years, 4 time points in total	T1: 138 T2: 116 T3: 113 T4: 99		CAPE (20 items)

Spauwen et al. (2006)	Germany, EDSP, prospective longitudinal cohort, Gen. pop.	Mean: 15.1, SD = 1.1, range: 14 - 17)	49%	3 years, 6 months from T0 to T2, 4 time points in total	T0:3021 T1:1228 T2: 2548 T3: 2210 Analysis: N = 918	Analysed for purpose: Risk Set of those 14 -17 of age at T0 (younger cohort) with first and second follow-up, demographic and family history data documented , PLEs measured at T0, T1 and T2, urbanicity at T0.	1. T0: SCL-90-R combined across time points (T0 and T1) T2: 15 M-CIDI core psychosis items on delusions (11 items) and hallucinations (4 items), lifetime cumulative incident
Cougnard et al. (2007)	Germany, EDSP, prospective longitudinal cohort, Gen. pop.	Mean: 18.3 (SD = 3.3, range: 13 - 25)	48.8%	7.4 – 10.6 years, 4 time points in total, PLEs measured at T0 and T2	T0:3021 T1:1228 T2: 2548 T3: 2210 Analysis: 2452	Analysed for purpose: risk set with valid data at T0 and T2	1. T0: SCL-90-R subscales Psychoticism and Parnaoia at T0 (16 items) 2. T2: M-CIDI psychosis G-section at T2 psychotic experience defined as any items endorsed, cumulative incidence data up to the respective age.
Van der Werf et al. (2011)	Germany, EDSP, prospective longitudinal cohort, Gen. Pop	Mean = 18.3 (SD = 3.3, range : 14 - 24)	50.7%	7.4 – 10.6 years, 4 time points in total	T0:3021 T1:1228 T2: 2548 T3: 2210	Analysed for purpose: PLEs a T0 , T2 and T3, predictors at T0, T2 and T3	1.T0: SCL-90-R 2. T2 (lifetime version) and T3 (interval version): DIA-X/M-CIDI 20 core psychosis items of DIA-X/M CIDI-G section
Wigman, van Winkel et al. (2011)	Netherlands, TRAILS, prospective cohort study, Gen. Pop.	Mean: 11.1 (SD = .06)	51%	5 years, 3 time points (first three data collection waves of cohort)	T1: 2230 T2: 2149 T3: 1816	Analysed for purpose: PLEs at all time points, predictors at T1 unless otherwise stated.	9 items from the YSR thought problems subscale
Wigman et al. (2012)	Netherlands, TRAILS, prospective cohort study, Gen. Pop.	Mean: 11.1 (SD = .06)	51%	5 years, 3 time points (first three data collection waves)	T1: 2230 T2: 2149 T3: 1816	Analysed for purpose: PLEs at all time points, predictors at T1 unless otherwise stated.	9 items from the YSR thought problems subscale
Lin et al. (2011)	Australia, High Schools, Gen. Pop.	Mean: 15.69 (S.D. = 2.6)	51 %	3 years, 3 time points in total	T1: 813 T2: 647 T3: 514	Analysed for purpose: PLEs, predictor and confounder at all time points	CAPE
Collip et al. (2013)	Australia, secondary schools, Gen. Pop.	Mean: 15.6 (SD = 2.6)	51%	3 years, 3 time points in total	T1: 881 T2: 652 T3: 512	Analysed for purpose: PLEs and predictors at all time points	CAPE

Mackie et al. (2011)	UK, High Schools, (subsample scoring high, 17%, or low on four personality risk factors), Gen. Pop.	Mean: 14 years, 7 months	Not reported	18 months, 4 time points in total	Analysis: N = 438	Analysed for purpose: PLEs at all time points, predictors at T1	PLEQ
Mackie et al. (2013)	UK, High Schools, Gen. Pop.	Mean: 13.6	39.1 %	24 months, 5 time points in total	T1: 1048 T2: 851 T3: 988 T4: 843	Analysed for purpose: PLEs at all time points, predictors at T1	PLEQ
Thapar et al. (2012)	UK, ALSPAC birth cohort, Gen. Pop.	Mean: 11.5 years	Not reported	Yearly follow up from birth, PLEs measured at 4 time points over 5 year period	T1 (age: 11.5): 7572 T2 (age: 13): 7129 T3 (age 14): 6037 T4 (age 16.5): 5131	Analysed for purpose: 7387 participants who completed PLIK-Q at 2 or more time points	PLIKS –Q
Sullivan et al. (2014)	UK, ALSPAC birth cohort, Gen. Pop	Mean: 12	Not reported	Yearly follow up from birth, PLEs measured at 2 time points (12 and 18 years), over 6 year period	Sample at birth: 14 775 Analysis: N = 7632	Analysed for purpose: data of at least one measure of depression or PLEs each, at 12 or 18	PLIKSi
Thompson et al. (2014)	UK, ALSPAC birth cohort, Gen. Pop.	Mean: 12	Not reported	Yearly follow up from birth, PLEs measured at 2 time points (12 and 18 years), over 6 year period	Sample at birth: 14 775 Analysis: N = 4720 (PLE data available at 18)	Analysed for purpose: PLEs measured at 12 and 18, predictors measured at T1 or before.	PLIKSi
Wolke et al. (2014)	UK, ALSPAC birth cohort, Gen. Pop.	Mean: 12.9	56.5 % (at age 18)	Yearly follow up from birth, PLEs measured at 2 time points (12 and 18 years), over 6 year period	Sample size at birth: 14 775 Analysis: 4646	Analysed for purpose: longitudinal assessments of PLEs were available at 12 and 18, predictor measured at various time points.	PLIKSi

Abbreviations: SD = Standard Deviation, N = Number, T = Timepoint, PLE measure abbreviations: CAPE = Community Assessment of Psychic Experience, PLEQ = Psychotic – like Experiences Questionnaire, PLIKS –Q = Psychotic like experiences questionnaire , YSR = , PDI = Peters Delusion Inventory, DISC –C = Diagnostic Interview Schedule for Children, PLIKSi = Psychotic like experiences semi-structured interview, SCL-90-R = self-report Symptom Checklist-90-R, M-CIDI = Munich-Composite International Diagnostic Interview, BPRS = Brief Psychiatric Rating Scale

Table 2. Analyses, Predictors and Results

Study	Analytic method	PLE Outcome (by analysis)	Predictors with Measures	Variables Controlled for (except for PLEs at previous time points)	Results predicting Trajectory
Escher et al. (2002)	Maximum likelihood hazard models of delusional ideation, Censoring applied: children with delusions excluded from follow up	-Evidence of delusional ideation (score of 6 or 7 on any item) - No evidence of delusional ideation	Amongst others: - Depression (BPRS dimensions) -Disorganisation (BPRS dimensions) -Life events (measure not stated) - childhood adversity (measure no stated) …. (overall more than 50 predictors assessed)	None reported	Predicting onset of delusions controlling for baseline levels of delusions - Depression - Disorganisation - Life events
Goodwin et al., (2004)	Generalised estimating equation model	- Number of psychotic symptoms experienced in previous month (degree of psychoticism)	No. of Panic attacks (Clinically significant panic attacks in past 36 months, intervals: 15 to 18 and 18 to 21, interview based on items from the CIDI)	Significant confounders only: Psychotic symptoms at previous assessment, (aged 16 or 18), depression, social phobia, agoraphobia, alcohol dependence, cannabis dependence , deviant peer affiliations, family conflict, family socioeconomic status, life events in past 12 months, neuroticism	Statistically significant relationship between panic attacks and psychoticism when controlling for confounders and baseline PLEs.
De Loore et al. (2007)	Logistic regression	- PLE present (positive answer to at least one of the questions) - PLE absent	- Negative life events (4 questions at each time point, no event, little to moderate influence, a lot of influence) - Bullying (1 question, at both time points, present or not, dependent on frequency of occurrence) - Unwanted negative sexual experiences (1 item, yes or no)	Age at baseline, gender, duration between baseline and follow-up assessment and educational level	Predicting PLEs, controlling for baseline PLEs: - Total negative life events and sexual trauma significant, dose response effect when looking at severity of life events in separate logistic regression. - Bullying not significant when controlling for confounders
Scott et al (2009)	Logistic regression	PDI (4 quartiles of severity)	Self-report general childhood pathology (YSR)	Gender and age at T4, repeat analysis with those without substance abuse	Strength of association between PLE measures at T3 and T4 compared for highest quartile on YSR and entire sample: Strength of association greater for highest quarter of general pathology compared to entire sample (confidence intervals not reported)

Wigman, Lin et al. (2011)	Path modelling, cross –lagged path model	Degree of PLE	Depression (CES –D)	Gender and age	Depression and PLE, significantly correlated at all time points PLEs were never predicted by earlier depression scores or vice versa
Spauwen et al. (2006)	Logistic Regression, additive interaction between baseline PLE and Urbanicity in predicting psychotic experience at T2	Baseline: - PLE present: a priori defined as group with highest 25% score for time span of T0 to T1 combined - PLE absent Outcome: - Psychotic experience present (at least one positive rating on any of core psychosis items) - Psychotic experience absent	Urbanicity (Munich or country side)	Gender, SES, drug use, family history of psychotic disorder as reported by parent	Predicting PLEs at T2: Additive significant interaction between baseline PLEs and urbanicity, risk-increasing effect of urbanicity on occurrence of psychotic symptoms only apparent in those with pre-existing psychotic experiences. Excluding those with onset of CIDI psychotic symptoms of more than one year, did not change results.
Cougnard et al. (2007)	General linear model, additive interaction effect between baseline PLE and environmental load	T0: - PLE exposure (10 percent with highest scores on measure, defined a priori) - PLE non-exposure (remainder) T2: - psychotic experience (any item endorsed) - no psychotic experience	Environmental load: (cannabis, trauma and urbanicity) Level 0: no exposure, Level 1: 1 out of 3 exposure Level 2: 2 or 3 exposures Trauma(PTSD and Trauma module from CIDI , any traumatic event category) Urbanicity (city vs not city) Cannabis exposure (L-section of M-CIDI)	Age, sex, educational level any T0 CIDI lifetime DSM-III-R diagnosis, excluding those with onset of psychotic disorder more than 1 year before follow up	Environmental load significant in an additive fashion, significant positive interaction between environmental load and baseline psychotic experiences, persistence of baseline PLEs could be ascribed to synergistic action of two factors for 29 -51%. Sensitivity analysis: results did not change after exclusion of those with onset of psychotic experiences more than 1 year prior to T2.
Van der Werf et al. (2011)	Multinomial logistic regressions	Baseline: SCL-90-R score Outcome: CDI Psychosis T2 and T3 combined 1. Dichotomous - present if at least one positive rating - absent 2. Severity (4 levels)	Cumulative lifetime incidence of hearing impairment T0 to T3, 1 lifetime and 3 interval versions (Self-report: 1 item, T0 lifetime version ratified by parent report)	Sex, age at baseline, education, any illicit drug use at baseline	Controlling for T0 PLEs, and analysing Hearing Impairment (HI) and baseline PLE interaction: HI significantly associated with CIDI psychosis, magnitude of the association with HI increased with increasing levels of CIDI-psychosis severity No interaction with (moderation by) baseline PLE, sign. interaction with age (association greater with younger age)

Wigman, van Winkel et al., (2011)	1.MANOVA's 2. logistic regression	4 Classes (LGM) - Low - Decreasing - Increasing - Persistent	- depression/anxiety (subscale of YSR) - social problems (YSR) - attentional problems (YSR) -Occurrence of life events before T1 (sum of incidents) - Trauma between T1 and T3 (sum of incidents) - Developmental problems (parent interview) - ethnic minority group status -Urbanicity	Not stated	1. Significant differences between groups (MANOVAS) : - Depression/anxiety - Social problems - Attentional problems 2. Logistic Regression (low group reference group): Ethnic minority group status associated with persistent group membership Urbanicity not consistently associated with belonging to four groups Life events before age 16 ,exposure to trauma and developmental problems predict decreasing, increasing or persistent in dose-response fashion
Wigman et al., (2012)	Multinomial Logistic regression	4 Classes (LGM) - Low - Decreasing - Increasing - Persistent	- Trauma scale (derived from ratings of occurrence of life events before T1 and trauma between T1 and T3) - Parental psychopathology - general and psychotic at T1 (interview)	Gender, Parental psychopathology in trauma analysis	Reference group: low Trauma predicted belonging to decreasing, increasing and persistent class General psychopathology n.s. Psychotic psychopathology, predicted membership of persistent class No interaction between general or psychotic parental psychopathology and trauma on group membership prediction
Lin et al. (2011)	Path analysis	4 classes: (LCA) - low - moderate decreasing - strong decreasing - persistent Analyses: CAPE continuous	Coping Style (CISS)	Depressive symptoms (CES-D)	CAPE and emotion-oriented coping positively correlated at all time points, emotion-oriented coping predicted PLEs at following time point twice, bidirectional relationship once, bidirectional relationship between task oriented coping and PLEs at one time point, no correlations with avoidance coping
Collip et al. (2013)	Cross lagged path modelling	- Degree of bizarre experiences - Degree of perceptual abnormalities - Degree Persecutory ideation - Degree Magical thinking	- Interpersonal Functioning (13 Items from the Revised Multidimensional Assessment of Functioning Scale relating to family and peer functioning)	Gender, subclinical negative symptom scores (CAPE), depression at T1 (CES-D)	Interpersonal functioning at T1 predicted bizarre experiences and persecutory ideation but not perceptual abnormalities or magical thinking at T2, Interpersonal functioning at T2 predicted bizarre experiences, persecutory ideation, perceptual abnormalities and magical thinking at T3, PLEs did not predict interpersonal functioning over time.

Mackie et al. (2011) Uk General Population (subsample scoring high or low on four personality risk factors)	multivariate logistic regression	3 classes (GGMM): - Low - Increasing - Elevated	- Victimisation, (Olweus Bully/Vcitim Questionnaire) - Depression (BSI) - Anxiety (BSI) - Anxiety sensitivity (SURPS) - Hopelessness (SURPS) - Impulsivity (SURPS) - Sensation seeking (SURPS) - Alcohol - Cigarette Use - Cannabis use - Cocaine use - Other drug use	Combined model: Controlling for all other significant predictors	Persistent vs. Low: - Depression - Anxiety - Victimisation - Cigarette use Increasing vs. Low: - Sensation seeking All significant variables but sensation seeking in model: Persistent vs. Low - Victimisation Increasing vs. Low: - Cigarette use
Mackie et al. (2013)	1. multinomial logistic regressions, 2. random effects regression analysis	3 classes (GMM) - Low - Increasing - Elevated	-Cannabis Use (Reckless Behaviour Questionnaire) -Bullying by peers (Revised Olweus Bully/Vicitm Questionnaire) -Depression (depression scale from BSI))	Demographics, depression, cigarette use, alcohol, other illicit drug use	1. Bullying by peers predicted membership of the elevated class if membership or membership of the increasing class, depending on frequency of bullying (low as reference group) Depression (unplanned analysis): Depression at T1 predicted group membership of elevated and increasing classes (low as reference group) 2. Analysis within trajectory class: bullying by peers (controlling for cannabis use) predicted change in PLE between T2 and T5 for those belonging to increasing group
Thapar et al. (2012)	ICE-based multiple imputation approach with multinomial regression weighted by probability of class membership	4 Classes (LCGA): - Low - Intermittent - Decreasing - Persistent	Autistic traits, DAWBA (age 7) IQ age 8 per 10 pts Strengths and Difficulties, SDQ (age 9) Depressive symptoms MFQ, (age 10) Borderline personality traits CI-BPD (age 11),	Adjusted for sex, parental social class, housing type, benefits, parental education and family history of mental illness	Difference between increasing, intermittent and persistent classes with low class as reference group: Significant predictors: - SDQ (age 9) - MFQ (age 10) - CI-BPD (age 11) - FH depression No clear differences between persistent, intermittent and decreasing classes.

Sullivan et al. (2014)	1. Logistic Regression 2. Structural Equation Modelling	- PLEs not present - PLEs suspected or definitely present	Depression (SMFQ)	Gender, 2 proxy measures of social class (maternal education and maternal marital status at birth)	1.Logistic Regression: Depression at T1 predicts PLEs at 18 after controlling for PLEs at 12 and depression at 18 and vice versa 2. Structural equation modelling: Depression at 12 not associated with PLEs at 18, but PLEs predict depression.
Thompson et al. (2014)	Logistic regression	1. - PLE (any) suspected or definitely present at 18 - PLE not present at 18 2. Groups defined a priori based on occurrence of PLEs at both time points. - None (reference group) - Incident - Remitted - Persistent	- Nightmares at age 2 - 9 - Nightmares at age 12 - Night terrors at age 12 - Sleepwalking at age 12 - Any parasomnias at age 12 Semi structured interviews based on DSM-IV criteria, not present, suspected, definitely present for each problem	Gender, IQ at age 8, Family adversity index score, Psychiatric disorders, depression at 10, 11.6 or 12.6,child physical or sexual abuse up to age 6.8. enuresis, development and wellbeing at 7 (any axis 1 diagnosis), anxiety disorder at age 10	1. Controlling for PLEs at age 12: - Nightmares and any parasomnia associated with PLEs at 18 2. -Nightmares and any parasomnias at 12 associated with incidence PLEs -All of the parasomnias associated with remitted psychotic experiences -Persistent childhood nightmares, and night terrors at 12 and parasomnia at 12, associated with persistent PLEs, no longer significant when remittent as reference group.
Wolke et al. (2014)	1. Logistic Regression and Path Analysis 2. Path analysis	- PLEs Absent - PLEs Suspected or Definite	Bullying and victimisation, constructed from parent and child report. Child report measure: Bullying and Friendship Interview Schedule collected at age 8 and 10 1. 4 classes: Neutral, bully/victim, pure victim, pure bully 2. for path analysis: any victimisation vs no victimisation	Confounders: Gender, IQ (age 8), any DSM-IV Axis I diagnosis (age 7), sum of internalising/externalising behaviour at 8, 9.5 and 11 years Proposed mediators: Depression symptoms at 12, 13 or 14 (SMFQ), baseline PLEs	1. Controlling for PLEs at age 12.9: Pure victims, bully/victims and bullies more likely to experience PLEs at 18 (depending on type of report of bullying) 2. Victimisation had direct effect on PLEs at 18 and indirect effect through PLEs at 12.9 and through depression (controlling for all other associations simultaneously)

Analytic Method abbreviatons: GMM = Growth Mixture Modelling, LCA = Latent Class Analysis, LCGA = Latent class growth analysis, LGM = Latent Growth Modelling
Predictor Measure abbreviations with references: CISS = Coping Inventory for Stresssful Situations (Endler and Parker, 1990), CES-D = Centre for Epidemiological Studies Depression Scale (Radloff, 1977), BSI = Brief Symptom Inventory (Derogatis and Spencer, 1993), Olweus Bully Victim Questionnaire (Olweus, 1996), Reckless Behaviour Questionnaire (Shaw, Wagner, Arnett & Aber, 1992), SURPS = Substance Use Risk Profile Scale (Conrad and Woicik, 2002), DAWBA = Development and Well-Being Assessment (Goodman, Richards, Gatward & Meltzer, 2000), SDQ = Strengths and Difficulties Questionnaire (Goodman, 1999), MFQ = Moods and Feelings Questionnaire (Ancold and Stephen, 1995), CI-BPD = Childhood Interview for DSM-IV Borderline Personality Disorder (Zanarini, 2003), YSR = Youth Self Report (Achenbach, 1991) Revised Multidimensional Assessment of Functioning Scale, designed at Orygen Youth Health, SMFQ = Short Moods and Feelings Questionnaire (Ancold and Stephen, 1995), Bullying and Friendship Interview Schedule (Wolke et al., 2012), CIDI = Composite International Diagnostic Interview, version 1.1 (Smeets and Dingemans, 1993), M-CIDI = Munich – Composite International Diagnostic Interview (Wittchen and Pfister, 1997), BPRS = Brief Psychiatric Rating Scale (Overall and Gorham, 1962; Lukoff et al., 1986)

Design and Measures of PLEs

As per inclusion criteria, all studies followed children and young people longitudinally, measured and included PLEs at least twice in their model predicting PLE outcome and further included at least one *a priori* hypothesised psychosocial risk factor in the model, measured before the final PLE outcome measure. In the studies reviewed, PLEs were assessed with ten different measures (see Appendix A). Eight of the measures were questionnaire based self-report measures: De Loore et al. (2007) used three items derived from the Diagnostic Interview Schedule for Children (DISC-C) for the Diagnostic and Statistical Manual of Mental Disorders, DSM-III (previously used by Poulton et al., 2000). The Community Assessment of Psychotic Experience questionnaire (CAPE; Stefanis et al., 2002) was used by three studies (Collip et al., 2013, Lin et al., 2011 and Wigman, Lin et al., 2011) and the Psychotic-like Experiences Questionnaire (PLEQ) was used by three studies (Laurens et al., 2007; used by Mackie et al. 2011 and Mackie et al., 2013). Items from the Youth Self Report Inventory (YSR, Achenbach et al. 1991) were used by Wigman, Van Winkel et al. (2011), Wigman, van Winkel et al., (2012) and Scott et al. (2009) as their baseline measure. Escher et al. (2002) utilised three delusion items from the Brief Psychiatric Rating Scale (BPRS, Overall and Gorham, 1962; Lukoff, Liberman, Nuechterlein et al., 1986). The PLIKS – Q, a questionnaire based on the Psychotic like experiences semi-structured interview (PLIKSi; Horwood et al., 2008) was employed by Thapar et al. (2012), and the Peters Delusions Inventory (PDI; Peters, Joseph and Garety, 1999) was used as final PLE outcome by Scott et al. (2014). Goodwin et al. (2004) and those studies examining the EDSP cohort, for their baseline measure only, employed the self-report Symptom Checklist-90-R Psychoticism and Paranoia subscales (SCL-90-R, Derogatis, 1983). To measure PLEs at follow up (lifetime and interval psychotic symptoms) the studies examining the EDSP, used the Munich-Composite International Diagnostic Interview (M-CIDI, Wittcher & Pfister, 1997), an updated version of the World Health Organisation's CIDI version 1.2 (WHO, 1993). Those studies reporting on data from the ALSPAC cohort used the psychosis-like-symptoms-semi structured interview (PLIKSi, Horwood et al., 2008) at all time points, administered by trained assistant psychologists.

Patterns of PLE trajectories and analytical methods employed

Six studies modelled trajectories of PLEs. Lin et al. (2011) identified trajectory classes that varied both in terms of stability and severity (low, moderate decreasing, strong decreasing and persistent). All other trajectory classes only varied with regards to stability (Mackie et al., 2011 and Mackie et al., 2013, Greater London cohort: low, increasing, elevated; Wigman et al., 2012 and Wigman, van Winkel et al., 2011, TRAILS sample: low, decreasing, increasing, persistent; Thapar et al., 2012, ALSPAC cohort: low, intermittent, decreasing and persistent).

Prediction of class of PLE trajectory was predominantly analysed using logistic regression, contrasting any other class or a specific class with the low symptoms class as reference group (Mackie et al. 2011 and Mackie et al., 2013, Thapar et al. 2012, Wigman et al., 2012 and Wigman, van Winkel et al. 2011). One study compared means of predictors at baseline by trajectory class (Wigman, van Winkel et al., 2011) employing Multivariate Analysis of Variance (MANOVA). Thompson et al. (2014) also used trajectory classes as outcomes in some of their logistic regressions in addition to a binary PLE outcome, however defined these trajectories *a priori* (none, incident, remitted, persistent) by taking into account incidence at two time points.

Nine studies used a categorical outcome, measuring PLEs as either present or absent at final time point (as defined by *a priori* cut-offs) or split PLEs into four quartiles of severity (Scott et al., 2009; Van der Werf et al., 2011). Of those, four employed logistic regression(s) to investigate the effect of the predictor(s) on final outcomes controlling for PLEs at an earlier time point (De Loore et al., 2007, Sullivan et al., 2014; Thompson et al., 2014, Van der Werf et al., 2011), two employed structural equation modelling (SEM) or path analysis (Wolke et al., 2014, Sullivan et al., 2014 in addition to logistic regressions) allowing for bidirectional correlations between PLEs and predictors at various time points, and one used maximum likelihood hazard modelling (Escher et al., 2002). Cougnard et al. (2007) and Spauwen et al., (2006), employing a generalised linear model and logistic regression, respectively, to predict follow up PLEs, assessed an additive interaction term between their predictor and baseline PLEs. Van der Werf et al. (2011) also examined an interaction term between their predictor

and baseline PLEs. Scott et al. (2009) compared strengths of associations between PLEs at two time points between subsamples split by degree of severity of the predictor

Four studies used continuous PLE outcomes at the final time point. Goodwin et al. (2004) employed a generalised estimating equation model predicting follow-up PLEs, controlling for baseline PLEs and three studies employed structural equation modelling (SEM), allowing for bidirectional correlations between PLEs and predictors at all time points (Collip et al. 2013; Wigman, Lin et al., 2011 and Lin et al., 2011).

Demographic Differences (gender, age and ethnicity)

Lin et al. (2011) examined whether trajectories were estimated differently by gender, comparing a model constraining paths to be equal for gender with a model allowing paths to be freely estimated. No significant difference was found between models. With regards to whether the proportional representation of demographics differed by PLE trajectory class, Mackie et al. (2011) found no difference between trajectory classes in gender or ethnicity. Mackie et al. (2013) found no group difference in gender, but found that adolescents belonging to the elevated class were significantly less likely to report Asian ethnicity than adolescents in the low class. Lin et al. (2011) found that gender proportion was significantly different between the low and strong decreasing classes, with more females in the latter. No differences in age were found. Thapar et al. (2012) found that gender was still associated with class membership even after controlling for other demographic variables (not including age or ethnicity) with females having greater odds of belonging to the persistent, decreasing or intermittent classes in comparison to the low class. Wigman, van Winkel et al. (2011), found that gender was not equally distributed over the four trajectory classes, with a greater percentage of girls in the increasing and persistent groups. The authors further found that ethnic minority was significantly associated with class membership, with non-Dutch participants more likely to be in the persistent as opposed to low symptoms class. Wigman et al., (2012) and Thompson et al. (2014) did not examine differences in distribution of demographic factors across trajectory class.

Overall, 13 out of 18 studies controlled for gender in their model predicting PLE trajectory. All of the six studies controlling for age at baseline also controlled for gender at baseline. No study controlled for BME status. Studies did not generally report the significance of demographics when entered as confounders. Escher et al. (2002) reran their analysis on a subsample of children above 13, due to concerns that PLEs might have been over reported in younger children and found that their patterns of results remained largely unchanged. Van der Werf et al., (2011) found that the relationship between hearing impairment and PLEs was moderated by age, with the relationship stronger in a younger age group (14 -17) but not older participants (18-24).

Predictors of Trajectories

Intrapsychic

Intrapsychic predictors of trajectories examined were: specific child psychopathology (anxiety, depression, panic attacks, borderline and other personality traits, autistic traits), coping style, nightmares and sleep problems, and indicators of general emotional wellbeing and behavioural problems (such as measured by the Strength and Difficulties Questionnaire, SDQ; Goodman, 1999) and indicators of general child pathology (such as measure by the Youth Self Report, YSR, Achenbach, 1991).

Eight studies examined the effect of depression on PLE trajectory, out of which four studies reported evidence for depression driving PLE trajectory. Two studies found that depression at baseline predicted class membership. Thapar et al. (2012) found that depression at baseline predicted membership of any trajectory class compared to the low class (with no differences between the persistent, intermittent and decreasing classes) and Mackie et al. (2013) found that depression at baseline predicted membership of the elevated and increasing classes in comparison to the low symptom class. Wigman, van Winkel et al. (2011) found differences in a combined depression and anxiety construct at baseline between trajectory groups (post hoc

not reported). Escher et al. (2002) found that depression predicted delusional experience controlling for past delusional experiences.

However, Mackie et al. (2011), in a subsample scoring high and low on particular personality measures, found that depression and anxiety no longer predicted group membership of the persistent class over and above victimisation. Sullivan et al. (2014) found depression to be predictive of PLEs at 18 years controlling for PLEs at 12 years (and depression at 18 years) using logistic regression, but with SEM this relationship was no longer significant. PLEs predicted depressive symptoms with both analytic methods. Wigman, Lin et al. (2011), also using SEM, found that although depression was significantly correlated with PLEs at all time points, depression was never predicted by earlier PLE scores or vice versa.

With regards to other specific child psychopathology, Goodwin et al. (2004) found that panic attacks predicted PLEs when controlling for past PLEs over and above depression and various other confounders. Additionally, borderline personality traits at age 11 were found to predict trajectory membership whilst autistic traits at age eight were not found to be significantly associated with trajectory membership (Thapar et al., 2012). Mackie et al. (2011) found that baseline scores on sensation seeking predicted membership of the increasing vs. low group (likely to do with greater subsequent substance use) whilst all other personality characteristics examined were not predictive of class membership (anxiety sensitivity, hopelessness and impulsivity).

With regards to indicators of general emotional wellbeing and behavioural problems, overall score on the SDQ predicted any class membership in comparison to the low symptom class (Thapar et al., 2012). Baseline social problems and attentional problems (Wigman, van Winkel et al., 2011) differed between trajectory groups, although post hoc tests were not reported. For those children with greater general childhood pathology as measured on the YSR the strength of association between baseline and follow up PLEs was found to be greater (Scott et al., 2009). Additionally, Escher et al. (2002) found that disorganisation was associated with delusions at follow-up controlling for delusions at baseline. Thompson et al., (2014) found that

nightmares and any parasomnias at age 12 years were associated with PLEs at age 18 years, controlling for PLEs at age 12 years.

Lin et al. (2011) using SEM, found that PLEs and emotion-oriented coping positively correlated at all time points, and there was a bidirectional prediction over time between emotional-oriented coping and PLEs and across fewer time points between task oriented coping and PLEs. No temporal associations between PLEs and avoidance coping were found.

Interpersonal

Interpersonal factors examined were parental psychopathology (which is likely to affect the offspring through both genes but also parent child interactions and parenting) and interpersonal functioning. Collip et al., (2013) found that interpersonal functioning (combining family and peer functioning) predicted some components of PLEs as measured by the CAPE (in particular bizarre experiences and persecutory ideation), and that the number of components predicted increased at later time points (including perceptual abnormalities and magical thinking). Wigman et al., (2012) found that psychotic parental psychopathology but not general parental psychopathology predicted membership of the persistent PLE class.

Environmental/Social

Environmental predictors examined were bullying, negative life events, ethnic minority group status, unwanted negative sexual experiences, trauma, urbanicity and hearing impairment.

Bullying was found to predict PLE trajectory in three studies. Peer victimisation predicted membership of the persistent PLE class, controlling for other significant predictors (Mackie et al., 2011) and membership of the increasing and elevated class in comparison to the low class controlling for confounders (Mackie et al., 2013). Additionally bullying predicted change in PLEs within the increasing group, controlling for cannabis use and confounders (Mackie et al., 2013). Wolke et al. (2014), using path modelling found that peer victimisation had a direct

effect on PLEs at age 18 and an indirect effect through baseline PLEs and earlier depressive symptoms, controlling for confounders and all other associations simultaneously. In contrast, De Loore et al. (2007), found that bullying was no longer a significant predictor of PLE final outcome, when controlling for confounders and baseline PLEs.

Wigman et al. (2012) found that trauma and life events combined (cumulative up to the final time point) predicted membership of the decreasing, increasing and persistent class compared to the low symptoms class. Likewise Wigman, van Winkel et al. (2011), also TRAILS sample, found that trauma separated into life events before age 16 years and trauma after age 16 years, predicted membership of the increasing and persistent class in a dose response fashion. De Loore et al. (2007), found total negative life events and unwanted negative sexual experiences to be significant predictors of PLEs, controlling for confounders and baseline PLEs. Escher et al. (2002) also found that life events significantly predicted delusional ideation in a sample of children hearing voices, controlling for delusions at baseline.

There were mixed findings for urbanicity, with Spauwen et al. (2006) finding a significant interaction between baseline PLE and urbanicity when predicting final PLEs, meaning that only in the presence of PLEs urbanicity increased the likelihood for persistence, whilst Wigman, van Winke et al. (2011), in the TRAILS sample, found that urbanicity was not consistently associated with belonging to any of the four PLE trajectories. Cougnard et al. (2007) found that the strength of the association between baseline and follow up PLEs varied with different levels of environmental load (a compound of the three variables of cannabis use, trauma and urbanity) in an additive fashion.

Wigman, van Winkel et al. (2011), found that ethnic minority group status was associated with belonging to the persistent PLE group. Van der Werf et al. (2011) found that hearing impairment was associated with PLEs, with the magnitude of the association increasing with increasing PLE severity, controlling for baseline PLEs. This effect was moderated by age with a stronger association in younger children (14 -17 years compared to 18-24 years). The

authors did not find the interaction term of hearing impairment and baseline PLEs to be significant.

Patterns of interaction – Moderation, Mediation and Bidirectional prediction

Mediation

Mediation refers to when the effect of a predictor on the outcome is not direct but rather the predictor has a distal effect on the outcome by influencing a more proximal factor, which is then hypothesised to be closer in the causal chain to the outcome in question. Mackie et al. (2011), controlling for all other significant predictors in their final model (anxiety, depression and cigarette use), found that victimisation was significant over and above the other predictors. However no association between these factors and victimisation was demonstrated. Wolke et al. (2014), using path modelling found that peer victimisation had a direct effect on PLEs at 18 and an indirect effect through baseline PLEs and earlier depressive symptoms, controlling for confounders and all other associations simultaneously.

Moderation

Moderation is present when the effect of a predictor on the outcome varies according to the level of another predictor. Four studies examined specific *a priori* moderating interaction effects. Two studies analysed the interaction of two predictors and three studies included interaction effects to assess the influence of the predictor on trajectory (analysing the moderation of the strength of association between baseline and follow up PLEs by the predictor variable).

Wigman et al. (2012), examined an interaction between (general and psychotic) parental psychopathology and trauma, and found no interaction between the variables on group membership prediction. Van der Werf et al. (2011) found that hearing impairment was

associated with PLEs and that this effect was moderated by age with a stronger association in younger children (14 -17 years compared to 18-24 years).

Cougnard et al. (2007) found a significant interaction between baseline psychotic experiences and environmental load (a compound of the variables cannabis use, trauma and urbanity), with the strength of the association between baseline and follow up PLEs varying with different levels of environmental load in an additive fashion. Spauwen et al. (2006) found a significant interaction between baseline PLE and urbanicity when predicting final PLEs, meaning that only in the presence of PLEs, urbanicity increased the likelihood for persistence. Van der Werf et al. (2011) found that hearing impairment did not moderate the strength of the association between baseline and follow up PLEs.

Bidirectional relationships

Five studies examined bidirectional relationships between PLE trajectory and predictors. Sullivan et al. (2014) found that PLEs at age 12 were associated with depression at age 18 (controlling for baseline depression and follow up PLEs), using logistic regression and SEM, however depression predicted PLE trajectory only when using logistic regression, whilst Wigman, Lin et al. (2011) found that depression was never predicted by earlier PLE scores (or vice versa). Collip et al. (2013) found that none of the components of PLEs examined predicted interpersonal functioning over time. Lin et al. (2011) found that emotion-oriented coping and PLEs interactively increased each other over time, proposing a vicious cycle of the two. De Loore et al. (2007) found that the risk of unwanted sexual experiences and bullying was not greater for adolescents with subclinical psychotic experiences at baseline, however those children with PLEs at baseline had more negative life events at follow up (analyses were adjusted for confounders but unclear whether adjusted for baseline levels of predictors).

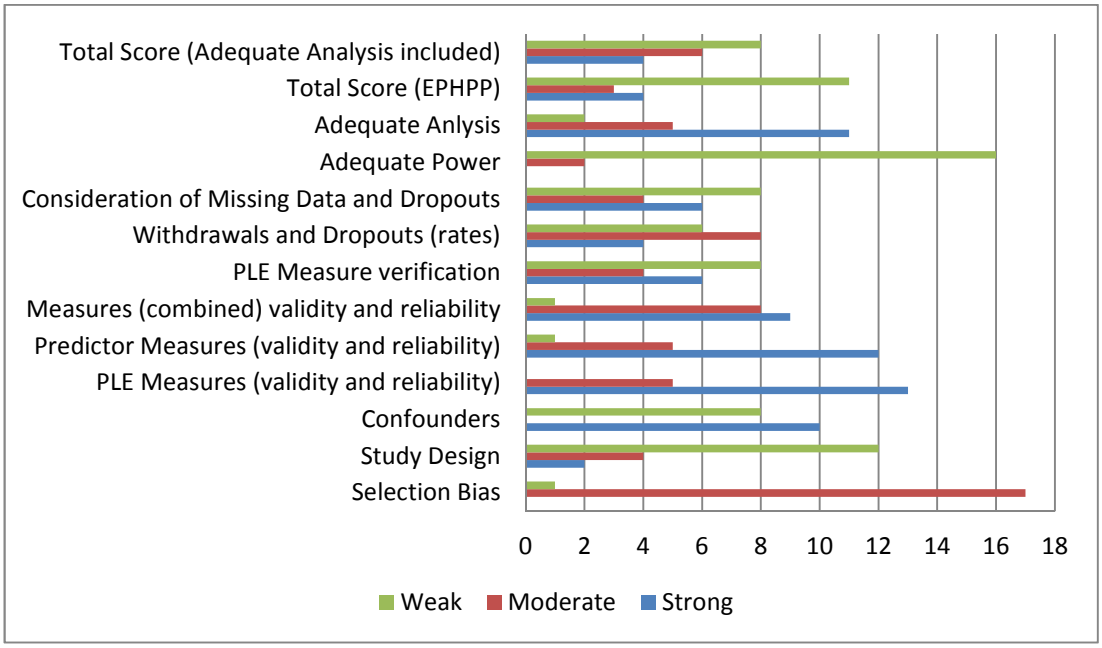
Quality Assessment of included studies

Methodological quality was assessed using an adapted version of the EPHPP tool (2007) for quantitative studies. Each study received a score for each methodological domain (selection bias, design, confounders, measurement quality, rate of withdrawals and dropouts, consideration of missing data and dropouts, adequate power and adequate analysis), as well as two overall quality ratings (see Figure 1) . The first was based on those domains included by the EPHPP in the global rating (except blinding), the second quality rating substituted the confounders domain for the adequate analysis domain, which is the one that will be referred to in text (see Appendix B and C for table with ratings for each criterion and domain for each study).

A total of four studies achieved an overall 'strong' quality rating (Cougnard et al., 2007; Spauwen et al., 2006; Van der Werf et al., 2011, Wigman, Lin et al. 2011). The remaining studies were found to be of moderate (N =6) and weak (N = 8) quality. The main limitations were withdrawal and dropout rates of more than 40% (N =6) equating to a 'weak' withdrawal and dropout domain rating; and a 'weak' rating for the design domain (N = 12), where studies did not provide a rationale for the developmental stage of the sample or the length of follow up and did not report and/or exclude those who at baseline were identified as meeting criteria for psychotic disorder or ultra high risk status. Three studies included sensitivity analyses excluding those with onset of psychotic disorder one year prior to follow up (Cougnard et al., 2007), those with lifetime psychotic disorder (Scott et al., 2009) and those with onset of subthreshold psychotic symptoms one year prior to follow- up (Spauwen et al., 2006). The method of Scott et al., (2009) is deemed most appropriate as Cougnard et al., (2007) might still have included those with psychosis at baseline and Spauwen et al., (2006) only examined incident psychotic symptoms in their sensitivity analysis. However the fact that they found no differences in predictors between analyses of the full sample and the subsample suggests that the drivers for persistence and incidence may have been the same and that the association was not purely driven by those with psychotic disorder at baseline. Studies were generally of good quality (strong: N= 9, moderate: N= 8) with regards to validity and reliability

of measures and of moderate quality regarding sample representativeness (moderate: N = 17), with most studies accessing general population samples, however rarely reporting how many were approached in comparison to those who agreed. Ten studies gave a rationale for the confounders which were controlled for and/or reported analyses with and without confounders. With regards to the additional domains added, only two studies (Spauwen et al., 2006; Thompson et al., 2014), discussed power and adjustment of p- values in response to multiple testing and nine studies described adequate consideration of missing data or dropouts in their analyses, whilst six considered both. With regards to adequacy of analysis, two studies were given a weak rating: Escher et al. (2002), due to evident lack of consideration of multiple testing (about 50 separate analyses with a baseline sample size of N = 80) and Scott et al. (2009), due to drawing conclusions on the basis of comparisons of strengths of associations derived from separate analyses, without reporting confidence intervals. Eleven studies obtained a 'strong' rating for the appropriateness of analysis section.

Figure 2. Number of studies achieving weak, moderate or strong quality by domain and overall scores



Discussion

Summary of Findings

The goal of this review was to identify, evaluate and integrate studies examining psychosocial predictors or drivers of PLE trajectories in children and young people. The purpose was to identify those factors causally linked to PLE persistence, increase or remission, to analyse the interactive relationship between these factors, to investigate possible bidirectional relationships between PLEs and psychosocial factors and to investigate whether latent subgroups of trajectories, characterised by distinct risk factors and mechanisms can be identified.

Overall 18 studies were identified from ten separate cohorts. Six studies modelled the occurrence of PLEs over time and identified, using path modelling, distinct trajectories or symptom patterns over time in their samples. Overall trajectories of PLEs were relatively homogenous and predominantly varied in terms of stability (persistent increasing and decreasing) and not in terms of severity. However, the classes derived are likely a reflection of the PLE measure used. For example Lin et al., (2011) was the only study to use a measure incorporating distress ratings for each psychotic like experience, the CAPE, and the only study to find that trajectories were classed by severity as well as frequency. Gender appeared to be associated with differences in trajectory patterns, with a trend across studies for females to be more likely to belong to unfavourable trajectory groups.

Predictors of PLE trajectory were examined according to domains: intrapsychic, interpersonal, and social/environmental.

The majority of predictors examined were intrapsychic. No particular patterns with regards to the quality of studies and results was identified. Sullivan et al., (2014) was rated as ‘weak’ due to high withdrawal rates and poor design, however sample size was large and the analytic

method employed was appropriate. Escher et al. (2012) was also rated 'weak' due to inadequate analyses and weak design.

Evidence regarding the predictive utility of depressive symptoms at baseline was mixed. Those studies (Sullivan et al., 2014; and Wigman, Lin et al.,2011) using arguably superior analytic methods for the purpose of examining trajectory methods - SEM allowing depression measures and PLEs to covary at all time points - found that depression did not predict PLEs over time. Sullivan et al., (2014) found that PLEs predicted depression but not vice versa and Wigman, Lin et al., (2011) found that the two were co-occurring phenomena that did not predict one another over time. With regards to quality of these studies Sullivan et al., (2014) was rated as 'weak' due to high withdrawal rates and a poor 'design' rating, however sample size was big and the analytic method employed was appropriate. Wigman, Lin et al.'s, (2011) sample was small. With regards to analyses predicting class membership, depression was linked to persistent or increasing classes compared to low symptoms classes, in three studies (Mackie et al., 2013; Thapar et al., 2012; Wigman, van Winkel et al., 2011). However, these studies looked at *baseline* differences in predictors across trajectories, which does not preclude the possibility that the trajectory and the predictor are merely correlated but do not predict one another over time (see section below for elaboration on this point). Depression was linked to the development of delusions by Escher et al. (2012), but the study was rated as methodologically weak, due to inadequate analyses (multiple testing) and weak design. Mackie et al. (2011), found that depression was no longer predictive of unfavourable trajectory classes, when controlling for victimisation in their logistic regression analyses.

There was evidence that other specific child psychopathology (borderline personality traits: Thapar et al., 2012; panic disorders: Goodwin et al., 2004) and non-specific child psychopathology (behavioural and emotional problems: Wigman van Winkel et al. 2011; Scott et al., 2009 and nightmares: Thompson et al., 2014) were linked to PLE trajectories. There was a paucity of research with regards to cognitive or behavioural predictors. Only one study (Lin et al., 2011, using SEM) examined a cognitive/behavioural response to stress (coping) and found that emotion oriented coping predicted increasing PLEs across time points and vice

versa, with the authors hypothesising a vicious cycle, whereby emotion oriented coping increases PLEs, which in turn triggers even greater emotion oriented coping, leading to persistence of PLEs. Similarly there was a paucity of research on interpersonal factors, with one study (Collip et al., 2013) finding that interpersonal functioning (peer and family) predicted some components of the CAPE, in particular persecutory ideation and bizarre experiences, and that this relationship was not bidirectional.

Regarding environmental and social factors, there was unequivocal evidence that trauma and life events were predictive of an unfavourable PLE trajectory and all but one study (De Loore et al., 2007, rated as 'weak' due to 'weak' ratings for the 'study design' and 'withdrawal and dropout' domains) found that peer victimisation impacted PLE trajectory negatively. De Loore et al. (2007) further found that PLEs were predictive of life events but not bullying or unwanted sexual experience. Findings regarding urbanicity were mixed, suggesting that urbanicity might influence trajectory in combination with other factors. Notably two of the studies investigating urbanicity (Spauwen et al., 2006 and Cougnard et al., 2007) were rated as 'strong' and examined the interaction effect between baseline PLEs and urbanicity, which is deemed together with SEM, to be the most direct way to measure whether the psychosocial factor influences trajectory (changes in the strength of the association between baseline and follow up PLEs) over and above incidence. Both of these studies also made efforts to control for the degree of psychotic disorder at baseline. There was further evidence for the influence of hearing impairment and ethnic minority status on PLE trajectory.

Two studies examined the effect of one predictor over and above another. Wolke et al., (2014) found that depression partially mediated the effect of victimisation on PLEs, whilst Mackie et al., (2011) found that depression at baseline was no longer predictive of membership of the persistent as opposed to low class when controlling for victimisation. Wolke et al., (2014) used the more appropriate analytic method (SEM, allowing correlations between variables at all time points), but their study was rated as overall 'weak' due to weak design (no rationale provided for developmental stage of sample and length of follow up and no effort to exclude

individuals with diagnosable psychotic disorder or ultra-high risk status) and high withdrawals and dropouts.

Two studies examined moderation (over and above interaction effects between baseline PLE and predictors described above). One study (Van der Werf et al., 2011) found that the effect of hearing impairment on trajectory was moderated by age, with the effect more pronounced in younger children. Another study found that parental psychopathology did not moderate the effect of trauma on PLE trajectory (Wigman et al., 2012).

There was a paucity of research reporting on studies influencing PLE trajectory in a positive direction, with no such study identified.

Methodological considerations

Several methodological limitations apply to the reviewed studies in relation to the question of what drives PLE trajectories.

Analytic Methods employed

Most analysis employed logistic regression to predict trajectory class or follow up PLEs, whilst controlling for baseline PLEs.

Using regression alone, without controlling for baseline PLEs, any association between psychosocial predictor and trajectory class could simply reflect co-occurrence in time between the two factors, without any causal association (i.e. high depression scores at baseline are associated with high PLE baseline scores, a prerequisite for belonging to the persistent or decreasing class as opposed to the low or increasing class, hence the association with class). Equally, a distinction by predictor between a low and increasing class is ultimately a test of prediction of PLE incidence as opposed to trajectory.

Predicting follow up PLEs whilst controlling for baseline PLEs, essentially tests the association between the psychosocial factor and PLEs, when keeping baseline PLEs constant or assuming average levels of baseline PLEs. A non-significant result after controlling for baseline PLEs, which was significant prior to this, is an indication that there is correlation but no prediction over time. A significant result reflects incidence or frequency prediction over time, ensuring this is not driven by baseline correlation between PLEs and tested predictors.

In order to measure the effect of the predictor on trajectory one needs to examine the effect of the predictor on the strength of the association between baseline and follow up PLEs (persistence). Cougnard et al. (2007), argue that 'the risk of persistence of baseline psychotic experiences is defined as the strength of the association between baseline psychotic experiences and follow-up experiences' and that if the association between baseline psychotic experiences and follow-up psychotic experiences is significantly different for different levels of a predictor, this supports the hypothesis that the predictor affects the persistence of baseline follow-up experiences' (p. 517), However, such an analytical model assumes that the predictor and baseline psychotic experiences (the variables making up the interaction) are independent. Given that it is likely that what drives persistence also drives incidence, the analysis cannot distinguish between a model of the predictor causing poor prognosis of prevalent psychotic experiences and a model of the predictor causing incident poor prognosis psychotic experiences. However Cougnard et al. (2007) argue that the distinction is academic. This design was employed by Cougnard et al. (2007) and Spauwen et al. (2006). Van der Werf et al. (2011), who also tested a baseline PLE and hearing impairment interaction, which was nonsignificant.

Finally structural equation modelling allows variables to correlate at all time points, enabling the control of all potential relationships between variables and the examination of the direction and nature of the relationship between variables (employed by: Collip et al., 2013; Lin et al., 2011; Sullivan et al., 2014; Wigman, Lin et al., 2011; Wolke et al., 2014).

Measurement of PLEs

Linscott and van Os (2010) in their systematic reviews on categorical versus continuum models in psychosis, conclude that half of the observed study heterogeneity in PLE incidence rates is attributable to methodological factors. The authors found that rates were considerably higher in studies using smaller convenience samples and using self-report assessment methods. Kelleher et al. (2011) found that predictive power of items assessing PLEs varied substantially and that the question on auditory hallucinations had the highest positive predictive power (71.4%) and the highest negative predictive power (88.4%) with regards to interview-verified auditory hallucinations and had a 100 percent positive predictive value for any PLE. Good predictive power was also found for items on visual hallucinations and paranoid thought. This means that those measures including these items will likely pick up on PLEs, if present. However if further items are included the screener might be overly inclusive and participants who report symptoms, which would not be classed as valid in interview and who hence are not associated with a general PLE phenotype, might be falsely included. Consequently, any examinations concerning drivers of trajectories would lose power due to greater sample variability. Additionally some studies in this review used different measures of PLEs at baseline and follow-up. Notably all studies from the EDSP cohort assessed PLEs via self-report at baseline and via clinician rated interview at follow up. This could potentially influence the estimations of the influence of drivers as the 'remission' of PLEs previously falsely labelled as such due to measurement limitations would be incorporated into any parameter estimates.

Another problem with included studies is the lack of control of individuals with psychotic disorder or ultra-high risk status as baseline. Parameter estimates concerning trajectories and drivers of trajectories might be skewed by those individuals in the sample with psychosis at baseline. However, those studies in the current review, which made efforts to account for this (i.e. by running analyses with and without those with baseline psychosis or subthreshold psychosis) did not find significant differences in their model.

Additionally the current construct of PLEs might be limiting. The focus of the PLE measures utilised in the reviewed studies is almost exclusively on positive symptoms. However trajectories of subclinical psychotic symptoms are likely to incorporate an array of symptoms, ranging from positive through to negative symptoms to motor and cognitive problems. Measuring a greater variability of symptoms would have the advantage that potential subpopulations, potentially associated with distinct trajectories and drivers, would not be artificially excluded. Seaton, Goldstein and Allen (2001) point out that any analysis is only modelling the response patterns given by participants on the chosen measures, which are constrained by the type of measures used and do not necessarily reflect latent pathological constructs.

Insufficient data to estimate more complex trajectory patterns and interactions between predictors

The relationship between psychosocial drivers, PLE incidence and PLE trajectory is likely to be complex and interactive. Based on the reviewed studies it appears that individual drivers moderate one another and interact with one another with regards to their influence on PLE trajectory. Additionally, there is some evidence that relationships between drivers and PLE incidence and trajectory are bidirectional. In order to disentangle such complex relationships large scale longitudinal studies are needed and indeed many of the included studies followed large samples over extended periods of time. However, despite the large sample sizes and lengthy durations of follow-up, many studies only incorporated assessments of PLEs at two time points in the relevant analyses (with the exception of studies using SEM). Measuring PLEs (and predictors) at frequent time points will further elucidate the dynamic relationships and lead to more accurate estimations of trajectories.

The modelling of these complex relationships could elucidate how proximal risk factors exert their influence on psychosis (i.e. through sensitisation). This increased understanding could then translate into time sensitive interventions, targeting those factors driving PLE persistence.

Selective Dropout Rates

Selective dropout rates were high in the studies reviewed (in 6 studies the dropout rate was greater than 60%, and in 8 the dropout rate was between 60 and 79 %). Dropout was not calculated with regards to the initial cohort but with regards to those time points included in the analyses, which is the less conservative approach. In the ALSPAC study, it was reported that those not included in the analyses, were more likely to have a range of adverse background characteristics, score more highly on markers of emotional and behavioural problems during childhood and were more likely to report PLEs at any time point (Thapar et al., 2012). Hence it is likely that those children who are at the more severe end of the PLE spectrum might be missed by longitudinal analyses, potentially minimising estimates of the effects of social adversity and associated factors on PLE trajectory. Hence efforts to maintain as many participants of the original sample as possible is pivotal for accurately understanding factors influencing PLE trajectory.

Suggestions for Future research: Expanding systematic review Inclusion criteria

This current systematic review has been limited to psychosocial predictors, defined as those whose mechanism of operation is not understood to be predominantly biological. Hence any studies on drug use and the pre and antenatal environment have been excluded. Additionally studies investigating structural and functional brain changes have not been included. With regards to the latter it is unclear whether these processes might be correlates or are part of (one or more) trajectories of a psychosis phenotype or whether they actually causally influence trajectory. Also, characteristics of PLEs themselves, such as associated distress, frequency of occurrence and conviction with which unusual beliefs are held might plausibly influence trajectory of PLEs and need for care and functional outcomes. The current study did not examine whether dimensions associated with PLEs were also driving PLE trajectory.

Additionally the current study was limited to studies of young people with subclinical PLEs who were not classed as ultra-high risk or at familial risk of psychosis. Assuming

phenomenological continuity within a psychosis phenotype, in line with the psychosis proneness-persistence-impairment model (Linscott and van Os, 2010), it would be hypothesised that similar or the same drivers are implicated in the transition from persistent PLEs to prodromal states and from prodromal states to first episode psychosis. However this remains to be examined.

Additionally, 13 of the reviewed studies were from a cohort that published more than one study on their data. Quality for studies from the same cohort still differed due to different retention rates at different phases of the cohort and different analyses employed. However, studies from the same cohort were more likely to be similar with regards to quality (i.e. same measures used, same design employed) and hence the respective quality ratings are not completely independent. This needs to be considered when drawing conclusions based on the concordance in findings of multiple high quality studies; as a lot of high quality studies used the same sample this has implications for how generalizable these findings are.

Future systematic reviews could review studies which use broader definitions of drivers and look at a greater spectrum of psychotic experiences, with regards to illness progression and associated dimensional characteristics. Further the current review only focused on significance of association and did not examine the strength of association between drivers and predictors. There is scope for this be examined in the context of a meta-analysis.

Recommendations for the design and analyses of studies investigating trajectories

In order to disentangle the complex relationships between drivers of PLE trajectories, once incidence is present, several suggestion for future research are proposed below, with regards to study design, measurement of PLEs and analytic methods employed:

Suggestions for measurement of PLEs are to measure a greater variability of symptoms associated with a subclinical psychosis phenotype, providing the advantage that characteristics of possible subpopulations, potentially associated with distinct trajectories and

drivers would not be artificially excluded. It is additionally recommended to measure PLEs across many time points, allowing more accurate models of trajectories and to specifically measure dimensional characteristics of PLEs, such as associated distress, frequency and degree of conviction in delusions, as these also might influence trajectory.

Recommendations for study design are to use large samples and follow them over extended periods of time across multiple time points and to minimise dropout as this is likely to lead to selective sample retention. Additionally it is recommended to specify a priori predictions regarding drivers of PLE trajectories and to include predictions about protective factor, positively influencing PLE trajectory (leading to remittance over time). Predictions about putative preventative factors can also be investigated through controlled intervention and prevention studies, specifically targeting hypothesised protective or ameliorating factors. Additionally, in order to determine causality it is necessary to establish the temporal association between drivers and trajectories. This is difficult when there is greater ambiguity regarding clear temporal boundaries (such as illness onset) in studies concerning subclinical symptoms in general population samples. Hence screening for PLEs early on in cohort studies and excluding those who display attenuated symptoms or psychotic disorder at baseline, is crucial to ensure that drivers are indeed causal with regard to the trajectory of PLEs rather than model estimates potentially reflecting associations between psychosocial risk factors and established symptoms of psychosis or prodromal symptoms.

Suggestions for analysis are to employ analytic methods such as path modelling which allow predictors and symptoms to co-vary at all time points, or to employ analyses that specifically investigate whether the strength of the association between PLEs across time points varies by predictor. These are deemed the most direct ways to measure what drives PLE trajectory over and above what influences PLE incidence.

Conclusions

In conclusion, the relationship between psychosocial drivers, PLE incidence and PLE trajectory is likely to be complex and interactive. There is mixed evidence regarding the role of depression as a driver for trajectory and strong evidence for the role of life events, bullying and trauma. Additionally several other interpersonal and environmental factors appear to be implicated. The quality of the assessed studies varied; the most common limitations concerned design weakness with regards to controlling for baseline psychotic disorder and reporting rationales for design and analytic decisions, high dropout rates and limitations with regards to the analyses employed. No clear pattern between quality of studies and results was established. Key recommendations for future research include retention of the sample at follow-up, multiple measurements of PLEs, restricted testing of predictors identified a priori, to ensure power, and, where the aim is test predictors of PLE persistence (rather than the continuity of predictors across a hypothesised spectrum of disorder), to exclude young people with clinical psychosis. The development and testing of child-focused interventions for PLEs is at present very under-developed. However, current findings indicate that targeting mood and trauma would be potentially useful to improve outcomes for these young people.

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Appendices

Appendix A. Table to show PLE measures, including items and response characteristics.

Studies	Measures	Items	Response Characteristics
Lin et al. (2011) Collip et al. (2013) Wigman, Lin et al. (2011)	CAPE (20 items) Community Assessment of Psychic Experience (Stefanis et al., 2002)	1. Have you ever felt as if people seem to drop hints about you or say things with a double meaning? 2. Have you ever felt as if things in magazines or on TV were written especially for you? 3. Have you ever felt as if some people are not what they appear to be? 4. Have you ever felt that you are being persecuted in some way? 5. Have you ever felt as if there is a conspiracy against you? 6. Have you ever felt as if you are destined to be someone very important? 7. Have you ever felt that you are a very special or unusual person? 8. Have you ever thought that people can communicate telepathically? 9. Have you ever felt as if electrical devices such as computers can influence the way you think? 10. Have you ever believed in the power of witchcraft, voodoo or the occult? 11. Have you ever felt that people look at you oddly because of your appearance? 12. Have you ever felt as if the thoughts in your head are being taken away from you? 13. Have you ever felt as if the thoughts in your head were not your own? 14. Have your thoughts ever been so vivid that you were worried other people would hear them? 15. Have you ever heard your thoughts being echoed back to you? 16. Have you ever felt as if you ae under the control of some force or power other than yourself? 17. Have you ever heard voices when you were alone? 18. Have you ever heard voices talking to each other when you were alone? 19. Have you ever felt as if a double has taken the place of a family member, friend or acquaintance? 20. Have you ever seen objects, people or animals that other people can't see?	18 positive symptom items, 14 negative symptom items and eight depressive symptom items Measuring Frequency and Distress on two 4-point likert scales: - Scale: 0—never, through sometimes and often, to 4—nearly always Overall and total score by subscale derived by summation of scores on the frequency and distress scales.
Mackie et al. (2013)	UEQ (9 items)	1. Some people believe that their thoughts can be read, have other people ever read your thoughts?	Responses on 3-point likert scale from 0-not true through sometimes true to 3 –often.

Mackie et al. (2011)	Unusual Experiences Questionnaire Laurens et al. (2007), 5 items adapted from the Diagnostic Interview Schedule (Costello et al., 1982)	2. Have you ever believed that you were being sent special messages through the TV? 3. Have you ever thought that you were being spied upon? 4. Have you ever heard voices that no-one else could hear? 5. Have you ever felt that your body had changed in some unusual way? 6. Have you ever felt that you were under the control of some special power? 7. Have you ever known what someone else was thinking even though they were not speaking? 8. Do you have some special powers that other people do not have? 9. Have you ever seen something or someone that other people could not see?	Total score as sum of responses
Thapar et al. (2012)	PLIKS –Q, questionnaire based on the PLIKSi interview (Horwood et al., 2008)	Experiences enquired about: - visual hallucinations - auditory hallucinations - beliefs about being spied upon - others using special powers to read their thoughts - being sent special messages - some special power controlling them	Asking about presence and level of conviction (definitely or maybe), past-year frequency (none, less than once per month, monthly or more) and context of experiences
Thompson et al. (2014) Sullivan et al. (2014) Wolke et al. (2014)	PLIKSi (Psychotic like experiences semi-structured interview) (Horwood et al. 2008)	Semi-structured face-to-face interview conducted in private with the study member. Comprises 12 core questions eliciting key psychotic experiences covering hallucinations (visual and auditory), delusions (spied on, persecution, thoughts read, reference, control and grandiosity and other unspecified delusions) and experiences of thought inference (thought broadcasting, insertion and withdrawal) - 7 stem questions from the Diagnostic Interview Schedule for Children IV (DISC-IV) five from the Schedules for Clinical Assessment in Neuropsychiatry version 2.0 (SCAN 2.0)	Coding followed the glossary definitions and rating rules for SCAN
Wigman, van Winkel et al. (2011).,Wigman et al. (2012), Scott et al. (2009), 2 items in bold	9 items from the thought problem subscale of Youth Self-Report, YSR (Achenbach et al. 1991), 3 items excluded on skin picking, storing up things and sleeping less than other children (Bogt et al., 2003)	- taking one's mind off things - thinking about self-harm **- hearing things that others do not (I hear sounds or voices that other people think are not there.)** - twitching, nervous behaviour - repeating certain behaviours **-seeing things that others do not (I see things that other people think are not there.)** - displaying behaviours that others find strange - having ideas that others find strange - sleeping problems	Items rates as 0-not present through sometimes present to 2-very often present in the last six months

De Loore et al. (2007)	3 items derived from the Diagnostic Interview Schedule for Children (Poulten et al., 2000)	1. Have you ever had messages sent just to you through television or radio? 2. Have you ever thought that people are following you or spying on you? 3. Have you ever heard voices other people cannot hear?	
Scott et al. (2009) - final time point	Peters Delusional Inventory (21 items), (Peters, Joseph and Garety, 1999)	1. Do you ever feel as if you are under the control of some force or power other than yourself? 2. Do you ever feel as if you are a robot or zombie without a will of your own? 3. Do you ever feel as if you are possessed by someone or something else? 4. Do you ever feel as if your feelings or actions are not under your control? 5. Do you ever feel as if someone or something is playing games with your mind? 6. Do you ever feel as if people seem to drop hints about you or say things with a double meaning? 7. Do you ever feel as if things in magazines or on TV were written especially for you? 8. Do you ever think that everyone is gossiping about you? 9. Do you ever feel as if some people are not what they seem to be? 10. Do things around you ever feel unreal, as though it was all part of an experiment? 11. Do you ever feel as if someone is deliberately trying to harm you? 12. Do you ever feel as if you are being persecuted in some way? 13. Do you ever feel as if there is a conspiracy against you? 14. Do you ever feel as if some organisation or institution has it in for you? 15. Do you ever feel as if someone or something is watching you? 16. Do you ever feel as if you have some special abilities or powers? 17. Do you ever feel as if there is a special purpose or mission to your life? 18. Do you ever feel as if there is a mysterious power working for the good of the world? 19. Do you ever feel as if you are destined to be someone very important 20. Do you ever feel that you are a very special or unusual person? 21. Do you ever feel that you are especially close to God?	Measuring distress (not at all distressing- 1 throught to very distressing -5), preoccupation (hardly ever think about it -1 through to think about it all the time- 5) and conviction (don't believe it's true -1 through to believe it's absolutely true -5) in relation to each belief
Escher et al. (2002)	Brief Psychiatric Rating Scale (BPRS) (Overall and Gorham, 1962, Lukoff et al., 1986)3 delusions items on suspiciousness,	3 items: - suspiciousness - unusual thought content - grandiosity	1- 7 likert scale, score of 6 or 7 on any of these items was considered as delusional thinking

	unusual thought content, grandiosity		
Spauwen et al. (2006), baseline, EDSP Van der Werf et al. (2011), baseline, EDSP Cougnard et al. (2007), baseline, EDSP Goodwin et al. (2004), 10 items in bold	self-report Symptom Checklist-90-R (SCL-90-R)Psychoticism and Paranoia subscales (Derogatis, 1983)	**7.The idea that someone else can control your thoughts** 8.Feeling others are to blame for most of your troubles **16.Hearing voices that other people do not hear** **18.Feeling that most people cannot be trusted** **35.Other people being aware of your private thoughts** **43.Feeling that you are watched or talked about by others** **62. Having thoughts that are not your own** **68. Having ideas or beliefs that others do not share** 76. Others not giving you proper credit for your achievements 77. Feeling lonely even when you are with people 83. Feeling that people will take advantage of you if you let them 84. Having thoughts about sex that bother you a lot 85. The idea that you should be punished for your sins **87. The idea that something serious is wrong with your body** **88. Never feeling close to another person** **90. The idea that something is wrong with your mind**	Rated regarding how much the problem has 'bothered or distressed' the individual, rated on 5 point likert scale (not at all, moderately, quite a bit, extremely)
Spauwen et al. 2006 Van der Werf et al. 2011 EDSP Cougnard et al. (2007) EDSP	Munich-Composite International Diagnostic Interview (M-CIDI), DIA-X/M-CIDI (Wittcher and Pfister, 1997), updated version of the World Health Organisation's CIDI version 1.2 (WHO, 1990), standardized computer-assisted diagnostic interview in accordance with the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV)	Spauwen et al: at final follow-up core, 15 core psychosis items on M-CIDI (delusions 11), hallucinations (4): G3-G5, G7-G14, G17, G18, G20, G21 - covering classic psychotic experiences, involving persecution, thought interference and auditory hallucinations -items read through by participants and then discussed with psychologist Van der Werf et al. (2011)T2 and T3: 20 core psychosis items of the DIA-X/M-CIDI-G section: G1, G2a, G3-G5, G7-G13, G13b, G14, G17, G18, G20, G20c, G21, G22a - including symptoms of delusions, hallucinations and passivity phenomena Cougnard et al. (2007): 15 M-CIDI core psychosis items on delusions (11 items) and hallucinations (4 items) used to assess the presence of psychotic experiences: G3-G5, G7-G14, G17, G18, G20, G21	- participants first read a list all the psychotic experiences and were then asked whether they ever experienced these symptoms, all items rated as present or absent, no intermediate levels -assessments undertaken by clinical psychologists

Appendix B. Table to show ratings for each question of the EPHPP Quality Tool (adapted taking into account quality questionnaire applied by Rubio, Sanjuan, Florez-Salamanca and Cuesta, 2012)

	Domain: Selection bias		**Domain: Design**			**Domain: PLE verification**	**Domain: Data collection Tools PLEs**		**Domain: Data collection Tools predictors**		**Domain: Withdrawals and Dropouts (rates)**		**Domain: Consideration of missing data and drop outs**	**Domain: Consideration of Power**		**Domain: Adequacy of Analysis**
	Q1	Q2:	Q1:	Q2:	Q3:	Q1:	Q1:	Q2:	Q1:	Q2:	Q2	Q1	Q1	Q1	Q2	Q1
Escher et al. (2002)	3	4	1	2	3	2	2	2	1	1	1	2	3	3	3	3
Goodwin et al. (2004)	1	5	2	2	3	1	1	2	1	1	1	1	3	3	3	1
De Loore et al. (2007)	1	5	2	2	3	1	1	2	2	2	2	4	3	3	3	2
Scott et al. (2009)	2	5	2	2	1	2	2	2	1	1	1	2	1	3	3	3
Wigman, Lin et al. 2011	2	2	2	2	1	2	1	1	1	1	1	2	1	3	3	1
Spauwen et al. 2006	1	5	1	2	1	1	1	1	1	1	1	2	3	2	3	1
Cougnard et al. (2007)	1	5	1	2	1	1	1	1	1	1	1	2	3	3	3	1
Van der Werf et al. (2011)	1	5	1	2	3	1	1	1	1	2	1	2	3	3	3	1

Wigman, van Winkel et al. (2011)	1	5	2	2	3	2	1	1	2	2	1	1	3	3	3	2
Wigman et al. (2012)	1	5	2	2	3	2	1	1	3	2	1	1	3	3	3	1
Lin et al. (2011)	2	5	2	2	3	2	1	1	1	1	1	3	2	3	3	1
Collip et al. (2013)	2	5	2	2	3	2	1	1	2	2	1	3	2	3	3	1
Mackie et al. (2011)	2	5	2	2	3	2	1	1	1	1	1	1	1	3	3	1
Mackie et al. (2013)	2	5	2	2	3	2	1	1	1	1	1	2	2	3	3	2
Thapar et al. (2012)	1	5	2	2	3	2	1	1	1	1	1	2	1	3	3	2
Sullivan et al. (2014)	1	5	2	2	3	1	1	1	1	1	1	4	1	3	3	1
Thompson et al. (2014)	1	5	2	2	3	1	1	1	2	1	1	4	1	3	1	2
Wolke et al. (2014)	1	5	2	2	3	1	1	1	1	1	1	4	2	3	3	1

Appendix C. Table to show Global Domain Ratings for the adapted EPHPP Quality Assessment Tool.

Study	Selection Bias	Study Design	PLE verification	PLE measures	Predictor measures	Combined measures rating	Confounders	Withdrawal and Dropouts	Missing Data and Dropouts considered	Adequate consideration of Power	Adequate Analysis	Total Rating According to EDSP	Total rating (Analysis domain)
Escher et al. (2002)	Weak	Moderate	Moderate	Moderate	Strong	Moderate	Weak	Moderate	Weak	Weak	Weak	Weak	Weak
Goodwin et al. (2004)	Moderate	Weak	Strong	Moderate	Strong	Moderae	Weak	Strong	Weak	Weak	Strong	Weak	Moderate
De Loore et al. (2007)	Moderate	Weak	Moderate	Moderate	Moderate	Moderate	Weak	Weak	Weak	Weak	Moderate	Weak	Weak
Scott et al. (2009)	Moderate	Moderate	Moderate	Moderate	Strong	Moderate	Strong	Moderate	Strong	Weak	Weak	Strong	Moderate
Wigman, Lin et al. 2011	Moderate	Moderate	Weak	Strong	Strong	Strong	Weak	Moderate	Strong	Weak	Strong	Moderate	Strong
Spauwen et al. 2006	Moderate	Strong	Strong	Strong	Str**o**ng	Strong	Strong	Moderate	Weak	Moderate	Strong	Strong	Strong
Cougnard et al. (2007)	Moderate	Strong	Strong	Strong	Strong	Strong	Strong	Moderate	Weak	Weak	Strong	Strong	Strong
Van der Werf et al., (2011)	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong	Moderate	Weak	Weak	Strong	Strong	Strong

Wigman, van Winkel et al. (2011).	Moderate	Weak	Weak	Strong	Moderate	Moderate	Weak	Strong	Weak	Poor	Moderate	Weak	**M**oder**a**te
Wigman et al. (2012)	Moderate	Weak	Weak	Strong	Weak	Weak	Strong	Strong	Weak	Poor	Strong	Weak	Weak
Lin et al. (2011)	Moderate	Weak	Weak	Strong	Strong	Strong	Strong	Weak	Moderate	Poor	Strong	Weak	Weak
Collip et al. (2013)	Moderate	Weak	Weak	Strong	Moderate	Moderate	Weak	Weak	Moderate	Weak	Strong	Weak	Weak
Mackie et al. (2011)	Moderate	Weak	Weak	Strong	Strong	Strong	Strong	Strong	Strong	Poor	Strong	Moderate	Moderate
Mackie et al. (2013)	Moderate	Weak	Weak	Strong	Strong	Strong	Weak	Moderate	Moderate	Poor	Moderate	Weak	Moderate
Thapar et al. (2012)	Moderate	Weak	Weak	Strong	Strong	Strong	Strong	Moderate	Strong	Poor	Moderate	Moderate	Moderate
Sullivan et al. (2014)	Moderate	Weak	Strong	Strong	Strong	Strong	Weak	Weak	Strong	Weak	Strong	Weak	Weak
Thompson et al. (2014)	Moderate	Weak	Moderate	Strong	Moderate	Moderate	Strong	Weak	Strong	Moderate	Moderate	Weak	Weak
Wolke et al. (2014)	Moderate	Weak	Strong	Strong	Strong	Strong	Strong	Weak	Moderate	Weak	Strong	Weak	Weak

Appendix D. Key to adapted EPHPP Quality Assessment Tool

Domain 1: Selection Bias

Q1: Are the individuals selected to participate in the study likely to be representative of the target population?

1: Very likely (random selection of list of individuals in the target population)

2: Somewhat likely (selected from source (clinic) in systematic manner)

3: Not likely (self-referred)

4: Can't tell

Q2: What percentage of selected individuals agreed to participate?

1: 80 - 100% agreement

2: 60 – 79% agreement

3: less than 60% agreement

4: Not applicable

5: Can't tell

Selection Bias Global Rating:

Strong: The selected individuals are very likely to be representative of the target population (Q1 is 1) and there is greater than 80% participation (Q2 is 1).

Moderate: The selected individuals are at least somewhat likely to be representative of the target population (Q1 is 1 or 2); and there is 60 - 79% participation (Q2 is 2). 'Moderate' may also be assigned if Q1 is 1 or 2 and Q2 is 5 (can't tell).

Weak: The selected individuals are not likely to be representative of the target population (Q1 is 3); or there is less than 60% participation (Q2 is 3) or selection is not described (Q1 is 4); and the level of participation is not described (Q2 is 5).

Domain 2: Study Design

Q1: Rationale given for selection of sample with regard to developmental stage.

1: Rationale provided

2: No rationale provided

Q2: Rationale given for duration of follow up

1: Rationale provided

2: No rationale provided

Q3: Exclusion at baseline of those diagnosed with psychotic disorder/UHR

1: Sensitivity analyses or excluded

2: Percentages reported

3: No information

Design Global Rating:

Strong: Rationale is given for both developmental stage and length of follow up (Q1 and Q2 have a rating of 1) and those with psychotic disorder at baseline or UHR status have been excluded or reported (Q3 has a rating of 1 or 2).

OR

Those with psychotic disorder or UHR status have been excluded (Q3 has a rating of 1) and rationale was provided for either the length of follow up or developmental stage of the sample (either Q1 or Q2 have a rating of 1).

Moderate: A score of 1 on any of the three questions OR a score of 2 on item 3.

Weak: A rating of 2 on Q1 and Q2 and a rating of 3 on Q3.

Domain 3: Confounders

Q1: Were confounders considered and a rationale was provided for inclusion or exclusion?

1: Rationale provided or analyses reported with and without confounders **(Strong)**

2: No rationale provided and analyses not reported without confounders **(Weak)**

Domain 4.1: PLE Measure (validity and reliability)

PLE tools, validity and reliability of measures demonstrated for their stated purpose in this sample

Q1: PLEs validity

1: Yes

2: Face validity

3: No/questionable face validity

Q2: PLEs reliability

1: Yes

2: No

3: Can't tell

PLE Measure Global Rating:

Strong: The data collection tools have been shown to be valid (Q1 is 1); and the data collection tools have been shown to be reliable (Q2 is 1).

Moderate: The data collection tools have been shown to be valid (Q1 is 1) or have been shown to have face validity (Q1 is 2); and the data collection tools have not been shown to be reliable (Q2 is 2) or reliability is not described (Q2 is 3).

Weak: The data collection tools have not been shown to be valid (Q1 is 2) or both reliability and validity are not described (Q1 is 3 and Q2 is 3).

Domain 4.2: Predictor Measures (validity and reliability)

Predictor measures, validity and reliability of measures demonstrated for their stated purpose in this sample

Q1: Predictor measures validity

1: Yes

2: Face validity

3: No/questionable face validity

Q2: Predictor measure reliability

1: Yes

2: No

3: Can't tell

Predictor Measure Global Rating:

Strong: The data collection tools have been shown to be valid (Q1 is 1); and the data collection tools have been shown to be reliable (Q2 is 1).

Moderate: The data collection tools have been shown to be valid (Q1 is 1) or have been shown to have face validity (Q1 is 2); and the data collection tools have not been shown to be reliable (Q2 is 2) or reliability is not described (Q2 is 3).

Weak: The data collection tools have not been shown to be valid (Q1 is 2) or both reliability and validity are not described (Q1 is 3 and Q2 is 3).

Domain 4.3: Measures (combined) validity and reliability

All Measure Global Rating:

Strong: Both the PLE and predictor data collection tools have been rated as strong.

Moderate: Both the PLE and predictor data collection tools have been rated as moderate or one has been rated as moderate and the other as strong.

Weak: Either the PLE or predictor data collection tools have been rated as weak.

Domain 4.4: PLE Measure verification

1. PLEs validity verified by interview **(Strong)**

2. Narrow definition (exclusion of PLEs related to sleep or fever) **(Moderate)**

3. PLE validity not verified **(Weak)**

Domain 5: Withdrawals and Dropouts (rates)

Q1: Were withdrawals and drop-outs reported in terms of numbers per group?

1: Yes

2: No

3: Can't tell

Q2: Indication of the percentage of participants completing the study.

1: 80% - 100%

2: 60 – 79%

3: Less than 60%

4: Can't tell

Withdrawals and Dropouts Global Rating:

Strong: will be assigned when the follow-up rate is 80% or greater (Q2 is 1).

Moderate: will be assigned when the follow-up rate is 60 – 79% (Q2 is 2) OR Q2 is 5 (N/A).

Weak: will be assigned when a follow-up rate is less than 60% (Q2 is 3) or if the withdrawals and drop-outs were not described (Q2 is 4).

Domain 6: Consideration of Missing Data and Dropouts

Q1: Some consideration for missing data and differences in drop out analysed

1: both **(Strong)**

2: one **(Moderate)**

3: none **(Weak)**

Domain 7: Adequate Power

Q1: Consideration for and discussion of power of analyses conducted

1: discussed and all analyses powered

2: discussed

3: not mentioned

Q2: Multiple testing considered/p-value adjusted or justified why not adjusted

1: considered

2: not considered

Adequate Power global rating:

Strong: Analyses powered or power only discussed (Q1 is 1 or 2) and Multiple testing considered (Q2 is 1)

Moderate: Either analyses powered/ power discussed (Q1 is 1 or 2) or Multiple testing considered (Q2 is 1)

Weak: Neither analyses powered/power discussd (Q1 is 3) or Multiple testing considered (Q2 is 2)

Domain 8: Adequate Analyses

1: Analysis most likely to yield most accurate parameters (modelling entire data sets) **(Strong)**

2: Analysis appropriate but not modelling entire datasets, not taking into account predictors' effects over and above effects of other predictors (all predictors in the same model) **(Moderate)**

3: Analyses inadequate or information presented on analyses inconclusive **(Weak)**

Total Score (adapted from EPHPP)

Rated across 5 domains: selection bias, study design, confounders, data collection method and withdrawals and dropouts

STRONG (no WEAK ratings)

MODERATE (one WEAK rating)

WEAK (two or more WEAK ratings)

Total Score (Adequate Analysis included instead of confounders)

Rated across 5 domains: selection bias, study design, data collection method, withdrawals and dropouts and adequacy of analysis

STRONG (no WEAK ratings)

MODERATE (one WEAK rating)

WEAK (two or more WEAK ratings)

Empirical Project

Differences in psychosocial correlates of childhood psychotic-like experiences according to their dimensional attributes and content/type.

Supervised by

Dr. Suzanne Jolley, Institute of Psychiatry, Psychology and Neuroscience

and

Dr. Catherine Stewart, South London & Maudsley NHS Foundation Trust and Institute of Psychiatry, Psychology and Neuroscience

TABLE OF CONTENTS

Abstract

Schizophrenia is a mental health condition, which is heterogeneous in presentation and outcome. Recent research in adults has found that specific psychosis symptoms can be predicted by unique psychosocial risk factors. Research on subclinical psychotic-like experiences (PLEs) in children and young people, has shown that similar risk factors predicting psychotic symptoms also predict PLEs and has shown some indication that PLEs cluster into sub-dimensions by content type and dimension (conviction, frequency and associated distress and life impact) and that these are uniquely predicted by specific psychosocial risk factors. This cross sectional study investigated the predictive value of 'jumping to conclusions' (JTC) reasoning bias, affect and the number of negative life events in an inpatient adolescent sample (N = 56 to 64, depending on analysis) as previously found by Ames et al., (2014). The study also aimed to replicate the association of these risk factors with particular content types (hallucinations, grandiosity and paranoia) as found by Ruffell et al., (2015). The severity of PLEs was associated with the putative psychosocial factors of life events and emotional problems predicting about 25 % of the variance in overall PLE severity in a linear regression model. Additionally these psychosocial factors were significantly associated with delusions and hallucinations as hypothesised, and also with conviction, frequency and distress/impact of PLEs. It was not possible to conclusively delineate whether the variables were associated with the risk factors over and above one another due to high collinearity of variables. No effects for JTC were found, but power was limited for the analyses involving JTC. Recommendations for future research and clinical implications are discussed.

Introduction

The latent structure of schizophrenia

Schizophrenia as defined by current diagnostic classification systems, refers to a cluster of positive, negative and disorganised symptoms leading to significant impairment for the individual. However current classification systems, the Diagnostic and Statistical Manual of Mental Disorders, DSM V (American Psychiatric Association, 2013) and the International Statistical Classification of Diseases and Related Health Problems, ICD -10 (World Health Organization, 2004), do not claim that their diagnostic construct or threshold maps onto any theoretical underlying construct of schizophrenia but instead serves clinical utility.

Population studies have observed a higher prevalence of subclinical psychotic-like symptoms than of clinical psychosis, giving rise to the hypothesis of continuity of schizophrenia (Van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009). Linscott and Van Os (2010) argue that considerations of continuity versus discontinuity generate three main questions regarding the latent structure of schizophrenia. The first question is whether the causal processes giving rise to the disorder are the same as those giving rise to the phenomena that resemble the signs and symptoms of schizophrenia. The second question is whether there is phenomenological continuity over time within individuals, supposing a trajectory of subclinical signs or symptoms which, through moderation and mediation by intrinsic and extrinsic factors lead to the onset of clinically significant disorder in some individuals. The third question concerns continuity in population structure, asking whether general population sample variability in schizophrenia manifestation arises from graded individual differences within a single population or whether the variability is a product of two or more discontinuous homogenous subpopulations or a combination of the two.

Linscott and Van Os (2010), conducted a systematic review of the literature regarding continuity of phenomenology and continuity of population structure. They concluded that the current state of the literature, bearing in mind significant design limitations, suggests that ‘discontinuous subpopulations underlie a continuum of experience’. They conclude that there is clear evidence of continuity between clinical signs and symptoms (positive, negative and schizophrenia-like (disorganisational) subclinical experiences and behaviour) and diagnosable disorder, although

they also identify several artefacts i.e. cohort variables such as convenience sampling, response rate and mean age of cohort, assessment variables, such as number of items in assessment instrument and the reference interval or period and experience criterion variables and analyses variables) giving rise to results in support of phenomenological continuity. Additionally they conclude that evidence is inconsistent with a continuum view on population structure and that the weight of the evidence supports the notion of a non-arbitrary boundary between those within a psychometric risk category of schizophrenia (capturing an estimated 11% of the population) and those not at psychometric risk of schizophrenia.

Discontinuity in population structure/latent subgroups within schizophrenia psychopathology – a theoretical perspective

Another issue is that of non-arbitrary schizophrenia subtypes. Schizophrenia is a heterogeneous condition both with regards to symptom profiles and clinical outcome, but the identification of meaningful and stable subtypes has proven difficult (Seaton, Goldstein and Allen, 2001). Historically attempts to classify subtypes have ranged from the causal distinction between process and reactive schizophrenia (Herron, 1962), to clustering schizophrenia based on the dominance of positive or negative symptoms in presentation (Andreasen, 1982). Numerous factor analytic studies have arrived at a three dimensional structure of symptoms, including positive, negative and disorganised symptoms (Seaton, Goldstein, & Allen, 2001).

Seaton et al. (2001), proposed a model with both cognitive and symptom heterogeneity, suggesting that this heterogeneity is multiply determined. Some heterogeneity, in particular with regards to cognitive function, is attributed to the variability expected in any diverse population. However some of the cognitive and most of the symptom variability is attributed to the schizophrenia itself. In their systematic review they point to the distinction between subtypes and symptom clusters derived by factor analysis, with cluster membership determined by level of performance as opposed to discontinuity in population structure. They propose multidisciplinary studies to determine unique profiles across behavioural, neurobiological and genetic dimensions.

Linscott and Van Os (2010), in their systematic review point to a paucity of high quality studies investigating schizophrenia-related phenotype boundaries within psychopathology. Only a study

by Blanchard, Horan, and Collins (2005) was identified as meeting their inclusion criteria (studies reviewed were limited to those employing coherent-cut kinetic and factor mixture modelling analyses as opposed to factor or latent class analysis). This study reported evidence of a non-arbitrary boundary between deficit and non-deficit schizophrenia.

From a clinical point of view, research on heterogeneity of presentation is less concerned with identifying aetiologically different latent subtypes, but instead is focused on the identification of symptoms, symptom clusters and symptom characteristics, which are related to need for care, poor functional outcome and distress. Within this, in order to develop and refine psychosocial treatments, research has focused on identifying those components of schizophrenia and the mechanisms associated with them, that are amenable to change through psychosocial interventions or preventative measures.

A clinical perspective on heterogeneity and models of predictors of positive psychotic experiences

Intervention development research of this kind has predominantly focused on positive symptoms in schizophrenia, such as delusions and anomalous perceptual experiences. Garety, Kuipers, Fowler, Freeman, and Bebbington (2001), proposed 'a cognitive model of the positive symptoms of psychosis', aiming to provide a psychological description of psychotic phenomena, which allows the derivation of testable hypothesis concerning causal processes. The authors conceptualise hallucinations and delusions in one framework, and propose two pathways to positive psychotic experiences. In the first a triggering event leads to a disruption of basic automatic cognitive processes leading to anomalous conscious experiences. These experiences are attributed externally and delusions are formed through processes such as emotional changes (depression and anxiety) and biased conscious appraisal, such as externalising attributional styles, belief confirmation biases and a jumping to conclusions data gathering style. The second route proposes the formation of delusional belief in the absence of anomalous perceptual experiences, where life events trigger negative affect, and the activation of biased appraisal processes, leading to an external appraisal (the delusion). Positive psychotic experiences are proposed to be maintained by similar factors to those implicated in causing them; reasoning processes, negative affect, adverse social environments, marked by negative intrusive life events,

trauma and stress. On the cognitive level Garety et al. (2001), propose that negative schemas predating the onset of disorder and secondary appraisals of the developing disorder further influence the development of positive psychotic experiences, with their maintenance being closely linked with affect and negative social environments.

Brett-Jones, Garety, and Hemsley (1987), proposed that positive psychotic experiences are multidimensional and vary not just by content type but by characteristics, such as degree of conviction, frequency of experience and associated distress and life impact. Freeman (2007), argues that what follows from this is that each dimension of delusional experience needs to be understood in isolation (i.e. cause of the content, degree of belief conviction, resistance to change and distress) and that it is plausible that different factors are relevant for different dimensions of delusional experiences.

Research has indicated that discrete and differing psychological mechanisms and risk factors are associated with both content type and dimensions associated with positive psychotic experiences.

Associations between psychosocial predictors, paranoia and hallucinations

There is evidence that negative life events, trauma and negative affect are linked to the formation and maintenance of paranoid delusions and hallucinations.

Freeman (2007), in his systematic review on paranoid delusions, notes that anxiety has repeatedly been found to be associated with paranoid thoughts (Fowler et al., 2006; Freeman, Garety, et al., 2005; Johns et al., 2004; Martin & Penn, 2001) and persecutory delusions (Freeman & Garety, 1999; Huppert & Smith, 2005; Naeem, Kingdon, & Turkington, 2006; Startup, Freeman, & Garety, 2007). Anxiety has also been shown to be predictive of the occurrence of paranoid thoughts (Freeman & Garety, 2003; Freeman, Garety, et al., 2005) and of the persistence of paranoid delusions (Startup et al., 2007). Additionally, paranoia has been found to be associated with lower self-esteem and higher depression (Ellett, Lopes, & Chadwick, 2003; Fowler et al., 2006; Freeman, Dunn, et al., 2005; Johns et al., 2004; Martin & Penn, 2001). Freeman et al. (2012), found that insomnia, worry anxiety and depression were potential risk factors for the inception of new, as well as the maintenance of established, paranoid thinking. Furthermore,

Freeman et al. (2013) found that depression and anxiety were highly prevalent and significantly associated with paranoia, in their sample of people with non-affective psychosis experiencing paranoid delusions. Fowler et al. (2011), employing a longitudinal design in a clinical sample, found that the link between depressed mood and paranoia appeared to be mediated by negative cognition. Similar links between affect and hallucinations have been found (Freeman & Garety, 2003). Smith et al. (2006), found that individuals with more depression and lower self-esteem had auditory hallucinations of greater severity and more intensely negative content, and were more distressed by them.

Research has further identified a specific link between trauma and paranoia and hallucinations. Gracie et al. (2007), in a student sample, found that post-traumatic stress disorder predisposed individuals to both paranoia and hallucinations, with PTSD re-experiencing symptoms most strongly linked to a predisposition to hallucinations (albeit only explaining 3% of the variance), and negative beliefs about the self to a predisposition to paranoia. Freeman and Fowler (2009), found, that a history of trauma (in particular severe childhood sexual abuse and non-victimisation events) was associated with both persecutory delusions and hallucinations. The effect of trauma history on delusions was mediated by anxiety. This was not found to be the case for hallucinations. Raune, Bebbington, Dunn, and Kuipers (2006), examining delusions and hallucinations by content type in a sample of individuals who had a first episode of psychosis, found that intrusive life events were associated with the development of hallucinations with persecutory themes. Trauma has been found to be associated with hallucinations (Read, Agar, Argyle, & Aderhold, 2003) with hallucinations also observed in PTSD (Hamner et al., 2000). Hardy et al. (2005), found that over half of their sample who experienced hallucinations had experienced a subjectively significant trauma and that for 30.6 percent of the total group this trauma had at least one type of phenomenological association to their hallucinations.

Associations between reasoning biases and grandiosity

The jumping to conclusions bias (JTC), or hasty data gathering has been consistently associated with the presence of delusions (Dudley, Taylor, Wickham, & Hutton, 2015; Freeman, 2007; Garety et al., 2012). Similarly, Fine, Gardner, Craigie, and Gold (2007) in a series of meta-analyses in which the jumping to conclusions bias was assessed with the 'beads task', found that

a tendency to gather less evidence was reliably associated with the presence of delusional symptoms. The JTC bias was not amplified by emotionally salient material. Additionally there is evidence that JTC and other explanatory and confirmatory biases appear to be more prominent in those with grandiose beliefs over and above delusions of other types (Jolley et al., 2010, Garety et al., 2012; Knowles, McCarthy-Jones, & Rowse, 2011).

Garety et al. (2012), found that negative self-evaluations and depression and anxiety were significantly associated with persecutory delusions whilst grandiose delusions were predicted by less negative self-evaluations, lower anxiety and depression, higher positive self and other evaluations. Although reasoning biases were common in both groups, those in the grandiose group were significantly more likely to display reasoning biases, including JTC, than those in the persecutory group. People with grandiose delusions have been found to display externalising and self-serving attributional biases, in contrast to a more 'depressive' cognitive style associated with persecutory delusions (Knowles et al., 2011; Smith et al., 2006).

Associations between psychosocial predictors and dimensions of positive psychotic experiences

Reasoning biases have been linked to the degree of conviction with which delusions are held. Contrasting grandiose and paranoid delusions, Appelbaum, Robbins, and Roth (1999) found, in a clinical population sample, that grandiose and religious delusions were held with the greatest conviction, whereas persecutory delusions were characterised by strong negative affect and a propensity to act. In a number of recent investigations, the link between JTC and other reasoning biases and conviction of delusions was confirmed (Garety et al., 2005; So et al., 2012). Trauma and adverse life events, possibly through re-experiencing or poor processing, have been associated with increased occurrence (i.e. frequency), particularly of hallucinatory experiences, but also other perceptual anomalies and distressing beliefs (Birchwood, Meaden, Trower, Gilbert, & Plaistow, 2000; Freeman & Fowler, 2009; Gracie et al., 2007; Raune et al., 2006). Alongside this, there is evidence that negative affect, such as depression and anxiety is particularly linked to the distress associated with the experience of delusions. Startup et al. (2007), found that high levels of anxiety, worry and catastrophizing were associated with high levels of persecutory delusion distress and with persistence of delusions over a three months period.

Content type and dimensions of psychotic-like experiences in children and young people

As discussed in the previous chapter of this thesis, psychotic-like experiences (PLEs) are symptoms that resemble the presentation of clinical disorder, albeit at a subclinical level. They are much more common in childhood than in adulthood, and mostly remit over time, although they are associated with a range of adverse mental health outcomes, particularly when persistent (Laurens et al., 2011, Kelleher et al., 2012). Most child-focused measures of PLEs focus on subclinical positive symptoms (Kelleher, Harley, Murtagh, & Cannon, 2011). Within a framework of phenomenological and causal continuity of psychosis, PLEs are hypothesised to be 'a non-silent behavioural expression of increased psychosis liability' (Wigman et al., 2012), p. 353, (Linscott & Van Os, 2013; Van Os et al., 2009).

With regards to understanding PLEs as subclinical expressions of psychosis vulnerability, one indicator in favour of this hypothesis is that factors implicated in the onset of psychosis have been found to be the same as those implicated in the onset and maintenance of PLEs in both adults and children, implying similar aetiology. (Linscott & Van Os, 2013; Scott et al., 2009; Van Os et al., 2009). Ames et al. (2014), found that a model including emotional symptoms, jumping to conclusions bias and negative life events explained 50 percent of the variance in PLEs in a sample of 8 -14 year old children referred to a community child and adolescent mental health service. Hassanali et al. (2015), found that the presence of PLEs was significantly associated with the presence of the JTC bias, irrespective of age and task comprehension (employing a slightly modified version of the beads task for young people). Consequently it appears that those factors hypothesised by Garety and colleagues (Garety, Bebbington, Fowler, Freeman, & Kuipers, 2007; Garety et al., 2001) in their 'cognitive model of the positive symptoms of psychosis', might play a similar role in childhood PLEs.

If the incidence of PLEs is an indication of an 'at psychometric risk of psychosis' subpopulation (Linscott & Van Os, 2013) and possibly an expression of an underlying schizophrenia liability or phenotype, understanding which psychosocial and cognitive factors are implicated in the occurrence and maintenance of PLEs is crucial to intervening successfully in order to ameliorate potential unfavourable outcomes. It is further conceivable that, just like positive clinical symptoms, PLEs vary by content type and dimensions and that distinct and separate factors are implicated

in the development of PLE sub-dimensions. This could be of relevance with regards to understanding transition to psychotic disorder, with sub-dimensions of symptoms potentially differing in their association to clinical disorder (Wigman, Vollebergh, et al., 2011) as well as their responsiveness to particular interventions (Ruffell et al., 2015).

Evidence for sub-dimensions of PLEs is mixed. In a sample of 9 – 11 year old school children, Laurens and colleagues (Laurens, Hobbs, Sunderland, Green, & Mould, 2012) found that PLEs (measured by the nine item Psychotic-like Experiences Questionnaire, PLEQ) clustered into a single factor, strongly associated with both internalising and externalising psychopathology. However Wigman, Vollebergh, et al. (2011), using the Community Assessment of Psychic Experiences questionnaire (CAPE, 20 items), in a sample of 12 – 16 year olds, found that PLEs were best represented by five underlying dimensions, labelled 'hallucinations', 'delusions', 'paranoia', 'grandiosity' and 'paranormal beliefs' (this five-dimensional structure was replicated by Wigman et al. (2012) in a sample of young adult females). Three further studies derived similar factors using the CAPE as their measure of PLEs. Armando, Nelson, Yung, Ross, Birchwood, Girardi, and Fiori Nastro (2010), arrived at five factors labelled 'bizarre experiences', 'perceptual abnormalities', 'persecutory ideas' and 'grandiosity'. Similarly (Yung et al., 2009a), arrived at a three factor structure of 'bizarre experiences', 'persecutory ideas', and 'magical thinking', and (Yung et al., 2006) identified the components 'bizarre experiences', 'perceptual abnormalities', 'persecutory ideas' and 'magical thinking'.

Psychosocial predictors of psychotic-like experiences in children and young people

There is emerging evidence that sub-dimensions of PLEs are associated with discrete and differing psychological mechanisms and risk factors. Persecutory ideas and bizarre experiences have consistently been linked with distress, depression and poor functioning (Armando, Nelson, Yung, Ross, Birchwood, Girardi, & Nastro, 2010; Yung et al., 2006; Yung et al., 2009b) to a greater extent than 'magical thinking' (Yung et al., 2006 and Alison et al., 2008) and perceptual abnormalities and grandiosity (Marco Armando, Nelson, Yung, Ross, Birchwood, Girardi, & Nastro, 2010). Ruffell et al. (2015) investigated variations in the psychosocial processes found by Ames et al., (2014) to be associated with self-reported PLE severity (reasoning, negative life events and emotional problems) in relation to PLE dimensions (frequency, conviction and a

combined distress and impact score) and content type (according to the established 'five factor' model; Wigman, Vollebergh, et al., 2011) in a clinically referred sample of 8 -14 year olds using the 9 item 'psychotic-like experiences questionnaire', PLEQ (Laurens et al., 2012). Regression analyses revealed associations of: reasoning biases with the dimension of conviction and the content domain of grandiosity; of negative life events with the dimension of frequency, and the content domains of hallucinations and paranoia; and of emotional problems with the PLE dimension distress/adverse life impact and the content domains of paranoia and hallucinations.

Such studies require replication, in different populations and across the spectrum of clinical severity, before they can reliably inform intervention development. The present study aimed to contribute to this endeavour by investigating psychosocial correlates of PLEs in an adolescent inpatient sample, comprising young people with severe mental health conditions.

Current Study

This study aimed to replicate the investigations by Ruffell et al. (2015) and Ames et al. (2014) in a slightly older adolescent inpatient sample (aged 12 to 18 years) with a more severe clinical presentation.

More specifically, to replicate Ruffell et al. (2015) it was investigated whether the same baseline associations between PLE dimensions and content types with the psychosocial factors, 'jumping to conclusions bias', 'negative life events' and 'emotional problems' could be found. And in order to replicate Ames et al. (2014) the association of these factors with overall PLE severity was tested.

Ruffell et al. (2015), aimed to test whether specific associations between psychosocial factors ('jumping to conclusions bias', 'negative life events' and 'emotional problems') with PLE subdimensions, which had been found in adult populations, could also be established in a clinically referred child population with the view to inform the development of individualised treatment protocols and to test whether psychological models of the onset and persistence of psychosis can inform the understanding of onset and persistence of childhood PLEs. The design was cross-sectional and 72 children aged 8 -14 years completed the battery. In order to establish

subdimensions the authors grouped these by content but also completed a confirmatory factor analysis. Statistical power of the investigation was not reported and given that this was the first investigation of this nature no effect size estimates were available. Given the size of the sample, correlations of r = .39 magnitude could be detected with .8 per cent power and alpha set to .1 to control for multiple testing. Therefore, the study was limited with regards to detecting effects of a smaller magnitude. The authors concluded that their results allowed the tentative conclusion (given the limitations of the study) that the cognitive model of psychosis derived from studies on adult psychosis appears consistent and can be applied to subthreshold PLE's in children. In order to strengthen this conclusion and develop a model of the possible delineation of pathways by which transient and non-distressing PLE's might develop into distressing and persistent phenomena, associated with greater future mental health risk, further studies are needed that ideally look at cohorts longitudinally or investigate samples that vary with regards to key characteristics such as age, and severity of presentation. This will increase the understanding of the pathway from subclinical PLEs to more severe psychotic phenomena, likely characterised by a dynamic interplay between risk factors and symptom profiles across development.

Similarly, Ames et al. (2014) aimed to test whether psychosocial risk factors implicated in the development and maintenance of psychosis in adults ('jumping to conclusions bias', 'negative life events' and 'emotional problems') had explanatory value for the severity of PLE's in children. Similarly to Ruffell et al. (2015), they investigated whether adult models of psychosis can be accurately applied to subclinical symptoms in children, with the view to developing targeted interventions, informed by adult models. Their cross sectional sample comprised of 40 clinically referred 8 -14 year old (note: samples of Ames et al. 2014 and Ruffell et al. 2015 overlapped, so findings from these studies are not entirely independent of one another). Power calculations were not reported but due to their relatively small sample the study was not powered to detect smaller effects. The authors found that the key psychological processes proposed by the cognitive model of psychosis independently contributed to overall PLE severity and tentatively concluded that the cognitive model of psychosis can be applied to childhood PLEs. Again for this conclusion to be strengthened, these findings need to be verified across samples varying with regards to age and severity of presentation.

The measures chosen for these constructs were the PLEQ to measure PLEs, the 'emotional problems' subscale of the Strengths and Difficulties Questionnaire (as a measure of affect), and the beads task as a measure of JTC. A checklist of traumatic life experiences was included to measure negative life events. (See Appendix A. for measures). Ethical approval for the study was granted by the London Brent ethics committee (Reference 12/LO/1984).

The following hypothesis were posited:

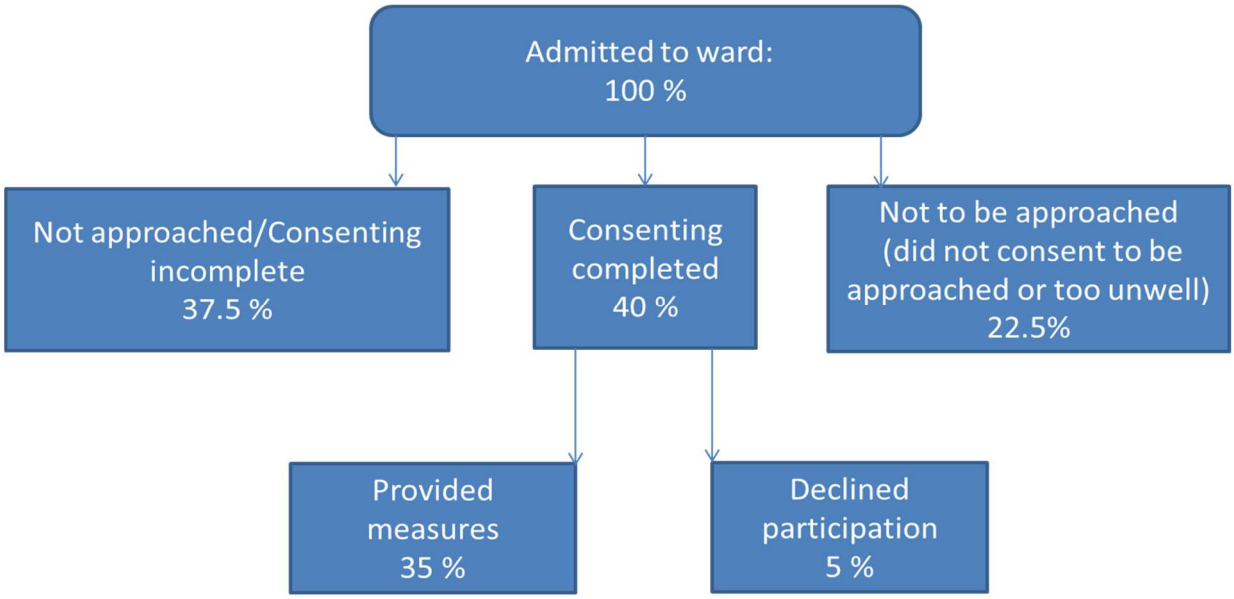
1. Hypothesis 1: Overall PLE severity will be associated with the psychosocial factors of 'emotional problems', 'life events' and JTC
2. Hypothesis 2: Emotional problems will be associated specifically with PLE distress/impact, paranoia and hallucinations
3. Hypothesis 3: Frequency of traumatic life events will be associated specifically with PLE frequency and the occurrence of hallucinations and paranoia
4. Hypothesis 4: Reasoning biases will be associated specifically with PLE conviction and grandiosity

Methods

Participants and Recruitment

Participants were recruited from November 2014 until January 2016 for this project, which was part of a larger study of young people with an admission to adolescent inpatient units (the Inpatient-stay Improvement Study, IIS). There were no exclusion criteria. Unusual experiences are trans-diagnostic phenomena, and young people with any diagnosis who were admitted to the ward could take part in the study. Non-English speaking young people could take part if the clinical team was able to book an interpreter. Hence all young people admitted were approached regarding participation if they or their families had agreed for them to be approached for research in general and they had demonstrated capacity (as routinely assessed by the treating clinician) to consent to research. Exceptions were if the ward team felt that young people were unsuitable for participation due to their clinical presentation (i.e. highly aroused or confused; at immediate risk of harm to themselves or others; or at risk of exacerbation of their condition due to the emotional and life experience content of assessment material being potentially too triggering of distressing memories, thoughts or feelings). Figure 1 outlines the representativeness of the sample in relation to the entire inpatient population at the time of testing. As data on sample representativeness were only available for the second recruitment wave, details provided only relate to the second phase of recruitment. Young people were usually admitted to the ward due to acute risk or difficulties in safely managing their mental health in the community; common presentations included first episode psychosis, personality disorders, obsessive compulsive disorder, depression, anorexia nervosa and post-traumatic stress disorder (see Table 1 for proportion of index problems in the sample).

Figure 1. Sample representativeness in relation to young people admitted to ward in percent



Measures

Demographic variables

Demographic variables (age, gender and black minority ethnic (BME) status) were self-reported and corroborated using the electronic patient record system/ medical record, from which participants' diagnosis and information regarding their care history such as length of stay and previous admissions was obtained

Psychotic-like Experiences Questionnaire

PLEs were assessed using a nine item scale assessing hallucinatory experiences and delusional beliefs termed the Psychotic-like Experiences Questionnaire, PLEQ (Laurens et al., 2012; Laurens et al., 2007). The first five items were adapted from the Diagnostic Interview Schedule (Costello et al. 1982) and four additional questions were added and validated in a community sample of children and adolescents by Laurens et al. (2007), who found moderate agreement between the PLEQ and the results of a subsequent clinical interview in a random sample of their screened population. They reported kappa scores of between 0.16 and 0.65 for agreement between clinician and child on each of the screening questions, with most falling into either the "fair agreement" (0.21–0.40) or the "moderate agreement" range (0.41–0.60).

Items, if endorsed, were rated across four dimensions: conviction (rated on a three point Likert scale: 0/not true; 1/somewhat true; 2/certainly true), frequency (rated on a four point Likert scale: 0/not at all through 1/only once; 2/two to four times; to 3/five or more times), associated distress and impact (each rated on a four point Likert scale: 0/not at all; 1/only a little; 2/quite a lot; a great deal).

Item totals were scored by summing the scores for each individual dimension rating and ranged from 0-11 per item. Content type scores (paranoia, hallucinations and grandiosity) were derived by scoring the item totals of those items found to load onto the respective factors in the factor analysis on endorsement ratings conducted by Ruffell et al. (2015). One paranoia item ('Have you ever thought that you were being followed or spied upon?') and two hallucination items ('Have you ever heard voices that other people could not hear?', 'Have you ever seen something or someone that other people could not see?') were identified by content and loaded onto separate factors. Additionally a cluster of the three grandiose/ bizarre items was identified ('Have you ever felt that you were under the control of some special power?', 'Have you ever felt as though your body had been changed in some way that you could not understand?' and 'Do you have any special powers that other people do not have?'). Hence the total for 'paranoia' ranged from 0 -11, for 'hallucinations' from 0 -22 and for 'grandiosity' from 0 -33.

The three dimension variables (conviction, frequency and distress/impact) were calculated by summing the scores across all nine items for conviction (possible range from 0 -18), frequency (possible range 0 -27) and combined distress impact ratings (possible range 0 -54).

Jumping to conclusions bias, JTC, on the 'beads task'

Two computerised versions of the Garety and colleagues' (2005) probabilistic reasoning task were used to assess the JTC bias. In the first task two jars of 100 orange and black beads were shown on screen with 85:15 and 15:85 ratios respectively. Participants were told that the jars were mixed by the computer and they were shown the jars with the different colour beads mixed in the jars. This was followed by instructions that participants would be shown one bead at a time chosen from one of the two jars, that the beads were chosen at random from this jar and that it was their task to guess which jar the beads were drawn from. It was made clear that beads were

returned to the jar after having been shown, that participants could request to see as many beads as they wished and that they should only decide when certain. Previously shown beads remained on screen and participants were asked after each bead whether they wished to decide now or see another bead. The sequence of beads was predetermined. The second task was identical except that beads were green and purple and the ratio of different colour beads was 60:40 and 40:60, respectively. JTC outcome was dichotomous with JTC defined as making a choice on the basis of two or fewer beads on at least one of the two beads tasks (Garety et al., 2005). The wording of the instructions was slightly simplified, with the permission and approval of the creator of the computerised version of the task, and the adapted version, called the 'Beads Game', has recently been validated in a sample of 5 – 14 year olds (Hassanali et al., 2015).

Negative Life events

Negative life events were assessed using a scale adapted from an adult trauma checklist (the Trauma History Questionnaire, (Green, 1996)) for use with adolescents particularly for the IIS project. It assessed the occurrence of ten types of events (serious illness, being in a serious accident, being in a natural disaster, being hurt physically, being hurt sexually, being hurt emotionally, seeing somebody else seriously hurt or killed, being bullied, scary or threatening contact with mental health services and other problem or experiences that led to coming to hospital that were scary or threatening (i.e. hearing voices, paranoid ideation). Participants rated each item on a three point frequency scale from 'no' (did not occur), 'happened only once' to 'happened more than once'. Life events outcome was computed as the number of difficult experiences endorsed as happening at least once. No distinction was made between events occurring only once or more than once.

Emotional problems (Strengths and Difficulties Questionnaire, SDQ)

The SDQ (Goodman, 2001) is a self-report questionnaire, comprised of five subscales of five items each (emotional problems, conduct problems, hyperactivity-inattention, peer relationship problems and prosocial behaviour). Each item is rated with regards to the past 6 months on a three point Likert scale: 0 (not true); 1 (somewhat true); 2 (certainly true). The emotional problems subscale was used as an indicator of low mood and anxiety. Scores on this subscale range from 0 -10, and a score of 7 is regarded as clinical cut-off whilst a score of 6 is regarded as indicative of 'borderline' emotional problems. The SDQ is used widely with young people and has been

shown to have good internal reliability, test-retest stability and validity in children aged 8 -16 (Goodman, 1997, 2001; Goodman, Meltzer, & Bailey, 2003).

Burt word reading test

The Burt Word reading test (Burt; Gilmore, Croft, & Reid, 1981) is a standardised test of context-free word recognition. Participants are presented with a list of 110 words of increasing difficulty, arranged in groups of ten and asked to read the words aloud. Testing continues until 10 consecutive words are not attempted or pronounced incorrectly. The total score is the number of correctly pronounced items (possible range from 0 – 110). Scores can be converted into reading age but raw scores were used for the purpose of this study.

Consent and Procedure

Consent was twofold. The first opt-in (step 1, 'mini IIS') allowed the project team to use for research purposes the data that were collected routinely on the ward and of which two measures overlapped with the battery of measures used for IIS, the SDQ; (Goodman, 2001) and the PLEQ (Laurens et al., 2012). Additionally, consent was obtained to access information on the electronic notes system/medical records to confirm demographic and clinical characteristics. The second opt-in (step 2) resulted in meeting the researcher at a time point close to admission (data used for the current baseline study) and, for the overarching study, at discharge.

A detailed protocol (see Appendix B.) was followed to ensure that consent was obtained appropriately from young people and parents (if the young person in question was below 16 years old) and to ensure that any distress resulting from the assessment or any risk issues that were revealed were dealt with appropriately. The protocol had been developed in conjunction with and had been approved by ward staff.

Participants completed the battery of measures as soon after admission as possible (including the baseline measures used for this study) and just before discharge (for the wider study). The order of administration of the questionnaire measures was flexible according to the young person's presentation and the time available each meeting, but usually measures of mood were completed before measures of trauma and PLEs to promote young people's engagement before

asking potentially distressing questions. The reasoning task was presented last, as an interactive game. The measures were self-report, and took approximately 60 minutes to complete. If young people could not complete the measures in one sitting due to distress or fatigue, another sitting was arranged. The researcher was sitting with the participants during completion and was available to support the participants to complete the measures if this was helpful.

Statistical Analysis

Planned analyses

Data were analysed using the Statistical Package for the Social Sciences (SPSS version 22, IBM 2011). Emotional problems on the SDQ, life events and PLE severity were not normally distributed and hence bootstrapping was applied for bivariate correlations (sample: 10 000, a = .01). Due to multiple testing alpha levels were adjusted to .01 for all analyses. The first hypothesis concerning PLE severity was tested using bivariate correlations between PLE severity and emotional problems, life events and JTC respectively. A multiple linear regression, with PLE severity as the dependent variable and the hypothesised putative risk factors as the independent variables was computed to test the relative contribution of all three factors. It should be noted that the regression analysis was designed to test association, not to impute cause as the regression model is in the counter direction to hypotheses about cause. Partial correlations, derived from the regression model, were reported, rather than regression coefficients. The terms 'contribution' and 'prediction' are used to refer to statistical constructs, without any implication of causality. The hypotheses regarding associations of PLE dimensions and content types with specific psychosocial putative risk factors were tested by first computing correlations between the dimension/content types and the respective hypothesised psychosocial risk factors. With regards to emotional problems and life events the relative strength of the association with the hypothesised content types (hallucinations and paranoia) and dimensions was tested using partial correlations derived from two separate linear regression analyses for each risk factor, with the hypothesised psychosocial factors (emotional problems and life events) as the dependent variables and the hypothesised content types and dimensions as independent variables, respectively. The residuals of the model were normally distributed so bootstrapping was not applied. Linear regressions were run twice, with age and gender entered as potential confounders and without confounders. Age and gender

were chosen as confounders as PLE severity has been found to differ according to both. Ruffell et al. (2015) also controlled for these factors in their analyses.

With regards to JTC the relative strength of the association with the hypothesised content types (grandiosity) and dimensions (conviction) was tested with bivariate correlations and with two logistic regression analysis with JTC bias as the dependent variable using 1) grandiosity in the first and 2) conviction as predictor in the second model whilst controlling for Burt reading scores. The residuals of the model were normally distributed so bootstrapping was not applied. Analyses were also run with age and gender as additional variables as confounders, due to Ruffell et al. (2015) controlling for these variables and due to Hassanali et al. (2015) reporting that age was significantly associated with JTC.

A post hoc factor analysis (CFA) of dichotomised endorsement ratings (conviction 0 or > 0) for the nine PLE items using direct-oblimin rotation to accommodate for inter-relationships was undertaken, to investigate whether a similar factor structure was underlying responses to the PLEQ as was found by Ruffell et al. (2015).

A priori power calculation

A priori power calculations were conducted with alpha set to .01 to compensate for multiple testing, and beta set to .8. Analyses were powered for effect sizes corresponding to the partial correlations found by Ames et al., for life events and emotional problems (r = .4 and r = .5) respectively. Analyses concerning JTC were exploratory as it was not deemed feasible to power the study for an expected effect size, corresponding to a partial correlation of r = .3. Given above parameters, to detect a correlation of r = .5 a sample size of 42 was required and to detect a correlation of r = .4 a sample size of 68 was required.

Achieved power

Analyses concerning emotional problems had a sample size of 64, with the power of .8 to detect a true correlation of the strength of .41. Analyses concerning life events had a sample size of 61, with the power of .8 to detect a true correlation of the strength of .42. Analyses concerning JTC had a sample size of 56, with the power of .8 to detect a true correlation of the strength of .44. Alpha was set at .01 for all power calculations.

Completion and treatment of missing data

Baseline data were collected for 64 young people, all of whom provided data for the SDQ emotional problems subscale and the PLEQ, 61 provided data for the Life Events and 56 provided data regarding the Jumping to Conclusions bias (data missing for five participants) and 51 for the Burt reading task (data missing for 10 participants). Participants were excluded and sample sizes reported if items were missing.

Results

Sample Characteristics

Descriptive statistics of baseline demographic and clinical characteristics of the sample are summarised in Table 1.

Table 1. Clinical and demographic characteristics of the sample

Variable (obtained range)	Mean (SD)	N
Age in years (15 -17)	16.30 (0.71)	64
Burt reading task (45 -110)	96.82 (14.79)	51
SDQ emotional problems scale (range 0 -10)	6.33 (2.55)	64
PLE Dimensions		
Conviction (0-18)	5.78 (5.04)	64
Frequency (0-27)	6.94 (6.78)	64
Distress/Impact (0-54)	12.30 (12.87)	64
PLE Content		
Hallucinations (0 - 22)	8.41 (8.22)	64
Paranoia (0 -11)	1.64 (2.89)	64
Grandiosity (0-33)	5.69 (7.80)	64
PLE Severity (0 – 99)	25.02 (23.99)	64
Life events (0 -10)	3.90 (2.40)	61
	N (%)	
Gender (male/female)	18 (28.10)/46 (71.90)	
Ethnic Background (BME/non-BME)	19 (29.70)/45 (70.30)	
Reasoning (JTC/no JTC)	10 (11.80)/46 (54.10)	
Index Problem		62
Mood Disorders	19	
Anxiety Disorders	7	
Eating Disorders	9	
Emerging Personality Disorders	9	
Psychotic Disorders	9	
Unspecified	9	

*Abbreviations: PLE = psychotic-like experience, SD = Standard Deviation, N = Sample Size, Burt = Burt word reading test, SDQ = Strengths and Difficulties Questionnaire, BME = Black and ethnic minority, JTC = jumping to conclusions

Associations of clinical variables with demographic variables

None of the baseline demographic variables (gender, BME status and age) were significantly correlated with PLE severity (maximum r value = -.158, minimum p value = .212) life events (maximum r value = .168, minimum p value = .196) or JTC (maximum r value = .075, minimum p value = .583). BME status was significantly correlated with emotional problems (r = -.354, p

=.004), but was not significantly correlated with any of the PLE dimensions and content type variables (most highly correlated paranoia, r = -.176, p = .163) (see Appendix C. for correlation matrix).

Hypothesis 1: Predictors of PLE Severity

Both emotional problems and life events were positively correlated with overall PLE severity (emotional problems: r = .422, p = .001, N = 64, 99 % confidence interval for effect size: -.073 to .539; life events: r = .372, p = .005, N = 61, 99% confidence interval for effect size: -.099 to .726). No significant association between JTC and overall PLE severity was found r = .041, p = .765, N = 56, 99 % confidence interval for effect size: -.254 – .387).

The overall model predicting PLE severity (see Table 2) including all three hypothesised predictors was significant (F (3, 52) = 5.99, p = .002) and explained 25 percent of the variance in total PLE severity (R square = .254). Neither age nor gender significantly contributed to PLE severity. When including age and gender in the model life events was significant at p = .01 (see Appendix D.).

Table 2. Linear regression, regressing emotional problems, life events and jumping to conclusions on total psychotic-like experiences severity

	B	SE B	beta	t	p	Zero-order	partial
Constant	-6.27	8.27		- .76	.452		
SDQ Emotional Problems	3.27	1.16	.35	2.82	.007	.373	**.301**
Life events	2.79	1.23	.28	2.28	.027	.422	**.364**
Jumping to conclusions cognitive bias	.59	7.59	.01	.08	.938	.041	**.011**

*Abbreviations: B = Beta, SE = Standard Error, t = hypothesis test statistic, p = p-value, zero-order = zero-order correlation, partial = partial correlation

Hypothesis 2: Associations between hallucinations and paranoia and emotional problems

The emotional problems scale score on the SDQ was significantly correlated with both hypothesised content domains; hallucinations (r = .425, p < .001, 99% confidence interval: .128 -

.67) and paranoia (r = .411, p = .001, 99 % confidence interval: .098 - .684). The regression model was significant (F (3,60) = 7.126, p = .002) but the partial correlation coefficient for both predictors was not significant (see Table 3). This was also the case when age and gender were controlled for (see Appendix E.). This is due to shared variance between the two factors, whereby both explain emotional problems but do not uniquely explain emotional problems when the other is controlled for.

Table 3. Linear Regression, regressing hallucinations and paranoia on emotional problems

	B	SE B	Beta	t	p	Zero order	partial	Tolerance	VIF
Constant	5.07	.46		11.15	.000				
Hallucinations	.09	.07	.27	1.25	.215	.425	**.158**	.28	3.58
Paranoia	.11	.14	.18	.82	.416	.411	**.104**	.28	3.58

*Abbreviations: B = Beta, SE = Standard Error, t = hypothesis test statistic, p = p-value, zero-order = zero-order correlation, partial = partial correlation, VIF = variance inflation factor

Hypothesis 2: Associations between PLE dimensions and emotional problems

All three dimensions of PLEs were significantly correlated with emotional problems: conviction (r = .336, p = .007, 99 % confidence interval: - .046 - .531), frequency (r = .328, p = .008, 99% confidence interval: .005 - .582) and distress/impact (r = .46, p < .001, 99% confidence interval: .178 – .67). The regression model was significant (F (61, 2) = 7. 604, p < .001) but only distress/impact remained significant in the overall model (see Table 4). When age and gender were controlled for there was a trend for conviction (p =. 029) (see Appendix F.).

Table 4. Linear Regression, regressing psychotic-like experiences conviction, frequency and distress/impact on emotional problems

	B	SE B	Beta	t	p	Zero order	partial	Tolerance	VIF
Constant	5.63	.43		13.03	.000				
Conviction	-.25	.16	-.49	-1.51	.138	.336	**-.191**	.11	8.76
Frequency	-.09	.11	-.24	-.85	.402	.328	**-.108**	.16	6.43
Distress/Impact	.22	.06	1.12	3.63	.001	.460	**.425**	.13	7.91

*Abbreviations: B = Beta, SE = Standard Error, t = hypothesis test statistic, p = p-value, zero-order = zero-order correlation, partial = partial correlation, VIF = variance inflation factor

Hypothesis 3: Associations between hallucinations and paranoia and life events

Both hypothesised content types were significantly correlated with number of difficult life events: hallucinations (r = .425, p < .001; 99 % confidence interval: -.018 - .617) and paranoia (r = .303, p = .018; 99 % confidence interval: .704-.934).

Neither hypothesised content type was significantly associated with life events in the overall regression model (F (58, 2) = 3.967, p = .024) which accounted for about 12 percent of the overall variance in life events (R square = 12).(see Table 5). This is understood to be due to high collinearity between the two factors, with neither contributing significantly to the outcome variable beyond the shared variance. Neither age nor gender were significantly associated with life events when added to the model (see Appendix G.).

Table 5. Linear Regression, regressing hallucinations and paranoia on life events

	B	SE B	Beta	t	p	Zero order	partial	Tolerance	VIF
Constant	2.89	.46		6.28	.000				
Hallucinations	.01	.07	.04	.17	.862	.303	**.023**	.29	3.43
Paranoia	.19	.14	.31	1.37	.176	.346	**.177**	.29	3.43

*Abbreviations: B = Beta, SE = Standard Error, t = hypothesis test statistic, p = p-value, zero-order = zero-order correlation, partial = partial correlation, VIF = variance inflation factor

Associations between PLE dimensions and Life Events

Two dimensions of PLEs were significantly correlated with life events: Conviction (r = .336, p = .008, 99 % confidence interval: -.077 - .662) and distress/impact (r = .383, p = .002, 99% confidence interval: -.067 - .722). There was a trend for frequency (r = .319, p = .012, 99% confidence interval: -.129 - .670). Neither dimension was significantly associated with life events in the overall regression model (F (57, 3) = 3.343, p = .025) accounting for an estimated 15 percent of the overall variance in life events (R square = .15; see Table 6). Neither age nor gender were significantly associated with life events when added to the model (see Appendix H.).

Table 6. Linear Regression, regressing psychotic-like experiences conviction, frequency and distress/impact on life events

	B	SE B	beta	t	p	Zero order	partial	Tolerance	VIF
Constant	3.08	.46		6.75	.000				
Conviction	-.03	.17	-.07	-.19	.851	.336	**-.025**	.118	8.443
Frequency	-.03	.11	-.09	-.28	.777	.319	**-.038**	.160	6.268
Distress/Impact	.1	.06	.52	1.54	.129	.383	**.200**	.129	7.723

*Abbreviations: B = Beta, SE = Standard Error, t = hypothesis test statistic, p = p-value, zero-order = zero-order correlation, partial = partial correlation, VIF = variance inflation factor

Associations between grandiosity and PLE conviction with JTC

JTC was not significantly associated with the content domain grandiosity (r = -.045, p = .74, 99 % confidence interval: -.304 - .296) nor with the dimension of conviction (r = .019, p = .889, 99 % confidence interval: -.246 - .324). Two logistic regression analysis were conducted to predict JTC bias using 1) grandiosity in the first and 2) conviction as predictor in the second model whilst controlling for Burt reading scores (see Tables 7 and 8 respectively). Tests of each of the full models against a constant only model was not statistically significant, indicating that the predictors as a set did not reliably distinguish between those who evidenced the bias and those who did not (1) chi square = 3.506, p = .173 with df = 2; 2) chi square = 3.674, p = .159 with df = 2) Nagelkerke's pseudo-R^2 of .111 indicated a weak relationship between prediction and grouping of grandiosity and Burt reading task. Nagelkerke's pseudo-R2 of .117 indicated a weak relationship between prediction and grouping of conviction and Burt reading task. Neither age nor gender were significantly associated with JTC when added to the model (see Appendix I.).

Table 7. Logistic Regression, regressing grandiosity on jumping to conclusions bias, controlling for Burt reading scores

	B	SE B	Wald	Sig.	Exp(B)
Constant	2.35	2.07	1.29	.805	1.015
Grandiosity	.02	.06	.06	.068	.961
Burt	-.04	.02	3.33	.256	10.476

*Abbreviations: B = Beta, SE = Standard Error, Wald = hypothesis test statistic, Sig. = significance, Exp (B) = odds ratio

Table 8. Logistic Regression, regressing conviction on jumping to conclusions bias, controlling for Burt reading scores

	B	SE B	Wald	Sig.	Exp(B)
Constant	2.11	2.15	.97	.326	8.254
Conviction	.04	.09	.23	.630	1.042
Burt	-.04	.02	3.16	.076	.962

*Abbreviations: B = Beta, SE = Standard Error, Wald = hypothesis test statistic, Sig. = significance, Exp (B) = odds ratio

Post –hoc examination of psychometric properties of the PLEQ

Given the high degree of collinearity in the PLEQ data, a post hoc confirmatory factor analysis (CFA) was undertaken to confirm if the underlying latent constructs assumed on the basis of the CFA undertaken by Ruffell et al. (2015), could be confirmed in this sample. The CFA was undertaken for dichotomised endorsement ratings (conviction 0 or > 0) for the nine PLEQ items, specifying five factors and using direct-oblimin rotation to accommodate for inter-relationships. Tabachnick and Fidell (2007), p. 646, argue that correlations between factors greater than .32 are an indication that oblique rotation methods (such as direct-oblimin) should be chosen as this means that there is 10% (or more) overlap in variance among factors. Correlations between factors were as large as r = .41. Due to the high intercorrelation between factors an oblique method was chosen as an orthogonal rotation method assumes that factors are uncorrelated. All items loaded onto factor one, except one item which loaded onto factor three. Factor one and two had eigenvalues greater than one (Eigenvalue = 4.38 for factor one and Eigenvalue = 1.17 for factor 2). Factor one explained 48.63 % of the variance and factor two explained 13.02 percent of the variance. Correlations between items and factors ranged from .007 to .804. Another factor solution, not specifying any particular number of factors resulted in a two factor solution, with all items correlating most highly with factor one (correlations with factor one ranging from -.78 to .578 and with factor two from .031 to -.504). (see Appendix J.).

Table 9. Item loadings for each psychotic-like experience content grouping derived from a pragmatic confirmatory factor analysis of Endorsement of each Psychotic like experiences questionnaire item

PLEQ Item	Component				
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1. Some people believe that their thoughts can be read. Have other people ever read your thoughts?	.593	.031	**.651**	-.358	-.109
2. Have you ever believed that you were being sent special messages through the television?	.**696**	.264	-.387	-.091	-.424
3. Have you ever thought that you were being followed or spied upon?	**.669**	-.504	-.012	.378	-.256
4. Have you ever heard voices that other people could not hear?	**.753**	-.496	.008	.103	.300
5. Have you ever felt that you were under the control of some special power?	**.670**	.376	-.212	.279	.285
6 Have you ever known what another person was thinking even though that person was not speaking?	**.804**	.173	.059	.007	-.387
7. Have you ever felt as though your body had been changed in some way that you could not understand? Delusions	**.701**	.234	-.231	-.426	.298
8. Do you have any special powers that other people do not have?	.**578**	.462	.363	.390	.181
9. Have you ever seen something or someone that other people could not see?	**.780**	-.403	-.088	-.224	.145

* items in bold most strongly load onto the factor in that column

Discussion

The study was designed as an attempt to replicate the findings of two studies conducted in community child and adolescent mental health service settings with 8 to 14 year olds, with older participants, presenting with more severe mental health conditions. The first aim was to investigate the associations between overall PLE severity and negative life events, emotional problems and reasoning bias (JTC) in an attempt to replicate the findings of Ames et al. (2014). Secondly this study was designed to investigate differential prediction of PLE content types and dimensions by the three psychosocial predictors life events, emotional problems and JTC and to replicate Ruffell et al.'s (2015) findings that life events were specifically associated with PLE frequency, occurrence of hallucinations and paranoia, emotional problems with PLE distress/impact and the occurrence of hallucinations and paranoia and JTC with conviction and grandiosity.

Regarding the first aim, it was found that emotional problems and life events were significantly associated with PLE severity, both in bivariate correlations and the overall regression model (life events approached significance and was significant when controlling for confounders). JTC was not significantly associated with PLE severity, however these analyses were exploratory and not sufficiently powered (as discussed below). With regards to the second aim, both life events and emotional problems were significantly associated with the presence of hallucinations and paranoia, as predicted. However, when entered into the same model effects were suppressed, which is hypothesised to be due to collinearity between predictors. All PLE dimensions (conviction, frequency and distress/impact) were significantly associated with emotional problems and all but frequency (albeit approaching significance) with life events. For life events, all effects were suppressed when entered into a single regression, again likely due to high collinearity. For emotional problems, only the distress impact score remained significant, leading to the tentative conclusion that distress/impact uniquely explains some of the variance associated with emotional problems over and above PLE conviction and frequency, which confirms Ruffell and colleagues' (2015) finding. JTC was weakly and non-significantly correlated with both conviction and grandiosity. However, theses analyses were exploratory and lacked power. Post hoc examination of the psychometric properties of the PLEQ yielded an underlying factor solution with items

loading most strongly on one factor, indicating that PLE sub-dimensions are more strongly correlated in the current study than in Ruffell et al., (2015).

Hypothesis 1: Associations with PLE severity

Emotional problems and life events were found to be significantly associated with PLE severity, both in bivariate correlations and the overall model (life events approached significance and was significant when controlling for confounders). JTC was not significant. The overall model explained less of the variance in PLE severity than Ames et al., (2014)'s model (55% of the variance explained compared to 25% of the variance explained in the current study).

The effect found for emotional problems was smaller than that found by Ames et al. (2014), (r = .63, compared to .42 in the current study) and the effect for life events was also somewhat smaller (r = .37 current study vs. r = .43) The 99 % confidence intervals for the effect of life events found in the current study included the r value found by Ames and colleagues. However, the association between PLE severity and emotional problems might be significantly smaller in the current study (upper end of 99 % confidence interval was .54 in the current study, confidence interval not reported by Ames et al., 2014).

JTC was not significantly associated with PLE severity. However Ames et al. (2014) found a correlation of r = .32, and the current study was only powered to detect a true correlation of the strength of .44 with regards to JTC. The association found was r = .041, and the 99% confidence interval -.304 to .296 crossed zero, and did not include the value found by Ames et al., (2014), who did not report their confidence interval. Despite this study being underpowered with regards to detecting an effect of JTC, it is very likely, albeit not certain, that the effect (if present) in the current sample is smaller than the one identified by Ames et al., (2014).

Hypotheses 2 and 3: Associations between life events and emotional problems and PLE content types

With regards to variations in the psychosocial correlates of PLE content types, both emotional problems and life events were significantly associated with hallucinations and paranoia (emotional

problems: r = .425 for hallucinations and r = .411 for paranoia; Life events: r = .425 for hallucinations and r = .303 for paranoia). The strength of the associations was similar to those found by Ruffell et al., (2015) who found partial correlations of .3 between life events and emotional problems with hallucinations and paranoia, respectively. Note that partial correlations are expected to be smaller.

However when examining the associations of both hypothesised content types with each psychosocial risk factor in conjunction, both content domains were non-significant in both analyses. This was understood to be due to high collinearity between the two content domains, so that although both hallucinations and paranoia explained variance in emotional problems and life events, neither uniquely explained variance in the outcome when the other factor was controlled for.

Hypotheses 2 and 3: Associations between life events and emotional problems and PLE dimensions

Similarly, with regards to variations in the psychosocial correlates of PLE dimensions, both emotional problems and life events were moderately correlated (approaching significance in relation to frequency and life events, otherwise significantly) with PLE conviction, frequency and distress/impact. The correlations that mapped onto the partial correlations found by Ruffell et al., (2015) were of similar but somewhat smaller magnitude (partial correlation between life events and frequency = .4, current study: r = .319, partial correlation between emotional problems and distress/impact = .5, current study r = .46). The values found by Ruffell et al., (2015) were included in the confidence intervals reported for the current study.

For life events, all effects were suppressed when entered into a single regression, considered to be due to high collinearity as explained above. For emotional problems, only the distress impact score remained significant, leading to the tentative conclusion that distress/impact uniquely explains some of the variance associated with emotional problems over and above PLE conviction and frequency, which confirms Ruffell and colleagues' (2015) finding. However parameters estimated by the linear regression models need to be interpreted with caution as collinearity between predictors leads to poor model and parameter estimation.

Hypothesis 4: Associations between JTC and grandiosity and conviction

Regarding JTC, neither grandiosity nor conviction were associated with JTC with or without controlling for Burt reasoning or age and gender. However, analyses were not powered to detect effect sizes of the magnitude of around .3 (those found by Ruffell et al., 2015). Associations found in the current study were of much smaller magnitude (JTC and grandiosity: r = .045; JTC and conviction: r = .019). Regarding grandiosity the current study's upper limit of the 99 % confidence interval, .296, is smaller than partial correlation found by Ruffell et al., 2015), indicating that the effect of JTC, if present, is likely smaller in comparison.

Possible explanations for differences in findings between the current study and Ruffell and colleagues and Ames and colleagues.

The study design of Ames et al. (2014) and the current study is largely identical, with both employing a cross sectional design and using similar measures (only the 'life events' measure differed). The main differences were that the current study investigated the contribution of the three putative psychosocial factors to overall PLE severity in a sample that differed with regards to age and severity of clinical presentation and that the current study was more highly powered (sample size of 56 for the multiple regression as opposed to 40 in Ames et al., 2014). Findings of this investigation are similar to Ames et al. (2014), apart from JTC not having been found to be significantly associated with overall PLE severity in this investigation. However, for this particular effect this study was underpowered so no definite conclusions about an absence of the effect could be drawn, which is a limitation of this study in the attempt to replicate Ames et al. (2014). Several factors could have contributed to not finding this effect, including less variability in the JTC data in this sample (only 12 per cent of young people displayed bias), constraints on examining contributions of specific factors to outcomes in a heterogeneous sample (a limitation of this investigation compared to Ames et al. 2014, whose sample was more homogenous regarding clinical presentation) and the possibility that at the more severe end of difficulties, JTC might not have much explanatory value with regards to explaining differences in PLE severity. The latter two points are further elaborated below.

Equally Ruffell et al (2015) and the current study employed a very similar design, testing associations between putative risk factors and subdimimensions of PLEs cross-sectionally. Apart from the sample characteristics, the studies differed in that Ruffell et al.'s (2015) analyses were exploratory, whilst the current investigation only tested (and was only powered to test) those associations that had been found to be significant by Ruffell et al (2015). Additionally, when investigating the contribution of two factors on variation in the outcome variable in a multiple regression model, Ruffell et al. (2015) used a 'stepwise' method whilst this study employed an 'enter' model. If there is high collinearity in the data (the intercorrelations between subdimensions of PLEs in Ruffell et al.'s, 2015 data were not reported in their publication so it is unclear whether high intercollinearity was present) the use of a 'stepwise' method increases the risk that the factors selected to remain in the final model is based on very slight differences in predictive value and that factors which are predictive, just marginally less, are excluded. As with the replication of Ames et al. (2014), one possibly limiting factor of this study is the greater sample heterogeneity.

Given the high collinearity between PLE content types and dimensions, it was hypothesised that differences in findings between the current study and Ruffell et al., (2015) might be due to a difference in the underlying factor structure of responses on the PLEQ questionnaire. A post hoc factor analyses confirmed that, in this adolescent inpatient sample, a different factor structure was suggested from that found by Ruffell and colleagues in a clinically referred group of children with emotional and behavioural problems. In the current study, all items most strongly loaded onto a single factor with an eigenvalue greater than one, when number of factors was not specified. When the analysis was conducted with five factors specified, items did not delineate in the same way as found by Ruffell et al., (2015) (all items continued to load predominantly onto one factor except the item concerning thought reading).

Given that this study was conducted in an acutely unwell clinical sample it is conceivable that sub-dimensions of PLEs and specific associations between psychosocial risk mechanisms and sub-dimensions are less discriminated in this population with greater symptom severity (mean scores for all clinical variables except JTC exceeded those found by Ames et al, 2014 and Ruffell et al., 2015). Patterns of associations might be less clearly delineated at the extreme end of the distribution of both symptom severity and the presence of psychosocial risk factors. Additionally, clustering at the extreme end of expression may have limited the variance in scores on measures

of potentially common mechanisms, such as life events and emotional problems, compared to a community sample. Testing across the spectrum of severity in the same study would be required to investigate this, but parallels have been found for other spectrum disorders, for example in autism research, the triad of autistic traits is highly correlated in those with a clinical diagnosis of autism but in the general population symptoms do not cluster to the same extent.

One mechanism by which the delineation of associations might become less clear at the extreme end of the spectrum of severity of presentation could be the interactive effects between sub-dimensions of PLEs and risk factors. It has been shown (although not unequivocally) that the experience of PLEs is itself predictive of emotional difficulties (Sullivan et al., 2014; Wigman, Lin, et al., 2011) and further occurrence of negative life events (De Loore et al., 2007) and it is conceivable that if one type of PLE is established this in itself could be a risk factor for further unusual experiences of a different kind. If relationships between risk mechanisms and PLEs are at least partially bidirectional it is likely that risk mechanisms and sub-dimensions delineate at an earlier point of the development of PLEs whilst at a later more clinically significant stage most risk factors and sub-dimensions may occur in conjunction. This would explain the high collinearity between sub-dimensions of PLEs.

Limitations and Suggestions for Future Research

There are some limitations to this study. The sample size is relatively small and consequently the analysis may have been underpowered to detect some of the predicted effects. Additionally, multiple comparisons raise the risk of detecting effects purely by chance. This was somewhat mitigated by raising the alpha level to .01.

The content factors were adopted from Ruffell et al., (2015) who based them predominantly on content factors previously delineated from the CAPE. As the current measure of PLEs only contained nine items, content type constructs contained only between one and three items, decreasing the likelihood that they robustly represent the latent construct for that construct/content type. This also decreases variability as subtle differences in presentation are less likely to have been captured. As in the current study, Laurens et al., (2012) found that the PLEQ comprised a single factor in a nonclinical sample. Hence it is possible that less delineation

in sub-dimensions is unrelated to the severity of PLEs but instead captures a characteristic of the measure used. Linscott and van Os (2010) argue that over half of the observed heterogeneity in PLE incidence measures is attributable to methodological factors, with considerably higher rates in studies using smaller convenience sampling and self-report assessment modes. Although incidence was not the primary outcome it is conceivable that measure effects could account for the detectability or possibly artificial measurement of sub-dimensions. Seaton et al. (2001) similarly point out that cluster analysis is sensitive to the nature of the attributes measured, delineating response patterns which may or may not correspond to underlying latent symptom clusters.

An important variable to consider when interpreting results is the representativeness of the sample in relation to the target population, in this case the entire inpatient population. Based on the recruitment data available for the second batch of recruitment about one third of admissions (35 %) provided data. This rate varied throughout recruitment, but this variation should not have introduced a systematic bias with regards to which patients provided measures. There were two groups of inpatient who were considerably less likely to have been recruited into the current sample: those who were below the age of 16 at the time of their inpatient stay and those with a very severe presentation (i.e. acutely psychotic or at high risk of self-harm or re-traumatisation, comprising about 20 % of the inpatient sample). Regarding the former, only seven out of 64 young people tested were aged 15 years and none were younger than 15 years. This was due to the added complication of obtaining consent from parents, which delayed the recruitment process, so that often young people were discharged by the time recruitment was almost completed. Regarding the latter, young people who were acutely unwell often remained too unwell to be approached throughout their inpatient stay or until shortly before their discharge, so that they were less likely to complete consent to take part in the study. Regarding those young people approached, approximately five per cent declined participation. No data were recorded with regards to who was more likely to decline but based on the assessor's recollection those who declined were more likely to be below 16 years, or on the ward for externalising behavioural problems. The sample comprised of participants with varied index problems. The most prominent index problem was mood disorders, including bipolar disorder (N = 19). Anxiety disorders, eating disorders, psychotic disorders, emerging personality disorders and those with disorders 'not otherwise specified' were roughly equally represented (Ns ranged between seven and nine).

Consequently, apart from considerations regarding age, any interpretations of patterns of results in PLE's are potentially less likely to generalise to those with very acute psychotic experiences (to the extent where these were impacting young people's capacity to consent to taking part in research), those young people very acutely distressed and at risk of immediate self-harm and those young people with oppositional traits (who were less likely to comply with any tasks that were to be completed on a voluntary basis). In order to minimise bias several factors could have been optimised. These include improving the percentage of those approached to as near to 100 % as possible to minimise potential unconscious or systemic bias with regards to which young people were approached for consenting, speeding up consenting processes to ensure that more young people under 16 would provide data and keeping complete and more detailed records of recruitment data to be able to more accurately reflect on sample representativeness.

The current sample included young people with a diagnosis of psychotic disorder and hence psychotic symptoms, those with PLEs and other diagnoses and those with no PLEs. Whether or not this skews the associations found, depends on the assumptions regarding underlying subpopulations. If one assumes a full continuum, which mainly varies with regards to severity of symptoms, and specifically continuity of aetiology, there should be no differential association between risk factors and symptoms for those with subclinical and clinical psychotic experiences. If one assumes a psychometric risk category for schizophrenia (Linscott and Van Os, 2010), results might be skewed by including those with PLEs (whether of clinical severity or not) and those without PLEs if one does not control for this explicitly. This is the case as factors that drive the expression of PLEs in those at psychometric risk might drive other problems in those not at psychometric risk, hence potentially diluting associations. The current study combined young people with clinical psychotic symptoms (post first episode) and those with PLEs, and was not designed or powered (numbers of young people with clinical psychosis were low) to test for the effect of a diagnosed psychotic illness. The evidence for phenomenological and aetiological continuity (Linscott and Van Os, 2010) is strong but not unequivocal and it is still possible that content and dimensions of psychotic symptoms in young people with psychosis delineate to a lesser extent and or are driven by other or additional factors to those implicated in subclinical PLEs. Similarly effects of psychotropic medication and treatment might impact such associations.

Although the occurrence of PLEs is conceptualised as an expression of belonging to an 'at psychometric risk' for psychosis subpopulation (possibly explained by a genetic psychosis phenotype) when assuming phenomenological continuity, PLEs might also be implicated in other disorders possibly represented by belonging to other at psychometric risk subpopulations and phenotypes. Consequently additional risk mechanisms for PLEs might be at play in individuals without psychosis and not at risk for psychosis. Without controlling for these variables it is likely that sub-dimensions may be missed as moderators are not controlled for. Consequently, controlling for population type (no PLE evident, subclinical, and clinical) explicitly, in a very much larger sample with consequently increased power is recommended.

A further limitation is the current definition of PLEs which predominantly comprises positive psychotic experiences. In order to understand sub-dimensions of symptoms or clusters of symptoms, the unique psychosocial and biological predictors implicated in their development and potentially different trajectories associated with them, one needs to consider a range of clinical, cognitive, neurobiological and genetic evidence to arrive at unique profiles and subtypes (Seaton et al., 2001). Even if this were the case, Linscott and van Os (2010) argue that factor analysis is not a viable method to differentiate between continuity and nonarbitrary boundaries and suggest analytic methods specifically designed for this purpose (Linscott, Allardyce, & van Os, 2010; Linscott, Lenzenweger, & van Os, 2010; Meehl, 2004). Taking into account all relevant subclinical psychotic symptoms (as far as they are known) is not just important for delineating subtypes but also to understand the full clinical picture, to design prevention and intervention optimally.

This study's aim was to replicate Ames et al. (2014) and Ruffell et al. (2015), who both aimed to test whether adult models of the route to psychotic experiences apply to the development of subclinical PLEs in children. The fact that they found associations between symptoms and risk factors that fit with the cognitive model of psychosis and that have been found in the adult population led to their tentative conclusion that these models can be applied to young people with PLEs. However, such conclusions based on studies with cross sectional design need to be very tentative. A large body of work has shown that changes in brain structure continue into adolescence and early adulthood and it has been posed that puberty represents a period of synaptic reorganisation and that as a consequence the brain might be more sensitive to experiential input with regards to executive functions and social cognition (Blakemore and

Choudhury, 2006, Wolf, Bazargani, Kilford, Dumontheil and Blakermore, 2015) Consequently it is conceivable that during a time or reorganisation, PLEs, particularly those pertaining to social cognition such as believing to be watched, followed or being able to read others mind, might be an expression of such reorganisation processes. Persistent PLEs in this case could be the consequence of such reorganisation processes having concluded in non-optimal ways. To examine this theory that PLE's are non-pathological and unproblematic side effects of neural reorganisation, one could test several hypotheses which might support this understanding of PLE's. For example one might expect that PLE's related to social cognition occur during more distinct periods of development, are more widespread, and are less strongly associated with psychosocial risk factors and less likely to be associated with persistence, distress and psychopathology than for example experiences of hallucinations. This theory further highlights the importance of focusing research efforts on longitudinal studies investigating those factors that lead to persistence of such experiences, which framed in this context would mean non-optimal progression through a neurologically critical period.

Therefore suggestions for future research on sub-dimensions of PLEs are to measure a greater breadth of symptoms and symptom correlates changes in symptom patterns and profiles longitudinally to investigate distinct symptom and cluster trajectories. In particular there is a need to measure negative symptoms, as there are indications that subtypes of schizophrenia might be distinguishable by the persistence of enduring negative symptoms (Blanchard et al., 2005). Distinguishing and controlling for those individuals with diagnosed psychotic disorder, those with subclinical symptoms and those with no symptoms, might help to control for sample heterogeneity. Finally, developing measures of PLEs that are still phrased specifically to suit young people, but with more items, allowing for detection of more subtle variation in patterns of PLEs would be recommended.

Clinical Implications

This study confirmed the association of life events and emotional problems with the severity of PLEs. No association of these factors with any particular sub-dimension of PLEs over and above other sub-dimensions was found. Although causation cannot be concluded from cross sectional designs, a relationship between emotional problems and life events in PLEs is in line with the

hypothesised factors of Garety et al., (2001, 2007) in their cognitive model of psychosis and replicates previous associations found between trauma, life events and symptom severity, hallucinations and paranoia. Hence targeting these factors both through interventions and prevention is pivotal. Future research could aim to further delineate the exact mechanisms (such as appraisals) through which these factors impact PLEs, to investigate their predictive validity in terms of PLE incidence and trajectory and to delineate bidirectional relationships between PLEs and psychosocial factors. For example in the current study depression and anxiety were combined in a single construct, so disentangling their relative contribution is a suggestion for future research. Further a theoretical investigation regarding the effects of clinically significant trauma symptoms over and above the occurrence of objectively stressful and traumatic events could further elucidate the mechanisms by which negative life events impact the risk for PLEs. Additionally, current intervention strategies to target anxiety and depression in individuals with an 'at risk mental state' and strategies to address trauma in individuals with a first episode of psychosis, could usefully be extended to younger individuals presenting with distressing subclinical psychotic-like experiences.

Conclusions

The severity of PLEs in this sample of children on an inpatient ward, was associated with the putative psychosocial factors of life events and emotional problems predicting about 25 % of the variance in overall PLE severity. Additionally these psychosocial factors were significantly associated with delusions and hallucinations as hypothesised and also with conviction, frequency and distress/impact of PLEs. In the case of hallucinations, it is proposed that PLE impact/distress is associated with hallucinations over and above frequency and conviction. Reponses on the PLEQ loaded onto a single factor and content types and dimensions were highly correlated, and it is hence questionable whether separating the constructs into sub-dimensions in this particular clinical group is valid. It appears more likely that responses on the PLEQ questionnaire reflected one underlying latent factor, which is hypothesised to be due to severity of presentation and or characteristics of the chosen PLE measure. Effects of JTC were not found but the study was insufficiently powered to conclude with a high level of certainty that effects were not present.

Future research aimed at delineating latent subtypes of PLEs could measure a greater breadth of symptoms and correlates and ideally, would measure changes in symptoms patterns and profiles longitudinally to investigate distinct symptom cluster/subtype trajectories, as well as controlling explicitly for population type.

Regarding clinical implications, this study's findings point to continuity between previous studies employing community samples of children, and the research in adult samples with both psychosis and subclinical experiences, with regards to the associations between affect, life events and PLE severity and sub-dimensions. Consequently the implication for treatment of distressing PLEs in child community mental health settings, is that treatment recommendations regarding these aspects for adult populations with psychosis can likely be generalised to child and adolescent populations with distressing subclinical psychotic-like experiences, though specific evaluation of interventions in these populations is still required. Additionally future research to delineate the mechanisms by which affect and life events impact on PLEs in children is recommended to inform formulation based treatment, employing specific cognitive behavioural therapeutic strategies to address hypothesised links between symptoms and psychosocial factors, such as appraisals.

Previous research has suggested that different symptoms in psychosis and psychotic-like experiences in adult and child populations may be driven by distinct psychosocial risk factors. This has clinical implications as targeted therapies have larger effect sizes (Mehl, Werner, & Lincoln, 2015). This finding was not replicated in the current sample. Factors that might account for these differences in findings, such as decreased variance in symptoms and presence of risk factors at the extreme end of severity, were discussed. Additionally associations between content domains and dimensions and specific psychosocial factors might differ in children with psychosis, those with subclinical PLEs and those with PLEs and alternative diagnoses. Hence replication across age ranges and samples is needed. Future research could then address what may be specific to PLEs (of different dimensions and content domains), rather than different dimensions and types of symptoms of clinical psychosis in children. The extension of interventions addressing mood, anxiety and trauma to individuals presenting with distressing subclinical psychotic-like experiences, would require evaluation in children specifically, rather than mixed at-risk groups including adults, to substantiate treatment recommendations by demonstrating improvement in outcomes for these vulnerable young people.

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Appendices

Appendix A. Measures in order of administration

Participant ID:
DoB:
Gender:

Date of Questionnaire Completion:
Assessment Stage:
Name of Researcher (Initials only):

'How I Feel' 1

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain or the item seems daft. Please give your answers on the basis of how things have been for you ***OVER THE LAST MONTH***.

Question	Not True	Somewhat True	Certainly True
I try to be nice to other people. I care about their feelings			
I am restless, I cannot stay still for long			
I get a lot of headaches, stomach-aches or sickness			
I usually share with others (food, games, pens, etc)			
I get very angry and often lose my temper			
I am usually on my own. I generally play alone or keep to myself			
I usually do as I am told			
I worry a lot			
I am helpful if someone is hurt, upset or feeling ill			
I am constantly fidgeting or squirming			
I have one good friend or more			
I fight a lot. I can make other people do what I want			
I am often unhappy, down-hearted or tearful			
Other people my age generally like me			
I am easily distracted, I find it difficult to concentrate			
I am nervous in new situations. I easily lose confidence.			
I am kind to younger children			
I am often accused of lying or cheating			
Other children or young people pick on me or bully me			
I often volunteer to help others (parents, teachers, children)			
I think before I do things			
I take things that are not mine from home, school or elsewhere			
I get on better with adults than with people my own age			
I have many fears, I am easily scared			
I finish the work I'm doing. My attention is good.			

SDQ

Participant ID:
DoB:
Gender:

Date of Questionnaire Completion:
Assessment Stage:
Name of Researcher (Initials only):

'Unusual Experiences' 1

Circle the answers that apply to you.

1. Some people believe that their thoughts can be read. Have other people ever read your thoughts? **If true:**	**Not true**		**Somewhat true**	**Certainly true**
How often has it happened over the last 2 weeks?	Not at all	Only once	2-4 times	5 or more times
How much has it upset you?	Not at all	Only a little	Quite a lot	A great deal
How much has it made things hard at home or school?	Not at all	Only a little	Quite a lot	A great deal
2. Have you ever believed that you were being sent special messages through the television? **If true:**	**Not true**		**Somewhat true**	**Certainly true**
How often has it happened over the last 2 weeks?	Not at all	Only once	2-4 times	5 or more times
How much has it upset you?	Not at all	Only a little	Quite a lot	A great deal
How much has it made things hard at home or school?	Not at all	Only a little	Quite a lot	A great deal
3. Have you ever thought that you were being followed or spied upon? **If true:**	**Not true**		**Somewhat true**	**Certainly true**
How often has it happened over the last 2 weeks?	Not at all	Only once	2-4 times	5 or more times
How much has it upset you?	Not at all	Only a little	Quite a lot	A great deal
How much has it made things hard at home or school?	Not at all	Only a little	Quite a lot	A great deal
4. Have you ever heard voices that other people could not hear? **If true:**	**Not true**		**Somewhat true**	**Certainly true**
How often has it happened over the last 2 weeks?	Not at all	Only once	2-4 times	5 or more times
How much has it upset you?	Not at all	Only a little	Quite a lot	A great deal
How much has it made things hard at home or school?	Not at all	Only a little	Quite a lot	A great deal
5. Have you ever felt that you were under the control of some special power? **If true:**	**Not true**		**Somewhat true**	**Certainly true**
How often has it happened over the last 2 weeks?	Not at all	Only once	2-4 times	5 or more times
How much has it upset you?	Not at all	Only a little	Quite a lot	A great deal
How much has it made things hard at home or school?	Not at all	Only a little	Quite a lot	A great deal

UNUSUAL EXPERIENCES IES

Participant ID:
DoB:
Gender:

Date of Questionnaire Completion:
Assessment Stage:
Name of Researcher (Initials only):

6.Have you ever known what another person was thinking even though that person wasn't speaking? If true:	**Not true**		**Somewhat true**	**Certainly true**
How often has it happened over the last 2 weeks?	Not at all	Only once	2-4 times	5 or more times
How much has it upset you?	Not at all	Only a little	Quite a lot	A great deal
How much has it made things hard at home or school?	Not at all	Only a little	Quite a lot	A great deal
7.Have you ever felt as though your body had been changed in some way that you could not understand? If true:	**Not true**		**Somewhat true**	**Certainly true**
How often has it happened over the last 2 weeks?	Not at all	Only once	2-4 times	5 or more times
How much has it upset you?	Not at all	Only a little	Quite a lot	A great deal
How much has it made things hard at home or school?	Not at all	Only a little	Quite a lot	A great deal
8.Do you have any special powers that other people don't have? If true:	**Not true**		**Somewhat true**	**Certainly true**
How often has it happened over the last 2 weeks?	Not at all	Only once	2-4 times	5 or more times
How much has it upset you?	Not at all	Only a little	Quite a lot	A great deal
How much has it made things hard at home or school?	Not at all	Only a little	Quite a lot	A great deal
9.Have you ever seen something or someone that other people could not see? If true:	**Not true**		**Somewhat true**	**Certainly true**
How often has it happened over the last 2 weeks?	Not at all	Only once	2-4 times	5 or more times
How much has it upset you?	Not at all	Only a little	Quite a lot	A great deal
How much has it made things hard at home or school?	Not at all	Only a little	Quite a lot	A great deal
10.If you have not had any of these experiences in the last 2 weeks, have you had any of them in the last year?	**Not true**		**Somewhat true**	**Certainly true**

UNUSUAL EXPERIENCES IES

Participant ID:
DoB:
Gender:

Date of Questionnaire Completion:
Assessment Stage:
Name of Researcher (Initials only):

Difficult Experiences 1

1. Questions about any difficult experiences you may have had.

a) Below is a list of difficult experiences that may have happened to you. For each one, please could you say whether or not it happened, and if it happened only once or more than once.

Type of Trauma	No	Happened only once	Happened more than once
Illness or being very poorly or sick			
Being in a serious accident			
Being in a natural disaster like an earthquake or tidal wave			
Other people hurting me in some way physically			
Other people hurting me in some way sexually			
Other people hurting me in some way emotionally			
Seeing somebody else seriously hurt or killed			
Being bullied			
Contact with mental health services that was scary or threatening (like coming into hospital, reactions of family, friends or staff)			
Other problems or experiences that led to you coming into hospital that were scary or threatening (like hearing voices, seeing unusual things, thinking someone or something was out to harm you).			

b) Is there anything else that you would like me to pass on to your care team about any difficult experiences that have happened to you?
REMEMBER, you don't have to tell us anything else – only say if you want to, although people often find it helpful to talk about what has happened. Whatever you tell us, we will pass it on to one of the staff on the ward who is working with you so that they can help you.

Participant ID:
DoB:
Gender:

Date of Questionnaire Completion:
Assessment Stage:
Name of Researcher (Initials only):

'How I Think' 3: Word reading

Say: 'I'm going to ask you to read some words from this card'. Give card to participant or put on table. Either point to the words to guide or allow them to read themselves. Mark on the copy below, using dots and dashes, which words are read correctly and which not. Offer the participant encouragement and praise, do not correct, coach or tell them whether they are right or wrong. You can say explicitly that you are not allowed to say this.

to is up he at
for my sun one of

big some his or an
went boys that girl water

just day wet pot things
no told love now sad

nurse carry quickly village scramble
journey terror return twisted shelves

beware explorer known projecting tongue
serious domineer obtain belief luncheon

emergency events steadiness nourishment fringe
formulate scarcely universal commenced overwhelmed

circumstances destiny urge labourers exhausted
trudging refrigerator melodrama encyclopaedia apprehend

motionless ultimate atmosphere reputation binocular
economy theory humanity philosopher contemptuous

autobiography excessively champagne terminology perambulating
efficiency unique perpetual mercenary glycerine

influential atrocious fatigue exorbitant physician
microscopical contagion renown hypocritical fallacious

phlegmatic melancholy palpable eccentricity constitutionally
alienate phthisis poignancy ingratiating subtlety

BURT: Number of Words Read	

Participant ID:
DoB:
Gender:

Date of Questionnaire Completion:
Assessment Stage:
Name of Researcher (Initials only):

'How I Think' 4

The Beads Game

Black/Orange Jars

Which jar do you think the computer was picking beads from?	
How many beads did you see before deciding?	

Green/Purple Jars

Which jar do you think the computer was picking beads from?	
How many beads did you see before deciding?	

Why did you choose the jar you did in the **Black/Orange** Game?

Why did you choose the jar you did in the **Green/Purple** Game?

Thank you for filling out the questionnaires!

Appendix B. Local clinical operational agreement with the ward for purpose of recruitment

Identification of admissions and consenting:

Check Electronic notes system regularly to identify new admissions

Young people over 16:

- Check whether C4C (general consent for research) is ticked as yes and young person has capacity (as assessed regularly by the clinical team and noted on electronic notes system)
- Check with shift leader or member of core team whether there are any concerns regarding approaching young person
- Go through short info sheet with young person and give young people both short and long info sheet, mention option of mini IIS
- Write e-mail to core team and ward psychologist, letting them know you have explained the study to the young person and check again if there are any concerns with regards to the young person taking part in the study (using initials of young people in e-mail)
- Approach young person after minimum of 24 hours and check if they are interested in participation
- If yes, young people sign both consent form (also for mini IIS, just put note on top)
- Book young person to be tested
- Write e-mail to core team and ward psychologist letting them know that they decided to take part, and when they are booked to do the study

Young people under 16

- Check whether C4C is ticked as yes, young person has capacity and check with regards to parental responsibility
- Check with shift leader or member of core team whether there are any concerns re approaching young person
- Go through short info sheet and give young people the short info sheet, mention option of mini IIS
- Write e-mail to core team and ward psychologist, letting them know you have explained the study to them and checking if there are any concerns with regards to the young person taking part in the study and or any concerns with regards to the parents/carers being contacted/ask who is best person to contact re consent if in doubt (using initials of young people in e-mail)
- Approach young person after minimum of 24 hours and check if they are interested
- Explain study to parents/carers, they sign consent form
- Book young person to be tested by Nina
- Write e-mail to core team and ward psychologist letting them know that young person decided to take part and parent have consented and when they are booked to do the study

- If unable to get hold of parental responsibility holder, send letter with cover letter and information sheet, one week after sending letter, e-mail care team and ward psychologist to check that it is still OK to make the follow up call
- If there is a delay between the young person having initially expressed interest in the study and the obtaining of the parental consent, check with care team/shift coordinator whether there are any concerns with regards approaching the child to sign the assent form.

Document consent on EPJS, one copy of consent form for the young person/parent, one for researcher which is uploaded onto EPJS

Testing the young person and procedures after testing

- Before each meeting, check by telephone with the shift co-ordinator earlier in the day that still OK to go ahead
- On arriving on ward, present self to shift co-ordinator, and ensure they know where you are and what you are doing, with whom
- After each meeting, feedback verbally to shift co-ordinator, brief note on electronic note system, and mail to care team and ward psychologist, stating what was completed and a comment on how the YP presented
- Do all this before leaving the ward
- Feedback any reported trauma history. Format: 'On the trauma checklist they reported...' and or risk

In the case of acute distress or reports of trauma:

- Current distress – immediately alert a member of the ward care team to speak to the YP
- Still document the meeting and feedback in the usual way. Alert ward psychologist. Will need to discuss with ward psychologist, and care team whether to continue.

Appendix C. Table to show baseline associations between demographic and clinical variables, bivariate Pearson's correlations reported (bootstrapping not applied).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Gender (female = 1)	1	-.026	.231	-.109	.122	.075	-.158	-.138	-.074	-.199	-.223	-.154	-.126	-.013
2 Ethnicity (white British = 1)	-.026	1	-.129	-.354**	-.060	-.021	-.123	-.176	-.154	-.075	-.136	-.075	-.136	.089
3 Age	.231	-.129	1	.227	.168	.066	-.028	-.093	-.040	-.003	.001	-.089	-.006	.140
4 Emotional problems	-.109	-.354**	.227	1	.237	.037	.410**	.411**	.425**	.288*	.336**	.328**	.460**	.094
5 Life events	.122	-.060	.168	.237	1	.065	.366**	.346**	.303*	.272*	.336**	.319*	.383**	-.158
6 JTC	.075	-.021	.066	.037	.065	1	.041	.060	.137	-.045	.019	.033	.051	-.294*
7 PLE severity	-.158	-.123	-.028	.410**	.366**	.041	1	.855**	.899**	.865**	.963**	.954**	.984**	-.167
8 Paranoia	-.138	-.176	-.093	.411**	.346**	.060	.855**	1	.849**	.574**	.816**	.842**	.830**	-.150
9 Hallucinations	-.074	-.154	-.040	.425**	.303*	.137	.899**	.849**	1	.686**	.851**	.844**	.898**	-.247
10 Grandiosity	-.199	-.075	-.003	.288*	.272*	-.045	.865**	.574**	.686**	1	.842**	.809**	.857**	-.061
11 Conviction	-.223	-.136	.001	.336**	.336**	.019	.963**	.816**	.851**	.842**	1	.906**	.925**	-.132
12 Frequency	-.154	-.075	-.089	.328**	.319*	.033	.954**	.842**	.844**	.809**	.906**	1	.896**	-.097
13 Distress/Impact	-.126	-.136	-.006	.460**	.383**	.051	.984**	.830**	.898**	.857**	.925**	.896**	1	-.203
14 Burt reading score	-.013	.089	.140	.094	-.158	-.294*	-.167	-.150	-.247	-.061	-.132	-.097	-.203	1

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-taile

Appendix D. Table to show linear regression, regressing emotional problems, life events and jumping to conclusions on total psychotic like experiences severity, controlling for age and gender

	B	SE B	beta	t	p	Zero-order	partial
Constant	102.46	69.01		1.49	.144		
SDQ Emotional Problems	3.21	1.20	.325	2.68	.010	.373	.355
Life events	3.55	1.16	.380	3.05	.004	.422	.396
Jumping to conclusions cognitive bias	1.98	7.36	.031	.27	.788	.041	.038
Gender	- 11.27	6.83	-.197	-1.66	.105	-.207	-.227
Age at first Assessment	- 6.043	4.43	-.170	-1.36	.179	-.035	-.189

*Abbreviations: B = Beta, SE = Standard Error, t = hypothesis test statistic, p = p-value, zero-order = zero-order correlation, partial = partial correlation

Appendix E. Table to show Linear Regression, regressing hallucinations and paranoia on emotional problems

	B	SE B	beta	t	p	Zero order	partial	Tolerance	VIF
Constant	-10.88	6.67		-1.63	.108				
Hallucinations	.08	.07	.25	1.20	.235	.425	.154	.28	3.61
Paranoia	.13	.14	.20	.96	.342	.411	.124	.27	3.67
Gender	-.72	.65	-.13	-1.11	.273	-.109	-.143	.93	1.08
Age at first assessment	1.03	.42	.29	2.49	.016	.227	.309	.94	1.06

*Abbreviations: B = Beta, SE = Standard Error, t = hypothesis test statistic, p = p-value, zero-order = zero-order correlation, partial = partial correlation, VIF = variance inflation factor

Appendix F. Table to show Linear Regression, regressing PLE conviction, frequency and distress/impact on emotional problems, controlling for age and gender

	B	SE B	beta	t	p	Zero order	partial	Tolerance	VIF
Constant	-9.03	6.43		-1.40	.166				
Conviction	-.37	.17	-.74	-2.25	.029	.336	-.283	.10	9.79
Frequency	-.02	.10	-.06	-.22	.824	.328	-.029	.15	6.83
Distress/Impact	.23	.06	1.18	3.90	.000	.460	.456	.12	8.20
Gender	.10	.41	.28	2.46	.017	.227	.308	.89	1.13
Age at first assessment	-1.12	.65	-.20	-1.73	.090	-.109	-.221	.84	1.19

*Abbreviations: B = Beta, SE = Standard Error, t = hypothesis test statistic, p = p-value, zero-order = zero-order correlation, partial = partial correlation, VIF = variance inflation factor

Appendix G. Table to show Linear Regression, regressing hallucinations and paranoia on life events, controlling for age and gender

	B	SE B	beta	t	p	Zero order	partial	Tolerance	VIF
Constant	-8.24	7.11		-1.16	.251				
Hallucinations	-2.75	.07	.00	.00	1.00	.303	.000	.29	3.46
Paranoia	.23	.14	.38	1.66	.103	.346	.217	.29	3.51
Gender	.66	.66	.12	.99	.327	.122	.131	.94	1.07
Age at first assessment	.62	.44	.18	1.42	.162	.168	.186	.94	1.06

*Abbreviations: B = Beta, SE = Standard Error, t = hypothesis test statistic, p = p-value, zero-order = zero-order correlation, partial = partial correlation, VIF = variance inflation factor

Appendix H. Table to show Logistic Regression, regressing grandiosity on JTC, controlling for Burt reading scores and age and gender

	B	SE B	Wald	Sig.	Exp(B)
Constant	-2.68	10.48	.065	.798	.069
Grandiosity	.02	.06	.098	.754	1.019
Burt	-.04	.02	3.365	.067	.960
Gender	.16	.90	.032	.857	1.176
Age at first Assessment	.30	.66	.204	.652	1.347

*Abbreviations: B = Beta, SE = Standard Error, Wald = hypothesis test statistic, Sig. = significance, Exp (B) = odds ratio

Appendix I. Table to show Logistic Regression, regressing conviction on JTC, controlling for Burt reading scores and age and gender

	B	SE B	Wald	Sig.	Exp(B)
Constant	-2.60	10.38	.063	.802	.074
Conviction	.05	.09	.295	.587	1.050
Burt	-.04	.02	3.133	.077	.962
Gender	.24	.92	.069	.793	1.274
Age at first Assessment	.27	.66	.169	.681	1.310

*Abbreviations: B = Beta, SE = Standard Error, Wald = hypothesis test statistic, Sig. = significance, Exp (B) = odds ratio

Appendix J. Table to show Item loading for each psychotic like experience content/type grouping derived from a pragmatic confirmatory factor analysis of Endorsement of each psychotic like experience questionnaire item

Psychotic-like experience questionnaire item	Component	
	Factor 1	Factor 2
1. Some people believe that their thoughts can be read. Have other people ever read your thoughts?	.593	.031
2. Have you ever believed that you were being sent special messages through the television?	.696	.264
3. Have you ever thought that you were being followed or spied upon?	.669	-.504
4. Have you ever heard voices that other people could not hear?	.753	-.496
5. Have you ever felt that you were under the control of some special power?	.670	.376
6 Have you ever known what another person was thinking even though that person was not speaking?	.804	.173
7. Have you ever felt as though your body had been changed in some way that you could not understand?	.701	.234
8. Do you have any special powers that other people do not have?	.578	.462
9. Have you ever seen something or someone that other people could not see?	.780	-.403

Service Evaluation Project

Performance of a modified Brief Illness Perception Questionnaire, designed to predict engagement and response to Cognitive Behavioural Therapy for Psychosis (CBTp), in a psychological therapy service.

Supervised by

Dr. Suzanne Jolley, Institute of Psychiatry, Psychology and Neuroscience

Service Setting: SHARP (Social Hope and Recovery Project), Part of Increased Access to Psychological Services for Severe Mental Illness (IAPT SMI)

Abstract

Background and Objectives: There has been recent evidence that illness perceptions can predict treatment uptake and response to treatment in research trials of Cognitive Behavioural Therapy for Psychosis (CBTp). This study aimed to evaluate the usefulness of measuring illness perceptions in a service context, in terms of identifying patterns of engagement with, and response to, therapy, that could inform service delivery.

Methods: 255 service users with psychosis, referred for CBTp, completed a measure of illness perceptions before starting therapy. It was examined whether the measure performed similarly in the service context to the research context, its associations with baseline characteristics, and whether illness perceptions predicted: i) treatment uptake; and ii) treatment response, as measured by the primary routine outcome measure for the service.

Results: The illness perceptions measure showed a similar factor structure in the service setting as to the research context, constituting three factors; 'Impact', 'Control/Understanding' and 'Psychological Change'. Associated subscales, formed by summing the relevant items for each factor were reliable in their structure. The total score, and the 'Impact' and the 'Control/Understanding' subscales were significantly associated with baseline distress. Those who completed a course of therapy had a greater belief that change could occur through psychological means than those who did not take up therapy. Within those who completed therapy, a greater belief in change through psychological means at baseline and more therapy sessions attended was associated with greater improvement.

Conclusions: The 'Psychological Change' subscale of the illness perceptions measure performs in the clinical frontline as in research studies, and could potentially be implemented as a predictor of engagement and response to therapy. Specifically targeting beliefs about change through psychological means early on in therapy may lead to better outcomes in therapy. Targeting such beliefs in the early stages of engagement may encourage people to engage in therapy.

TABLE OF CONTENTS

Introduction

Psychosis is a mental health condition that is characterized by heterogeneous symptoms including positive symptoms (hallucinations and delusions) and negative symptoms (amotivation and apathy). Further, it is often accompanied by mood disturbances and anxiety disorders. The burden of disease of psychosis is high with increased risk of physical health problems and mortality (Chang et al., 2011) and a twelve times greater risk of suicide compared to the general population (Dutta et al., 2010). According to NICE (National Institute for Health and Care Excellence, NICE, 2014), medication is only partially effective with 40% , over a third and two thirds, continuously experiencing positive, affective and negative symptoms, respectively.

Cognitive behavioral therapy for psychosis (CBTp) is an adaption of CBT for affective and anxiety disorders. It uses the principles and techniques of cognitive and behavioral modification to help patients change their appraisals of their psychotic symptoms and/or to reduce concurrent affective and anxiety symptoms (Morrison and Barratt, 2010).

Trial-based research and service evaluations have demonstrated evidence for the positive impact of CBTp on positive symptoms, distress and functioning compared to routine care (NICE, 2014). However, the degree of engagement in therapy varies. In routine services about half of those offered therapy will refuse (Prytys, Garety, Jolley, Onwumere and Craig, 2011) and not all who initially engage in the therapeutic relationship, will necessarily engage in the full range of therapeutic techniques.

In the Psychological Prevention of Relapse in Psychosis (PRP) trial (Garety et al., 2008), a large randomized controlled trial comparing CBTp with treatment as usual, heterogeneity in take- up of therapy determined outcome. In this study, random allocation to CBTp resulted in very little benefit (Garety et al., 2008). However, a planned structural equation modeling analysis showed that patients who had more active types of therapeutic techniques (41%) spent less time in remission and had less severe psychotic and affective symptoms than those control group patients who would have engaged in CBTp, had they been offered. There was a degree of symptomatic deterioration (albeit non-significant) in the 38% of patients who were maintained in therapy but received only basic assessment and engagement components before termination of therapy

(Dunn et al., 2012). Consequently it appears that engagement is a pivotal factor in outcome and that by predicting engagement, resource allocation could be optimized. Further, if psychological predictors of engagement can be identified interventions can be developed which target modification of such predictors, creating the optimal context for positive therapy outcomes.

Health psychologists posit that what predicts treatment uptake and engagement in the field of physical health is people's appraisals of their illness (Leventhal, Diefenbach & Leventhal, 1992). The Illness Perception Questionnaire (IPQ; Weinman, Petrie, Moss-Morris & Horne, 1996) taps into the 'cognitive representations' of illness specified in Leventhal's self-regulatory model. These include the identity and nature, cause, likely duration and consequences of the illness and whether and how the illness can be cured or managed. The IPQ assesses five main constructs: symptoms, causes, consequences, cure/control and timeline.

Freeman et al. (2013) examined whether illness perceptions as measured by the IPQ predicted therapy uptake in a subsample of participants in the PRP trial that had completed the IPQ. They found that take-up of therapy was not predicted by levels of psychiatric symptoms as measured by the PANSS (Kay, 1991) and the Beck Depression Inventory (BDI; Beck, Steer & Brown, 1996) nor by insight, but that it was predicted by illness representations. The authors found that those patients who did not take up therapy believed that their symptoms would not last as long compared to those who attended. Those who did not proceed to full therapy had a lower sense of control over their problems and a more biological view of their causes of their problems. Those patients who progressed through full therapy were more likely to attribute the cause of their problems to personality and state of mind. Freeman et al. (2013) concluded that those who understood their problems as more psychologically driven and with the potential to gain control over them, may be more likely to fully engage with and derive benefits from standard CBT for psychosis, irrespective of the severity of their problems.

Marcus et al. (2014) piloted a modification of the IPQ (M – IPQ), which was designed to predict response following CBT for psychosis. They selected those 11 items from the original IPQ, which had predicted engagement in the Freeman et al (2013) analysis. To these, three further items from the talking therapies outcome literature were added, designed to measure expectations of change and the extent of fit between a CBT approach and the individual. Principal components

analysis identified 3 components, which were labelled ‘Cure/Control plus’, ‘Timeline’ and ‘Internal/External Causality’. In two trials comparing brief psychological therapy compared to a control group (Garety et al., 2014; Freeman et al., 2015), neither causal attributions nor the ‘Timeline’ factor predicted therapy outcome as measured by a brief scale of five visual analogue ratings taken from Green’s et al. (2008) Paranoid Thought Scale. Higher levels of perceived ‘Cure/Control’ were, however, associated with therapy outcomes (Marcus et al., 2014).

The aim of the current study was to examine the psychometric properties and the predictive utility of illness perceptions for engagement and therapy outcome in a service context as compared to a research trial context. As a measure of illness perceptions, the Brief Illness Perception Questionnaire (BIPQ, Broadbent, Petrie, Main & Weinmann, 2006) was modified, with the items piloted by Marcus et al. (2014) included in lieu of the generic treatment effectiveness item on the original BIPQ scale. This modified version of the Brief Illness Perception Questionnaire (M- BIPQ) was given to patients who were part of the Improving Access to Psychological Therapies for people with Severe Mental Illness (IAPT –SMI) South London and Maudsley National Health Service (NHS) Foundation Trust (SLaM) psychosis demonstration site at the start, midpoint, and end of therapy.

The aim was to investigate whether the psychometric properties of the M-BIPQ in this service setting were similar to those found in the research setting using a similar measure (M – IPQ; Marcus et al., 2014), to investigate associations between the M-BIPQ and baseline demographics and care pathways and to investigate whether similar associations of illness perceptions with therapy uptake and therapy outcome were found, such that those with a more psychologically oriented view of their problems were more likely to: i) engage fully; and ii) do well when offered CBTp as part of the IAPT-SMI service.

Methods

Service context

SLaM, part of the King's Health Partners Academic Health Sciences Centre, serves four London boroughs with a diverse population high rates of population movement, drug use, crime, socio-economic deprivation, and psychosis incidence. Within SLaM services are provided within Clinical Academic Groups (CAGs) in order to develop specialist practice. The Psychosis Clinical Academic Group (CAG), operates across four Care Pathways; Early Intervention (EI), Promoting Recovery (PR), Complex Care, and Acute Inpatient Care. The IAPT-SMI pilot is overseen by PICuP (Psychological Interventions Clinic for Outpatients with Psychosis) in the EI and PR pathways, operating alongside existing psychological therapy provision and the multidisciplinary Community Mental Health Teams (CMHTs). The PR pathway serves people with established schizophrenia spectrum diagnoses, or with psychotic symptoms in the context of bipolar affective disorder. The EI pathway sees people with a first presentation of psychotic symptoms, which may reach the criteria for a range of diagnoses. Therapy is provided by psychological therapists, and a full time equivalent of ten therapists (UK Agenda for Change bandings 7 and 8) work in IAPT-SMI. All participants gave consent for their measures to be used pseudonymously, in aggregate, to evaluate the service, and the service evaluation was approved by SLaM's audit and evaluation committee (ref. PSYCHLO-13-18). Data used for this evaluation were collected from the start of the service in November 2012 until December 2014.

Referrals

The IAPT-SMI service is designed for service users with psychosis whose needs can be appropriately met within a psychological therapy service (interested to engage in talking intervention, attending reasonably reliably, and not currently present with very high levels of risk or chaotic behavior). Referrals streams are primary and secondary care and self-referral. Medical and social care needs are managed by the CMHT or in primary care during therapy.

Assessment

All referrals are screened by clinicians within the service to ensure referral criteria are met and

those accepted are assessed by an independent assessor for a pre-therapy assessment, usually taking place over a single session (a graduate psychology assistant). Independent assessments are repeated at three-months and at the end of therapy. Therapists offer a first therapy appointment as soon as possible following assessment and sessional measures are completed at every meeting, if consented by the service user, with the therapist's help if needed.

Therapy

Therapy is individualised and formulation based, but adheres to published manuals and the CORE CBTp competence framework (Roth & Pilling, 2013) in terms of central principles, structure, and techniques employed. Individuals are offered between 16 and 30 sessions, in line with NICE guidelines and sessions last approximately an hour and are offered at weekly to fortnightly intervals over a period of six to nine months. Location is usually in the referring team's base or a central clinic, with some flexibility to suit the individual. Therapists receive fortnightly to monthly individual supervision and fortnightly group supervision in groups of 3-6 therapists for 1.5 hours. Supervisors are senior clinicians with between 10 and 20 years of experience of training therapists and of providing therapy within randomised controlled trials. Therapists are trained to competence, using evidence-based assessments of adherence and competence (Fowler, Rollinson, & French, 2011); training is usually 12-24 months of post-qualification and postgraduate study (Jolley et al., 2015).

Measures

IAPT Demonstration Site Measures

One of the demonstration site aims was to pilot routine outcome monitoring, including activity (referrals, waiting times, attendance); performance (clinical and functioning outcomes and service use); user experience and satisfaction. The IAPT-SMI clinical outcomes battery comprised the CHOICE (Greenwood et al, 2009), the Clinical Outcomes in Routine Evaluation-10 (CORE-10; Barkham et al., 2013), the Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS, Tennant et al., 2007), the Work and Social Adjustment Scale (WSAS, Mundt, Marks, Shear, & Greist, 2002) and the Psychotic Symptom Rating Scales (PSYRATS - Haddock, McCarron, Tarrier, & Faragher, 1999), together with patient experience, satisfaction and feedback questionnaires, and the Euroqol group' s EQ5D (1990) measure of Quality of Life. Functional outcome was rated

according to IAPT criteria as engaged in meaningful activity (in a work, domestic, voluntary or academic setting) or unoccupied.

Demographic and service use data were collected by self-report and, for existing users of SLaM services, from the clinical record. Self-reported ethnicity was dichotomised into Black and Minority Ethnic (BME) or other group (non-BME). For the current evaluation, the CHOICE data and an additional measure of illness perceptions were employed.

Choice of outcome in cognitive therapy for psychoses (CHOICE; Greenwood et al., 2010; 2012) is an 11-item shortened version of the CHOICE (Greenwood et al., 2009), a user-defined outcome measure, which was developed specifically for the IAPT-SMI initiative, based on the highest loading items from the 34-item measure. Because of its high correlation with a range of measures of affective disturbance (Greenwood et al., 2010) and user-led design, the CHOICE was determined centrally and a priori as the primary outcome measure for the psychosis demonstration sites, and reliable improvement/deterioration was predetermined as a change of ≥1.45 in mean total score. The short version Inter-rater, internal, and test-retest reliability for the new measure are all good, as is criterion validity (Greenwood et al., 2012). The measure was completed sessionally. Each item is rated from 0 (worst) to 10 (best), yielding a mean total score ranging from 0 to 10 and the average score is calculated. Scores hence range from 0 to 11. A positive percentage change on the CHOICE reflects improvement in wellbeing.

Modified Brief Illness Perception Questionnaire (M- Brief IPQ) (Broadbent et al 2006)

As a measure of illness beliefs the 10 item Modified Brief Illness Perception Questionnaire (M-BIPQ) was developed and piloted in a service context. It is a modification of the Brief Illness Perception Questionnaire (BIPQ, Broadbent et al., 2006) .The BIPQ is a short, 8 item version of the Illness Perception Questionnaire – Revised (IPQ-R), and was developed by Broadbent et al. , 2006 as a shorter and simpler measure of illness perceptions to be used in large population wide studies and in service contexts. It was developed by devising one item that best summarized each subscale of the IPQ –R (consequences, timeline, personal control, treatment control, identity, concern, understanding and emotional response). It is further designed to measure cognitive (consequences, timeline, personal control, treatment control, identity) and emotional (concern and emotional response) representations of illness and illness coherence (understanding). The

BIPQ has been shown to have good test retest validity and concurrent validity with relevant measures across various illnesses in a variety of contexts (Broadbent et al., 2006).

Out of the 8 original BIPQ items 7 were included in the M-BIPQ. Out of the five items on the BIPQ assessing cognitive illness representations: consequences (Item 1 in the M-BIPQ), timeline (Item 2 in the M-BIPQ), personal control (Item 3 in the M-BIPQ) and identity (Item 4 in the M-BIPQ) were included in the modified measure. The treatment control question was not included in the M-BIPQ. Both items assessing emotional representations: concern (Item 5 in the M-BIPQ) and emotions (Item 7 in the M-BIPQ) were included and so was the one item assessing illness comprehensibility (Item 6 in the M-BIPQ).

Wording for these items had been modified for the use with psychosis from 'illness' to 'problems/illness' for people who did not consider themselves to have an illness (Jolley and Garety, 2004, Watson et al., 2006). The three items piloted by Marcus et al. (2014), help through talking therapy, improvement through change in thinking and help through looking at things differently (Item 8, 9 and 10 in the M-BIPQ respectively) were added in lieu of the generic 'treatment control' item on the original BIPQ scale. Items were rated on a likert scale from 0 to 10. Items 3, 6, 8, 9 and 10 were reverse scored as higher scores indicated illness beliefs hypothesized to be more helpful. Hence for the mean M-BIPQ lower scores reflect illness beliefs hypothesized to be less problematic. Scores hypothetically range from – 5 to + 5.

Analysis

Data were analysed using SPSS version 20 (IBM, 2011).

The first part of the analysis focused on the characteristics of the M-BIPQ scale and associations between dimensions of the M-BIPQ scale and demographic characteristics of the sample. Baseline M-IPQ scores for the full sample were subjected to a principal component analysis. Subscales were formed by summing the items loading on each factor. Inter-item correlations and internal consistency (Cronchbachs' a) were calculated for the full scale and for each subscale. Descriptive statistics were calculated for all those who had completed the M-BIPQ at baseline.

The association of the M-BIPQ full scale and subscales with baseline demographics (age, gender and ethnicity) was examined in the full sample using correlational analysis and one-way ANOVA.

The second part of the analysis focused on investigating differences in demographic characteristics across categories of therapy engagement (using Chi-squared analysis for categorical and ANOVA analysis of variance for continuous variables) and on differences in illness beliefs between categories of engagement (using ANOVA analysis of variance with engagement entered as independent and M-BIPQ total and subscale scores entered as dependent variables, alone and controlling for baseline level of distress as measured on the CHOICE). The decision to control for baseline scores on the CHOICE was made due to significant associations between baseline levels of distress on the CHOICE and the M-BIPQ total and two of the M-BIPQ subscales. Although there were no significant differences in scores on the CHOICE between groups of engagement at baseline, this could have been due to small group size. Hence controlling for baseline levels of distress was important to ensure that differences in illness beliefs between categories of engagement were not influenced by baseline levels of distress. Engagement was operationalized according to national IAPT-SMI criteria as 'no uptake of therapy' (client assessed but did not attend any sessions), 'partial therapy' (client attended at least one session but fewer than five) and 'full therapy' (client attended five or more sessions).

For all univariate ANOVA analyses making comparisons between more than two groups Bonferroni corrected results are reported.

The third part of the analysis focused on predictors of therapy outcome in the subsample who had completed the M-BIPQ and had completed the pre and post assessment (this includes service users across all of above three groups of engagement and also those who did not fall in any of any of the three groups of engagement). Improvement was operationalized as a reduction of distress, reflected in percentage change on the CHOICE pre and post therapy. A positive percentage change on the CHOICE reflects improvement in wellbeing. Associations of B-MIPQ subscales, demographic variables and number of sessions with therapy outcome were examined using bivariate correlations. Those variables significantly correlated with improvement were further added as predictors to a multiple regression model predicting therapy outcome.

Results

Demographics

A total of 375 clients were referred to the service within the given time frame of whom 255 completed all items on the M-BIPQ and were hence included in the analyses. Of those 255 service users, 155 completed a course of therapy, 10 chose not to take up therapy after the initial assessment and 20 ended therapy before the full course. Therapy was ongoing for the remainder. Demographic and clinical characteristics of these 255 service users are shown in Table 1.

Table 1. Baseline Demographic and Clinical Characteristics

Variable	**Total N**
Age (years)	37.26 (range: 17 – 65; SD = 11.46)
Gender	
Female	123
Male	132
Ethnicity (N = 254)	
White-British/Irish/Other	115
Black/Asian/Mixed	139
Team	
SHARP	63
PICUP	119
Early Intervention	73
CHOICE (baseline) (N = 249)	4.651

*N = 255, unless otherwise stated, N = number, SD = Standard Deviation

Reliability and factor structure of the M-BIPQ

The internal consistency of the full M-BIPQ scale was poor (Cronbach's a = .579). There was some collinearity amongst the items, with multiple inter-item correlations of .3 or above, indicating that the derivation of factors was appropriate. Principal Components Analysis (PCA), with varimax rotation resulted in the extraction of two related components with Eigenvalues > 1. On inspection of the items in the third component there was face validity that these items tapped into a conceptually distinct construct (Control and Understanding) and it was decided to include the

third component with Eigenvalue of .92. Hence the first three principal components accounted for 37.8%, 24.2% and 9.2% of the variance, respectively (71.22 % of the variance in total).

The three component and item loadings are shown in Table 2, and were labelled, 'Impact', 'Control/Understanding' and '(Belief in change in mental health through) Psychological change'. M-BIPQ subscale scores were calculated by adding the relevant items loading most highly on each factor. The 'Control/Understanding' and 'Psychological Change' subscales were composed of items which were reverse scored as a higher score reflected more adaptive illness beliefs for all items on these scales (i.e. greater control and understanding and a belief in amenability of symptoms to change via psychological means), unlike the impact subscale where higher scores reflected greater perceived impact of symptoms.

The Impact subscale included five items (items 1, 2, 4, 5 and 7). Items tapping into illness duration, symptom experience, concern and impact were represented by this subscale. The subscale showed good internal consistency (Cronbach's alpha of .867) and high inter-item correlations (range: r = .49 - .64). The Psychological Change subscale comprised the three items that were added to the brief IPQ. These tapped into beliefs about the impact of changes in perspective and thought and the impact of talking therapy on the problem. Internal consistency for this subscale was good (Cronbach's alpha = .853) and inter-item correlations high (range: r= .58 - .81). The Control subscale contained two items, enquiring about perceived control and understanding of the problem. The internal consistency of the subscale was acceptable (Cronbach's alpha of .603) and the inter-item correlation was medium (r = .432).

Table 2. Item loadings for each factor of the modified Brief Illness Perception Questionnaire

Item	Factor 1	Factor 2	Factor 3
1. How much do mental health problems affect your life	.841		
2. How long do you think your mental problems will continue	.731		
3. How much control do you feel you have over your MH problems	-.454		.614
4. How much do you experience symptoms from your MH problems	.822		
5. How concerned are you about your MH problems	.791		
6. How well do you feel you understand your MH problems			.924
7. How much do MH problems affect you emotionally	.802		
8. How much do you think talking therapy can help with your MH problems		.802	
9. How much do you think changing the way you think/do can improve MH[A] probs		.905	
10. How much do you think looking at things differently can be helpful		.912	

*Coefficients < 0.3 are suppressed
***N = 255*
[A] MH = Mental Health

Demographic and clinical characteristics and the M-BIPQ

There were no significant associations between M-BIPQ scores (mean of the total and of each of the three subscales) and gender or BME group.

Age was positively correlated with the Total M-BIPQ Scale (r =.16, p < .05), the 'Control/Understanding' subscale (r = .13 p < .05) and the 'Impact' subscale (r = .25, p < .01), meaning that older service users had more negative overall illness perceptions, considered their mental health problems to have a greater impact and had less perceived control over their mental health problem. Due to low internal consistency of the 'Control/Understanding' scale individual correlations with both items are reported (Control: r = .17, p < .01; Understanding: r = .05, p >. 05). Age was negatively correlated with the 'Psychological Change' subscale (r = -.17, p <.01), meaning that the older service users were, the more they held beliefs that their problems were amenable to change through psychological means.

Baseline distress as measured on the CHOICE was negatively correlated with the total M-Brief IPQ scale (r = -.685, p = .001), the 'Impact' subscale (r = -6.45, p = .001) and the 'Control/Understanding' subscale (r = -569, p = .001), meaning that those with greater baseline

distress had more negative illness perceptions, perceived the impact of their illness to be greater and felt less in control of their symptoms.

After controlling for age and baseline distress there were no significant differences between different teams (SHARP, PICUP or Early Intervention) on the overall M-BIPQ score ($F(3,251) = 1.13$, $p = .325$) the 'Impact' factor ($F(3, 251) = 1.708$, $p = .183$), the 'Control/Understanding' factor ($F(3,251) = .191$, $p = .826$) and the individual items on the 'Control/Understanding' subscale (Control: $F(3,251) = .972$, $p = .380$; Understanding: $F(3,251) = .051$, $p = .950$,) and the 'Psychological Change' subscale ($F(3,251) = 1.925$, $p = .148$).

Differences between categories of engagement

Out of the 255 service users included in the M-BIPQ validation analysis, 155 had completed therapy at the time, 20 had partially completed therapy and 10 had chosen not to take up therapy after having completed the pre assessment measures. For 59 service users therapy was still ongoing at the time, for two therapy was on hold and nine service users were awaiting assessment or an offer of therapy post-assessment. Hence 185 service users were included in the following analyses.

Demographic and Clinical Characteristics and Engagement

Service users in each of the three categories of engagement did not differ significantly in age ($F(2,181) = .326$, $p = .722$), gender ($X(2,182) = 1.075$, $p= .584$) and ethnic minority status ($X(2, 181) = .763$ $p= .683$) or pre therapy measures of distress, as measured by the CHOICE ($F(2, 182)= 2.476$, $p = .087$) (see Table 3 for frequencies, means and standard deviations).

Table 3. Demographic and clinical characteristics by category of engagement

Engagement Category	Gender		Ethnic Minority Status		Age		Baseline CHOICE	
	Frequency		Frequency		Mean	SD	Mean	SD
	Male	Female	BME	White				
Full therapy	88	67	79	75	36.25	11.08	4.46	2.17
Partial therapy	11	9	12	8	35.90	11.64	5.54	1.89
Declined therapy	4	6	6	4	33.03	13.08	5.05	1.76

* SD = Standard Deviation

M-BIPQ scores and engagement

Differences in M-BIPQ baseline scores between the three groups of engagement were analysed with and without controlling for baseline levels of distress on the CHOICE. As noted in the analysis section, the decision to control for baseline scores on the CHOICE was made due to significant associations between baseline levels of distress on the CHOICE and the M-BIPQ total and two of the M-BIPQ subscales. Although there were no significant differences in scores on the CHOICE between groups of engagement at baseline, this could have been due to small group size. Hence controlling for baseline levels of distress was important to ensure that difference in illness beliefs between groups of engagement was not influenced by baseline levels of distress.

Service users in each of the three categories of engagement did not significantly differ in their baseline total M-BIPQ score and their score on the 'Impact' and the 'Control/Understanding' subscales, nor on the 'understanding your problems' items of the control subscale (see Table 4). This remained the case when controlling for baseline levels of distress on the CHOICE. There was a significant difference in the Psychological change subscale of the M-BIPQ between groups of engagement ($F(2,182) = 3.731$ $p = .026$). Those in the declined therapy group had lower expectations of change through psychological means than the full therapy group ($p = .058$). The pairwise comparison was significant when controlling for baseline levels of distress on the CHOICE ($F(2, 176) = 3.54$, $p = .016$; pairwise comparison: $p = .038$). Further those in the partial therapy group felt significantly more in control of their symptoms than those in the full therapy group (pairwise comparison: $p = .023$). However this effect was no longer present when

controlling for baseline levels of distress on the CHOICE (Engagement: F (2,176) = 1.563, p = .212).

Table 4. M-BIPQ dimensional scores and clinical characteristics by group of engagement

Measure	N	Mean	SD	F	df	p
M-BIPQ -Total						
Full therapy	155	.2084	1.589			
No therapy	10	.320	1.215			
Partial Therapy	20	.00	1.291	.198	2	.821
M-BIPQ – Impact						
Full therapy	155	7.023	2.171			
No therapy	10	6.660	2.606			
Partial Therapy	20	6.959	6.61	4.08	2	.665
M-BIPQ – Psych. Change						
Full therapy	155	- 7.5849	1.942			
No therapy	10	- 6.0667	2.5083			
Partial Therapy	20	- 6.8500	1.927	.373	2	.026
M-BIPQ -Control						
Full therapy	155	- 5.138	2.519			
No therapy	10	-5.950	2.303			
Partial Therapy	20	- 6.250	2.251	2.135	2	.121
M-BIPQ – Control (item)						
Full therapy	155	- 4.697	2.836			
Partial therapy	10	- 5.500	2.759			
Declined therapy	20	- 6.500	2.585	3.869	2	.023
M-BIPQ – Understanding (item)						
Full therapy	155	5.580	3.012			
Partial therapy	10	6.400	2.547			
Declined therapy	20	6.000	3.418	.475	2	.623

*M-BIPQ = Modified-Brief Illness Perception Questionnaire, N = Number, SD = Standard Deviation, F = F statistic, df = degrees of freedom, p = statistical threshold

Predictors of Outcome

As a measure of outcome, percentage change on the CHOICE measure from the first CHOICE to the last CHOICE was used. A total of 145 service users had completed the M-BIPQ and had completed the pre and post assessment (this includes service users from all of above three groups of engagement). A positive percentage change on the CHOICE corresponds to improvements in wellbeing (maximum score on the CHOICE is 11 and minimum is 0, with 11 corresponding to the greatest wellbeing), however the percentage change measure as used in Table 5, is scored inversely, meaning that a negative value corresponds to positive percentage change. Overall service users' reported level of distress as measured by the CHOICE, decreased as reflected by a positive percentage change in the CHOICE of 11.78 percent (mean CHOICE pre therapy: 4.568, SD = 2.11 and mean CHOICE post therapy 5.526, SD = 2.67). There was no significant relationship between pre therapy scores on the total M-BIPQ and the 'Impact' and the

'Control/Understanding' subscales with post therapy outcome (see Table 5). However the 'Psychological Change' subscale was significantly correlated with outcome, with greater levels of pre therapy belief in change through psychological means associated with more positive outcomes.

As a proxy measure of quality of engagement number of therapy sessions was used. There was a significant association between number of sessions attended and change scores in the CHOICE (see Table 5), with greater improvement associated with greater number of sessions. Further there was a significant positive correlation between the 'Control/Understanding' subscale and number of therapy sessions ($r = .164$, $p < .05$), meaning that the greater the sense of control and understanding the fewer sessions accessed.

Both number of sessions and 'Psychological Change' scores on the M-BIPQ predicted outcome in terms of percentage change in the CHOICE independently in a regression model ($F (3, 141) = 9.02$, $p =<.001$; number of sessions: beta = - 2.79, t = - 3.53 , p = .001; psychological change: beta = .187,t =,2.37 p = .019). The model overall explained 11. 3 percent of the variance in change in the CHOICE (R square = .113). The 'Control/Understanding' factor was not significant when added to the model and was hence not included.

Table 5. Percentage Change CHOICE (scored inversely; negative numbers correspond to positive percentage change) and M-BIPQ dimensional scores and number of therapy sessions

Measure	**N**	**Mean (SD)**	**beta**	**t**	**df**	**p**
Percentage Change CHOICE	145	-11.78(18.55)				
M-BIPQ-Total	145	.156 (1.46)	-.067	.802	1	.424
M-BIPQ Impact	145	6.936 (2.071)	.043	.510	1	.611
M-BIPQ Psych. Change	145	-7.46 (1.77)	.186	2.268	1	.025
M-BIPQ Control	145	-5.369 (2.38)	-.094	-1.125	1	.262
N. of Therapy Sessions	145	16.24 (8.902)	-.279	-3.471	1	.001

*M-BIPQ = Modified-Brief Illness Perception Questionnaire, N = Number, SD = Standard Deviation, t = t statistic, df = degrees of freedom, p = statistical threshold

Discussion

This service evaluation is the first attempt to analyse the factor structure of a modified version of the BIPQ (Broadbent et al, 2006). The M-BIPQ showed acceptable psychometric properties and formed three factors, from which three reliable subscales were derived. The first factor, 'Impact', broadly incorporated items about consequences (Item 1), timeline (Item 2), identity (Item 4) concern (Item 5) and emotions (Item 7). The second, 'Control/Understanding', incorporated the items about personal control (item 3) and illness comprehensibility (Item 6). The third subscale, 'Psychological Change', captured expectation of change through psychological means and was comprised of the three items piloted by Marcus et al., (2014), which were 'help through talking therapy '(Item 8), 'improvement through change in thinking' (Item 9) and 'help through looking at things differently' (Item 10).

The 'Impact' subscale contained all but two of the original BIPQ items. This confirms that the items from the original scale mainly tap into one unitary construct of appraisal of psychotic illness, with high impact appraisals incorporating longer expectation of duration of problems, greater symptom severity, greater concern and greater impact on life and emotions. The other two original BIPQ items 'control over one's problems' and 'understanding of one's problems' differentiated from the 'Impact' items in our sample, suggesting that feeling in control of and in particular having an understanding of psychotic difficulties is a construct somewhat independent of perceived impact. In the current study the 'Psychological Change' subscale was clearly differentiated from the 'Impact' and 'Control and Understanding' subscales, indicating that service user's sense of whether their symptoms can improve through changes in thought and perspective and through talking therapy is relatively independent from the perceived impact of their problem and their perceived 'control/understanding' of their problem.

The M-BIQP does not confirm the categories of illness representations proposed by Broadbent et al (2006); cognitive, emotional and coherence type representations. However, these were theoretical, and intended to apply to illness experiences in general rather than psychosis in particular. The structure has not previously been confirmed by factor analysis in this group.

The only items used in the M-IPQ (Marcus et al., 2014) that overlapped with the items used on the M-BIPQ were the three items tapping into change through psychological means. Hence comprehensive comparisons with regards to the underlying factor structure of the two scales are not possible. In Marcus et al. (2014) those three items, albeit loading onto the same factor, did not form a separate component but instead loaded onto an expanded Cure/Control construct including items on personal control over illness outcomes and hopefulness. In the current study the 'psychological change' subscale was clearly differentiated from the Control subscale. However it needs to be noted that in the M-BIPQ there is only one item that directly asks about perceived control.

Construct validity for the M-BIPQ was good with large positive correlations between the total M-BIPQ scale and the 'Impact' and the 'Control and Understanding' subscales with baseline distress as measured on the CHOICE.

This study investigated the usefulness of the M-BIPQ both with regards to predicting engagement and predicting therapy outcome in those who engaged in therapy. The 'Psychological Change' scale was the only subscale which predicted engagement after controlling for baseline levels of distress as measured on the CHOICE. Those in the declined therapy group had lower expectations of change through psychological means than those in the full therapy group. This fits with Freeman et al.'s (2013) finding that those who took up full therapy were more likely to attribute the cause of their problems to personality and state of mind.

Further, 'psychological mindedness' as measured by the 'Psychological Change' subscale and number of therapy sessions attended both independently predicted positive change in therapy outcome on the CHOICE (accounting for about 10 percent of the variance). Marcus et al. (2014) found that their expanded 'Cure/Control' construct at baseline predicted paranoia post treatment controlling for baseline paranoia (and baseline distress, conviction and belief inflexibility). The expanded construct included all items of the 'Psychological Change subscale'. Outcome measures were only available for those who had engaged in therapy and hence this study did not attempt to investigate Freeman et al.'s (2013) finding of symptomatic deterioration in those who only partially engaged in therapy. Within the group who engaged (attended 5 session or more) more sessions led to better outcomes.

The primary limitations of the evaluation in terms of wider applicability, are its service specificity and uncontrolled design. However, these limitations are inherent in a service-based study. Referrals were accepted on a needs basis and do not represent a representative subsample of those suffering from psychosis. Further the relatively small number of closed cases may limit representativeness of those undergoing psychological therapy. Assessments were not blind, which may inflate effects and effects are pre-post and within participants, with no control group. It can therefore not be inferred with any certainty that changes in presentation occur as a result of therapy. Additionally, comparison between therapy completers and those who disengaged may be limited by possible difficulties of the disengaging group, unmeasured by the assessment carried out. A further limitation is the unequal size in categories of engagement, which limits statistical power.

This service evaluation demonstrated the Modified Brief Illness Perceptions Questionnaire (M-BIPQ) to have acceptable psychometric properties when used in this routine care setting. The full scale as well as the 'Impact' and 'Control and Understanding' subscales were associated with baseline distress. A 'Psychological Change' construct examining a degree of fit between the CBT framework and the service users own appraisals predicted both take up of therapy and therapy outcome in those who attended five sessions or more. Hence this study replicates the use of illness perception questions and in particular those assessing psychological mindedness in predicting engagement and therapy outcome (Freeman et al., 2012 and Marcus et al., 2014) in a service context. Given that the 'psychological change' construct only explained about 10 percent of the variance in outcome on the CHOICE, this measure cannot be used to accurately predict who can benefit from CBT for psychosis. However it can be used as a screening tool to identify those whose understanding of their illness is not matching with the underlying principles of CBT for psychosis and potentially to incorporate this mismatch into the formulation and therapeutic intervention.

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