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Schizotypal traits and psychotic-like experiences during adolescence: An update

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Abstract

Background: The psychosis phenotype is distributed along a severity continuum that ranges from psychological well-being to full-blown psychosis. Schizotypal traits and psychotic-like experiences are considered as one of the possible phenotypic indicators of the latent liability for psychosis (named schizotypy). This selective review offers a general overview and update of trait schizotypy and psychotic like experiences during adolescence. **Method:** The previous literature on schizotypal traits and psychotic like experiences is selectively reviewed. **Results:** We begin with a brief introduction of psychosis syndrome from an extended psychosis phenotype framework as well as a brief definition of trait schizotypy and psychotic-like experiences. We introduce the study of these traits and experiences from a developmental perspective, where the psychosis proneness-persistence-impairment model is highlighted. We provide a selective review of the tools available for assessment these constructs from the psychometric high-risk paradigm. We then discuss the factorial validity of the studies conducted in adolescents. In addition, the links between this set of subclinical traits and experiences and other variables gathered from a translational approach are discussed, with the aim to establish a nomological network. **Conclusions:** We conclude by considering remaining questions and future directions for the understanding of trait schizotypy and psychotic-like experiences during adolescence.

Key words: Schizotypy, Psychotic-like experiences, Psychosis, Adolescent, Schizotypal traits.

Resumen

Rasgos esquizotípicos y experiencias psicóticas atenuadas en la adolescencia: una actualización. Antecedentes: el fenotipo psicótico se distribuye a lo largo de un continuo de gravedad. Los rasgos esquizotípicos y las experiencias psicóticas atenuadas son considerados posibles indicadores fenotípicos de la vulnerabilidad latente a la psicosis (denominada esquizotipia). Se ofrece una revisión selectiva referente al estudio de los rasgos esquizotípicos y de las experiencias psicotiformes durante la adolescencia. **Método:** la literatura previa sobre la esquizotipia y las experiencias psicóticas atenuadas fue revisada. **Resultados:** se realiza una introducción al síndrome de psicosis desde el modelo fenotipo psicótico "extendido", así como una definición y delimitación de la esquizotipia y las experiencias pseudo-psicóticas. Se introduce el estudio de estas experiencias y rasgos desde una perspectiva del desarrollo, y se pone énfasis en el modelo propensión-persistencia-deterioro de la psicosis. Se revisan las herramientas de medición disponibles para su evaluación desde el paradigma de alto riesgo psicométrico y se discute la validez factorial. Además, se analizan los nexos de unión entre este conjunto de experiencias psicotiformes y otras variables a partir de un enfoque translacional, con el objetivo de establecer una red nomológica. **Conclusiones:** se comentan algunas cuestiones así como direcciones futuras de investigación para la comprensión de la esquizotipia y experiencias pseudo-psicóticas durante la adolescencia.

Palabras clave: esquizotipia, experiencias psicóticas atenuadas, psicosis, adolescentes, rasgos esquizotípicos.

The continuum model of psychosis phenotype

The psychosis syndrome is characterized by the disruption of higher mental functions where any basic psychological process can be altered (Lemos Giráldez, Fonseca-Pedrero, Paino, & Vallina, 2015). Particularly, a heterogeneous combination of symptoms such as hallucinatory experiences, delusional ideation, disorganized speech and behavior, affective flattening or loss of initiative, as well as social and occupational impairment may define this syndrome (Kahn et al., 2015; van Os, Kenis, & Rutten, 2010). Moreover, deficits in attention, memory, executive functions, and social cognition can be found (Kahn et al., 2015; van Os et al., 2010). To date, although its etiology is still unknown, psychotic syndromes are hypothesized to be the result of a complex interplay between genetic and environmental factors. Specific clinical symptoms or etiopathogenic markers for its precise diagnosis have not yet been found (Kahn et al., 2015; van Os et al., 2010).

Psychotic-spectrum disorders include a series of mental disorders such as schizophrenia, schizoaffective disorder, affective psychosis, and psychotic disorder induced by substances as well as schizoid, schizotypal, and paranoid personality disorders. The psychosis syndrome affects about 2-3% of the population (Perälä et al., 2007). The onset of symptoms occurs usually in late adolescence and begins gradually and progresses over time, between two to five years before clinical diagnosis (Fusar-Poli,

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Carpenter, Woods, & McGlashan, 2014). Psychotic-spectrum disorders have a clear impact at personal, educational, family, and occupational levels as well as on healthcare costs and societal expenditure. For instance, schizophrenia and other psychoses are amongst the ten leading causes of disability-adjusted life years in the group aged 10-24 years (Gore et al., 2011), representing the third most expensive disorders in Europe (Olesen, Gustavsson, Svensson, Wittchen, & Jönsson, 2012).

The psychosis phenotype is distributed along a serenity continuum that ranges from psychological well-being to full-blown psychosis. For example, hallucinatory experiences and delusional ideation are experienced by the general population in the absence of mental illness without being necessarily associated with a mental disorder, medical condition, or need for care (Linscott & van Os, 2013; van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009). This set of subclinical psychotic experiences and traits which do not reach clinical threshold and are distributed throughout the general population are usually known as schizotypal traits and psychotic-like experiences (PLEs).

Epidemiological studies and meta-analyses have demonstrated that the mean prevalence of PLEs reported in the general population is around 5-8% (Linscott & van Os, 2013; McGrath et al., 2015; Nuevo et al., 2012). A meta-analysis carried out by Linscott and van Os (2013) found 7.2% prevalence and 2.5% mean annual incidence. An international study conducted by McGrath et al. (2015), using a sample of 31,261 adults from 18 countries, found that the average prevalence of 5.8%, 5.2% and 1.3% for PLEs, hallucinatory experiences, and delusional experiences, respectively. Furthermore, a meta-analysis of PLEs during childhood and adolescence conducted by Kelleher et al., (2012), found a mean prevalence rate of around 17% in participants aged 9 to 12 years, and 7.5% in participants aged 13 to 18 years. Similarly, Dolphin et al. (2015) conducted a study using a national representative sample of 12-19 year olds from Ireland, in which auditory hallucinations were reported by 13.7% of participants, visual hallucinations reported by 10.4%, and paranoid thoughts reported by 13.1% of the sample. These reports are also consistent with data originating from a U.S. representative sample of 7,054 adolescents, in which Calking et al. (2014) found that between 3.8-17.6% of the sample endorsed "Definitely agree" in some PLEs items.

As it can be seen, previous empirical research has demonstrated that the frontiers of the psychosis phenotype extend beyond the traditional borders proposed by the international classification systems (e.g., DSM-5, ICD-10), which offers support to the existence of a psychometric continuity between the clinical and subclinical psychosis phenotypes (Linscott & van Os, 2013). From this continuum, the expression of this extended phenotype would fluctuate from a normal state of functioning, going from subclinical psychotic experiences and traits, toward its clinical manifestation in the form of certain psychotic-spectrum disorders (Linscott & van Os, 2013; van Os et al., 2009). Figure 1 depicts the possible architecture of the psychosis phenotype (Fonseca-Pedrero, Paino-Piñeiro, Lemos-Giráldez, Sierra-Baigrie, & Muñiz, in press a).

Schizotypal traits and psychotic-like experiences: A tentative differentiation

Several authors use the constructs PLEs, schizotypy, schizotypal traits, psychosis-proneness, and psychotic experiences as interchangeable, even though there is no scientific rationale or evidence. For instance, recent review studies have shown that there is no clear definition of PLEs across studies (Lee et al., 2016). Thus, an operationalization of these phenomenon are required, amongst others, to guide this measurement framework, to provide the basis for construct validation, to test and validate psychosis models, and to differentiate from other related constructs.

First, schizotypy is defined as a latent personality organization reflecting a putative liability for psychotic-spectrum disorders (Meehl, 1962). It is hypothesized that this diathesis is expressed according to a vulnerability continuum that ranges from psychological well-being to schizophrenia-spectrum personality disorders and full-blown psychosis (Kwapil & Barrantes-Vidal, 2015). This liability would theoretically be present in about 10% of the general population (Meehl, 1962). Recent conceptualizations of the schizotypy framework indicate that it provides a unifying construct that efficiently links a broad continuum of clinical and subclinical psychosis manifestations (e.g., schizotypal traits, PLEs, attenuated psychotic symptoms, basic symptoms), as well as "normal" personality variation (Kwapil & Barrantes-Vidal, 2015). Thus, schizotypal traits, PLEs, attenuated psychotic symptoms, schizotypal personality disorder features, and frank psychotic symptoms should be described as indicators of schizotypy (Lenzenweger, 2015). Hence, the heterogeneity in the phenotypic indicators of psychosis liability shows that it is not necessarily isomorphic (Lenzenweger, 2010). In particular, schizotypal traits and PLEs are considered as one of the possible phenotypic indicators of this diathesis. This liability can be measured by genetic, psychometric, laboratory, and clinical indicators (Lenzenweger, 2010).

Second, PLEs by definition are transitory in nature and tend to disappear over time (particular during adolescence) (Linscott & van Os, 2013; Debbané et al., 2013). Only a minority percentage of

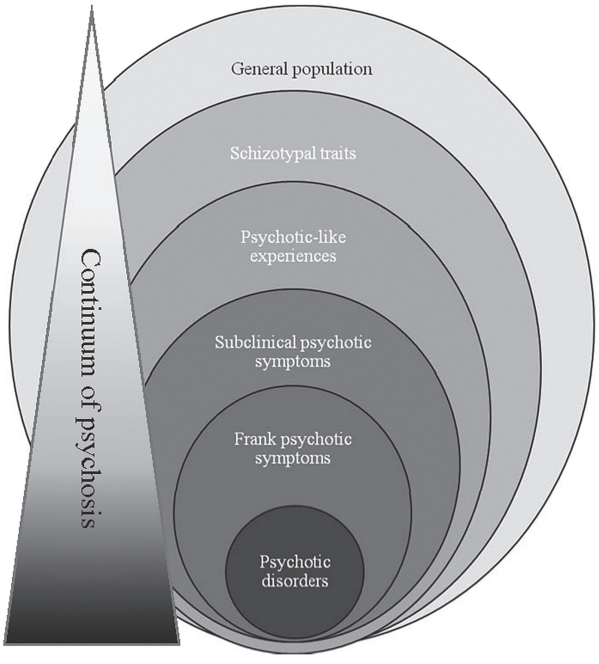

Figure 1. Possible architecture of psychosis phenotype across the continuum of severity (Fonseca-Pedrero et al., in press a)

the PLEs reported are persistent over time. Basically, schizotypal traits usually are stable in time (*trait-like approach*), whereas PLEs are unstable or a state in nature (*symptom approach*) (Debbané & Barrantes-Vidal, 2015). This is a key issue to differentiate PLEs from related constructs, such as schizotypal traits.

Third, PLEs are commonly referred to as a set of unusual perceptual experiences related with the positive dimension of the psychosis phenotype, mainly hallucinations and delusional-like experiences. Although some authors have also included the negative (e.g., anhedonia) and depressive dimensions within the PLEs construct (based on the Community Assessments of Psychic Experiences-42, CAPE-42), previous meta-analyses, epidemiologic studies, and factor analyses conducted to date are based mainly on the positive dimension (Kelleher, Connor et al., 2012; Linscott & van Os, 2013; van Os et al., 2009). This issue is also relevant to differentiate PLEs from trait schizotypy. The former is defined as a set of subtypes of positive psychotic experiences, i.e., bizarre experiences, perceptual abnormalities, grandiosity, persecutory ideas, that should not be regarded as a homogenous entity (Yung et al., 2009), while the latter is defined as a multidimensional construct that refers basically to anomalies across Cognitive-Perceptual (e.g., hallucination, suspiciousness, ideas of reference), Interpersonal (e.g., constrict affect, no close friends, anhedonia), and Disorganized (e.g., odd behavior and speech) dimensions (Debbané & Barrantes-Vidal, 2015).

Fourth, trait schizotypy and PLEs would be located at some point of this severity continuum and could be seen as an "intermediate" phenotype, qualitatively similar to the symptomatology found in patients with psychosis, but quantitatively less severe, showing a lower frequency, severity and persistence, as well as without the distress, help-seeking behavior, or/and functional impairment (Fusar-Poli et al., 2014; Yung, Stanford et al., 2006). This is also a key point to differentiate PLEs and schizotypal traits from subclinical psychotic symptoms, frank psychotic symptoms, and psychotic-spectrum disorders (see Figure 1). Moreover, these factors are relevant to explain and understand the transitions between these phenomena across the severity continuum of the psychosis phenotype. Although there are blurred boundaries between these phenotypic expressions, in fact, the clinical impact (e.g., distress, help-seeking behavior, functional decline, and functional impairment) is essential in order to differentiate these phenomena, and, particularly relevant to predict the risk of developing full blown psychotic-spectrum disorders and the need for care. To date, it is important to note that the boundaries between these phenomenological traits and experiences are fuzzy and sometimes unclear.

Etiological validity of trait schizotypy and psychotic-like experiences

The principal motivation of the schizotypal traits and PLEs constructs is based on the idea of early identification of those individuals at risk for psychotic-spectrum disorders prior to clinical presentation so as to implement preventive prophylactic interventions. Furthermore, the understanding of trait schizotypy and PLEs may help elucidate relevant etiological mechanisms and protective factors for psychotic-spectrum disorders (Barrantes-Vidal, Grant, & Kwapil, 2015) in particular, and mental health in general. In fact, we would rather suggest that their underlying mechanisms surely represent the best possible targets for preventive interventions, gathering the potential clinical pathology before it develops.

Previous research has shown that both PLEs and schizotypal traits may be a valid putative phenotypic liability marker for psychosis-spectrum disorders. First, prospective studies carried out in adolescents from the general population and those at clinical or genetic high risk for psychosis who report PLEs or schizotypal traits are at greater probability of psychiatric outcome, particularly psychotic-spectrum disorders (Debbané et al., 2015; Poulton et al., 2000; Welham et al., 2009; Zammit et al., 2013); however, the transition rate to clinical psychosis is low (Kaymaz et al., 2012). Moreover, they also increase risk of onset of non-psychotic mental health disorders (e.g., depression, posttraumatic stress disorder, suicide) (Fisher et al., 2013). Thus, PLEs and trait schizotypy are not only useful for psychosis-spectrum disorders, but also for other psychopathological disorders and symptoms. Second, PLEs and schizotypal traits are genetically continuous with schizophrenia and are heritable (Linney et al., 2003; Zavos et al., 2014). Moreover, they are common in adolescents with 22q11 Deletion Syndrome (22q11DS), a group of genetic high risk for psychosis (Fonseca-Pedrero, Debbané, Schneider, Badoud, & Eliez, 2016). Schizotypal traits are present in genetic risk populations, such as siblings of probands, where about a third of affected individuals develop psychotic spectrum disorders. Third, healthy family members of patients with psychosis have higher rates of schizotypal traits and PLEs (Kendler et al., 1993). Fourth, family-specific variation of subclinical psychosis dimensions in the general population have been found (Hanssen, Krabbendam, Vollema, Delespaul, & Van Os, 2006). Fifth, they share the same environmental and demographic risk factors as those found in patients with psychosis (e.g., childhood adversities, cannabis use, urbanicity) (Linscott & van Os, 2013). Finally, these subclinical experiences can be reliable and valid measured by quantitative measures (e.g., Fonseca-Pedrero, Gooding, Debbané, & Muñiz, 2016; Lee et al., 2016). According to a recent review of Fonseca-Pedrero et al., (in press a) the key points of the PLEs research during adolescence are depicted in Table 1.

The phenotypic expression of schizotypy, such as schizotypal traits and PLEs, may be considered the behavioral expression of increased vulnerability for psychosis. Based on these findings, the subclinical psychotic experiences and traits may constitute a tentative endophenotype. Moreover, these data lend validity to these constructs, as well as offer support to the assumed continuity between the subclinical and clinical psychosis phenotype (Kelleher, Connor et al., 2012).

Schizotypal traits and psychotic-like experiences during adolescence: A developmental framework

Adolescence is an interesting period for the study of psychological experiences and traits in mental health in general and psychosis-spectrum disorders in particular. First, it is a critical developmental stage for the appearance of the first PLEs and psychotic symptoms (Fusar-Poli et al., 2014; Linscott & van Os, 2013). Second, increasing adjustment problems as well as social, motor, and cognition deficits in adolescents prior to clinical diagnosis have been reported (Dickson, Laurens, Cullen, & Hodgins, 2012; Fusar-Poli et al., 2012). Third, psychotic-spectrum symptoms and disorders that emerge during late adolescence or early adulthood seem to develop and originate at earlier

stages of development, suggesting the existence of a pathogenic developmental process (Zammit et al., 2013). Previous studies have shown that the symptoms of psychosis begin around three to five years before the first hospitalization (Fusar-Poli et al., 2014; Häfner & An Der Heiden, 1999). In addition, it is well known that during adolescence and the onset of puberty, a wide diversity of maturational, hormonal, brain, cognitive, and social changes take place. These "normal" neuromaturational changes could become developmental stressors that can increase the risk for the emergence of psychotic-spectrum disorders (Walker & Bollini, 2002). For example, stressful life events or environmental "hits" that occur during adolescence, such as traumatic experiences or sexual abuse, are associated to a greater vulnerability toward the future development of a serious mental disorder (van Os et al., 2009).

Recently, Debbané and Barrantes-Vidal (2015) have proposed a new integrative view of schizotypy within a developmental framework. Previously, schizotypy models implicitly recognized its developmental nature; however, these authors offer an explicitly re-conceptualized view of trait schizotypy from a developmental psychopathology perspective, where adolescence is a key stage to study. This developmental perspective has a clear relevance in understanding how this latent liability for psychosis is influenced by social learning opportunities, psychosocial stress factors, and polygenetic potentiators playing a crucial role, during maturation, in the clinical expression of psychotic disorders as well as other possible developmental trajectories (e.g., depression, bipolar disorder). This idea is clearly convergent with diathesis-stress models, although focusing on developmental dynamics. Debbané and Barrantes-Vidal (2015) situate trait schizotypy in the emerging domain of psychosis high-risk research and argue for the added value of a transactional, multidimensional examination of schizotypy during development. Hence, trait schizotypy would be a developmental vehicle towards emerging psychopathology (not only for psychotic-spectrum disorders). Moreover, trait schizotypy may serve as a distal risk marker for psychosis and could reflect, at the clinical level, the underlying disease process that may be unfolding in the development of psychosis.

Several etiological models have been proposed to understand the role of PLEs and schizotypal traits and their links with (subclinical) psychotic states. The neurodevelopmental models, vulnerability-stress models, or the psychosis proneness-persistence-impairment model, are some good examples. The latter is a pragmatic model focused on the interface established between environmental and genetic factors from a developmental perspective (Cougnard et al., 2007; van Os et al., 2009). This developmental schizotypy framework is clearly related to the psychosis proneness-persistence-impairment model formulated by van Os and colleagues (2009). This heuristic model focuses on the interface established between environmental and genetic factors to understand the etiopathogenesis of the psychosis syndrome. The presence of schizotypal traits or PLEs during adolescence is not a necessary or sufficient condition for the later development of a psychotic disorder, although it is true that in a small group of adolescents such subclinical experiences and traits may interact synergistically or additively with genetic (e.g., family members with psychosis), environmental (e.g., trauma, migration, urbanicity, cannabis use), and/or psychogical factors (e.g., depression, anxiety, avoidance coping), becoming abnormally persistent and clinically relevant, leading to the development of clinical psychosis and need for care. The Gene-x-Environment interaction combined with the presence of other factors, such as, for example, the occurrence, severity, persistence, and associated distress of these traits and experiences as well as associated social dysfunction and functional impairment, would explain the transition to the clinical outcome (Kaymaz et al., 2012).

Table 1
Key points in the study of psychotic-like experiences in adolescent population (Fonseca-Pedrero et al., in press a)

– They are distributed throughout the general population, below the clinical threshold, in a severity continuum of psychosis.
– They are not necessarily related with associated distress, help-seeking behavior and/or functional impairment.
– They may fall within a spectrum of normal developmental experience.
– They can have different clinical-psychopathological meaning, depending on the subtypes (e.g., bizarre experiences, perceptual abnormalities, grandiosity, persecutory ideas) and other factors (e.g., distress, appraisal, degree preoccupation, and conviction). They should not be regarded as a homogenous entity.
– They can have different developmental trajectories as well as underlying causes.
– They are common in the general population. Mean annual prevalence among adolescents aged 13 to 18 is 7.5%.
– Self-report instruments tend to over-estimate the prevalence.
– They are more frequent in adolescence than in adulthood.
– They are transitory and disappear over time. Persistence rate is about 10-40% of cases.
– They predict onset of later psychotic disorder (rate 0.5 per year), particularly if persistent.
– They increase risk of onset of non-psychotic mental health disorders (e.g., depression, posttraumatic stress disorder, suicide).
– They are associate with a wide range of mental health problems (e.g., poor mental health, depressive symptoms, emotional distress, sleep disturbances, suicidal ideation, etc.) as well as multiple co-occurring Axis I mental disorders (e.g., anxiety disorder).
– They are associated with the same demographic, environmental, and genetic risk factors as those found in patients with psychosis (e.g., family history of mental illness, cannabis use, childhood trauma, urbanicity, income, age, gender, marital status, etc.).
– They are also associated with neurocognitive deficits, structural and functional brain abnormalities, and functional dysconnectivity similar to those found in patients with psychosis.
– They need to interact synergistically or additively with genetic (e.g., family members with psychosis), demographic (e.g., age, gender), environmental (e.g., trauma, urbanicity, cannabis use), and/or psychological factors (e.g., depression, anxiety, distress, avoidance coping, degree of preoccupation and conviction), to become abnormally persistent and clinically relevant, leading to the development of clinical psychosis, impairment, and need for care.

The assessment of trait schizotypy and psychotic-like experiences during adolescence

Due to these previous facts, over the past decades, several authors and clinicians have tried to predict the onset of clinical psychosis based on liability markers or/and preclinical states (e.g., schizotypal traits, PLEs, prodromal symptoms, at-risk mental states, basic symptoms) that increase the risk for conversion to a psychotic state. One of the possible strategies to achieve this goal is the reliable and early identification of those individuals at risk or with greater predisposition for psychotic-spectrum disorders. Prophylactic interventions (e.g., antipsychotics, psychotherapy, omega-3 fatty acid) may then be implemented in order to delay, ameliorate, or even prevent the onset to frank psychotic features and need for care. For example, previous research studies have shown that reducing the duration of untreated psychosis with an early effective intervention treatment has clear benefits at multiple levels (e.g., fewer severe symptoms, reduce the transition) and is associated with better outcomes (Fusar-Poli et al., 2014; Stafford, Jackson, Mayo-Wilson, Morrison, & Kendall, 2013).

During the last two decades, an increasing interest has steadily grown in the reliable and valid identification and screening of individuals potentially at risk for psychotic-spectrum disorders (e.g., Fonseca-Pedrero, Gooding, Debbané et al., 2016; Mason, 2015). Precise definition and reliable assessment of psychosis liability is essential for psychosis-risk screening purposes as well as for early detection, in a timely manner, of those individuals potentially at risk for psychosis. Moreover, reliable and valid measures are needed to capture and to measure this construct in operational terms. According to Kwapil and Barrantes-Vidal (2015) a clear operationalization of this construct is necessary, among others, to guide this measurement framework and provide the basis for construct validation. In fact, the psychosis continuum model implies the assumption that this set of subclinical experiences and traits can be measured in non-clinical populations (van Os et al., 2009).

The assessment of trait schizotypy and PLEs, in adolescents from the general population, by means of interviews and self-reports falls within the psychometric high-risk approach. This paradigm aims to identify, through psychometric tests or based on score profiles, adolescents who have a higher probability of developing a schizophrenia-spectrum disorder in the future. At present, assessment this set of experiences and traits using measurement instruments is considered to be a feasible and useful strategy which permits a series of advantages with respect to other assessment methods. Moreover, it is a noninvasive method of rapid application and easier administration, scoring, and interpretation (Fonseca-Pedrero, Gooding, Debbané et al., 2016; Mason, 2015). To date, there are several measurement instruments available for clinicians and researchers to document the presence, frequency, and severity of schizotypal traits and PLEs in this age group. Table 2 summarizes some of the measurement instruments specifically developed or used to assess trait schizotypy and PLEs in adolescent samples. Clinicians and researchers have good measurement instruments available to assess the subclinical psychosis phenotype in this age group. However, there is no gold standard assessment measure to assess PLEs (Lee et al., 2016) and schizotypal traits in adolescents samples.

The number of available self-reports for trait schizotypy and PLEs assessment in adolescents is limited and their psychometric characteristics have been barely examined (e.g., Fonseca-Pedrero, Paino-Piñeiro et al., in press a; Fonseca-Pedrero, Paino-Piñeiro, Lemos-Giráldez, Sierra-Baigrie, & Muñiz, in press b). A reliable and valid schizotypy measure is essential to capture this construct as well as to measure it in a scientific and rigorous manner. Several good revisions of this topic have been published elsewhere

Table 2
Measurement instruments to assess trait schizotypy and psychotic-like experiences in adolescents

Name	Number of items	Format	Reference
Trait schizotypy			
Junior Schizotypy Scales (JSS)	95	Yes/No	(Rawlings & MacFarlane, 1994)
Multidimensional Schizotypal Traits Questionnaire-Reduced (MSTR-R)	51	Yes/No	(DiDuca & Joseph, 1999)
Schizotypy Traits Questionnaire for Children (STA-C)	37	Yes/No	(Cyhlarova & Claridge, 2005)
Oviedo Questionnaire for Schizotypy Assessment (ESQUIZO-Q)	51	Likert 5	(Fonseca-Pedrero, Muñiz, Lemos-Giráldez, Paino, & Villazón-García, 2010)
Schizotypal Personality Questionnaire-Child (SPQ-C)	22	Yes/No	(Raine et al., 2011)
Melbourne Assessment of Schizotypy in Kids (MASK)	57	Likert 4	(Jones et al., 2015)
Psychotic Like Experiences			
Community Assessments of Psychic Experiences-42 (CAPE-42)	42	Likert-4	(Stefanis et al., 2002)
Community Assessments of Psychic Experiences-15 (CAPE-15)	15	Likert-4	(Capra, Kavanagh, Hides, & Scott, 2013)
PRIME Screen (PRIME)	12	Likert-7	(Miller et al., 2004)
PRIME Screen-Revised (PS-R)	12	Likert-7	(Kobayashi et al., 2008)
Specific Psychotic Experiences Questionnaire (SPEQ)	63	Yes/no, Likert-4, and Likert-6	(Ronald et al., 2014)
Psychosis-like Symptoms Interview (PLIKS-I)	12	Binary	(Horwood et al., 2008)
Psychosis-like Symptoms Questionnaire (PLIKS-Q)	12	Likert-3 Conviction and past-year frequency	(Zammit, Owen, Evans, Heron, & Lewis, 2011)
Adolescent Psychotic-Like Symptom Screener (APSS)	7	Likert-3	(Kelleher et al., 2011)
Eppenford Schizophrenia Inventory (ESI)	40	Likert-4	(Mass, Haasen, & Borgart, 2005)

(Fonseca-Pedrero, Gooding, Debbané et al., 2016; Fonseca-Pedrero, Paino-Piñeiro et al., in press a, in press b; Lee et al., 2016; Mason, 2015). The tools used in adolescents need to satisfy some criteria, such as: a) specifically developed and validated for this population; b) adequate psychometric properties (e.g., reliability, sources of validity evidence, norms); c) brief; d) easy to answer and to administer, and e) have understandable language. Previous research have demonstrated that the items used to measure PLEs seem to be valid (Kelleher, Harley, Murtagh, & Cannon, 2011) and reliable (Linscott & van Os, 2013) in adolescent samples. Thus, although new psychometric studies are needed, some of these measures can be used in both clinical and research settings. For instance, it would be necessary to continue advancing in their exhaustive analysis as well as obtain psychometric data supporting their predictive validity in representative and random samples of adolescents from the general population.

Factorial validity of schizotypal traits and psychotic-like experiences during adolescence

The understanding of the structure and content of trait schizotypy and PLEs in adolescent populations has considerably advanced in the last two decades. First of all, the number, structure, and content of the dimensions found depends clearly on the measurement instrument used, the sample analyzed (e.g., country, random vs. convenience sample), the statistical analyses conducted (exploratory vs. confirmatory factor analysis), and level of analyses employed (items vs. subscales). Therefore, it must be kept in mind that the strict comparison among factorial studies is a difficult task, which is often hindered by these variables.

When the factorial structure underlying the trait schizotypy tools in this age group is analyzed, it can be observed to be a multidimensional construct in nature, phenotypically similar to that found in the general adult population as well as in patients with psychosis. In previous studies conducted in patients, at least three separate dimensions (e.g., positive, negative and disorganization symptoms) have been reported (e.g., Liddle, 1997). Just as schizophrenia is phenotypically heterogeneous, encompassing a broad range of emotional, cognitive, perceptual, social and behavioral functions, trait schizotypy involves a diverse set of traits.

Recent review of the main factorial studies conducted in adolescent populations in the last years have demonstrated that the number and content of the schizotypy dimensions ranges from three to five factors (Fonseca-Pedrero, et al., in press b). The Positive (unusual perceptual experiences, cognitive-perceptual, reality distortion) and Negative (anhedonia, interpersonal) dimensions have been widely replicated and have been consistently found across studies and measures. Furthermore, using the Schizotypal Personality Questionnaire (SPQ), its brief version (SPQ-B) or child version (SPQ-C), the three-factor model, composed by the Cognitive-Perceptual, Interpersonal, and Disorganized dimensions, is possibly one of the most replicable and consistent models across studies and samples. It has been found in nonclinical, outpatient, and 22q11DS adolescents and stable across differing statistical techniques and level of analysis (Ericson, Tuvblad, Raine, Young-Wolff, & Baker, 2011; Fonseca-Pedrero, Debbané et al., 2016; Fonseca-Pedrero, Lemos-Giráldez, Paino, Villazón-García, & Muñiz, 2009; Raine, Fung, & Lam, 2011). Moreover, these dimensions have been shown to be invariant across gender, age, and culture (Fossati, Raine, Carretta, Leonardi, & Maffei, 2003; Ortuño-Sierra et al., 2013).

To summarize, although there is no unanimous agreement on the number of dimensions, the results of the different empirical studies taken as a whole allow us to assert that trait schizotypy in adolescent populations is composed, at a minimum, of three dimensions, namely: Cognitive-Perceptual (Positive, Reality Distortion), Interpersonal (Negative Anhedonia), and Disorganized (Cognitive Disorganization). Moreover, the SPQ, SPQ-B or SPQ-C are the most commonly used measurement instruments for testing the multidimensional structure of schizotypal traits as an indirect measure of schizotypy during adolescence. Taken together, these findings suggest that a similar factorial structure of trait schizotypy can be found across samples with different clinical status (e.g., non-clinical adolescents, adolescents at genetic high risk, adolescents at clinical high risk, and patients), which provides support for the multidimensional continuum model of psychosis phenotype.

During the last decade, several exploratory and confirmatory factor analyses have been conducted to understand the underlying structure of the PLEs measures. The main factorial studies of PLEs conducted in adolescents analyzing their structure and content discussed in this section focus on the CAPE positive dimension (20 items) and CAPE-15 (for a review, Mark & Toulopoulou, 2016). For instance, Yung et al., (2009), using the positive dimension of the CAPE in a sample of 946 students and exploratory factor analysis, four subtypes of PLEs were identified: Bizarre experiences, Perceptual abnormalities, Persecutory ideas, and Magical thinking. In another study, Yung et al, (2006) also reported three dimensions in a clinical sample of adolescents (Bizarre experiences, Persecutory ideas, and Magical thinking). Armando and colleagues (2010), using 18 items of the positive dimension of the CAPE in a sample of adolescents and young adults and exploratory factor analysis, found four factors (Bizarre experiences, Perceptual abnormalities, Persecutory ideas, and Grandiosity). Barrangan et al. (2011), in a community sample of 777 Spanish adolescents in a principal component analysis, identified four factors of positive symptoms: Persecutory ideation, Grandiose thinking, First-rank/Hallucinatory experiences, and Self-referential thinking. Wigman et al. (2011), in two large samples of adolescents (n= 5,422; n= 2,230) conducting a confirmatory factor analysis, found five underlying dimensions named: Hallucinations delusions, Paranoia, Grandiosity, and Paranormal beliefs. Recently, Nuñez et al. (2015), testing the factorial structure of the CAPE-15 through exploratory structural equation models, found that the underlying structure of PLEs was consistent with both multidimensional (Persecutory ideation, Bizarre experiences, Perceptual abnormalities) and bifactor model. These findings are quite relevant as they reveal the existence of a general factor underlying the CAPE-15 scores. In addition, these results may suggest the possibility of building a one general dimension of the PLEs phenomenon.

To summarize, previous factorial studies conducted in adolescent populations have reported 5-factor, 4-factor, 3-factor models, and a bifactor model. The factor structure of PLEs, measured through the CAPE positive dimension, seems to be multidimensional. Thus, the number of factors is not replicated and consistent across studies; however, it is also true, that there are a lot similarities between the structure and contents of the factors reported. Although there is no unanimous agreement on the number of dimensions, the results of the different empirical

studies allow us to assert that PLEs in adolescent populations is composed, at a minimum, of three dimensions (Bizarre experiences, Delusional ideations, and Perceptual abnormalities) (Mark & Toulopoulou, 2016), perhaps collapsed in a bifactor model (general PLEs factor).

Predictive validity and temporal persistence of the schizotypal traits and psychotic-like experiences

As mentioned above, prospective studies carried out in adolescents from the general population and those at clinical or genetic high risk for psychosis who reported PLEs or schizotypal traits are at greater probability of psychiatric outcome, particularly psychotic-spectrum disorders (Debbané et al., 2015; Domínguez, Wichers, Lieb, Wittchen, & van Os, 2011; Kaymaz et al., 2012; Poulton et al., 2000; Welham et al., 2009; Zammit et al., 2013). In a recent meta-analysis conducted by Kaymaz et al. (2012), it was found that the risk of conversion to a clinical psychotic outcome in individuals who reported subthreshold psychotic experiences (0.56%) was 3.5 times higher than for individuals without psychotic experiences (0.16%), particularly if the psychotic experiences were severe/persistent. In another follow-up study conducted by Zammit et al. (2013), in a sample of 4,724 participants evaluated by structured interviews, found that adolescents who at 12 years of age reported definitive psychotic experiences were at greater risk of psychotic disorders at age 18 (Odds Ratio: 12.7; CI 95%: 6.2-26.1). However, it is equally true that new studies show the low specificity of such experiences, and that their developmental trajectory not only is circumscribed to the clinical diagnosis of psychosis, but also to other mental disorders (e.g., posttraumatic stress disorder) (Fisher et al., 2013), which questions its usefulness as a clinical predictor for psychosis (Werbeloff et al., 2012). In this sense, it is hypothesized that this set of subclinical experiences and traits present at early ages may be useful as a marker of adult mental health problems more broadly (Fisher et al., 2013).

Another extremely fascinating issue is to determine the degree of continuity and temporal persistence from early and late adolescence or from adolescence to adulthood. The analysis of the factors and related variables that make these experiences either transient, resolving spontaneously, or persistent over time, evolving into a psychotic state with functional impairment and need for care, is essential for prevention purposes. Previous factorial studies have demostrated that the temporal persistence of these the temporal persistence of these experiences during adolescence is around 10-40% (De Loore et al., 2008; Domínguez et al., 2011; Downs, Cullen, Barragan, & Laurens, 2013; Kelleher, Cederlöf, & Lichtenstein, 2014; Kelleher, Keeley et al., 2013; Linscott & van Os, 2013; van Os et al., 2009).

For example, Loore et al. (2008) examined a sample of 1,903 adolescents, and found that after 2 years, PLEs persisted in 28.7% of the cases that had reported such experiences at T0 (5.3% of the adolescents). Dominguez et al. (2011), in an 8-year-longitudinal study conducted in a sample of 845 German adolescents, found that of the participants who had been considered as clinical cases of psychosis at the end of the assessment period, 38.3% had previously presented at least one psychotic experience, and 19.6% of these cases had been preceded by at least two subclinical psychotic experiences. Downs et al. (2013), found that two-thirds (66%) of children reported PLEs at baseline and approximately two years later, PLEs persisted in 39% of those children. Moreover, children with persisting PLEs experienced a greater risk for later internalizing and externalizing psychopathology. Finally, Kelleher et al. (2013), using a nationally representative prospective cohort study of 1,112 adolescents, found persistence rates of 41% (from baseline to 3-months follow-up) and 40% (from 3-months follow-up to 12-months follow-up).

Similar results have been found when schizotypal traits are analyzed. Previous research has shown that schizotypal traits are highly stable across measures and samples, particularly during adolescence (Cella et al., 2013; Debbané, Badoud, Balanzin, & Eliez, 2013; Ericson et al., 2011). For instance, Ericson et al. (2011) found that the stability of SPQ Child scores between early and middle adolescence was $r = 0.58$, which reflects moderate stability. Similar results have been found in adolescents with 22q11DS (Fonseca-Pedrero, Debbané et al., 2016).

These results are quite important as they show the predictive validity of these sets of traits as well as the usefulness of this approach. However, empirical evidence indicates that PLEs and schizotypal traits may have low predictive value for psychotic disorder (rate 0.5 per year particularly if persistent). In particular, the vast majority of PLEs are transient, resolve spontaneously, disappear over time, and never progress to a clinical psychotic disorder. Approximately a third of adolescents who report PLEs showed persistence over the follow-up course. In this sense, the possible developmental trajectories and pathways toward psychotic-spectrum disorders may be heterogeneous. Therefore, the simple presence of PLEs or schyzotipal traits at early stages of the development does not necessarily implicate the transition of a severe mental disorder later in life. Specifically, according to the psychosis proneness-persistence-impairment model, these subclinical experiences and traits can interact synergetically or additively with other sociodemographic, environmental, genetic and/or psychological factors to surpass the subclinical threshold and evolve into a psychotic disorder and need for care (Cougnard et al., 2007; van Os et al., 2009).

Building a nomological network of trait schizotypy and psychotic-like experiences: A translational approach

Much research and clinical work has been conducted over the past decade to understand the link between PLEs, trait schizotypy, and psychosis. There has been an accumulation of data examining the association between psychotic-spectrum disorders with subclinical psychotic experiences and traits in the general population (Cohen, Mohr, Ettinger, Chan, & Park, 2015; Ettinger, Meyhöfer, Steffens, Wagner, & Koutsouleris, 2014; Nelson, Seal, Pantelis, & Phillips, 2013). In the last decade, validity evidences have been gathered from many levels of analysis (e.g., genetic, brain, physiology, cognition, and behaviour). This previous extensive empirical research conducted in the schizotypy (liability to psychosis) arena is essential to building a strong scientific model (to be tested), not only based on its relevance as a liability marker or its role in understanding etiological mechanisms for psychosis, but also in relation with other constructs from multiple levels of analyses and unit of analysis (e.g., genetics, cells, brain, cognitive, behavioral). Due to the extensive research available in this section, only some levels of analysis will be revised.

Paul E. Meehl is not only an outstanding scientist for his schizotypy work, but also for positing the concept of a nomological network, working together with Lee Cronbach (Cronbach & Meehl,

1955). This *net* is essential to schizotypy construct validation and will be a relevant endeavor for schizotypy in the coming years. In brief, a nomological network for schizotypy research is needed to: (a) have a clear representation and operationalization of the latent construct (allowing it to be measured); (b) establish their observable manifestations; and (c) set their interrelationships with other constructs (related or not); that is, the links between theoretical constructs that can be measured. In this regard, the schizotypy construct should be measured by several indicators (e.g., genetic, psychometric, laboratory, and clinical indicators) (Lenzenweger, 2010) and several units of analysis following the guidelines of the Research Domain Criteria (RDoC) (Insel et al., 2010) (see Figure 2). The schizotypy nomological network is an ongoing process based on empirical research.

At the genetic level, for example, recent studies have demonstrated the genetic and environmental influences on PLEs as a quantitative phenotype (Ronald, 2015). These kinds of empirical studies have been addressed recently. Thus, although we are at an early stage, between 15 and 59% of variance in PLEs is explained by additive genetic effects in a community sample of adolescents (Zavos et al., 2014). However, a twin study has found less heritability estimates in the subtypes of PLEs (Sieradzka et al., 2015). Moreover, molecular genetic studies have found some tentative evidence that genome-wide significant variants associated with schizophrenia also account for variance in PLEs in the community; nevertheless, it is also true, that some negative evidences or little support for the hypothesis that psychotic experiences in community based samples of adolescents share a comparable genetic architecture to schizophrenia, have also been found (Sieradzka et al., 2014; Zammit et al., 2014).

At the anatomical and physiological levels, individuals who report PLEs compared to those who do not report these, show structural (Satterthwaite et al., 2016) and functional brain abnormalities (Dahoun et al., 2011; Wolf et al., 2015), functional disconnectivity (Satterthwaite et al., 2015), and a reduced amplitude of the P300 (event-related potentials) (Rawdon et al., 2013) similar to those found in patients with psychosis.

At the cognitive and behavioral levels, adolescents who report PLEs show neurocognitive (Kelleher, Clarke, Rawdon, Murphy, & Cannon, 2013), theory of mind (Barragan, Laurens, Blas Navarro, & Obiols, 2011), social cognition deficits (e.g., facial emotion recognition) (Roddy et al., 2012) and a developmental cognitive delay (Gur et al., 2014). Moreover, these participants may report, amongst others, low self-esteem, low optimism, school misconduct, high avoidance coping (Dolphin et al., 2015), low prosocial skills, poorer peer and familiar functioning (Núñez et al., 2015; Yung et al., 2009), and social withdrawal (Núñez et al., 2015).

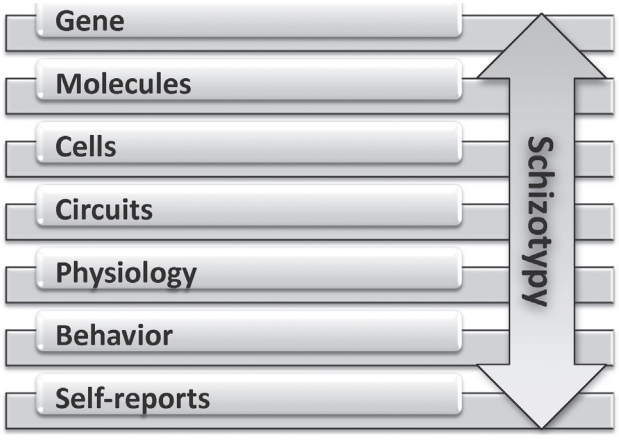

Figure 2. Possible network model of schizotypy based on the units of analysis of the Research Domain Criteria

At the psychopathological and clinical levels, PLEs are associated with a wide range of mental health problems, such as depressive symptoms (Armando et al., 2010; Barragan, Laurens, Blas Navarro et al., 2011; Yung et al., 2009), distress (Armando et al., 2010), stress and anxiety (Núñez et al., 2015), emotional and behavioral problems (Wigman et al., 2011), sleep disturbances (Lee, Cho, Cho, Jang, & Kim, 2012), childhood trauma and bullying (Kelleher et al., 2008; Kelleher, Keeley et al., 2013), suicidal behavior (ideation, attempts) (Kelleher et al., 2014; Kelleher, Corcoran et al., 2013), cannabis use (Hides et al., 2009), and increased risk for multiple co-occurring Axis I mental disorders (Kelleher, Keeley et al., 2012).

Similar results have been found when schizotypal traits are studied, showing clear lines of overlap between trait schizotypy and PLEs across these levels of analysis. Previous research has shown that adolescents who report schizotypal traits also present subtle brain function, psychophysiological, motor, neurocognitive, social cognition, emotional, affective, behavioral, and/or social deficits (Ettinger et al., 2014). For instance, adolescents who scored high on schizotypal measures showed, amongst others, more depressive symptoms, maladaptive personality traits, obsessive compulsive symptoms, behavioral problems, suicidal ideation, poorer social functioning, prosocial skills, reflective functioning, and quality of life as well as neurocognitive deficits in comparison with those who scored low (Barrantes-Vidal et al., 2002; Debbané et al., 2013; Debbane et al., 2014; Ettinger et al., 2014; Fonseca-Pedrero, Ortuño-Sierra, Paino, Lemos Giraldez, & Muñiz, 2015; Fonseca-Pedrero, Paino, Lemos-Giráldez, & Muñiz, 2011; Raine et al., 2011).

In overall terms, previous research has shown that adolescents who report PLEs and schizotypal traits also present subtle brain function, psychophysiological, motor, neurocognitive, social cognition, emotional, affective, behavioral, and/or social deficits similar to those found in patients with psychosis. Thus, research PLEs and schizotypal traits in adolescents may represent a valuable population to study the etiology of psychosis and related conditions and lend validity to these constructs, as well as offer support to the assumed etiological continuity between the subclinical and clinical psychosis phenotype (Kelleher & Cannon, 2011; Linscott & van Os, 2013; van Os et al., 2009).

Gaps in knowledge

The study of subclinical psychotic experiences and traits during adolescence is a field that is in clear expansion where several extremely interesting questions remain unsolved.

First, based on previous reviews (Lee et al., 2016), in the new generation of studies, it is relevant to build an operative definition of this set of experiences and traits as well as to differentiate related constructs. For instance, previous research studies have shown that schizotypal traits, PLEs, and self-reported clinical high risk symptoms are moderately associated but can be differentiated in community derived samples of adolescents (Barrantes-Vidal et al., 2013; Fonseca-Pedrero, Gooding, Ortuño-Sierra, & Paino, 2016). An operationalization is essential to measure these phenomena in a reliable and valid manner as well as to develop testable models.

Second, the role of PLEs and trait schizotypy in the prediction of psychotic disorders and non-psychotic disorders (e.g., depression) should continue to be explored in greater depth through independent longitudinal studies in both non-clinical adolescents and participants potentially at high risk for psychosis (e.g., genetic high risk, ultra-high risk). For instance, further longitudinal studies are required to examine the extent to which schizotypal traits (e.g., Cognitive-Perceptual, Interpersonal, and Disorganized dimensions) or PLEs (Bizarre experiences, Delusional ideations, and Perceptual abnormalities) could contribute to improving the prediction of conversion to psychotic-spectrum disorders. In order to improve the predictive validity, the combination of multiple high-risk approaches (e.g., clinical, genetic, and psychometric), liability markers and risk factors (e.g., genetic and environmental), in a close-in and multi-step strategy, may improve our predictive power of those individuals theoretically at high risk and develop prevention strategies. Thus, new algorithms to improve sensitivity and specificity indicators from an integrated psychobiological perspective are needed. The new studies have to facilitate the integration of early and late risk mental states as well as different etiological models within a developmental framework.

Third, the study of the extended psychosis phenotype from multiple levels of analyses and multiple indicators is essential in the new era of studies. For instance, combining genes, molecules, cells, circuits, physiology, behaviors, and self-report levels of analyses allows us to better understand psychotic-spectrum disorders as well as to examine which factors and level analyses could determine the transition to a psychotic state in high-risk participants. Moreover, new studies would be integrated following the guidelines of the RDoC. RDoC is a novel research framework to promote new ways of studying mental disorders. It integrates many levels of information, from genomics to self-reports, to better understand basic dimensions of functioning underlying the full range of human behavior and processes, from normal to abnormal. Thus, we encourage a translational approach. Along these lines, Ford et al. (2014), have explored how hallucinations might be studied within the RDoC framework. Building a scientific model based on the translational approach is required.

Fourth, with regard to the use of measurement instruments in this age group, their psychometric properties have to be tested in representative samples of adolescents from the general population as well as high risk groups, being particularly relevant to gathering new evidences of their validity in independent longitudinal studies. To this end, new measurement approaches and psychometric procedures such as McDonald's omega, item response theory, computerized adaptive testing, differential item functioning, new structural equation models, or network analysis have to be incorporated in this field. These methodological advances may better capture the complexity and heterogeneity of the schizotypy phenotype. For instance, new methodological designs such as the experience sampling method (ESM) have to be added progressively in schizotypy research. ESM is a structured diary technique assessing cognition, affect, symptoms, and contextual factors in the real context (Oorschot, Kwapil, Delespaul, & Myin-Germeys, 2009). ESM offers several advantages to traditional cross-sectional procedures, for instance, ESM: (a) repeatedly assesses individuals in their daily environment, enhancing ecological validity, (b) assesses the participants' experiences at the time of the signal, minimizing retrospective bias, (c) allows for an examination of the context of individuals' experiences, and (d) captures the interactional nature of the vulnerability-stress model by analyzing dynamic person-environment interactions. Advances in the field of measurement open up new horizons for the assessment and the understanding of the structure and content of these set of experiences and traits.

Fifth, given the public health relevance of mental health during adolescence and its possible impact during adulthood, a new interesting line of research would be to use PLEs and trait schizotypy (or other phenotypic indicators of psychosis) within a prevention approach. PLEs and schizotypal traits, as an index of mental health status, should be used for screening purposes in a mental health worldwide strategy. Moreover, during the last few decades most of the researchers have focused their lines of research on psychosis risk factors, liability markers, endophenotypes, at risk mental states, etc., however, few studies have been conducted to analyze the strengths of these individuals. The study of protective and resilience factors may help us to: a) find new clues to delay, ameliorate, or even prevent the onset to frank psychotic symptoms; b) elucidate relevant etiological mechanisms for mental health problems; and b) expand to other research areas of interest and move away from a "non-pathological" view of these subclinical experiences and traits.

Finally, big data projects and sharing data across international groups would be desirable. Hence, the International Lemanic Workshop on Schizotypy Research (Geneva, December, 2013) set the foundations for future collaborative research through the creation of the Consortium for International Schizotypy Research (CISR) (Debbané & Mohr, 2015).

Conclusions

Psychotic-spectrum disorders have an impact at multiple levels and a clear societal and health expenditure. The public burden caused by these severe mental disorders is clear, thus the early identification of adolescents potentially at risk for psychotic-spectrum disorders in order to conduct prophylactic treatments may improve outcome. Furthermore, the implementation of preventive approaches in adolescent mental health in general, and in psychotic-spectrum phenomena in particular, is necessary.

Psychotic symptoms occur in continuous gradation from severe symptoms to those seen in milder forms of disorders and further into personality traits and psychological experiences distributed in the general population. Subclinical psychotic experiences and traits which do not reach the clinical threshold for psychosis, that are not related with associated distress, help-seeking behavior and/or functional impairment, and that are continuously distributed across the general population, are known as PLEs or schizotypal traits. Although, to date, is difficult to establish a clear differentiation between both constructs, schizotypal traits and PLEs are considered as amongst many of the possible phenotypic indicators of the psychosis liability (named schizotypy), where schizotypal traits are stable whereas PLEs are unstable or a state in nature (Debbané & Barrantes-Vidal, 2015). In fact, schizotypal trait are commonly refers as a multidimensional construct, whereas PLEs are referred as positive dimension of psychosis phenotype.

The study of these traits and experiences during adolescence and their relationship to the subsequent risk for psychotic-spectrum disorders and other mental health problems has become an area of interest within the current scientific research field. The idea of early detection and prevention of those adolescents

potentially at risk for psychosis to mitigate the possible impact of the illness on many levels (e.g., personal, familiar, occupational) as well as to delay, ameliorate, or even prevent the onset to frank psychotic symptoms, has exponentially increased the number of studies on subclinical psychotic experiences. Moreover, it opens the possibility of examining and understanding risk markers, protective factors, and etiological mechanisms of psychotic-spectrum disorders prior to the clinical expression of the clinical disorder.

Epidemiological studies have demonstrated that this set of experiences and traits are quite common during adolescence and may fall within a spectrum of "normal" developmental experience. In most of the cases disappear over time and never progress to a clinical disorder. PLEs and schizotypal traits may have different clinical-psychopathological meanings, depending on the subtypes and dimensions as well as other factors (e.g., associated distress, appraisal, degree preoccupation, and conviction). They need to interact synergistically or additively with genetic, demographic, environmental, and/or psychological factors to become abnormally persistent and clinically relevant, leading to the development of clinical psychosis, impairment, and need for care.

Clinicians and researchers have good measurement instruments available to assess the risk for psychosis during adolescence. There are several measurement instruments available for clinicians and researchers to document the presence, frequency, severity, trajectory, and associated distress of subclinical psychotic experiences and schizotypal traits in this age group. To date, the psychometric properties of PLEs and trait schizotypy tools used in adolescent populations are adequate for their use in both clinical and research settings. The results of the factorial studies allow us to assert that PLEs in adolescent populations is composed, at a minimum, of three dimensions (Bizarre experiences, Delusional ideations, and Perceptual abnormalities), perhaps collapsed into a general PLEs dimension. For its part, the factor structure of trait schizotypy is essentially multidimensional. Although there is no unanimous agreement on the number of dimensions, the results of the different empirical studies allow us to assert that schizotypy in adolescent populations is composed, at a minimum, of three dimensions (Cognitive-Perceptual, Interpersonal, and Disorganized).

There is evidence that PLEs and trait schizotypy may be valid putative phenotypic liability markers for psychotic-spectrum disorders. This set of non-clinical experiences and traits predicts onset of later psychotic disorders (particularly if persistent) and the increased risk of onset of non-psychotic mental health disorders. Moreover, PLEs and schizotypal traits are associated with the same demographic, environmental, and genetic risk factors as those found in patients with psychosis. In addition, non-clinical adolescents who reported PLEs have demonstrated a wide range of mental health problems as well as neurocognitive deficits, structural and functional brain abnormalities, and functional disconnectivity, similar to those found in patients with psychosis and high risk samples. These findings support the notion of phenomenological, temporal, and etiological assumed continuity between the subclinical and clinical psychosis phenotype and lend validity to the PLEs and schizotypy constructs.

There is no doubt that in the study of subclinical psychotic experiences and traits in adolescents there are still many pieces of the puzzle to be solved, making it an extremely interesting field in expansion that yet has a fascinating future in store.

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