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ScienceDirect

Comprehensive Psychiatry 66 (2016) 201–208

COMPREHENSIVE PSYCHIATRY

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Assessing self-reported clinical high risk symptoms in community-derived adolescents: A psychometric evaluation of the Prodromal Questionnaire-Brief

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Abstract

Background: The reliable early identification of individuals at risk for psychosis requires well-validated screening measures. To date, there is little information about the psychometric properties of the screening measures for psychosis risk in nonclinical adolescents. The main purpose of the present study was to validate the Prodromal Questionnaire-Brief (PQ-B) in a community sample of non-clinical Spanish adolescents. We also analyzed the prevalence, factorial validity, and reliability of the PQ-B scores as well as the relationship between self-reported clinical high risk symptoms and schizotypal traits.

Method: Four hundred and forty-nine high-school students participated in a cross-sectional survey. The PQ-B and the Oviedo Schizotypy Assessment Questionnaire (ESQUIZO-Q) were used.

Results: Although 85.1% of the total sample reported at least one clinical high risk symptom, only 16% of the adolescents scored above the standardized cut-off. The PQ-B revealed an essentially unidimensional structure. The internal consistency of the PQ-B total score was 0.93. Pearson correlation coefficients indicated a high degree of overlap between self-reported clinical high risk symptoms and Positive and Disorganized schizotypal traits. A Canonical correlation between the PQ-B total score and ESQUIZO-Q dimensions showed that the associated variance between both sets of variables was 45.4% (adjusted $R^2 = 0.45$).

Conclusions: The PQ-B is a brief, easy, and reliable tool for screening self-reported clinical high risk symptoms in adolescents from the general population. These results also indicated that self-reported clinical high risk symptoms and schizotypal traits are closely associated at the subclinical level. The assessment of psychosis risk symptoms and their relationship with other distal risk factors, in a close-in strategy, may enhance the early identification of individuals at heightened risk for psychosis spectrum disorders.

1. Introduction

Early identification and timely intervention may delay, ameliorate, or prevent the onset of the clinical outcome in at-risk individuals for psychosis [1]. Furthermore, early detection is essential for gaining a better understanding of risk and protective factors, as well as identifying clinical precursors and studying etiological mechanisms for psychosis. Prior literature shows that the onset of symptoms and signs of psychosis is typically in late adolescence and begins two to five years before the clinical diagnosis [2,3]. The symptoms and signs that precede the clinical expression of psychosis phenotype are usually called prodromal [4]. This phase is prospectively called an "at-risk mental state" (ARMS) or clinical high risk (CHR) state [1]. Follow up studies carried out show that those individuals who report prodromal symptoms or ARMS have a greater probability of a psychiatric outcome, particularly psychosis [2] and show similar deficits (e.g., cognitive, neuroanatomical) to those found in patients with psychosis [1,5,6].

At present, there are several measures available for clinicians and researchers to assess the "ARMS", "prodromal period" or "ultra-high-risk (UHR) state" [7–11]. The PRIME Screen [12],

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http://dx.doi.org/10.1016/j.comppsych.2016.01.013
0010-440X/

Youth Psychosis At-Risk Questionnaire (Y-PARQ) and its brief version (Y-PARQ-B) [13,14], and the Prodromal Questionnaire (PQ) [15] or its Brief version (PQ-B) [16], are good examples of self-report screening instruments for this purpose. The PQ [15] is based partly on the Structured Interview for Psychosis Risk Syndromes (SIPS) [10] as well as the Schizotypal Personality Questionnaire (SPQ) [17]. The PQ items are summed to form four subscales: Positive, Negative, Disorganized, and General symptoms. However, in the brief version of the PQ the authors [18] retained only items related with the positive dimension as the basis for the CHR syndromes. In an attempt to improve the efficiency and accuracy of the measure, the PQ-B included only those items related to unusual perceptual experiences, paranoid ideation, perceptual aberrations, and magical thinking. Previous studies conducted showed that PQ-B is a valid and efficient measure to detect CHR symptoms in adolescents and young adults [7,16,19,20]. This measure has adequate levels of sensitivity and specificity, convergent validity with other psychosis screening measures and clinical interviews (e.g., SIPS; Comprehensive Assessment of At-Risk Mental States –CAARMS- [11]) as well as good internal consistency and temporal stability [7,16,19,20]. However, previous studies have not tested the factorial structure of the PQ-B, nor its accuracy using modern psychometric approaches such as Item Response Theory (IRT) [21] in a community sample of non-clinical adolescents.

Despite several efforts to define and measure CHR symptoms and states of imminent psychosis, inadequate attention has been specifically directed towards samples of adolescents [22,23]. It is important to use comprehensive screening measures validated in adolescents and youths that allow us to map these constructs in a reliable manner, in order to improve the accuracy of early identification in community settings. Moreover, to date, the distinction between the overlapping constructs such as psychosis CHR and schizotypy is an important topic that remains unclear in the field. Schizotypy is considered a latent personality organization reflecting a genetic liability for schizophrenia-spectrum disorders [24]. Acccording to Meehl's model, not all individuals with trait schizotypy will develop psychosis; some will remain clinically compensated, while others will fall along a broad continuum of clinical and subthreshold psychotic manifestations [25]. Independent follow-up studies have shown that individuals who report schizotypal traits are at greater risk of transition to psychosis [26,27]. In this regard, the assessment of clinical high risk symptoms and their relationship with trait schizotypy during adolescence provides a strategy for identifying individuals at heightened risk for psychosis spectrum disorders as well as allowing more comprehensive psychosis risk identification efforts. In addition, it may help us to solve some inconsistences in the operationalization of these related constructs at the earliest stages of psychosis without confounding factors found in clinical samples (e.g., medication).

To date, there is great interest in validating psychosis-spectrum measures for use in community samples [7]. However, previous studies have not tested the psychometric properties of PQ-B scores in nonclinical adolescents samples. Within this framework, the main goal of the present study was to validate the PQ-B as a screening tool designed to assess self-reported CHR symptoms, in a community sample of non-clinical Spanish adolescents. More specifically, we aimed to: a) study the prevalence of self-reported CHR symptoms as measured by the PQ-B; b) examine the factorial structure of the PQ-B using a new approach called Exploratory Structural Equation Modeling (ESEM) [28]; c) analyze the internal consistency and accuracy of the PQ-B scores from both Classical Test Theory (CTT) and IRT approaches; and d) analyze the relationship between self-reported CHR symptoms and schizotypal traits. Based on previous research, we hypothesized that CHR symptoms, measured using the PQ-B, would be able to be reliably assessed. In addition, we expected that these CHR symptoms would be relatively common in this community sample of adolescents, though less prevalent in this population relative to clinically-derived samples of CHR adolescents. Due to the fact that the PQ-B maps only positive CHR symptoms, we expected that the PQ-B would be characterized by an essentially unidimensional structure. Because the PQ-B only assesses positive symptoms, we expected that there would be a greater likelihood that positive aspects of schizotypy (i.e., reality distortion) would be positively correlated with the PQ-B total score. Given prior findings based upon nonclinical samples of adolescents using the ESQUIZO-Q that showed a strong relationship between Positive and Disorganized dimensions [29,30], we expected that PQ-B scores would be strongly associated with Disorganized dimensions as well. We expected that the PQ-B scores would be less associated with the Anhedonia dimension of schizotypy in this sample.

2. Method

2.1. Participants

In order to obtain a representative community sample, we recruited participants from different cities and different types of secondary schools (e.g., public, funded, and private) and vocational/technical schools belonging to Principality of Asturias, a region located at the north of Spain. Both rural and urban areas were represented, as well as a range of socioeconomic levels. We recruited from a total of ten schools, including educational and training centers. The initial sample included 518 students. We omitted participants whose ages were outside the range (i.e., younger than 13 or older than 19 years-old (n = 16); and/or who produced high scores on a validity scale (n = 43). The final sample consisted of 449 students, including 251 males (55.9%). The age of the participants ranged from 13 to 19 years-old (M = 15.14 years; SD = 1.47). The age distribution of the sample was as follows: 13 years (n = 7; 1.6%), 14 years (n = 196; 43.7%), 15 years (n = 110; 24.5%), 16 years (n = 69; 15.4%), 17 years (n = 23; 5.1%), 18 years (n = 17; 3.8%), and 19 years (n = 27; 6.0%).

2.2. Instruments

2.2.1. Prodromal Questionnaire–Brief [16]

The Prodromal Questionnaire-Brief (PQ-B) is a questionnaire-based screening measure containing 21-items that are answered in a dichotomous response format (true/false). The PQ-B asks additional questions regarding extent/severity of impairment and distress, rated on a Likert-type (1 "strongly disagree" to 5 "strongly agree") scales ranging from *no* to *always*, that improved specificity compared to the original measure. Based on Kline et al., [19] the following cut-off scores were used: higher than 6 points on the frequency scales and at or higher than 29 points on the Distress subscale of the PQ-B. The Spanish adaptation of the PQ-B was made in accordance with the international guidelines for test translation and adaptation [31].

2.2.2. The Oviedo Schizotypy Assessment Questionnaire (ESQUIZO-Q) [32]

The ESQUIZO-Q is a self-report measure developed for the assessment of schizotypal traits in adolescents. It comprises a total of 51 items with Likert type response format in five categories (from 1 "totally disagree" to 5 "totally agree"). Its 10 subscales were derived empirically by means of factor analysis, which in turn are grouped into three general dimensions: Reality Distortion (e.g., Positive symptoms: Ideas of Reference, Magical Thinking, Unusual Perceptual Experiences and Paranoid Ideation); Anhedonia (e.g., Physical Anhedonia and Social Anhedonia); and Social Disorganization (e.g., Odd Thinking and Speech, Odd Behavior, Lack of Close Friends and Excessive Social Anxiety). Internal consistency levels for the subscales ranged from 0.62 to 0.90 and showed good convergent validity with other psychopathology measures (e.g., depression, schizotypal traits, personality disorders, emotional problems) [33,34].

2.2.3. The Oviedo Infrequency Scale (INF-OV)

The INF-OV [35] is a 12-item self-report instrument with a Likert-type response format using five categories (from 1 "totally disagree" to 5 "totally agree"). Its objective is to detect those participants who respond to self-report questionnaires in a random, pseudo-random or dishonest fashion. (An example of an infrequency item is: "*The distance between Madrid and Barcelona is greater than the distance between Madrid and New York*"). Respondents who reply to more than three of these items incorrectly are automatically excluded from further study participation. This cut-off point is based on previous empirical research [35].

2.3. Procedure

The questionnaires were administered in groups of 10 to 35 students during normal school hours and in a classroom especially prepared for this purpose. For participants under 18, parents were asked to provide written informed consent in order for their child to participate in the study. Participants were informed of the confidentiality of their responses and of the voluntary nature of the study. No incentives were provided for students' participation. The questionnaires were administered under the supervision of researchers. The study was approved by the research and ethics committee at the University of Oviedo as well as the Education and Social/Behavioral Sciences Institutional Review Board of the University of Wisconsin-Madison.

2.4. Data analyses

First, we calculated descriptive statistics for the sample, including the prevalence of the self-reported clinical high risk symptoms, using the PQ-B. Second, we examined the psychometric properties of the PQ-B. The internal structure of the PQ-B and the internal consistency of the scores were tested using the frequency items. We performed Exploratory Structural Equation Modeling (ESEM) [28] in order to analyze the factorial validity of the PQ-B frequency items (dichotomous nature). The ESEM approach permits the evaluation of less restrictive measurement models than those used in traditional Confirmatory Factor Analysis (CFA) models, e.g., where all cross-loadings are constrained to zero. ESEM relaxes this restriction, whereby the factor loadings in all factors are estimated for each item, permitting one to obtain parameter estimates, standard errors, and goodness-of-fit indices usually associated with CFA. The following goodness-of-fit indices were used: Chi-square (χ^2), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Weighted Root Mean Square Residual (WRMR). Hu and Bentler [36] suggested that RMSEA should be .06 or less for a good model fit and CFI and TLI should be 0.95 or more, though any value over 0.90 tends to be considered acceptable. Furthermore, WRMR cutoff values close to 0.95 or 1.00 were suggested for models with dichotomous outcomes [37].

In addition, the internal consistency and reliability of the scores were performed for both the PQ-B and the ESQUIZO-Q. To assess the reliability of the scores, we calculated Ordinal alpha coefficients for categorical data. The ordinal alpha is conceptually equivalent to Cronbach's alpha [38]. Furthermore, the information functions of the total scores were estimated. The information function is an extension of the precision of measurement (e.g., reliability) in Classical Test Theory within the IRT framework. The information function provides an estimation of theta, the contribution of each item or dimension to the assessment of each level of the latent construct (e.g., schizotypy). Theta scores are measured on an interval scale ($M = 0$; $S^2 = 1$). The test information functions show the degree of precision at different levels of theta or latent trait [21]. Values over 5 (or 10) lead to reliabilities over .80 (or .90). In this way, we can test whether the accuracy of the test is better at a particular level of the latent trait. In high-risk paradigms, for example, we are selecting individuals at risk for psychosis and we need to accurately measure at the upper ends of the latent trait (i.e., individuals with high scores).

Third, we examined the associations between the frequency and severity of self-reported clinical high risk symptoms and

schizotypal traits using two types of computations, namely, Pearson's correlations, and canonical correlation. The canonical correlation is a multivariate technique that is used to examine the relationship between two variable sets (PQ-B and ESQUIZO-Q). The squared canonical correlation represents the proportion of variance shared by two sets of variables.

SPSS 15.0 [39], FACTOR 9.2 [40], and Mplus 7.0 [41] were used for data analyses.

3. Results

3.1. Descriptive statistics and prevalence of the self-reported clinical high risk symptoms

Table 1 provides descriptive statistics for the PQ-B total score and the ESQUIZO-Q dimensions. Descriptive statistics for the PQ-B items are provided in Table 2. As shown in Table 2, the prevalence of specific self-reported CHR symptoms ranged from 0.07 (item 3) to 0.46 (item 18). A total of 83.5% of the total sample reported at least one symptom. A subset (42.3%) of the adolescents scored ≥ 6 points, the standard cutoff for frequency of clinical high risk symptoms. An additional 16% of the sample met criteria for "at high risk" i.e., they scored at or higher than 6 points on the frequency scales and at or higher than 29 points on the Distress subscale.

No statistically significant differences were found by gender on the PQ-B total score and on the ESQUIZO-Q Reality Distortion or Social Disorganization dimensions ($p > 0.05$). Statistically significant differences were found by gender on the Anhedonia dimension ($t = 3.179$; $p = 0.001$), whereby males scored higher than the females. Age was positively associated with the Social Disorganization dimension of the ESQUIZO-Q ($r = 0.18$, $p \leq 0.05$), though not with PQ-B total score, Reality Distortion, or Anhedonia dimensions ($p > 0.05$).

3.2. Factorial structure of the PQ-B scores

Several factor models of PQ-B frequency items were tested using ESEM approach. The one-factor ESEM model yielded adequate goodness-of-fit indices for the total sample: $\chi^2 = 297.53$; $df = 189$; CFI = 0.961; TLI = 0.956; RMSEA = 0.036 (90% IC = 0.028–0.043); WRMR = 1.040. The two-factor ESEM model ($\chi^2 = 201.99$; $df = 169$; CFI = 0.985; TLI = 0.981; RMSEA = 0.029 (90% IC = 0.011–0.033); WRMR = 0.810) and the three-factor ESEM model ($\chi^2 = 176.62$; $df = 150$; CFI = 0.991; TLI = 0.986; RMSEA = 0.020 (90% IC = 0–0.031); WRMR = 0.714) also yielded adequate goodness-of-fit indices. The item grouping in the three-factor ESEM model did not have a clear psychological interpretation and only two items had high factorial loading in the third factor (<0.3). The standardized factor loadings for the one-factor and two-factor models are shown in Table 2. Based on the item content, the two factors did not yield a clear interpretation of the factorial solution.

Table 1
Descriptive statistics for the Prodromal Questionnaire-Brief (PQ-B) and the Oviedo Schizotypy Assessment Questionnaire (ESQUIZO-Q) dimensions.

	M	*SD*	Skewness	Kurtosis	Range	Ordinal alpha
PQ-B	5.26	4.39	0.70	−0.15	0–18	0.93
ESQUIZO-Q						
Reality Distortion	35.23	13.63	1.16	1.00	21–97	0.92
Anhedonia	15.24	4.76	1.03	1.17	9–33	0.77
Social Disorganization	47.38	14.17	0.52	0.02	21–93	0.91

Table 2
Descriptive statistics and standardized factorial loadings for one and two factor model of the Prodromal Questionnaire-Brief (PQ-B) items.

			One factor	Two factor	
Items	M[a]	SD	Factorial Loadings	Factorial Loadings	
1	0.10	0.30	0.50*	−0.10	0.63*
2	0.31	0.46	0.64*	0.63*	0.17
3	0.07	0.25	0.63*	−0.05	0.74*
4	0.14	0.35	0.60*	0.74*	−0.01
5	0.23	0.42	0.68*	0.27*	0.52*
6	0.22	0.42	0.58*	−0.02	0.65*
7	0.19	0.39	0.62*	0.81*	−0.03
8	0.43	0.50	0.64*	0.32*	0.43*
9	0.18	0.38	0.55*	0.26*	0.38*
10	0.27	0.44	0.68*	0.32*	0.47*
11	0.35	0.48	0.70*	0.37*	0.45*
12	0.26	0.44	0.58*	0.05	0.60*
13	0.18	0.39	0.58*	0.27*	0.41*
14	0.38	0.49	0.73*	0.28*	0.56*
15	0.17	0.38	0.47*	0.50*	0.07
16	0.25	0.43	0.44*	−0.13	0.59*
17	0.24	0.43	0.65*	0.14	0.59*
18	0.46	0.50	0.57*	0.05	0.58*
19	0.28	0.45	0.68*	0.49*	0.32*
20	0.19	0.39	0.77*	0.47*	0.43*
21	0.37	0.48	0.58*	−0.02	0.65*

[a] For the categorical items, the number of adolescents who reported some specific symptom is the equal to the mean value*100.

* Standardized factorial loadings estimated were statistically significant ($p \leq 0.05$).

3.3. Reliability estimation and accuracy of the PQ-B scores

The internal consistency of the PQ-B total score, estimated with Ordinal alpha, was 0.93. According to IRT, the study of measurement precision indicated that test information function provides optimal estimation at the medium and high level of the latent-trait (range interval + 0.8–1.2 *SD*) (see Fig. 1).

3.4. Associations between PQ-B and ESQUIZO-Q scores

We calculated the Pearson's correlation between the PQ-B total score and the ESQUIZO-Q dimensions. As shown in Table 3, the PQ-B total score was positively and strongly associated with both the Reality Distortion and Social Disorganization dimensions of the ESQUIZO-Q ($p < 0.01$). In contrast, there was no relationship between the PQ-B total

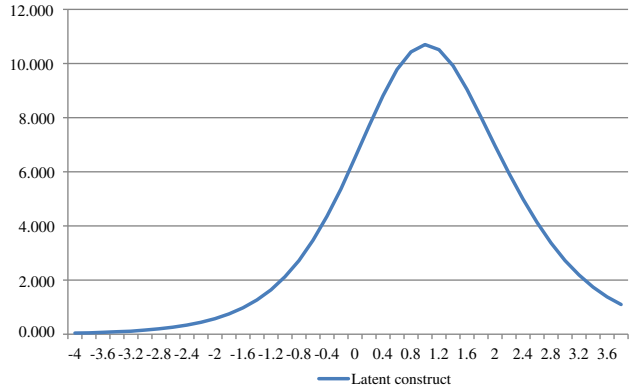

Fig. 1. Information function of the Prodromal Questionnaire-Brief. Note. The The X-axis provides the level of the latent construct in terms of standard deviation (SD) from the mean value. The information function provides optimal estimation at the medium and high levels of the latent-trait (i.e., range interval + 0.8–1.2 *SD*).

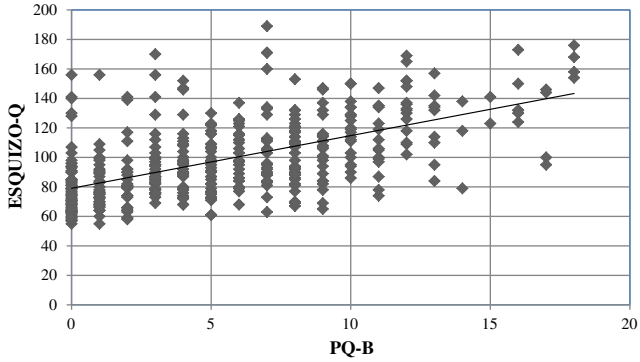

Fig. 2. Relationship between total score of the Prodromal Questionnaire-Brief (PQ-B) and the Oviedo Schizotypy Assessment Questionnaire (ESQUIZO-Q).

score and the ESQUIZO-Q Anhedonia dimension. Fig. 2 depicted the relationship between the total scores of both measures. The Pearson correlation between total scores of both instruments was 0.59 ($p < 0.01$).

Canonical correlation analysis was also performed. These results showed that the canonical correlation was statistically significant ($p \leq 0.05$). The adjusted R^2 between the PQ-B (canonical variate 1) and the ESQUIZO-Q dimensions (canonical variate 2) was 0.454, which represents 45.4% of variance shared. The squared correlation between PQ-B total score and ESQUIZO-Q dimensions were as follows: Reality Distortion (0.82), Anhedonia (0.01) and Social Disorganization (0.63).

4. Discussion

Precise definition and reliable assessment of CHR symptoms is essential for screening and early detection of individuals at heightened risk for psychosis spectrum disorders. Therefore, the main purpose of the present study was to psychometrically evaluate the Prodromal Questionnaire-Brief (PQ-B) [16] in a community sample of non-clinical adolescents. Specifically, our goal was to analyze the factor structure, reliability and accuracy of the Spanish translation of the PQ-B in adolescents. A secondary goal of the study was to examine the association between the PQ-B and scores on a well-validated measure of schizotypal traits in adolescents, namely, the ESQUIZO-Q. If a main goal in ongoing early intervention efforts is to identify individuals at high risk, then examining the associations between CHR symptoms and relevant risk factors, such as subclinical manifestations of psychosis (e.g. schizotypal traits) may help investigators to enhance the prediction of clinical outcome.

Table 3
Pearson's correlations between the Prodromal Questionnaire-Brief (PQ-B) total score and the Oviedo Schizotypy Assessment Questionnaire (ESQUIZO-Q) dimensions.

	PQ-B	Reality Distortion	Anhedonia
Reality Distortion	0.612**		
Anhedonia	−0.065	0.242**	
Social Disorganization	0.538**	0.633**	0.130**

** $p \leq 0.01$.

First, a total of 85.1% of the total sample self-reported at least one CHR symptom, though only 16% of the sample scored higher using the standardized cut-off (more than 6 points on the frequency scale and higher than 29 points on the Distress subscale). The results from the present study indicated that although these self-reported CHR symptoms are quite common in this adolescent sample, only a few students displayed clinically significant symptoms that were related to distress, and thus would warrant prophylactic treatment and need of care. These findings may help us to understand the significance of at-risk symptoms observed in nonclinical samples of children and adolescents in the general population [23]. Within an extended psychosis phenotype, previous studies have found similar results in CHR symptoms as well as in psychotic-like experiences and schizotypal traits [42–44]. To date, the prevalence of these symptoms in this age group is still not completely clear. For example, McGorry et al., [42] found that the prevalence of DSM-III-R prodromal symptoms in a sample of adolescents ranged from 10 to 15% to 51%, with almost 75% of the sample reporting one symptom of more. In a recent study using clinical interviews in a representative sample of the population, Schimmelmann et al., [22] found that the prevalence of any UHR symptom was 9.9%.

Second, our results reveal that the PQ-B seems to be an easy and brief tool for screening purposes in general population samples. We demonstrated that the PQ-B shows adequate psychometric properties regarding factorial structure, internal consistency, accuracy, and moderately high association with scores on schizotypy measure. The internal consistency level, estimated with ordinal alpha, was good. When an IRT framework was used, the results have shown that PQ-B provides more accurate information (less measurement error) at the medium and high end of the latent trait (e.g., CHR

symptoms). These findings are noteworthy, because the IRT framework provides a modern approach to study the precision of self-reported CHR symptoms across each level of the latent construct. That is, the PQ-B provides greater accuracy of measurement of those individuals with medium-high levels of the latent construct, i.e.,individuals at theoretically high risk.

Furthermore, the results suggest that CHR symptoms, using the PQ-B, are better considered as an essentially unidimensional structure. The two and three factor solution yielded adequate goodness of fit indices; however neither one of these factorial models had a good psychological interpretation of the factors. It is worth mentioning that the PQ-B was developed taking into account only the items of the Positive dimensions of the CHR construct. To our knowledge, this is the first empirical test of the factorial structure of the PQ-B in a non-clinical sample of adolescents. Although prior studies have not tested its factorial validity, earlier research showed that the PQ-B is a good measure for screening high-risk states. Prior research reports adequate levels of sensitivity and specificity in adolescents at clinical high risk, convergent validity with other psychosis screening measures as well as good reliability coefficients [7,16,19,20]. Not surprisingly, the psychometric data on self-report measures is markedly variable across studies, leading authors in a recent review to report that "no single measure has demonstrated both sensitivity and specificity exceeding 0.70 on more than two studies" [7]. Overall, it appears that self-report measures for prodromal symptoms or psychosis risk screening are in their nascent stage. Thus, further research is needed, not only to replicate the present findings, but also to extend the applicability of the PQ-B to new samples [9].

The present results also indicated that CHR symptoms and schizotypal traits are related with each other at the subclinical level. In particular, strong correlations were found with the Reality Distortion (Positive) and Social Disorganization dimensions. Canonical correlation analysis showed that the associated variance between both set of variables was 45.4%; however, 54.6% of the variance was not shared between the measures. Previous studies conducted in non-clinical young adults observed similar results to those found in this study [45–48]. For example, Bedwell and Donnelly [48] found that the total scores from the Schizotypal Personality Questionnaire-Brief (SPQ-B) and the Y-PARQ-B showed a significant positive correlation of 0.66, sharing 43% of the total variance. In another study, Kline et al. [47] found a Pearson's correlation of 0.55 between SPQ-B and PQ-B.

In addition, we did not find any relationship between schizotypal anhedonia and the PQ-B total score. We acknowledge, however, the following caveats: first, the Anhedonia dimension of the ESQUIZO-Q is only assessed with 6 items (i.e., there are only a few items to map this construct); and secondly, the Anhedonia subscale is an indirect measure of the "negative dimension" of the schizotypy construct, so caution is warranted when attempting to draw conclusions from our data. Finally, anhedonia is not only a significant predictor of psychosis and/or schizophrenia-spectrum clinical outcomes [26] but it is also quite present in the prodromal stages of psychosis (see [1,49]). Given that negative symptoms such as anhedonia have also shown predictive value for conversion to psychosis, our focus on positive symptoms, as measured by the PQ-B, may not fully capture the construct of a prodrome. While this is a limitation of the measure, it is also a limitation of the present investigation, which focused mainly on positive dimensions of schizotypy as well as positive symptoms of the "prodrome" or CHR status.

These results should be considered preliminary and interpreted with caution pending replication studies in larger samples of the general population. The presence of schizotypal traits or clinical high risk symptoms during adolescence is not a necessary or sufficient condition for the later development of a psychotic disorder. However, in a small group of adolescents, such subclinical experiences may interact synergistically and additively with genetic (e.g., parents with psychosis), environmental (e.g., stress, urbanicity), and/or psychosocial factors (e.g., depression), becoming abnormally persistent, and clinically relevant and leading to the development of clinical psychosis and need for treatment [44].

The present study advances our understanding of the relationships between self-reported clinical high risk symptoms and schizotypal traits in nonclinical populations without the confounding effects of medication and stigmatization that are frequently associated in patients with schizophrenia as well as clinical high-risk samples. This study also tries to facilitate the integration of two of the main approaches to identify individual at risk for psychosis, i.e., clinical high risk and psychometric high risk paradigms [25,50].The results obtained in the present study must be interpreted in the light of the following limitations. First, adolescence is a developmental period in which personality (and, in turn, psychopathology) may still be in its nascent ontogeny. The present results must thus be further evaluated in order to understand their natural developmental course. Second, in the present study, we relied solely on the PQ-B as a measure of clinical psychosis features. Due to the self-report nature of the PQ-B, the present study is subject to the problems inherent in any research based solely upon self-report measures. Third, the extent to which screening measures for clinical high risk symptoms of psychosis may be associated with false positives in community samples is unclear. Fourth, these measures have been associated with stigmatization, negative labeling, and stereotypes [23].

These results indicated that a) PQ-B scores showed adequate psychometric properties in this sample, and b) self-reported CHR symptoms and schizotypal tratis are closely related during adolescence. The assessment of these two phenotypic risk factors for psychosis, in community settings and in a close-in strategy, may help us to enhance the possibility of early identification of adolescents at risk for psychosis. Future research should continue to conduct follow-up studies in community settings as well as explore how the combination of these risk factors may be useful in predicting outcomes in at-risk adolescents.

Acknowledgement

We wish to thank the schools and students for their participation in this project. This research was funded by the Spanish Ministry of Science and Innovation (MICINN) (PSI2014-56114-P), 2015 edition of the BBVA Foundation Grants for Researchers and Cultural Creators, and by the Instituto Carlos III, Center for Biomedical Research in Mental Health Network (CIBERSAM). DCG was supported by a Leon Epstein Faculty Research Fellowship from the University of Wisconsin-Madison. EFP was supported by a José Castillejo Fellowship from MICINN (reference CAS14/00208; DCG, sponsor, and UW-Madison, host institution).

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