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ORIGINAL ARTICLE

Psychosis risk screening: Validation of the youth psychosis at-risk questionnaire – brief in a community-derived sample of adolescents

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Abstract

There have been several attempts to identify individuals potentially at high risk for psychotic-spectrum disorders using brief screening measures. However, relatively few studies have tested the psychometric properties of the psychosis screening measures in representative samples of adolescents. The main purpose of the present study was to analyse the prevalence, factorial structure, measurement invariance across gender, and reliability of the Youth Psychosis At-Risk Questionnaire – Brief (YPARQ-B) in a community-derived sample of adolescents. Additionally, the relationship between YPARQ-B, depressive symptoms, psychopathology, stress manifestations, and prosocial skills was analysed. One thousand and twenty students from high schools participated in a cross-sectional survey. The YPARQ-B, the Reynolds Adolescent Depression Scale, the Strengths and Difficulties Questionnaire, and the Student Stress Inventory – Stress Manifestations were used. A total of 85.1% of the total sample self-reported at least one subclinical psychotic experience. We observed a total of 10.9% of adolescents with a cutoff score of ≥11 or 6.8% with a cutoff score of ≥13. The analysis of internal structure of the YPARQ-B yielded an essentially unidimensional structure. The YPARQ-B scores showed measurement invariance across gender. The internal consistency of the YPARQ-B total score was 0.94. Furthermore, self-reported subclinical psychotic experiences were associated with depressive symptoms, emotional and behavioural problems, poor prosocial skills, and stress manifestations. These results would appear to indicate that YPARQ-B is a brief and easy tool to assess self-reported subclinical psychotic experiences in adolescents from the general population. The assessment of these experiences in community settings, and its associations with psychopathology, may help us to enhance the possibility of an early identification of adolescents potentially at risk for psychosis and mental health problems.

KEYWORDS

early detection, psychosis, risk, screening, YPARQ-B

1 | INTRODUCTION

During the last two decades, the early identification of individuals potentially at-risk for psychotic-spectrum disorders has become an extensive focus of research and debate (Addington, Stowkowy, & Weiser, 2015; Kline & Schiffman, 2014). Reliable identification of individuals at-high risk and timely prophylactic intervention may delay, ameliorate, or prevent the onset to frank psychotic symptoms and other mental health disorders as well as reduce its possible impact on many levels (e.g. personal, familiar, educational, occupational) (Fusar-Poli, Carpenter, Woods, & McGlashan, 2014). Moreover, it opens up the possibility of examining and understanding risk markers, protective factors, and possible etiological mechanisms of psychotic-spectrum disorder prior to the clinical expression of the clinical disorder with the aim to conduce prophylactic treatments that may improve outcome (Fonseca-Pedrero, Gooding, Ortuño-Sierra, & Paino, 2016). These are key points within the Roadmap for Mental Health Research in Europe (ROAMER) (Wittchen, Knappe, & Schumann, 2014).

Psychotic symptoms and signs usually display their onset during late adolescence or early adulthood, many years before the clinical diagnosis is made (Fusar-Poli et al., 2012a; Häfner & An Der Heiden, 1999). These preceding symptoms to the imminent clinical expression are usually called prodromal symptoms (Yung & McGorry, 1996). This phase is prospectively called "at-risk mental state" (ARMS) or clinical high risk (CHR) state (Fusar-Poli et al., 2014). Follow-up studies carried out show that those individuals who report attenuated psychotic symptoms (APS), or psychotic-like experiences (PLEs) have a greater probability of psychiatric outcome, particularly non-affective psychotic disorders (Debbané et al., 2015; Fusar-Poli et al., 2012a) as well as other mental problems (Fisher et al., 2013; Fusar-Poli et al., 2014).

Moreover, these subclinical experiences and symptoms have been associated with the same demographic, environmental, and genetic risk factors (Linscott & van Os, 2013) and show similar deficits (e.g. neurocognitive, structural and functional brain abnormalities) to those found in patients with psychosis (Calkins et al., 2014; Fusar-Poli et al., 2012b; Fusar-Poli et al., 2007; Wolf et al., 2015). From the extended psychosis continuum model, the expression of psychosis phenotype fluctuates from a normal state of functioning, going from subclinical psychotic experiences and symptoms, toward its clinical manifestation in the form of certain psychotic-spectrum disorder (Linscott & van Os, 2013; van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009). The subclinical experiences which do not reach clinical threshold for psychosis state, that are not related with associated distress, help-seeking behaviour and/or functional impairment, and that are continuously distributed across the general population, are known as PLEs.

At present there are several measurement instruments available for clinicians and researchers to document the presence, frequency, and severity of APS and PLEs (Addington et al., 2015; Kline & Schiffman, 2014). These measures have shown to be valid and efficient in identifying and recruiting high-risk samples (Kline & Schiffman, 2014), To date, however, there is no gold standard of self-report measure to assess CHR symptoms. The PRIME Screen (Miller, Cicchetti, Markovich, McGlashan, & Woods, 2004), the Prodromal Questionnaire (PQ) (Loewy, Bearden, Johnson, Raine, & Cannon, 2005), and the Youth Psychosis At-Risk Questionnaire (YPARQ) or its brief version (YPARQ-B) (Myles-Worsley et al., 2007; Ord, Myles-Worsley, Blailes, & Ngiralmau, 2004), are good examples of self-report psychosis risk screening measures.

The YPARQ in particular, is a 92-item tool specifically developed for screening CHR symptoms in adolescents. Based upon the Comprehensive Assessment of At-Risk Mental States (CAARMS) (Yung et al., 2005), the YPARQ items assess positive, negative, and affective domains of psychosis phenotype. It was validated on 648 high school students in Palau, a region where familial cases of schizophrenia have been followed-up extensively (Myles-Worsley et al., 2007; Ord et al., 2004). There is also a brief version, the YPARQ-B, which contains only 28 items. This abbreviated tool was derived from the most discriminating questions from the positive symptoms (Ord et al., 2004) of the CAARMS (Yung et al., 2005) in combination with criteria from the Personal Assessment and Crisis Evaluation (PACE) clinic of the Early Psychosis Prevention and Intervention Centre at the University of Melbourne, Australia.

Previous studies conducted showed that YPARQ-B is a good measure to screen CHR symptoms and sublinical psychotic experiences in adolescents as well as young adults. The scores of this tool have demonstrated good internal consistency coefficients and temporal stability as well as adequate levels of sensitivity and specificity (Bedwell & Donnelly, 2005; Kline et al., 2014; Kline et al., 2015; Kline et al., 2012a, 2012b; Lee, Cho, Cho, Jang, & Kim, 2012). Furthermore, this tool has shown good correspondence with the most recognized interviews, such as the Structured Interview for Psychosis Risk Syndromes (SIPS) (Miller et al., 2003) and other psychosis risk screening measures. For instance, Kline et al. (2012a, 2012b) recommended that a screening threshold of (≥ 11) yielded sensitivity of 0.65, specificity of 0.76, and PPV of 0.65 with regard to SIPS CHR/psychosis diagnoses. However, the within-sample optimized threshold was slightly higher (≥ 13) and yielded sensitivity of 0.65, specificity of 0.90, and positive predictive value (PPV) of 0.81. In another study, Kline et al. (2015), using the threshold of ≥13 found a sensitivity of 1.00, specificity of 0.80, PPV of 0.29, negative predictive value (NPV) of 1.00, and accuracy of 81%.

There is evidence indicating that APS and PLEs are relatively common during adolescence (Calkins et al., 2014; Kelleher et al., 2012c; Linscott & van Os, 2013; Schultze-Lutter, Michel, Ruhrmann, & Schimmelmann, 2014). Epidemiological studies have demonstrated that the mean annual prevalence of the PLEs among adolescents aged 13 to 18 is 7.5% (Kelleher et al., 2012a). In addition, individuals with APS or PLEs show overlapping yet less severe deficits and impairments to those found in clinical samples. Adolescents with APS or sublinical psychotic experiences for instance, reported a high prevalence of mental axis I diagnoses as well as psychopathology symptoms related with depression, anxiety, suicide attempts, and internalizing and externalizing problems. Moreover, functional and social impairments and neurocognitive deficits have been also reported (Calkins et al., 2014; Fusar-Poli et al., 2014; Fusar-Poli et al., 2012b; Kelleher, Cederlöf, & Lichtenstein, 2014; Kelleher, Clarke, Rawdon, Murphy, & Cannon, 2013a; Kelleher et al., 2012c; Thompson et al., 2015). In this regard, the assessment of subclinical psychotic symptoms or experiences and their relationship with other mental health indicators, during adolescence and in community settings, may provide a window to the reliable identification of those at heightened risk for psychosis spectrum disorders. More accurate and comprehensive psychosis risk detection efforts under a close-in strategy, may improve psychosis prevention within this age group.

Despite several efforts to define and measure psychotic symptoms and experiences, inadequate attention has been specifically directed towards samples of adolescents (Schimmelmann, Michel, Martz-Irngartinger, Linder, & Schultze-Lutter, 2015; Schimmelmann & Schultze-Lutter, 2012). The current study will focus on the validity of YPARQ-B to assess self-reported subclinical psychotic experiences and its associations with several psychopathological psychometric indicators in a large sample of non-clinical adolescents. To date, there have been several attempts to identify adolescents potentially at high risk for psychosis using brief psychosis risk screening measures; however, to the best of our knowledge, no previous studies have validated the YPARQ-B in this age group. For instance, the factorial validity of the YPARQ-B or the analysis of the reliability of the scores using modern psychometric approaches such us Item Response Theory (IRT) (Hambleton, Swaminathan, & Rogers, 1991) has not been conducted.

Within this research framework, the main purpose of the present study was to analyse the psychometric properties of the YPARQ-B scores, as well as the relationship between self-reported subclinical psychotic experiences and psychopathology in a community-derived sample of adolescents. Deriving from this general goal are the following specific objectives: (a) to analyse the prevalence of the self-reported subclinical psychotic experiences using the YPARQ-B; (b) to test the factorial structure and measurement invariance across gender of the YPARQ-B scores; (c) to examine the internal consistency and precision, through IRT, of the YPARQ-B scores; (d) to analyse the relationship between self-reported subclinical psychotic experiences and depression symptoms, behavioural and emotional problems, and stress manifestations.

Based on previous research, we hypothesized that subclinical psychotic experiences would be able to be reliably assessed, and found to be relatively common albeit low levels in this community sample. This tool is based on the most discriminating positive symptom questions of the CAARMS. Those items were used to calculate a positive symptom score in previous studies (Ord et al., 2004). Thus, we expected that the YPARQ-B would be characterized by a one-dimensional structure equivalent across gender. We also predicted that YPARQ-B scores would be associated with psychopathology 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 Navarra and La Rioja (regions located in the north of Spain). Both rural and urban areas were represented, as well as a range of socio-economic levels. We recruited students from a total of 10 schools, including educational and training centres. The initial sample included 1071 students, and we discarded data from participants who presented: (a) omissions of any demographics or items without responding ($n = 31$); and (b) scores in the range of outliers ($n = 20$) (e.g. scores higher than 2.5 standard deviations (SDs) in the subscales of the measures used). The final sample consisted of 1020 students, of which 392 were male (38.4%). The age of the participants ranged from 13 to 21 years-old [mean [M] = 16.12 years; SD = 2.12). The age distribution of the sample was the following: 13 years ($n = 60$; 5.9%), 14 years ($n = 171$; 16.8%), 15 years ($n = 253$; 24.8%), 16 years ($n = 169$; 16.6%), 17 years ($n = 118$; 11.6%), 18 years ($n = 126$; 12.4%), and 19–21 years ($n = 102$; 12.1%).

2.2 | Instruments

2.2.1 | The YPARQ-B

The YPARQ-B is a 28-item self-report instrument ("yes", "no", or "unknown"), specifically developed to screen CHR symptoms during adolescence. In this study "yes" was scored as "1" and "no" or "unknown" as "0". The Spanish adaptation of the YPARQ-B was made in accordance with the international guidelines for test translation and adaptation (Muñiz, Elosua, & Hambleton, 2013).

2.2.2 | The Reynolds Adolescent Depression Scale (RADS)

The Reynolds Adolescent Depression Scale (RADS) (Reynolds, 1987) assesses the severity of depressive symptoms in adolescents. It is composed of 30 items in a Likert response format with four options (1 = "almost never", 2 = "hardly ever", 3 = "sometimes", 4 = "most of the time"). The RADS encompasses four empirically derived scales: anhedonia, somatic complaints, negative self-evaluation, and dysphoric mood. The validated Spanish version of the RADS was used in the present study (Fonseca-Pedrero et al., 2010).

2.2.3 | The Strengths and Difficulties Questionnaire (SDQ)

The Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) is a self-report questionnaire that is widely used for the assessment of different emotional and behavioural problems related to mental health in adolescents. The SDQ is made up of a total of 25 statements distributed across five subscales: emotional symptoms, conduct problems, hyperactivity, peer problems, and prosocial behaviour. The first four subscales yield a total difficulties score. In this study we used a Likert-type response format with three options (0 = "Not true", 1 = "Somewhat true", 2 = "Certainly true"). The validated Spanish version of the SDQ was used in the present study (Ortuño-Sierra, Chocarro, Fonseca-Pedrero, Sastre i Riba, & Muñiz, 2015).

2.2.4 | The Student Stress Inventory – Stress Manifestations (SSI-SM)

The Student Stress Inventory – Stress Manifestations (SSI-SM) (Fimian, Fastenau, Tashner, & Cross, 1989) is composed of a total of 22 items in a Likert-type response format with five options (1 = "absolutely not", 2 = "few times", 3 = "sometimes", 4 = "often", and 5 = "a lot of times"). Items are grouped in three subscales: physiological responses (six items), emotional responses (10 items), and behavioural responses (six items). The total score is the sum of each subscale. In this study we used the validated Spanish version of the SSI-SM (Escobar, Blanca, Fernández-Baena, & Trianes, 2011; Ortuño-Sierra, Fonseca-Pedrero, Aritio-Solana, & Chocarro de Luis, 2016).

2.3 | Procedure

The questionnaires were administered collectively, in groups of 10 to 35 students, during normal school hours and in a classroom specially prepared for this purpose. For participants under 18, parents were asked to provide a 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 incentive was provided for their participation. Administration took place under the supervision of the researchers. The study was approved by the research and ethic committee at the University of La Rioja.

2.4 | Data analyses

First, we calculated descriptive statistics and the prevalence of the self-reported subclinical psychotic experiences. Second, in order to analyse the internal structure of the YPARQ-B scores confirmatory factor analysis (CFA) was used. Due to the fact that (a) no previous

research have tested the underlying structure of the YPARQ-B scores in adolescents, and (b) this tool map has only a positive dimension of psychotic symptoms (see Ord et al., 2004), thus a one-dimensional factor model was tested. The weighted least squares means and variance adjusted (WLSMV) estimator for dichotomous items was used. 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 (1999) suggested that RMSEA should be 0.06 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. For WRMR, values less than 0.95 indicate good model fit (for dichotomous outcomes) (Yu, 2002). Fourth, in order to test measurement invariance across gender, successive multigroup CFAs were conducted. Using Delta parameterization in Mplus, two steps on measuring invariance need to be considered: configural and strong invariance models (Muthén & Muthén, 1998–2012). The ΔCFI were used to determine in cases where nested models were practically equivalent.

Third, we examined internal consistency and test information function of the YPARQ-B scores. To obtain a measure of the reliability of the scores, we calculated Ordinal alpha coefficients for categorical data (Zumbo, Gadermann, & Zeisser, 2007). Ordinal alpha is conceptually equivalent to Cronbach's alpha and it performs well for dichotomous data (Zumbo et al., 2007). Furthermore, the test information function was estimated. The information function is an extension of the reliability in Classical Test Theory, within IRT framework (Hambleton et al., 1991). Test information functions are related to the measurement precision (less error of measurement) and show the degree of precision at different levels of theta or latent trait (e.g. subclinical psychotic experiences). Theta scores are measured on an interval scale ($M = 0$; $S^2 = 1$).

Fifth, the associations between self-reported YPARQ-B scores and psychopathology were examined using two analyses: (a) Pearson's correlations, and (b) multiple logistic regression. The YPARQ-B scores were dichotomized using the cutoff of ≥13, and RADS, SDQ, and SSI-SM scores were used as predictor variables. Age and gender showed no significant associations with YPARQ-B scores, these variables were not used as covariates.

3 | RESULTS

3.1 | Descriptive statistics and prevalence of subclinical psychotic experiences

Descriptive statistics for the subscales and total scores of the measuring instruments used are shown in Table 1. Descriptive statistics of the YPARQ-B items are depicted in Table 2. As can be seen in Table 2, the prevalence of self-reported subclinical psychotic experiences ranged from 0.06 (item 26, "Do things sound louder than usual to you?") to 0.37 (item 15, "Have you noticed any unusual bodily sensations such as tingling, pulling, pressure, burning, cold, vibrations, drilling tearing or electricity?"). A total of 85.1% of the sample reported at least one item of the YPARQ-B. We observed 10.9% of adolescents with a cutoff score of ≥11 (standard cutoff) and 6.8% with a cutoff score of ≥13. The norms for the YPARQ-B scores were for the following percentiles 10, 20, 30, 40, 50, 60, 70, 80, 90, and 95, were 0, 1, 2, 3, 4, 5 7, 9, 12, and 14, respectively. No statistically significant differences were found by gender in the YPARQ-B total score ($t = 1.352$; $p = 0.187$). Age was negatively associated with YPARQ-B total score ($r = -0.14$, $p < 0.05$).

3.2 | Factorial structure and measurement invariance of the YPARQ-B scores across gender

Table 3 shows the goodness-of-fit indices for the one-factorial model tested. This model yielded adequate goodness-of-fit indices for the total sample as well as for males and females. Due the fact that no previous studies have tested the factorial structure of the YPARQ-B, and

TABLE 1 Descriptive statistics for the self-report measures

	M	SD	Skewness	Kurtosis	Range	Ordinal alpha
YPARQ-B total score	5.11	4.86	1.30	1.78	0–28	0.94
RADS						
Dysphoric mood	16.18	4.39	0.60	0.02	8–32	0.76
Anhedonia	11.45	2.84	0.96	1.11	7–25	0.70
Negative self-evaluation	12.77	4.24	1.12	1.13	8–32	0.83
Somatic complains	15.52	3.46	0.26	−0.09	7–28	0.78
SDQ						
Emotional symptoms	3.21	2.38	0.62	−0.31	0–10	0.75
Conduct problems	2.02	1.70	1.05	1.26	0–10	0.72
Peer problems	1.88	1.84	1.33	2.00	0–10	0.74
Hiperactive	4.46	2.12	0.18	−0.30	0–10	0.71
Prosocial	8.34	1.76	−1.42	2.42	0–10	0.75
Total dificultes	11.57	5.51	0.55	0.00	0–30	0.84
SSI-SM						
Emotional	23.67	7.24	0.54	0.20	10–50	0.90
Physiological	10.96	3.47	1.08	1.83	6–27	0.78
Behavioural	10.37	3.20	1.04	1.98	6–29	0.79

Note: YPARQ-B, Youth Psychosis At-Risk Questionnaire – Brief; RADS, Reynolds Adolescent Depression Scale; SDQ, Strengths and Difficulties Questionnaire; SSI-SM, Student Stress Inventory – Stress Manifestations.

TABLE 2 Descriptive statistics and standardized factorial loadings for the Youth Psychosis At-Risk Questionnaire – Brief (YPARQ-B) items

Item	M	SD	Standardized factorial loadings		
			Total sample	Male	Female
1	0.22	0.41	0.30	0.30	0.31
2	0.27	0.44	0.52	0.51	0.54
3	0.25	0.43	0.50	0.49	0.50
4	0.19	0.39	0.66	0.71	0.63
5	0.25	0.43	0.58	0.69	0.53
6	0.24	0.43	0.46	0.51	0.42
7	0.22	0.41	0.64	0.70	0.61
8	0.18	0.38	0.39	0.56	0.33
9	0.30	0.46	0.60	0.64	0.54
10	0.08	0.27	0.51	0.47	0.54
11	0.11	0.31	0.41	0.40	0.41
12	0.16	0.37	0.67	0.62	0.71
13	0.10	0.29	0.73	0.73	0.75
14	0.16	0.36	0.51	0.57	0.46
15	0.37	0.48	0.62	0.57	0.67
16	0.22	0.41	0.58	0.54	0.61
17	0.17	0.38	0.66	0.77	0.58
18	0.10	0.30	0.51	0.55	0.48
19	0.20	0.40	0.74	0.74	0.74
20	0.13	0.34	0.67	0.68	0.67
21	0.12	0.33	0.72	0.75	0.69
22	0.08	0.28	0.75	0.75	0.75
23	0.12	0.33	0.72	0.79	0.68
24	0.19	0.39	0.72	0.69	0.76
25	0.25	0.43	0.70	0.70	0.71
26	0.06	0.24	0.60	0.66	0.57
27	0.28	0.45	0.63	0.57	0.67
28	0.09	0.29	0.74	0.73	0.75

Note: For categorical items, the number of adolescents who responding affirmatively one item of the YPARQ-B is the equal to the mean value × 100.

YPARQ-B items are based in the positive dimension of psychosis phenotype, only a unidimensional model was tested. The standardized factor loadings for the whole sample as well as for males and females are shown in Table 2. The range of the factor loadings, for the total sample was from 0.30 (item 1) to 0.75 (item 22). All standardized factor loadings estimated were statistically significant ($p < 0.01$)

Given that the one-factor model evidenced good model fit, we therefore tested the measurement invariance of the YPARQ-B scores across gender. Prior to the analysis of measurement invariance across gender, we tested whether the one-factor model showed a reasonably good fit to the data in each group separately (see Table 3). Goodness-of-fit indices for males and females were adequate. The configural invariance model in which no equality constraints across groups were imposed showed an adequate fit to the data. Next, a strong invariance model was tested with the item thresholds and factor loadings constrained to be equal across groups. The ΔCFI between the constrained and unconstrained models was under 0.01, indicating that strong measurement invariance across gender was supported for the YPARQ-B scores.

3.3 | Reliability estimation and accuracy of the YPARQ-B scores

The internal consistency of the YPARQ-B total scores, estimated with ordinal alpha, was 0.94. According to IRT framework, the study of measurement precision of the YPARQ-B scores indicated that the information function provides an optimal estimation at the high latent-trait (values between 0 and 2.8) (see Figure 1). The tool reduces its accuracy around the lowest level of the latent trait (< −2).

3.4 | Associations between subclinical psychotic experiences and depressive symptoms, psychopathology, and stress manifestations

We calculated the Pearson's correlation between YPARQ-B total score and the RADS, the SDQ, and the SSI-SM scores. As shown in Table 4, all of the associations between YPARQ-B scores and RADS, SDQ, and SSS-SM subscales were statistically significant ($p < 0.01$). Only the correlation between YPARQ-B and SDQ prosocial subscale was negatively associated. The multiple logistic regression model showed that the total score of the SDQ, negative self-evaluation (RADS), prosocial (SDQ), and physiological manifestations (SSI-SM) subscales predicted the YPARQ-B scores of the high-risk group (see Table 5). The adjusted R^2 for this regression model was 0.278. The Nagelkerke R^2 values were 0.222 (step 1), 0.249 (step 2), 0.264 (step 3), and 0.278 (step 4).

4 | DISCUSSION

The knowledge of the validity of YPARQ-B scores is relevant in order to use it as a psychosis screening measure in community settings during adolescence, a developmental stage of special risk for the

TABLE 3 Goodness-of-fit indices for the hypothetical models tested and measurement invariance across gender

Model	χ^2	df	CFI	TLI	RMSEA (90% IC)	WRMR	ΔCFI
One-factor	760.856	350	.943	.939	.034 (.031–.037)	1.279	
Measurement invariance							
Male (*n* = 392)	525.837	350	.937	.932	.036 (.029–.042)	1.081	
Female (*n* = 628)	538.579	350	.954	.950	.029 (.024–.034)	1.079	
Configural invariance	1063.15	700	.946	.941	.032 (.028–.036)	1.527	
Strong invariance	1053.79	728	.950	.948	.030 (.026–.034)	1.559	−.01

Note: χ^2 = chi square; df = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker–Lewis Index; RMSEA = root mean square error of approximation; IC = interval confidence; WRMR = weighted root mean square residual; ΔCFI = change in Comparative Fix Index.
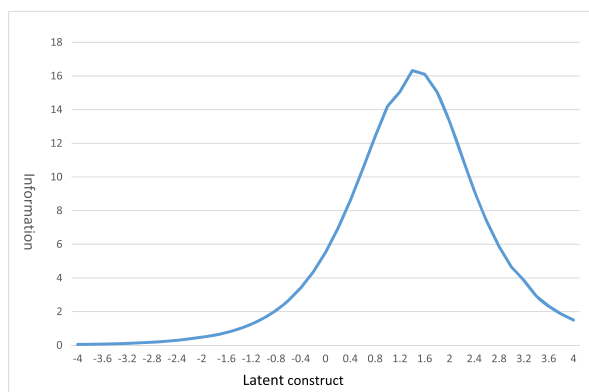
FIGURE 1 Test information function of the Youth Psychosis At-Risk Questionnaire – Brief.

development of the first symptoms of psychosis and other mental disorders and symptoms. Furthermore, reliable assessment of subclinical psychotic experiences and symptoms in adolescents is essential for psychosis screening purposes in order to allow for the early identification of those potentially at-risk for psychotic-spectrum disorders (Addington et al., 2015; Kline & Schiffman, 2014) and in this way, allow for the implementation of prevention strategies such as further evaluation or early intervention to improve the outcome. To date, however, we have little information about the psychometric properties of the YPARQ-B, as a psychosis risk screening tool in a community-derived sample of adolescents. Moreover, the phenotypic expression of subclinical psychotic experiences and their associations with psychopathology have scarcely been analysed.

The main goal of the present study was to examine the prevalence, factorial structure, measurement invariance across gender, and reliability of the YPARQ-B scores, as well as its associations with depression symptoms, psychopathology, and stress manifestations in a large sample of non-clinical adolescents. If the main goal is to examine the liability for psychosis or to identify individuals potentially at-high risk, then analysing the associations between subclinical psychotic experiences and psychopathology below clinical threshold, may help us to enhance the prediction of clinical outcome. It may be useful in the identification of clinical precursors and perhaps also to facilitate the study of etiopathogenic mechanisms for psychotic-spectrum disorders. These are relevant issues in the ROAMER work (Wittchen et al., 2014).

The results revealed that YPARQ-B is an easy, and brief tool to use for screening purposes. The psychometric properties of this measure were adequate in this sample. The internal consistency level, estimated with ordinal alpha, was good. Good use was also made of IRT as a modern psychometric approach, the tool measured with high accuracy individuals who scored at the high latent-trait. Furthermore, the results suggested that subclinical psychotic experiences, using YPARQ-B, is better considered as a unidimensional factor structure equivalent across gender. It is worth mentioning, that the YPARQ-B was developed taking into account only the most discriminating items of the positive dimensions of the psychosis phenotype assessed by CAARMS interview (see Ord et al., 2004). This is, to our knowledge, the first empirical test of the factorial structure of the YPARQ-B scores in a non-clinical sample of adolescents, thus new research studies should be conducted in order to validate these findings. For instance, Fonseca-Pedrero et al. (2016) using the brief version of the PQ-Brief in a sample of non-clinical adolescents, found a unidimensional factor structure.

Previous studies showed that YPARQ-B is a good measure for screening CHR states and demonstrated adequate levels of predictive validity in adolescents and young adults at CHR for psychosis as well as convergence with other psychosis screening measures (e.g. SIPS, PQ), as well as good reliability coefficients (Kline & Schiffman, 2014; Kline et al., 2012a, 2012b, 2015; Myles-Worsley et al., 2007; Ord et al., 2004). This empirical evidence suggests that this tool could be useful for more comprehensive identifying and recruiting strategies of individuals at CHR (Kline et al., 2015) as well as to expand its use to the non-clinical population, such as educational and primary care settings, where a required specialized training (i.e. costs, time) is not possible. To date, not surprisingly, the psychometric data on self-report measures is markedly variable across studies and are in their nascent stage (Fonseca-Pedrero et al., 2016; Kline & Schiffman, 2014). They have also been criticized (Schultze-Lutter et al., 2013). Thus, new empirical studies need to replicate the findings established here and define to what extent the new samples of the general population would be an important factor in future research.

The results showed that subclinical psychotic experiences are common in non-clinical samples of adolescents. Although a total of 85.1% of the total sample reported at least one psychotic experience, only 6.8% scored higher using the standardized cutoff score (≥ 13 points). Prior studies have found similar results using self-reports and interviews (Calkins et al., 2014; Kelleher et al., 2012a, 2012c). In particular, Kelleher *et al.* (2012a), conducted a meta-analysis of PLEs during childhood and adolescence and found mean prevalence rates of around 17% in children from 9 to 12 years of age and 7.5% in adolescents from 13 to 18. For instance, Calkins *et al.* (2014) in a US representative sample of 7054 adolescents, revealed that between 3.8% and 17.6% of the sample endorsed "Definitely agree" on some psychotic symptom items. In another study, Fonseca-Pedrero et al. (2016) using the PQ-Brief found that 16% of the adolescents scored above the standardized cutoff. As it can be seen, previous empirical

TABLE 4 Pearson's correlations between Youth Psychosis At-Risk Questionnaire – Brief (YPARQ-B) and the Reynolds Adolescent Depression Scale (RADS), the Strengths and Difficulties Questionnaire (SDQ), and the Student Stress Inventory – Stress Manifestations (SSI-SM) subscales

	Dysphoric mood	Anhedonia	Negative self-evaluation	Somatic complains		
YPARQ-B/ RADS	0.33**	0.24**	0.39**	0.30**		
	Emotional	Conduct	Peer problems	Hiperactive	Prosocial	Total
YPARQ-B/ SDQ	0.38**	0.35**	0.36**	0.24**	–0,16**	0.49**
	Emotional	Physiological	Behavioural			
YPARQ-B/ SSI-SM	0.36**	0.34**	0.28**			

**p < 0.01.

TABLE 5 Logistic regression model

Step	Variable	B	SE	Wald	p	OR	OR 95% CI Inferior	OR 95% CI Superior
1	SDQ total score	0.206	0.022	89.23	0.001	1.229	1.177	1.283
	Constant	−5.274	0.376	196.42	0.001	0.005		
2	Negative self-evaluation (RADS)	0.098	0.027	13.19	0.001	1.103	1.046	1.163
	SDQ total score	0.166	0.025	45.92	0.001	1.181	1.125	1.239
	Constant	−6.125	0.459	178.36	0.001	0.002		
3	Negative self-evaluation (RADS)	0.115	0.028	17.14	0.001	1.122	1.063	1.185
	Prosocial (SDQ)	−0.171	0.060	8.22	0.004	0.843	0.749	0.947
	SDQ total score	0.147	0.025	34.11	0.001	1.159	1.103	1.217
	Constant	−4.745	0.648	53.67	0.001	0.009		
4	Physiological (SSI-SM)	0.090	0.033	7.19	0.007	1.094	1.024	1.168
	Negative self-evaluation (RADS)	0.105	0.029	13.17	0.001	1.110	1.049	1.175
	Prosocial (SDQ)	−0.202	0.062	10.78	0.001	0.817	0.724	0.922
	SDQ total score	0.125	0.027	21.79	0.001	1.133	1.075	1.195
	Constant	−5.104	0.670	58.05	0.001	0.006		

Note: The YPARQ-B scores were dichotomized using the cutoff of >13.

research have demonstrated that the frontiers of the psychosis phenotype extends beyond the traditional borders proposed by the international classification systems (e.g. ICD-10; DSM-5), which offers support to the existence of a psychometric phenotypic continuity between the clinical and subclinical psychosis phenotypes. Moreover, this set of experiences fall within a spectrum of "normal" developmental experiences and in most of the cases disappear over time and never progress to a clinical disorder (Linscott & van Os, 2013).

In addition, YPARQ-B scores were moderate associated with a range of psychopathology symptoms at non-clinical level such as depression, stress responses, emotional and behavioural problems and poor prosocial skills. In particular, emotional and behavioural symptoms, negative self-evaluation, low prosocial skills, and physiological stress manifestations were the variables that predicted YPARQ-B. It is important to bear in mind that all measures and the correlations between measures showed non-normal distribution that may have several implications in the results found. Previous studies revealed similar results to those found in this study. For instance, adolescents who reported PLEs indicated a wide range of mental health problems, such as depressive symptoms (Armando et al., 2010; Yung et al., 2009), distress (Armando et al., 2010), emotional and behavioural problems (Wigman et al., 2011), sleep disturbances (Lee et al., 2012), childhood trauma and bullying (Kelleher et al., 2008, 2013b), suicidal behaviour (ideation, attempts) (Kelleher et al., 2014), cannabis used (Hides et al., 2009), and increase risk for multiple co-occurring Axis I mental disorders (Kelleher et al., 2012b). For instance, Lee et al. (2012), in a sample of 8530 students, found that the YPARQ-Q was positively correlated with the Beck Depression Inventory ($r = 0.48$, $p < 0.001$).

Furthermore, co-morbidity with depression and emotional symptoms is one of the most replicate findings regarding CHR symptoms, APS, and PLEs in both clinical high risk samples and general population and predicted poorer clinical outcome (Krabbendam et al., 2005; Yung, Philips, Pan Yuen, & McGorry, 2004). The presence of self-reported subclinical experiences during adolescence is associated with multiple

concurrent psychopathology symptoms, and it appears to be a fundamental part of the CHR picture. These results have clear implications in the understanding of links between risk factors for psychosis before clinical debut and may help us to enhance the possibility of an early identification of adolescents at risk for psychosis.

According to the psychosis–proneness–persistence–impairment model formulated by van Os et al. (2009), the presence of schizotypal traits or PLEs during adolescence is not a necessary or sufficient condition for the later development of a psychotic disorder. Nonetheless, 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 psychological factors (e.g. depression, stress, 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. 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, it is possible that sequential screening uses the combination of several risk factors and multiple screening measures, from different levels of analyses (from genomics to self-reports, as follow the guidelines of the Research Domain Criteria) to detect the early emergence of first onset psychosis. In a seminal comparison of two recruitment strategies, Rietdijk et al. (2012) found that sequential screening detected three times more individuals at risk of developing psychosis than the traditional case-recruitment strategy.

The results obtained in the present study must be interpreted in light of the following limitations. First, adolescence is a developmental period in which personality is still consolidating. The present results must thus be further evaluated in order to understand their natural

developmental course. Second, in the present study, we only investigated the YPARQ-B as a psychosis risk screening measure in non-clinical samples of adolescents. A new cross-validation research could be recommended for further study. This tool is a self-reporting tool with the problems inherent to any research based on these type of measures. Third, the extent to which screening measures for psychotic symptoms and experiences of psychosis may be associated with false positives in community samples is unclear. Fourth, these measures have been associated with stigmatization, negative labelling, and stereotypes (Schimmelmann & Schultze-Lutter, 2012).

5 | CONCLUSION

The results indicated that (a) YPARQ-B scores showed adequate psychometric properties in this sample, and (b) self-reported subclinical psychotic experiences and psychopathology are related during adolescence. Thus, the YPARQ-B seems to be an interesting psychosis screening risk tool to measure this set of experiences in non-clinical adolescents. More research is needed in order to establish reliable norms and screening thresholds for different settings, samples, and cultures. The role of the PLEs in the prediction of psychotic disorders and non-psychotic disorders should continue to be explored in greater depth through independent longitudinal studies in both non-clinical adolescent and participants potentially at-high risk for psychosis.

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DECLARATION OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

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