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A cross-national investigation of psychosis-like experiences in five European countries included in the E-CLECTIC study: Psychometric challenges in studying their measurement

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ABSTRACT

Background: Psychotic-like experiences (PLEs) are subtle, subclinical perturbations of perceptions and thoughts and are common in the general population. Their characterisation and unidimensionality are still debated.
Methods: This study was conducted by the Electronic–halluCinations-Like Experiences Cross-culTural International Consortium (E-CLECTIC) and aimed at measuring the Community Assessment of Psychic Experiences (CAPE) factorial structure across five European countries (Belgium; Czech Republic, Germany; Greece, and Spain) and testing the adequacy of the unidimensional polytomous Rasch model of the tool via Partial Credit Model (PCM) of the CAPE to detect people with a high risk for developing psychosis.
Results: The sample included 1461 participants from the general population. The factorial analysis confirmed the best fit for the bifactor implementation of the three-factor model, including the positive, negative and depressive dimensions and a general factor. Moreover, the unidimensional polytomous Rasch analysis confirmed that CAPE responses reflected one underlying psychosis proneness.
Conclusions: The study proved that the CAPE measures a single latent dimension of psychosis-proneness. The CAPE might help locate and estimate psychosis risk and can be used as a screening tool in primary care settings/education settings.

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1. Introduction

Psychotic-like experiences (PLEs) are subtle, subclinical perturbations of perceptions and thoughts common in the general population and are associated with an increased risk for mental disorders (Johns and van Os, 2001; Rössler et al., 2007). PLEs occurs across a life span, about 2 per 100 people, regardless of age (Staines et al., 2023), Their incidence might be related to heterogeneous factors as cannabis consumption, education, or trauma (Staines et al., 2023)

As they are currently conceptualized, PLEs include paranoid ideation, magical thinking, hallucination, or thought broadcasting (positive symptoms), which can co-vary with experiences of demotivation, apathy, abulia, and affective flattening (negative symptoms) and depression (Havers et al., 2022). According to the continuum hypothesis of psychosis, PLEs constitute an intermediate state between no psychotic experiences and clinical psychotic symptoms (van Os et al., 2000)

Hence, PLEs experienced by individuals without a diagnosis of psychotic disorder are assumed not to significantly differ in their basic phenomenology from those experienced by people with a psychotic disorder. Instead, they may be merely less frequent and less severe (Binbay et al., 2012; Havers et al., 2022; Van Os et al., 2009). Although PLEs are often transient (Staines et al., 2023, 2022), they are frequently distressing (Murphy et al., 2012; Preti et al., 2014), and associated with a decline in social (Hasmi et al., 2021) and work functioning, both concurrently over time (Asher et al., 2013; Zammit et al., 2013), along with an increased risk of suicide (Connell et al., 2016; Martin et al., 2015). Thus, these PLEs may represent a prevalent yet insufficiently acknowledged public health challenge (Zammit et al., 2013). These experiences are frequently present during the childhood, but typically manifest during early adulthood (Sullivan et al., 2020). Sullivan et al. (2020) observed that 21% of people at risk for mental disorder at 18 years old transitioned to a first-episode of psychotic disorder at 24 years. Moreover, persistent PLEs are associated to higher healthcare costs (Murphy et al., 2012; Staines et al., 2022). This highlights the importance of having useful tools to early detect people at risk before transitioning to psychotic disorders. The Community Assessment of Psychic Experiences (CAPE-42) is a widely used tool for the measurement of PLEs and has been applied for the investigation of psychosis proneness in both clinical and research settings and across countries (Hanssen et al., 2003; Mark and Toulopoulou, 2015; Pignon et al., 2021; Sahu et al., 2023). The CAPE-42 consists of positive, negative, and depressive dimensions structure, which has been replicated by both exploratory and confirmatory factor analysis (Mark and Toulopoulou, 2015)., Recently a more articulated hierarchical nine-dimensional structure has been described, consisting of a higher order of positive (bizarre experiences, hallucinations, paranoia, magical thinking, grandiosity), negative (social withdrawal, affective flattening, avolition experiences), and depressive symptoms (Schlier et al., 2015). However, replication of the CAPE-42's factor structure has been inconsistent across studies (Brenner et al., 2007; Mark and Toulopoulou, 2015), suggesting that the three dimensions may be influenced by a common psychotic latent trait. To date, the investigation of this psychotic latent trait using the CAPE-42 has not been conducted. The bifactor model (Reise et al., 2010; Rodriguez et al., 2016), which evaluates whether each item loads on a general factor, has been only examined in shorter versions of the CAPE-42, such as the CAPE-15, which focuses on positive symptoms (Núñez (Núñez et al., 2021, 2015; Therman and Ziermans, 2016).

Moreover, the validity and reliability of the CAPE-42 across samples have been examined based on the classical test theory (CTT) (Addington et al., 2015; Mark and Toulopoulou, 2015). The CTT focuses on overall, sample-based statistics, which provide little insight into how individual items actually work. Furthermore, the CTT makes specific assumptions, such as normally distributed populations and it does not take into account that response options may not be equally weighted and spaced among them, as it was demonstrated previously in the literature using ordinal categories (Fernández et al., 2023). An alternative psychometric approach is the Rash model based on item response theory (IRT) (Fox and Jones, 1998; van den Berg et al., 2013) The Rasch model (Rasch, 1960) evaluates the probability of an individual endorsing a specific item. This evaluation considers two critical factors: the item's difficulty (how challenging it is to endorse) and the respondent's ability (their propensity to endorse items).The Rasch model converts data into an interval scale, making it suitable for statistical analyses. This enhances the tool's reliability and validity by allowing generalizability across samples and items, and it assesses whether a scale measures a single underlying construct (unidimensionality).This is important for ensuring that an assessment tool is measuring what it intends to measure, and it can help to identify unexpected responses, which is helpful in research and clinical settings.

1.1. Aims

This study was promoted by the Electronic–halluCinations-Like Experiences Cross-culTural International Consortium (E-CLECTIC) (Siddi et al., 2019b), a multi-centric investigation aimed at estimating the cross-national proportion of people with PLEs and establishing the measurement validity of the tools designed to rate them (Fernández et al., 2023; Quijada et al., 2022; Sahu et al., 2023; Siddi et al., 2018). We present here the details concerning the part of the E-CLECTIC study aimed at measuring: a) the reliability of the CAPE-42 across five European countries using Cronbach's alpha and Omega; b) the factorial validity of the three-factor and the nine-factor structure of the CAPE-42 in its standard implementation, hierarchical with one or three super factors, and bifactor implementation. Then, provided that a unidimensional model is adequate to describe the responses recorded in the four ordered categories of the CAPE-42 items, we aimed to describe the results of of the unidimensional polytomous Rasch model of the tool via Partial Credit Model (PCM) applied to the CAPE-42.

2. Methods

The study complies with the Declaration of Helsinki and its revisions (World Medical Association, 2013). The appropriate institutional ethics committee (Fundació Sant Joan de Déu, the coordinating center, and all the involved centers) approved the study protocol (PIC-31-14). All participants signed an online informed consent form attesting their willingness to have their data analyzed anonymously and reported in summary statistics. Data was collected from 11 countries across Europe (Belgium, Czech Republic, Germany, Greece, Poland, Portugal, Spain, and United Kingdom), South America (Argentina, Brazil, and Chile), and Asia (India). However, for this study only data from Europe were included, and participants from Belgium, Czech Republic, Germany, Greece, and Spain were taken into account since these countries had enough data (minimum 200 people per country) to conduct the CFA analyses.

2.1. Psychotic –like experiences

The CAPE consists of 42 items rated from 1 to 4 for both the frequency ("never" to "nearly always") and the distress ("not distressed" to "very distressed"). These items are supposed to converge into three subscales of positive (20 items), negative (14 items), and depressive (8 items) symptoms (Stefanis et al., 2002). It was primarily based on the PDI-40 and PDI-21 developed by Peters, Joseph, and Garety (Peters et al., 2004, 1999). The CAPE-42 was available for almost all languages at: https://cape42.homestead.com/index.html, except for Czech language in which it was unavailable. The Czech translation was conducted by a fluent translator in English and Czech, adapting the terms for the Czech population. The scale was then back-translated into English by another fluent translator in both languages. This back-translation was reviewed by translators and the research team, and tested on a few lay people to ensure comprehension before being used for research

purposes.

2.2. Socio-Demographic Variables Schedule

Information regarding sex, age, education, marital status, employment status, family income, a past diagnosis of a mental or neurological disorder, as well as details regarding any medication or psychotherapy treatments that they may have undergone about that diagnosis, were collected. Variables were dichotomized to examine the associations between socio-demographic factors and indicators of PLEs. Variables used in the analyses were: female (vs male); having a bachelor or higher educational qualifications (vs lower educational level); being married (vs single, divorced or widowed); being employed or student or homemaker (vs unemployed, retired or on sick leave); having a low family income (vs average or higher than average family income).

2.3. Procedure

The study was conducted online and invited through advertisements in social media (Facebook, Institutional webs, etc.), and University adverts. Participation was voluntary, and no fee or other compensation was provided. Participants were required to exclude any experiences where they might have been under the effect of drugs or alcohol. Only people aged 18 to 70 years old were included in the survey.

2.4. Data analysis

All data were analyzed with IBM SPSS Statistics for Windows, Version 28.0 (IBM Corporation, 2021), and with dedicated packages running in R (R Core Team, 2020). Summary data were described as counts and percentages for nominal data and as mean with standard deviation and range (or 95% confidence interval when appropriate) for continuous data. All analyses were two-tailed. The threshold for statistical significance was set at $p<0.05$.

2.4.1. Confirmatory factorial analysis

Confirmatory factorial analysis (CFA) was applied to the data, by implementing the major factor models that were described in the literature. We tested the standard correlated three-factor model of positive, negative, and depressive dimensions; its hierarchical implementation with a second-order super factor of propensity to psychosis; and its bifactor implementation, with a general factor of propensity to psychosis and three additional nuance factors of positive, negative, and depressive dimensions. The nine-factor model was also tested, in its simple correlated implementation; its hierarchical implementation with three second-order super factors of positive, negative, and depressive dimensions; and its bifactor implementation, again with a general factor of propensity to psychosis and nine additional nuance factors of bizarre experiences (7 items); hallucinations (4 items); paranoia (5 items); grandiosity (2 items); magical thinking (2 items); social withdrawal (4 items); affective flattening (3 items); amotivation (7 items); depression (8 items) according to Schlier et al. (2015). All these models were tested against a simple unidimensional model, in which all items of the CAPE-42 loaded on a single latent trait of propensity to psychosis. The fit of the models has been estimated with the following parameters to establish minimal/good acceptability: the chi-square; the Comparative Fit Index (CFI) values of 0.90 (minimal)/ 0.95 (good) or higher; the Root Mean Square Error of Approximation (RMSEA) values of 0.08 (minimal)/0.04 (good) or lower; and the Standardized Root Mean Square Residual (SRMR) values of 0.08 or lower. CFA models were tested with the “lavaan” package running in R (Rosseel, 2012).

Reliability was measured as internal consistency. Both Cronbach’s alpha and the McDonald’s omega, as estimated from the confirmatory factor analysis (CFA) models, were used to measure the reliability of the CAPE-42 and its dimensions in the samples. The Cronbach’s alpha is considered “acceptable” when the values are >0.7 (Nunnally and Bernstein, 1994) for the total of the questionnaire, and >0.6 for the subscales of a multidimensional tool (Nunnally and Bernstein, 1994). For the McDonald’s omega, simulation studies indicate values >0.90 as good and >0.80 as acceptable (Nájera Catalán, 2019). Since the bifactor implementation of a factor structure tends to overfit, to check for reasonable unidimensionality of the general factor extracted from the bifactor models, the explained common variance (ECV) is higher than 0.70, the percentage of uncontaminated correlations (PUC) higher than 0.80, and Omega Hierarchical higher than 0.70 were calculated (see (Rodriguez et al., 2016). The bifactor indices were calculated with the "Bifactor Indices Calculator" package running in R (Dueber, 2021).

2.4.2. Unidimensional polytomous Rasch model by applying a Partial Credit Model (PCM)

Since both the unidimensional and the bifactor implementation of the original three-factor model of the CAPE-42 provided evidence of acceptable fit in the whole sample, we tested a unidimensional polytomous Rasch model by applying a PCM to the CAPE-42. The PCM is a generalization of the Rasch model for polytomous (multi-category) items, often used in situations where responses to items are not simply right or wrong but can fall into ordered categories (Masters, 1982). The PCM can be represented algebraically to show how it models the probability of a person achieving a certain score on an item given their latent trait (ability). For an item i with m_i+1 ordered response categories (where m_i is the m_i is the maximum possible score on the item), the probability that a person n with ability_θ_n scores k on item i (where k ranges from 0 to m_i) can be expressed as:

$$P(X_{ni}=k|\theta_n)=\frac{\exp\sum_{j=0}^{k}\left((\theta_n-\beta_{ij})\right)}{\sum_{h=0}^{m_i}\exp(\sum_{j=0}^{h}\left(\theta_n-\beta_{ij}\right)}$$

The package "eRm: Extended Rasch Model" running in R was used to implement this PCM model (Mair and Hatzinger, 2007). In applying the PCM, the original Likert scale (1 to 4) has been rescheduled from 0 to 3 to coincide with the lowest score within the latent dimension. Person separation reliability (PSR) was used to measure the proportion of person variance that was not due to error, an indirect indicator of the fit of the model, with values >0.90 indicating a good fit of the model. Essentially, the PSR represents the capacity of the measure to separate participants into distinct levels of the measured latent dimension. After fitting the model, we reported its person-item map, which displays the location of a person abilities and item difficulties along the same latent dimension. The person parameter is located on the scale from left (minimal propensity to psychosis) to right (high propensity to psychosis).Based on chi-square, infit and outfit statistics were used to test how each item fit the model. Finally, the proportion and the absolute number of persons who do not fit the Rasch model (Z-values > 1.96) were reported.

3. Results

The sample included 1461 participants from the general population. Baseline description has been reported in the Table 1. The sample included seven participants (out of 1029 who reported the information) who declared to have received in the past a diagnosis of psychosis within the spectrum of schizophrenia, and described a pharmacological therapy congruent with that diagnosis (one or more antipsychotics). Descriptive Statistic of CAPE-42 has been shown in table 2.

3.1. Confirmatory factor analysis of the factor structure of the CAPE-42

All models were rejected based on the chi-square; however, the additional parameters revealed a good fit for all models (Table 3).

Among the three-factor models, the bifactor implementation had the best fit. The general factor extracted by the bifactor implementation of the three-factor model, despite its PUC (0.641), was unidimensional on

Table 1
Baseline Information

Variables	N (%) or Mean (Standard Deviation)
N of Participants	1461
Number of participants per Country	Belgium (N = 302), Czech Republic (N = 295), Germany (N = 296), Greece (N = 228), Spain (N = 228)
Age mean Standard Deviation (SD)	31.7 years (9.22)
Gender Women	1037 (71%)
Marital status (Single, Divorced and Widowed)	1015 (69.4%)
Education (low education level)	442 (30.3%)
Unemployed or on sick leave	292 (20%)
Family Income (less than average)	111 (7.6%)

Table 2
Descriptive information of CAPE-42.

	Mean	Standard Deviation	Skewness	Kurtosis
CAPE POSITIVE	1,42	0,29	1,33	2,83
CAPE NEGATIVE	1,92	0,46	0,56	0,04
CAPE DEPRESSIVE	1,97	0,52	0,83	0,32
CAPE TOTAL	1,69	0,33	0,71	0,42

Table 3
Confirmatory factor analysis of the CAPE-42 Goodness-of-fit indices of the tested models.

Model	χ^2	df	p	CFI	RMSEA (90%CI)	SRMR
Unidimensional	4252.7	819	0.0001	0.934	0.054 (0.052 – 0.055)	0.077
Correlated three-factor	2584.1	816	0.0001	0.966	0.039 (0.037 – 0.040)	0.059
Hierarchical three-factor	2584.1	816	0.0001	0.966	0.039 (0.037 – 0.040)	0.059
Bifactor implementation of three-factor	1626.6	777	0.0001	0.984	0.027 (0.026 – 0.029)	0.045
Correlated nine-factor	1311.7	783	0.0001	0.990	0.022 (0.019 – 0.024)	0.039
Hierarchical nine-factor with three superfactor	1861.0	808	0.0001	0.980	0.030 (0.028 – 0.032)	0.047
Bifactor implementation of nine-factor *	2572.6	777	0.0001	0.966	0.040 (0.038 – 0.042)	0.057
Minimal threshold for fit			p>0.05	0.90	≥0.08	≥0.09

* The model was not identified.
Note: CFI= Comparative Fit Index, RMSEA = Root Mean Square Error of Approximation, SRMR= Standardized Root Mean Square Residual,

the basis of ECV (0.649), Omega general (0.931), and Omega Hierarchical (0.771). Omega Hierarchical for the three factors were: Positive=0.514; Negative=0.121; Depressive=0.176. This indicates that the variance of the negative and depressive symptoms dimensions was mostly subsumed under the general factor, while the positive symptoms dimension retained a fraction of the variance that was independent of those of the general factor.

The correlated nine-factor model and the hierarchical nine-factor model with three super factor fitted better than all three-factor models. Their fit was also better than the bifactor implementation of the nine-factor model. Overall, the general factor extracted by the bifactor implementation of the nine-factor model was reasonably unidimensional based on ECV (0.524), PUC (0.887), Omega general (0.938) and Omega Hierarchical (0.852). Omega Hierarchical for the nine basal factors were: Bizarre experiences=0.441; Hallucinations=0.531; Paranoia=0.245; Grandiosity=0.601; Magical thinking=0.618; Social withdrawal=0.267; Affective flattening=0.504; Amotivation=0.147; Depression=0.229. The bifactor implementation of the nine-factor model was not identified. The ratio of cases to parameters is probably the cause for non-identification, however, the results of its fitting to the data should be considered with caution.

3.2. Estimated reliability of the CAPE-42

The Cronbach's alpha of the factors estimated by CFA was good for all models (<0.70), with some decay for some factors of the nine-factor model (Table 4).

However, values were always above the minimum threshold that is considered acceptable for subscales of a multidimensional questionnaire (>0.60).

McDonald's omega was good (>0.90) to acceptable (>0.80) for all three-factor models (except the bifactor implementation, as expected), while it was poor (<0.80) for most factors of the nine-factor models (Table 4).

3.3. Unidimensional polytomous Rasch model of the CAPE-42 via PCM

Overall, the PCM fit was good (PSR of 0.916), confirming that CAPE-42 responses reflected one underlying latent trait hypothesized as psychosis proneness. At item level, the fit of the PCM model was also reasonably good, with just ten items showing misfit based on the infit and outfit statistics (χ^2 $p < 0.05$; see Table A1 in supplementary material). Eight of them are "delusional ideas", and most of them (Being special, Telepathy, Influence by devices, magic thinking, Thought echo, Capgras, Messages from TV). On the contrary, the remaining 32 items that fit well the unidimensional polytomous Rasch model include almost all the depressive symptoms and negative symptoms (self-report "negative symptoms" may also reflect certain degree of depressive experiences) and the non-bizarre delusional ideas.

Overall, only 7.3% of participants did not fit the model (i.e., 107 out of 1457 persons have Chi-square based Z-values > 1.96). To further investigate potential outliers, we conducted a residual analysis using a conservative threshold of 1.96, which identified 4% of the data as outliers. Importantly, the exclusion of these outliers did not affect the model's outcome, which maintained a PSR of 0.916. This result was expected, considering the robustness of testing a unidimensional model across 42 items with a sample size exceeding 1000 participants. Consequently, the minimal influence of outliers on the model's performance was confirmed.

Fig. 1 shows the person-item map for the CAPE-42. The person-item map indicates that the items of the CAPE-42 cover the full range of the participants' distribution. However, respondents were mainly located on the right of the map, indicating that most participants showed some degree of psychosis-proneness as measured by the CAPE-42.

The easiest items were those measuring depressive symptoms (item 1 "Do you ever feel sad?", item 40 "Do you ever feel that you are lacking in motivation to do things?") or negative symptoms (item 18 "Do you ever feel tense?"), while the more difficult items were those measuring positive symptoms (item 42 "Do you ever see objects, people or animals that other people cannot see?", item 24 "Do you ever feel as if the thoughts in your head are being taken away from you?", item 41 "Do you ever feel as if a double has taken the place of a family member, friend or acquaintance?").

Greater information of the test is at the low ("sometimes") to moderate ("often") occurrence of the psychosis-proneness (Fig. 2).

The CAPE-42 can be conceived as a tool measuring one single latent dimension of psychosis-proneness at low to the moderate occurrence of

Table 4
Confirmatory factor analysis of the 42 items CAPE. Reliability of the factors of the tested models.

Model	Factor	Cronbach's alpha	McDonald's omega
Unidimensional	Global	0.922	0.922
Correlated three-factor	Positive	0.837	0.828
	Negative	0.869	0.867
	Depressive	0.859	0.863
Hierarchical three-factor	Positive	0.837	0.828
	Negative	0.869	0.867
	Depressive	0.859	0.863
	Global	—	0.869
Bifactor implementation of three-factor	Positive	0.837	0.754
	Negative	0.869	0.506
	Depressive	0.859	0.557
	General	0.922	0.924
Correlated nine-factor	Bizarre experiences	0.704	0.702
		0.637	0.637
	Hallucinations	0.748	0.756
	Paranoia	0.631	0.636
	Grandiosity	0.707	0.715
	Magical thinking	0.683	0.672
		0.805	0.805
	Social withdrawal	0.813	0.817
		0.859	0.863
	Affective flattening		
	Amotivation		
	Depression		
Hierarchical nine-factor with three superfactor	Bizarre experiences	0.704	0.702
		0.637	0.637
	Hallucinations	0.748	0.755
	Paranoia	0.631	0.635
	Grandiosity	0.707	0.716
	Magical thinking	0.683	0.671
		0.805	0.804
	Social withdrawal	0.813	0.817
		0.859	0.863
	Affective flattening	—	0.777
		—	0.853
	Amotivation	—	1.000
	Depression		
	Positive		
	Negative		
	Depressive		
Bifactor implementation of nine-factor	Bizarre experiences	0.704	0.591
		0.637	0.599
	Hallucinations	0.748	0.487
	Paranoia	0.631	0.639
	Grandiosity	0.707	0.686
	Magical thinking	0.683	0.474
		0.805	0.724
	Social withdrawal	0.813	0.460
		0.859	0.623
	Affective flattening	0.922	0.937
	Amotivation		
	Depression		
	General		

it, as expected by design.

4. Discussion

The results of this study confirm the good psychometric properties of the CAPE-42. The reliability of the tool in the sample is good, and the original three-factor structure showed better reliability than the more recently tested nine-factor structure. Overall, the original three-factor structure can be implemented as the correlated model in the hierarchical implementation with a superimposed super-factor and a bifactor implementation, with a good fit to the data. Although the newly described nine-factor model (Schlier et al., 2015) showed a better fit to the data than the original three-factor model, the nine-factor model contains low numbers of items per factor for two of its factors (magical thinking, grandiosity), which is less than the recommended three items per latent variable (Costello and Osborne, 2005; Marsh et al., 1998). Nevertheless, despite these limitations, the nine-factor model had a good fit to the data and can be investigated in future studies.

The bifactor implementation helps define the variance attributable to the general factor as a vulnerability factor from the variance attributable to sub-domains that may have an independent role in the risk of psychosis. A previous study (Núñez et al., 2015) confirmed the bifactor implementation of the short version of the CAPE-15 that includes only the positive dimension, demonstrating the existence of a general super factor of the positive PLEs. Several studies have used a variety of statistical methods to investigate the reliability and validity of the CAPE-42 as a screening tool for psychotic disorders (Jaya et al., 2021; Mark and Toulopoulou, 2015; Pignon et al., 2021) and general population (Núñez et al., 2021; Pignon et al., 2017; Sahu et al., 2023; Vermeiden et al., 2019; Yung et al., 2009). Concerning the reliability (Bailes and Nandakumar, 2020), in addition to Cronbach's alpha, the Rasch model provides measures for each item and each person. The person measure indicates each individual's perceived tendency to agree with the underlying psychotic trait measured by the items.

The findings from the Rasch analysis provide valuable support for utilizing the CAPE-42 as a comprehensive measure of psychotic disorder. Notably, this is the first instance in which a unidimensional polytomous Rasch analysis has been applied to this assessment tool. The analysis highlighted varying difficulty levels of different items, with depressive and negative symptoms being more commonly endorsed by participants. In contrast, fewer participants supported items related to positive symptoms like hallucinations and delusions. Specifically, 32 items that fit well within the unidimensional polytomous Rasch model included almost all depressive and negative symptoms, as well as non-bizarre delusional ideas. This suggests that the unidimensional underlying latent trait might reflect general psychological distress rather than psychosis proneness. However, longitudinal studies have shown that depressive symptoms often precede the onset of psychosis, persist consistently, and may precede symptom exacerbations. These symptoms are more likely to be active causal factors in the development of psychosis rather than merely emotional consequences of its presence (Hartley et al., 2013).

Other study (Wiedemann et al., 2024) who examined PLEs in primary care settings among patients seeking treatment for anxiety and depression. Their study found that self-referential and persecutory ideas were quite common in these patients, while more severe psychotic symptoms, such as bizarre experiences and perceptual abnormalities, were less frequently reported and indicated higher severity and poorer recovery outcomes. Thus, in a population of people reasonably devoid of great vulnerability to psychosis, as the one involved in this study, it is fair less endorsed items pertain to severe psychotic symptoms.

Overall, these results align with existing literature, which consistently demonstrates a strong interplay between positive, negative, and depressive symptoms in both the general population (Hartley et al., 2013; Jeppesen et al., 2015; Unterrassner et al., 2017; Yates et al., 2019; Yung et al., 2009) and individuals with psychosis (Sax et al., 1996; Siddi et al., 2019a; Zhuo et al., 2021).

Moreover, various neuroimaging studies have identified common neural underlying substrates and mechanisms of depressive and positive symptoms (Siddi et al., 2019a; Wu et al., 2017; Zhuo et al., 2021). Early and intensive intervention in treating depression in individuals at clinically high risk for psychosis could potentially curb the advancement of PLEs or alleviate their persistence (Raballo et al., 2023). Following this, recent reviews have emphasized a heightened risk of individuals with PLEs engaging in suicidal behaviors (Staines et al., 2022; Yates et al., 2019). Notably, a study focusing on adolescents has shed light on the role of depression as a mediator in the relationship between PLEs and suicide (Nunez et al., 2020). These findings underline the importance of a comprehensive understanding of the complex interplay between different aspects of psychotic experiences and their possible implications

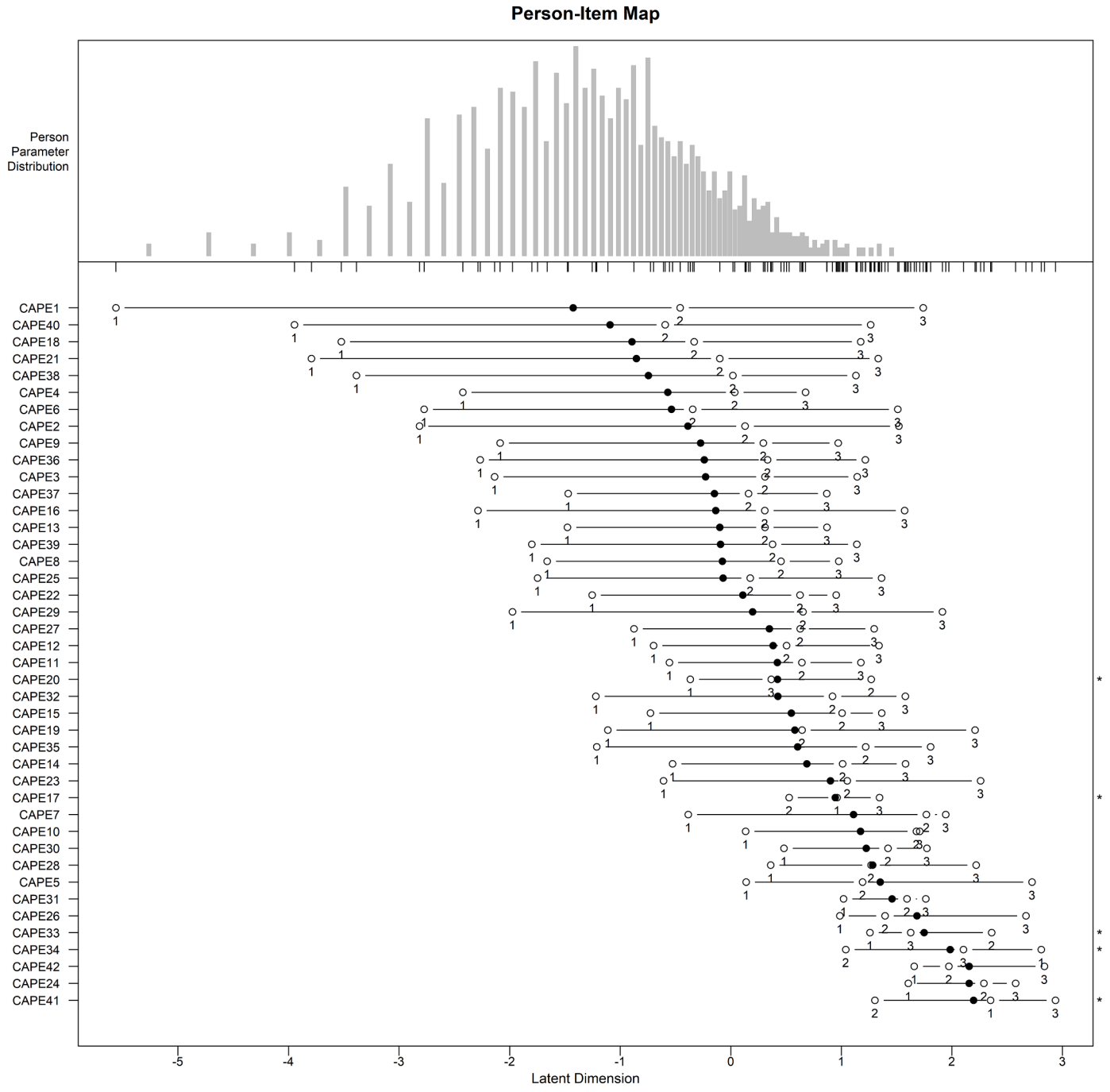

Fig. 1. Partial credit model – person-item map: locations of item difficulties are displayed with solid circles and thresholds of adjacent category locations with open circles. The participants are represented at the top of the map and the items are at the bottom. On the right of the map are the hardest items for participants to endorse. Items have been reordered to make evident the coverage of the whole interval of the latent dimension.

for mental health and well-being.

Practical screening tools such as the CAPE-42 are important for this purpose. This instrument used as a single dimension of psychosis proneness could be helpful, especially in populations at increased risk of psychopathology.

4.1. Future research

Future research is needed to extend the study to Non-European Countries with different cultures and various economic statuses, longitudinal studies to confirm the diagnostic properties to identify people at risk of psychosis, and also should be tested in clinical population.

4.2. Strengths and Limitations of the Study

Key strengths of this study include the fact that are the online version is accessible to a broad population for its low cost and to detect people at risk of psychosis; the use of a contemporary and well-regarded psychometric approach to evaluate the structural validity of the tool.

Nonetheless, the following limitations must be acknowledged: first, this study was entirely based on self-report tools, which might have introduced some bias into responses (e.g., social desirability). Moreover, those who are not online or who had to work might not have had the opportunity or time to complete it. Nevertheless, self-report measures generally favor the enrollment of large samples. The fact that data

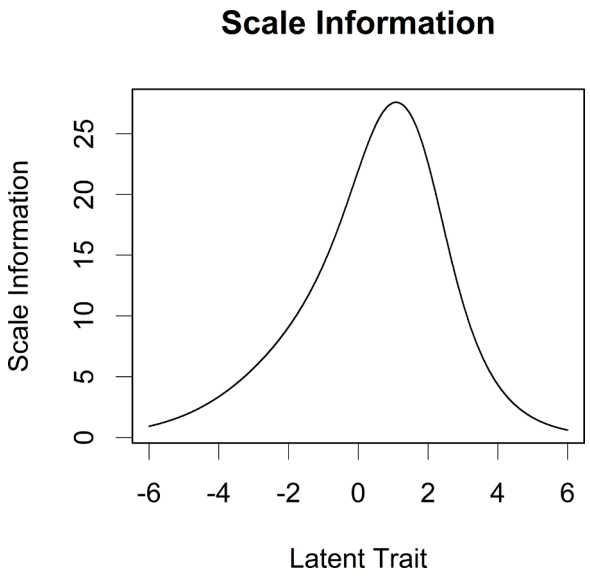

Fig. 2. Test information curve of the CAPE. It depicts the amount of information (y-axis) yielded by the test at any ability level (x-axis).

anonymity was guaranteed might have resulted in participants being more forthcoming in completing the questionnaires. Second, only people with Internet access could answer the surveys, which may explain the low participation rates among older people and people with lower incomes. Third, we enrolled convenience samples, people with mental distress are more likely to voluntarily take part in the study, and most of them were females, which cannot represent the populations of interest. Nevertheless, our analysis can be informative at the lower boundaries of what can be observed in representative samples.

Four, the issue of Insufficient Effort Responding (IER) or Careless Responding (CR) is an issue in large-scale surveys. The PCM cannot effectively identify and filter out such responses. Future analyses might apply alternative methods, such as Finite Mixture Modeling (FMM), to address this problem. However, based on infit and outfit statistics, only 7.3% of participants did not fit the model.

5. Conclusion

This study extended the previous research confirming the three CAPE-42 factors dimensions.

The novelty aspect of this study is its application of a unidimensional polytomous Rasch model to the CAPE-42 data. Instead of considering the CAPE-42 responses as indicators of multiple distinct factors, the study proposed that all the responses could be explained by a single underlying latent trait referred to as "psychosis proneness".

The analysis indicates that it is possible to position individuals along the latent trait using the total score of the CAPE-42. In future studies, ROC analysis will be used to determine threshold scores to better identify clinically significant levels of symptoms. This approach supports the use of a general score for the 42-item questionnaire, making it a practical and effective tool for assessing psychotic experiences.

For instance, this instrument may not only help clinicians to identify individuals at higher risk of developing psychotic disorders but also implement preventive age-sensitive strategies or early both pharmacological and non-pharmacological interventions to deter the onset of psychosis effectively. This study can help convey that these experiences exist on a continuum and are not solely associated with severe mental illness (Rössler et al., 2007; Unterrassner, 2018).

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Author Statement

We hereby confirm that the manuscript titled “A Cross-National Investigation of Psychosis-Like Experiences in five European Countries included in the E-CLECTIC Study: Psychometric challenges in studying their measurement” has not been published previously, nor is it under consideration for publication elsewhere. All authors have approved the manuscript and agree with its submission to Psychiatry Research. We have adhered to ethical standards, and any necessary permissions for data, images, or other content have been obtained. Any conflicts of interest have been disclosed.

Data availability statement

Research data are not shared since informed consent only allowed analysis and publication of collected data as a summary or group description.

CRediT authorship contribution statement

Sara Siddi: . **Susana Ochoa:** Writing – review & editing, Investigation, Funding acquisition, Conceptualization. **Frank Larøi:** Writing – review & editing, Supervision, Investigation, Conceptualization. **Tania M. Lincoln:** Writing – review & editing, Visualization, Validation, Methodology, Investigation, Conceptualization. **Björn Schlier:** Writing – review & editing, Validation, Methodology, Investigation. **Yuliya Zaytseva:** Writing – review & editing, Validation, Methodology, Investigation. **Julien Laloyaux:** Writing – review & editing, Methodology, Investigation. **Eva Kozáková:** Writing – review & editing, Methodology, Investigation. **Matteo Cella:** Writing – review & editing, Validation, Conceptualization. **Evangelos Ntouros:** Writing – review & editing, Validation, Methodology, Investigation. **Vasileios Bozikas:** Writing – review & editing, Validation, Methodology, Investigation. **Nuno Barbosa Rocha:** Writing – review & editing, Validation, Methodology, Investigation. **Łukasz Gawęda:** Writing – review & editing, Methodology, Investigation. **Susana Aguiar Rocha:** Writing – review & editing, Investigation. **Antonio Preti:** Writing – original draft, Validation, Supervision, Methodology, Formal analysis, Data curation.

Declaration of competing interest

Nothing to declare.

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Supplementary materials

Supplementary material associated with this article can be found, in

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