Predominance of Symptoms Over Time in Early-Onset Psychosis: A Principal Component Factor Analysis of the Positive and Negative Syndrome Scale

Marta Rapado-Castro, PhD; Cesar Soutullo, MD, PhD; David Fraguas, MD; Celso Arango, MD, PhD; Beatriz Payá, MD; Josefina Castro-Fornieles, MD, PhD; Ana González-Pinto, MD, PhD; Mara Parellada, MD, PhD; Montserrat Graell, MD; Inmaculada Baeza, MD, PhD; and Igor Bombin, PhD

Background: Early-onset psychosis is a symptomatically nonspecific and heterogeneous entity composed of several diagnoses. This study examined the dimensional structure of symptoms and the temporal stability of this structure during a 6-month follow-up.

Method: A principal component factor analysis of the Positive and Negative Syndrome Scale was conducted at baseline, 4 weeks, and 6 months in a sample of 99 first-episode psychotic patients (mean age = 15.5 years).

Results: The factor analysis produced a 5-dimension solution (Positive, Negative, Depression, Cognitive, Hostility) that explained 62.4% of the variance at baseline, 63.4% at 4 weeks, and 65.1% at 6 months. Negative dimension was the most consistent and stable over time and was predominant at baseline (23.9%) and at 4 weeks (25.7%). Depression was predominant at 6 months (31.1%).

Conclusions: There is a stable 5-dimension structure of symptoms in early-onset psychosis with varying predominance of symptoms over time. Negative symptoms are a core feature of psychosis and are thus important diagnostic criteria.

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Corresponding author: *Marta Rapado-Castro, PhD, Adolescent Unit, Department of Psychiatry, Hospital General Universitario Gregorio Marañón, C/ Ibiza 43, 28009 Madrid, Spain (mrapado@hggm.es).*

Early-onset psychosis is a rare, severe, and heterogeneous condition in which the first manifestations of psychotic symptoms appear before the age of 18. Early-onset psychosis has been associated with a higher severity of developmental disturbances,[1] higher rates of a family history of schizophrenia spectrum disorders,[2] a greater frequency of cytogenetic perturbations,[3,4] and poorer functional and clinical outcome,[5] and it has been considered a marker of poor prognosis.[6,7] The symptoms used to define early-onset psychosis are shared by several diagnoses. The frequent changes in symptom presentation lead to diagnostic instability in the early phases of the disorder.[8,9] The reliability of diagnosis has been improved primarily by focusing on externally observable symptoms,[10] although it is not yet clear which symptoms are specific to psychosis.

Due to the lack of reliable biologic markers, the concept of psychosis is constantly evolving, as descriptive psychopathology continues to be the basis for its diagnosis and treatment.[11] The use of dimensional models to study symptoms enables the identification of clinical subtypes and the search for associations between clinical manifestations and functional correlates. In addition, these models can be useful in the identification of symptomatic group predominance during the course of the disease. Many scales have been developed for research purposes in this field. The Positive and Negative Syndrome Scale (PANSS),[12] which has been validated in Spanish,[13] is a comprehensive instrument for measuring psychopathology in schizophrenia that is widely accepted by clinical and research communities for the evaluation of psychotic symptoms.[14,15] Data, primarily from adult patients, have been used to define psychotic symptom factors for the PANSS. Between 1990 and 2006, we identified 21 dimensional studies using the PANSS in an adult population with schizophrenia and other psychoses. Principal component factor analysis was applied in all but 3.[16–18] Peralta and Cuesta[19] found an 8-component structure reformulated into 3 components: positive, disorganized, and negative. Kay and Sevy[20] found a 7-factor structure reformulated into 4 components: negative, positive, depressive, and excitement. Basset et al[16] found 3 components, and Villalta-Gil et al[21] found a 4-factor structure: negative, excitement, affective, and positive. The other 17 studies reported a 5-dimensional model as follows: positive, negative, cognitive (disorganized), excitation (hostility), and depression.[14,18,22–36] This 5-factor solution had already been formulated as the one that was best adjusted for the PANSS scale in the meta-analysis by Smith et al.[37]

However, very few studies have examined the dimensional structure of symptoms in early-onset psychosis. Of the 5 existing studies, 2 used an adult sample of patients with early-onset schizophrenia to retrospectively infer the results in the child and adolescent population.[32,38] Only 3 studies[39–41] used principal component factor analysis to study the dimensional structure of symptoms in a sample of children and adolescents with early-onset psychosis. None examined this structure using the PANSS or were longitudinal studies.

The CAFEPS is a multicenter follow-up study designed to assess clinical characteristics, prognostic factors, diagnostic specificities, and pathophysiological changes in the brain during the first 2 years after a first psychotic episode through an integrative and translational approach. As a part of the CAFEPS study, we examined the dimensional structure of symptoms in early-onset psychosis and its stability over a 6-month period to determine the degree of similarity with adult-onset psychoses in terms of the number and composition of dimensions and consistency over time.

METHOD

The child and adolescent first-episode psychosis study (CAFEPS) is a Spanish multicenter 2-year longitudinal study designed to evaluate clinical, neuroimaging, biochemical, immunologic, genetic, and neuropsychological variables in early onset first-episode psychosis.[42] The complete methodology of the CAFEPS study has been comprehensively described elsewhere.[42]

Patients

A sample of 110 first-episode psychotic patients (74 males and 36 females; mean age = 15.5 years) was included according to the CAFEPS inclusion and exclusion criteria.[42] The inclusion criteria for patients were age between 7 and 17 years at the time of the initial evaluation and history of positive psychotic symptoms of less than 6 months. The exclusion criteria were presence of another Axis I disorder, mental retardation if functioning was impaired before the onset of the disorder, any neurologic or pervasive developmental disorder, history of traumatic brain injury with loss of consciousness, and pregnancy. Occasional substance use was not an exclusion criterion if psychotic symptoms remained 14 days after a negative urine drug test. Patients who fulfilled criteria for abuse or dependence were excluded from the study, ie, those subjects whose psychosis was precipitated by substance use were included only if psychotic symptoms persisted for more than 2 weeks after a negative urine drug analysis. Patients who fulfilled criteria for abuse or dependence (but not use, if symptoms persisted for more than 14 days after a negative urine drug analysis) were excluded from the study.

These patients were consecutively recruited from 6 Spanish hospitals between March 2003 and November 2005. The study was approved by the institutional review board at each clinical center. After providing complete information about the study, we obtained written informed consent from all patients and their parents or legal guardians.

Only 99 patients of the 110 included in the original CAFEPS study were included in the factorial analysis of the symptoms due to attrition for 11 patients during the 6-month follow-up. Only those patients who went through all the assessments at the 3 follow-up points were included in order to gain consistency in the results. The application of this criterion allowed us to examine the development of symptoms in the same sample over time.

Clinical Assessment

Diagnoses were established at baseline according to *DSM-IV* criteria using the Spanish version of the semistructured diagnostic interview Kiddie-Schedule for Affective Disorders and Schizophrenia, Present and Lifetime version, (K-SADS-PL),[43,44] designed to assess current and past psychopathology. Parents and patients were interviewed separately by psychiatrists trained in the use of the instrument and in the assessment of children and adolescents. Consensus diagnoses were made in those cases in which presence or absence of psychiatric diagnoses was in doubt. A provisional diagnosis was made at the first contact with the patients, and this diagnosis was reviewed after the first 6 months of follow-up to determine its accuracy. For descriptive purposes, we used the diagnosis established at the end of follow-up (6 months).

Clinical assessments were conducted by trained psychiatrists at the corresponding clinical center using the validated Spanish version[13] of the PANSS.[12] at baseline, 4 weeks, and 6 months. The scale includes 30 items that are divided into 3 subscales: positive symptoms (7 items), negative symptoms (7 items), and general psychopathology (16 items). The rater was the same for each patient at each of the 3 assessments during follow-up. Prior to recruitment, interrater reliability for the PANSS was determined in an independent sample of 10 psychotic patients using the interclass correlation coefficient, which was always superior to 0.80. Information on symptom presentation was gained from patients and parents based on the week preceding the corresponding assessment. Although this scale was initially designed for use in adults, we used it in this study to longitudinally study the psychopathological symptoms of psychosis in our initial sample of children and adolescents.[42]

Statistical Analyses

The mean, standard deviation (SD), and sample size were used to describe the continuous variables. Frequencies and percentages were used to describe discrete variables.

Clinical dimensions were obtained through a principal component factor analysis of all 30 PANSS items at baseline, 4 weeks, and 6 months. We used these 3 evaluations to establish the temporal stability of the dimensions obtained. To assess the validity of the factor analysis, we first examined

Table 1. Sociodemographic and Clinical Characteristics of the Sample of Patients With Early-Onset Psychosis

Characteristic	Patients, N = 99	Excluded Patients, N = 11
Sex, n (%)		
Male	66 (66.7)	8 (72.7)
Female	33 (33.3)	3 (27.3)
Age, mean (SD), range, y	15.46 (1.8), 9–17	16.09 (1.2), 14–17
Race/Ethnicity, n (%)		
Caucasian	87 (87.9)	7 (63.6)
Black	2 (2.0)	0
Hispanic	7 (7.1)	0
Other	3 (3.0)	4 (36.4)
Gypsy	2 (2.0)	1 (9.1)
Caribbean	1 (1.0)	0
North African	0	2 (18.2)
African	0	1 (9.1)
Socioeconomic status,[a] n (%)		
I	19 (19.2)	5 (45.5)
II	32 (32.3)	3 (27.2)
III	24 (24.2)	0
IV	12 (12.1)	0
V	12 (12.1)	2 (18.2)
Diagnosis at baseline, n (%)		
Schizophrenia	23 (23.2)	5 (45.5)
Mood disorder	24 (24.2)	2 (18.2)
Bipolar	17 (17.2)	1 (9.1)
Depression	7 (7.1)	1 (9.1)
Schizophreniform disorder	14 (14.1)	0
Schizoaffective disorder	5 (5.1)	0
Brief psychosis	5 (5.1)	0
Acute psychosis	0	2 (18.1)
Psychosis NOS	25 (25.3)	4 (36.4)
Other psychotic disorder	3 (3.0)	0
Antipsychotic medication at baseline, n (%)		7 (7.1)
Risperidone	60 (52.2)	ND
Olanzapine	23 (23.2)	ND
Quetiapine	23 (23.2)	ND
Ziprasidone	3 (2.6)	ND
Aripiprazole	2 (1.7)	ND
Haloperidol	2 (1.7)	ND
No antipsychotic medication	2 (1.7)	ND
Other medication at baseline, n (%)		
Benzodiazepine	44 (44.5)	ND
Antidepressant	17 (17.2)	ND
Mood stabilizer	13 (13.1)	ND
Anticholinergic	11 (11.1)	ND
Methylphenidate	1 (1.0)	ND
No other medication	13 (13.1)	ND
Education, mean (SD), y	8.42 (1.8)	5.45 (4.8)
Elapsed time since first psychotic symptom, mean (SD), mo	2.1 (1.7)	2.29 (1.7)
Duration of antipsychotic treatment, mean (SD), wk		2 (1.9)

[a]Parental socioeconomic status assessed with the Hollingshead Scale (ranging from 1 to 5). A rating of 5 corresponds to the highest socioeconomic status and a rating of 1 is the lowest socioeconomic status.
Abbreviations: ND = not determined, NOS = not otherwise specified.

the intercorrelation between variables using Bartlett's test of sphericity, which always proved to be significant ($P < .001$). Sampling adequacy was measured using the Kaiser-Meyer-Olkin index, which was always between 0.6 and 0.8. For the principal component factor analysis, we applied a varimax orthogonal rotation selecting eigenvalues that were greater than or equal to 1 and examining the correspondent scree plot. First, in order to determine the appropriate number of factors for the PANSS, a preliminary principal component factor analysis of all 30 items was conducted. Second, assuming that the number of different factors was equal to the number of eigenvalues greater than 1, we conducted a definitive principal component factor analysis limiting the number of factors to those significantly reflected on the scree plot. Factorial loads greater than 0.4 or 0.3 were selected to render the results easier to interpret.[45] Data analyses were performed using SPSS for Windows version 13.0 (SPSS Inc, Chicago, Illinois). The 2-tailed level of significance was set at $P < .05$.

RESULTS

Patients

Of the sample of 99 patients included in the analyses, only 23 (23.2%) had a diagnosis of schizophrenia, while 24 (24.3%) had a mood disorder (bipolar disorder and depressive disorder). The remaining 49.5% of the sample had a diagnosis of psychotic disorder as follows: psychotic disorder not otherwise specified (25.3%), schizophreniform disorder (14.1%), schizoaffective disorder (5.1%), and brief psychotic disorder (5%). Only 3 (3%) patients had other psychotic disorders (ie, obsessive-compulsive disorder comorbid with psychotic symptoms, in which the predominance of obsessive symptoms overlapped a proper psychotic diagnosis so that, based on clinical judgment and the observable predominant psychopathology, this classification was used for clinical purposes).[42] The mean (SD) duration of the illness, defined as the time between the appearance of the first positive symptom and enrollment, was 2.1 (1.7) months (range, 1–6 months). Before recruitment, 27 (27.3%) patients were receiving antipsychotic treatment, and the mean (SD) duration of this treatment was 5 (9.6) weeks. At baseline, 97 (98.3%) patients started antipsychotic treatment: 79 (81.8%) with monotherapy and 18 (16.2%) with 2 antipsychotics simultaneously. Only 2 patients were not receiving medication (due to the opposition of their parents) at the time of clinical assessments. The mean (SD) daily dose of the antipsychotic treatment in chlorpromazine equivalents at baseline was 325.9 (540.4) mg.[47,48] Other medications, such as benzodiazepines (44.5%), antidepressants (17.2%), mood stabilizers (13.1%), anticholinergics (11.1%) and methylphenidate (1.0%), were present at baseline. In the remaining 13.1% of the sample, no other medication was used. The sociodemographic and clinical characteristics of the sample are shown in Table 1.

There were no differences between the patients included in and excluded from the general CAFEPS sample with regard to sociodemographic and clinical characteristics (Table 1).

Factor Analysis of the PANSS Items at Baseline

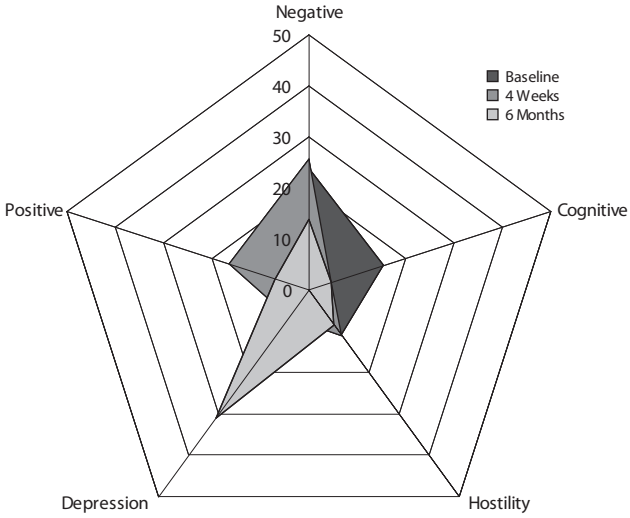
Preliminary factor analysis of the PANSS items at baseline produced a 7-factor solution that explained 70.2% of the

Table 2. Five-Factor Model of PANSS Items in Patients (N = 99) With Early-Onset Psychosis at Baseline[a]

	Factors				
PANSS Item	1	2	3	4	5
N6 Lack of spontaneity/ flow of conversation	**.870**				
N2 Emotional withdrawal	.867				
N3 Poor rapport	.826				
N1 Blunted affect	.815				
N4 Social withdrawal	.786				
G7 Motor retardation	.689				
G13 Disturbance of volition	.574				
G16 Social avoidance	.546				
N7 Stereotyped thinking	.502	.501			
P5 Grandiosity	–.481	.446			
G15 Preoccupation	.474			.319	
P2 Conceptual disorganization		**.784**			
G10 Disorientation		.705			
P4 Excitement		.696	.422		
G11 Poor attention		.678			
G5 Mannerisms and posturing	.398	.576			
N5 Abstract Thinking	.505	.538			
P3 Hallucinatory behavior		.412			.380
G1 Somatic concern		.358			
P7 Hostility			**.795**		
G14 Impulse control			.765		
G4 Tension			.742		
G8 Uncooperativeness	.341		.691		
G3 Guilt feelings				**.853**	
G6 Depression	.330			.755	
G12 Insight		.326		–.564	.349
G2 Anxiety			.425	.430	.426
G9 Unusual thought content				.307	
P6 Suspiciousness			.483		**.670**
P1 Delusions	–.351				.663

[a]Principal component factor analysis. Varimax rotation.
Abbreviation: PANSS = Positive and Negative Syndrome Scale.

Figure 1. Percentage of Variance in Each Factor of the Dimensional Model Over Time



total PANSS variability. After the scree plot was examined, a definitive factor analysis of the PANSS was conducted by reducing the number of factors to those 5 considered to be significant. The forced 5-factor solution accounted for 62.4% of the total variance. Table 2 shows the resulting 5-factor model in which dimensions were named as follows: negative, which accounted for 23.9% of variance, cognitive (15.4%), hostility (10.7%), depression (6.9%), and positive (5.4%).

Figure 1 shows the total percentage of the variance that is accounted for by each factor. The negative factor accounted for the highest percentage (23.9%) of the total variance at baseline.

In summary, the scree plot showed a 5-factor solution at the curve cutoff point. Eigenvalues for those components were > 1. The negative dimension was composed of 6 items from the negative subscale of the PANSS (N6, Lack of Spontaneity/Flow of Conversation; N2, Emotional Withdrawal; N3, Poor Rapport; N1, Blunted Affect; N4, Social Withdrawal; and N7, Stereotyped Thinking), 1 item from the positive subscale (P5, Grandiosity), and 4 items from the general psychopathology subscale (G7, Motor Retardation; G13, Disturbance of Volition; G16, Social Avoidance; and G15, Preoccupation). The cognitive dimension consisted of 4 items from the general psychopathology subscale (G10, Disorientation; G11, Poor Attention; G5, Mannerisms and Posturing; and G1, Somatic Concern), 1 item from the negative subscale (N5, Abstract Thinking), and 3 items from the positive subscale (P2, Conceptual Disorganization; P4, Excitement; and P3, Hallucinatory Behavior). The hostility dimension was composed of 3 items from the general psychopathology subscale (G14, Impulse Control; G4, Tension; and G8, Uncooperativeness) and 1 item from the positive subscale (P7, Hostility). The depression dimension was composed of 5 items from the general psychopathology subscale (G3, Guilt Feelings; G6, Depression; G12, Insight; G2, Anxiety; and G9, Unusual thought Content). Finally, the positive dimension included 2 items from the positive subscale (P6, Suspiciousness; and P1, Delusions).

Factor Analysis of the PANSS Items at 4 Weeks

Preliminary factor analysis of the PANSS items at 4 weeks resulted in 7 factors, accounting for 71.1% of the total variance in the PANSS scores. To determine the appropriate number of factors, we examined the scree plot. The scree plot showed a 5-factor solution at the cutoff point of the curve. A definitive factor analysis of the PANSS items was conducted by reducing to 5 the number of factors that accounted for 63.4% of the total variance. Table 3 shows the resulting 5-factor model, in which dimensions were named as follows: negative, which accounted for 25.7% of the total variance, positive (16.5%), hostility (11.1%), depression (6.6%), and cognitive (4.6%).

Figure 1 shows the total percentage of the variance that is accounted for by each factor. The negative factor explained

Table 3. Five-Factor Model of PANSS Items in Patients (N = 99) With Early-Onset Psychosis at 4 Weeks[a]

	Factors				
PANSS Items	1	2	3	4	5
N2 Emotional withdrawal	**.860**				
N4 Social withdrawal	.832				
N6 Lack of spontaneity/ flow of conversation	.828				
N1 Blunted affect	.827				
N3 Poor rapport	.726				
G7 Motor retardation	.689				
G16 Social avoidance	.600				
G13 Disturbance of volition	.583				
P3 Hallucinatory behavior		**.792**			
P1 Delusions		.741			
P6 Suspiciousness		.583	.569		
G9 Unusual thought content		.533			
G11 Poor attention		.497			
P5 Grandiosity		.488			.458
G8 Uncooperativeness			**.798**		
P7 Hostility			.786		
G14 Impulse control			.704		
G12 Insight		.445	.584	–.319	
G3 Guilt feelings				**.816**	
G6 Depression				.808	
G2 Anxiety				.707	
G15 Preoccupation	.396			.655	
G1 Somatic concern				.600	.384
G4 Tension			.495	.584	
G10 Disorientation					**.711**
G5 Mannerisms and posturing					.583
P2 Conceptual disorganization		.510			.553
N5 Abstract thinking					.520
P4 Excitement			.474		.517
N7 Stereotyped thinking					.413

[a]Principal component factor analysis. Varimax rotation.
Abbreviation: PANSS = Positive and Negative Syndrome Scale.

Table 4. Five-Factor Model of PANSS Items in Patients (N = 99) With Early-Onset Psychosis at 6 Months[a]

	Factors				
PANSS Items	1	2	3	4	5
G3 Guilt feelings	**.883**				
G1 Somatic concern	.806				
G6 Depression	.788				
G2 Anxiety	.781				
G4 Tension	.724				
G14 Impulse control	.584		.434		
G15 Preoccupation	.532				
G9 Unusual thought content	.493				
N2 Emotional withdrawal		**.837**			
N3 Poor rapport		.802			
N1 Blunted affect		.799			
G7 Motor retardation		.778			
N4 Social withdrawal		.730			
N6 Lack of spontaneity/ flow of conversation		.593			.592
G13 Disturbance of volition		.534		.464	
N7 Stereotyped thinking		.494			.364
P6 Suspiciousness			**.835**		
P7 Hostility			.736		
G12 Insight			.706		.406
G8 Uncooperativeness	.454		.636		
P1 Delusions			.605	.531	
G16 Social avoidance	.405	.442	.563		
P4 Excitement				**.789**	
P2 Conceptual disorganization				.711	
G5 Mannerisms and posturing				.678	
G10 Disorientation				.619	.455
P5 Grandiosity				.551	
P3 Hallucinatory behavior	.321			.436	
N5 Abstract thinking					**.671**
G11 Poor attention					.627

[a]Principal component factor analysis. Varimax rotation.
Abbreviation: PANSS = Positive and Negative Syndrome Scale.

the highest percentage (25.7%) of the total variance at 4 weeks.

As shown in Table 3, the negative dimension is composed of 5 items from the negative subscale of the PANSS (N2, Emotional Withdrawal; N4, Social withdrawal; N6, Lack of Spontaneity/Flow of Conversation; N1, Blunted Affect; and N3, Poor Rapport) and 3 items from the general psychopathology subscale (G7, Motor Retardation; G16, Social Avoidance; and G13, Disturbance of Volition). The positive dimension is composed of 4 items from the positive subscale (P3, Hallucinatory Behavior; P1, Delusions; P6, Suspiciousness; and P5, Grandiosity) and 2 items from the general psychopathology subscale (G9, Unusual Thought Content; and G11, Poor Attention). The hostility dimension includes 3 items from the general psychopathology subscale (G8, Uncooperativeness; G14, Impulse Control; and G12, Insight) and 1 item from the positive subscale (P7, Hostility). The depression dimension is composed of 6 items from the general psychopathology subscale (G3, Guilt Feelings; G6, Depression; G2, Anxiety; G15, Preoccupation; G1, Somatic Concern; and G4, Tension). Finally, the cognitive dimension includes 2 items from the general psychopathology subscale (G10, Disorientation; and G5, Mannerisms and Posturing), 2 from the positive subscale (P2, Conceptual Disorganization; and P4, Excitement), and 2 from the negative subscale (N5, Abstract Thinking; and N7, Stereotyped Thinking).

Factor Analysis of the PANSS Items at 6 Months

Preliminary factor analysis of the PANSS items at 6 months resulted in 7 factors, accounting for 72% of the total variance. After the scree plot was examined, a definitive factor analysis of the PANSS was conducted by reducing the number of factors to those 5 considered to be significant. This reduction resulted in a new 5-factor model, accounting for 65.1% of the total PANSS variance. Table 4 shows the resulting 5-factor model in which dimensions were named as follows: depression (31.1%), negative (13.9%), hostility (8.5%), positive (7%), and cognitive (4.5%).

Figure 1 shows the total percentage of the variance that is accounted for by each factor. The depression factor accounted for the highest percentage (31.1%) of the total variance at 6 months.

Table 5. Factor Stability of PANSS Items in Patients (N = 99) With Early-Onset Psychosis Over Time (Version A)[a]

	Factors				
Symptoms[b,c,d]	Positive	Negative	Cognitive	Hostility	Depression
P1 Delusions	**0–1**			**6**	
P3 Hallucinations	**1–6**		**0**		
P5 Grandiosity	**1–6**	**0**			
P6 Suspiciousness	**0–1**			**6**	
N1 Blunted affect		**0–1–6**			
N2 Emotional withdrawal		**0–1–6**			
N3 Poor rapport		**0–1–6**			
N4 Social withdrawal		**0–1–6**			
N6 Lack of spontaneity		**0–1–6**			
G7 Motor retardation		**0–1–6**			
G13 Volition		**0–1–6**			
G16 Social avoidance		**0–1**		**6**	
N7 Stereotyped thinking		**0–6**	**1**		
N5 Abstract thinking			**0–1–6**		
G10 Disorientation	**6**		**0–1**		
P2 Disorganization	**6**		**0–1**		
P4 Excitement	**6**		**0–1**		
G5 Mannerisms	**6**		**0–1**		
G11 Poor attention	**1**		**0–6**		
P7 Hostility				**0–1–6**	
G8 Uncooperativeness				**0–1–6**	
G14 Impulse control				**0–1**	**6**
G12 Insight				**1–6**	**0**
G2 Anxiety					**0–1–6**
G6 Depression					**0–1–6**
G3 Guilt feelings					**0–1–6**
G15 Preoccupation		**0**			**1–6**
G1 Somatic concern			**0**		**1–6**
G4 Tension				**0**	**1–6**
G9 Thought content	**1**				**0–6**

[a]Assessment points: 0 = baseline, 1 = 4 months, 6 = 6 months.
[b]**Superstable items:** correlate in the same factor throughout follow-up.
[c]***Stable items*** correlate only in 2 factors at 2 different moments during follow-up, but can be forced to be in the same factor at all 3 assessment points.
[d]*Unstable items* correlate in 2 different factors at different times during follow-up.

In summary, the scree plot showed a 5-factor solution at the cutoff point of the curve. Eigenvalues for those components were > 1. The depression dimension was composed of 8 items from the general psychopathology subscale of the PANSS (G3, Guilt Feelings; G1, Somatic Concern; G6, Depression; G2, Anxiety; G4, Tension; G14, Impulse Control; G15, Preoccupation; and G9, Unusual Thought Content). The negative dimension was composed of 6 items from the negative subscale (N2, Emotional Withdrawal; N3, Poor Rapport; N1, Blunted Affect; N4, Social Withdrawal; N6, Lack of Spontaneity/Flow of Conversation; and N7, Stereotyped Thinking) and 2 items from the general psychopathology subscale (G7, Motor Retardation; and G13, Disturbance of Volition). The hostility dimension included 3 items from the positive subscale (P6, Suspiciousness; P7, Hostility; and P1, Delusions) and 3 items from the general psychopathology subscale (G12, Insight; G8, Uncooperativeness; and G16, Social Avoidance). The positive dimension was composed of 4 items from the positive subscale (P4, Excitement; P2, Conceptual Disorganization; P5, Grandiosity; and P3, Hallucinatory Behavior) and 2 items from the general psychopathology subscale (G5, Mannerisms and Posturing; and G10, Disorientation). Finally, the cognitive dimension included only 2 items; 1 from the negative subscale (N5, Abstract Thinking) and 1 from the general psychopathology subscale (G11, Poor Attention).

Temporal Stability of the 5-Factor Model

The factor analysis produced a 5-dimension solution that accounted for 62.4% of the total variance at baseline, 64.4% at 4 weeks, and 65.1% at 6 months. At the 3 assessment points, dimensions were labeled as positive, negative, depression, cognitive, and hostility. The composition of the dimensions remained stable over time, but the predominance of the different dimensions differed considerably: the negative dimension was predominant at baseline (23.9%) and at 4 weeks (25.7%), and the depression dimension was predominant at 6 months (31.1%), as shown in Figure 1.

Temporal stability in our study was defined as the presence of an item/symptom in the same factor throughout the 6 months of follow-up. Tables 5 and 6 show the factor stability of the grouped symptoms over time. These tables show how symptoms/PANSS items were allocated in the same or different dimensions at the 3 assessments (baseline, 4 weeks, and 6 months). According to this criterion, the composition of the negative factor proved to be the most stable over time (72.7% of the symptoms were always assigned to this factor). The depression and hostility dimensions remained 50% stable over time, as half of the symptoms that composed these factors were the same at the 3 assessments. The positive dimension was 22.2% stable according to the composition of the grouped symptoms over time. The cognitive dimension was the least stable of the 5 dimensions, despite the fact that almost 50% of the items included correlated in this factor in 2 out of the 3 assessments.

Taking into account the temporal stability of the grouped symptoms, we formed a final model that included the most stable items over time. To form our final model, we defined 3 types of items: (1) Superstable items were those PANSS items that correlated highly in the same factor at the 3 assessments; (2) Stable items were those that correlated in the same factor at the 3 assessments, but, while the correlation in this factor was high at 2 out of the 3 assessments, these items had a higher correlation with a different factor in 1 of the 3 assessments. That is, these items can be included in the same factor at the 3 assessments by forcing 1 out of the 3 factorial solutions; (3) Unstable items were those that correlated highly in the same factor in 2 out of the 3 assessments, but, as they had a weak correlation with this factor at the other assessment, they could not be forced to be included in it.

Table 6. Factor Stability of PANSS Items in Patients (N = 99) With Early-Onset Psychosis Over Time (Version B)

	Positive	Negative	Cognitive	Hostility	Depression
	P1**	N1***	N5***	P7***	G2***
	P3**	N2***	G10**	G8***	G6***
	P5*	N3***	P2*	G14**	G3***
	P6*	N4***	P4*	G12*	G15**
	P2*	N6***	G5*	P6*	G1*
	P4*	G7***	G11*	G4*	G4*
	G5*	G13***	N7*		G9*
	G11*	G16**	P3*		G12*
	G9*	P6*	G1*		
		N7*			
		P5*			
Stability percentage on each factor	2/9 22.2%	8/11 72.7%	2/9 22.2%	3/6 50%	4/8 50%
Superstability percentage on each factor	0/9 0%	7/11 63.6%	1/9 11.1%	2/6 33.3%	3/8 37.5%

*Unstable Items: Items that correlate in 2 different factors at different times during follow-up.
**Stable Items: Items that correlate in 2 factors at 2 different points during follow-up but that can be forced to be in the same factor at all 3 assessment points.
***Superstable Items: Items that correlate in the same factor throughout follow-up.

With regard to stability of symptoms, it is important to clarify that this concept refers to the presence of an item/symptom in the same factor throughout the 6-month follow-up. That is to say, stable items are those symptoms that remained stable, correlating with other items within the same factor over time. This stability refers not to the severity of the symptom but to the tendency of that item to correlate with other items from the same factor over time, ie, to covary with the same group of symptoms, regardless of their severity. The final model was composed exclusively of superstable and stable items. We compared the 5 definitive factors/summary factors with previous dimensional studies to test the consistency of our dimensions (Table 7). Once again, according to this criterion the negative dimension proved to be the most robust and consistent factor.

Finally, clinical stability was defined as the preponderance of the type of symptoms at each assessment. Figure 1 shows our 5-factor model with the 3 factorial solutions obtained and their predominance, in terms of the percentage of variance accounted for, during the 6 months of follow-up.

DISCUSSION

This longitudinal study examined the factor structure of the PANSS in a large sample of children and adolescents with a first psychotic episode. This study replicates findings reported in adult populations on the existence of a dimensional structure in functional psychosis. In contrast to *DSM-IV* criterion A for schizophrenia, which recognizes 3 categories of characteristic symptoms—positive, negative, and disorganization—to be necessary for a diagnosis of psychosis, the current study and others show more complex symptom dimensions in psychosis. Our findings are consistent with the factorial structure found in PANSS adult-onset studies with schizophrenia and other psychoses,[14,18,22–36] in which a 5-factor structure of symptoms (positive, negative, depression, cognitive, and hostility) has been shown to be the best adjusted to this instrument.[37] Moreover, in our sample of patients with early-onset psychosis, this 5-dimension structure is consistently replicated during follow-up, although the preponderance of the clinical symptoms varies. The correspondence between dimensions in adolescents and adults suggests a continuum between early- and adult-onset forms of the disorder(s). The stability of this structure supports the existence of a unique psychopathological entity that can have its onset in early developmental or adult stages[8]

Dimensional Structure of Symptoms Over Time: Composition and Temporal Stability

Tables 5 and 6 show how the dimensional structure remained stable over time but how predominant symptoms changed between the assessments at 4 weeks and 6 months. The negative dimension was predominant at baseline and at 4 weeks, and depression was predominant at 6 months. These results underline the disabling impact of negative symptoms during the first month of treatment. (They are predominant at baseline and 4 weeks.) This disabling impact of symptoms seems to increase over the course of the disease, as depression persists at 6 months. These results highlight the importance of carefully assessing these symptoms, as postpsychotic depression (suicidal behavior) can emerge at this point of the disease[49]

Table 7 reviews and compares the composition of our symptom dimensions in our final model with the principal component factor analysis of the PANSS in the main published studies. We show the symptoms/items and factors in our study and the corresponding dimension in which other studies have grouped the particular items. Our results show that the negative dimension is the most robust factor and that which is most consistent with published studies. Negative symptoms have already been proposed as the core feature of psychosis.[50–52] Some authors found that negative symptoms were less predominant in first-episode cases than in chronic patients.[36] In contrast, our results show the presence of negative symptoms, which are predominant not only at baseline but also at 4 weeks. In other words, the negative dimension is the most stable during follow-up, and it was present from the onset of the disease.

The negative dimension included the largest number of superstable items, thus showing the consistency and temporal stability of this factor (Tables 5 and 6). This finding is especially relevant, as the overwhelming majority of studies show that negative symptoms are a marker of poor prognosis and therefore a good predictor of the outcome of psychosis.[9,53] As predominant symptom dimensions are used to

Table 7. Comparison of Results of the Present Study and the Main Research Studies Using PANSS Factor Analysis (1 = negative, 2 = cognitive, 3 = hostility, 4 = depression, 5 = positive)

Present study	Other Studies										
PANSS items included in each factor/symptom dimension	Kay et al,[20] 1990	Lindenmayer et al,[24] 1994	White et al,[26] 1997	Marder et al,[27] 1997	Lançon et al,[30] 1999	Lançon et al,[31] 2000	Mass et al,[34] 2000	Lykouras et al,[33] 2000	Wolthaus et al,[35] 2000	Emsley et al,[36] 2003	Bunk et al,[32] 1999[a]
1: Negative Factor											
N1. Blunted affect	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	
N2. Emotional withdrawal	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	
N3. Poor rapport	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	4
N4. Social withdrawal	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
N6. Conversation	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
G7. Motor retardation	**1**	**1**	**1**	**1**	**1**	**1**		**1**	**1**	**1**	**1**
G13. Volition	**1**	2	2	2	**1**			**1**	2	**1**	
G16. Social avoidance	**1**	**1**		**1**	**1**	**1**	**1**	3	**1**	**1**	**1**
2: Cognitive Factor											
N5. Abstract thinking	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
G10. Disorientation	**2**	**2**		**2**	**2**	**2**		**2**	**2**	**2**	
3: Hostility Factor											
P7. Hostility	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
G8. Uncooperativeness	**3**	**3**	**3**	**3**	**3**		**3**	**3**	**3**	**3**	**3**
G14. Impulse control	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
4: Depression Factor											
G2. Anxiety	**4**	**4**	4	4	4	4	4	4	4	4	4
G6. Depression	**4**	**4**	4	4	4	4	4	4	4	4	4
G3. Guilt feelings	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	1
G15. Preoccupation	**4**	**4**	2	2	1			1	2	2	2
5: Positive Factor											
P1. Delusions	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
P3 Hallucinations	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	3

[a]The only study examining the structure of the symptoms using the PANSS in an adult sample of patients with early onset schizophrenia but retrospectively inferring the results to child and adolescent population.
Abbreviation: PANSS = Positive and Negative Syndrome Scale.

define the diagnosis, this study highlights the importance of negative symptoms as a common core feature of psychosis and thus as an important diagnostic criterion that should receive special attention in early-onset psychosis. This important fact has been already highlighted by studies in adult samples of patients with schizophrenia.[50,51,54] The most controversial symptom/item in the negative factor is G13, Disturbance of Volition. Four out of 8 studies consider it to be in the cognitive dimension. This allocation may be due to a double conceptualization of the disturbance: (1) from a behavioral point of view, in which this symptom is considered a negative symptom similar to apathy and behavioral inhibition and (2) from a cognitive point of view, in which lack of volition can be viewed as an impairment of executive function, a deficit in target-oriented, self-monitored behavior.[55] Therefore, it is considered a cognitive symptom.

The depression dimension was quite stable according to our results, although it was composed of as many *superstable/stable* symptoms as of *unstable* ones. However, those symptoms located in the depression dimension at least twice have been consistently associated with this dimension by other authors. Item G15, Preoccupation, does not follow this rule, and it has been previously associated with the cognitive, negative, or hostility dimensions. Symptoms of depression are frequent in first psychotic episodes, and there is enough evidence to consider those symptoms as a core feature of psychosis.[36,44] Our results support this hypothesis in psychotic illness in children and adolescents. However, it should be taken into account that our sample included 24.3% of patients with a mood disorder, which could bias these results.

Cognitive impairment has been described as one of the main components of psychopathology in psychosis, and as such, cognitive symptoms have been consistently found in dimensional analyses.[32] Studies show that, the younger the psychotic patient, the more often core symptoms are associated with nonspecific symptoms such as cognitive impairment and emotional, behavioral, or interpersonal difficulties.[32,56,57] In our analysis, only 2 symptoms were consistently associated with this dimension (see Table 7). One of them, N5, Abstract Thinking, has also been shown to be a superstable item, that is, to correlate in the cognitive factor during follow-up (Tables 5 and 6). This association suggests that abstract thinking would be better considered a cognitive

rather than negative symptom and thus be excluded from the PANSS negative subscale. Symptoms less consistently associated with this dimension usually include phenomena that are strongly related to the cognitive impairment inherent to psychosis. Our results highlight the importance of assessing cognition in early-onset psychosis.

The results for the positive and hostility dimensions are also consistent with those of previous studies. The symptoms included in our summary model have been consistently allocated in the same dimension in most previous studies (see Table 7).

The main strength of this study is its large sample of children and adolescents with psychosis. To our knowledge, this is the first study to examine the dimensional composition/structure of symptoms using the PANSS in a large sample of children and adolescents in the early stages of psychotic illness.

Other strengths are the short time (less than 6 months, with a mean (SD) of 2.1 (1.7) months) from symptom onset to evaluation and the brief exposure to antipsychotic medication, which diminishes the potential confounding role of medication exposure and disease course and makes for a purer sample. Another strength is that our sample included patients with a wide range of psychotic disorders. Only 23% of the sample was diagnosed with schizophrenia.

Also important is the longitudinal approach, which enabled us to take into account the variability of symptom manifestation over time. Examining the temporal stability of symptoms allowed us to establish groups of symptoms that tended to correlate in the same dimension. This focus was an accurate approach to the predominance of symptoms during the course of the disease. The fact that the composition of the symptom dimensions remained moderately stable, despite the varying predominance of symptoms due to the disease course, reinforces the idea that the dimensions found are stable features of psychosis.

The limitations of this study include its diagnostic heterogeneity of the sample. Having a larger sample would have enabled us to analyze the existence of characteristic symptom profiles for each of the diagnoses by showing the consistency of the current classification of psychosis. It would be interesting to have conducted exploratory factor analyses for the schizophrenia and bipolar subgroups. Unfortunately, that analysis was not attempted due to the small sample size of those study subgroups (only 23 patients for the schizophrenia and 17 for the bipolar subgroups, see Table 1). That approach would have minimized statistical power and would have made the factor analysis unreliable. Although this study suggests a similar profile of clinical symptoms between early- and adult-onset patients, we still need data on differential diagnosis, as well as treatment and prognosis.[58–60] Diagnostic stability is also an important issue to take into account. We have already reported on this issue in previous studies by our group.[9] Since the authors used diagnosis only for descriptive purposes, and focused on symptom clusters but not on diagnosis, this aspect is not supposed to have an effect on the principal component factor analysis structures. As has also been stated before, no principal component factor analysis was performed within diagnostic categories. It is also important to note that, even though variability between different diagnoses does exist in the early course of psychotic illness, the diagnostic category of "psychotic disorders" remains stable over time.[61]

The preponderance of negative symptoms at baseline and at 4 weeks may be associated with a negative symptom-like effect of antipsychotic treatment during the first weeks of inpatient treatment (98.3% of the sample were on antipsychotics at baseline and at 4 weeks).[62] However, we considered that this preponderance of negative symptoms at baseline and at 4 weeks was mostly associated with clinical course rather than with possible but ambiguous antipsychotic-induced negative symptom-like effects.[63] Previous studies in adult samples of patients with schizophrenia[50,51,54] have also highlighted the presence and importance of negative symptoms as a common stable core feature of psychosis.

The limitations of this study derived from factor analysis are as follows: (1) The dimensional structure of psychotic symptoms seems to be more influenced by the measurement instrument than by any other factor.[64] This phenomenon can make comparison across studies difficult, and it leads to ambiguity and conceptual confusion. Symptom scales, such as the PANSS, that include not only psychotic manifestation but also other aspects of disease can provide more complex dimensional results than other, more specific or more manageable, symptom scales. Our results are consistent with the consensus of the existence of a 5-factor solution of the PANSS items; (2) Compared to other studies, differences in nomenclature may be due to an inherent limitation of factor analysis, that is, investigator subjectivity when interpreting results based on his/her clinical judgment. Labels are often applied according to the interests or the background of the researcher.[45] In that sense, interpretation regarding the cognitive symptoms has been made in congruence with previous studies with the PANSS in adult-onset psychosis[14,18,22–36] and the clinical expertise of the researchers. What is meant by *cognitive* has to do with items included in this factor that can be considered cognitive, such as N5, Abstract Thinking; P2, Conceptual Disorganization; or G10, Disorientation, but no cognitive tests were administered.

The use of a dimensional model is a more accurate approach to psychopathology in psychosis. Therapeutic issues may be better addressed from a dimensional point of view at the level of symptom complexes. This approach to the study of psychosis allows us to reduce the complexity of a large number of symptoms to unitary dimensions, thus improving not only our knowledge of the pathology of psychosis, but also the methodology we use when searching for associations with neurobiological correlates. The 5-factor approach in this study provides a paradigm that can

be used in research to try to identify subgroups within child and adolescent psychoses. Future research should validate this model in relation to other aspects, such as neurobiology or cognitive impairment and their association with symptoms in order to obtain a more accurate definition of the disease.

Guidelines based on disease-specific symptomatic domains continue to be necessary for an adequate systematization of research and treatment applications.[10] The prognostic and conceptual value of the traditional subtype classification of schizophrenia and other psychoses is limited,[65] as it has not yet produced any convincing results or accurate conclusions that can be extended from symptom configurations to underlying biologic and neuropsychological core features of the disorder. Our results highlight the importance of longitudinal assessments in patients with early-onset psychosis in order to identify and treat their varying clinical characteristics. The dimensional approach to the study of symptoms may offer a conceptualization of the psychosis that broadens our clinical understanding of these disorders and that may contribute to future *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*) and *International Statistical Classification of Diseases and Related Health Problems* (*ICD*) classifications.

Author affiliations: Adolescent Unit, Department of Psychiatry, Hospital General Universitario Gregorio Marañón, Centro de Investigación Biomédica en Red de Salud Mental, CIBERSAM, Madrid (Drs Rapado-Castro, Fraguas, Parellada, and Arango); Child and Adolescent Psychiatric Unit, Department of Psychiatry and Medical Psychology, University of Navarre Clinic (Dr Soutullo); Servicio de Salud Mental, Complejo Hospitalario Universitario de Albacete (Dr Fraguas); Unidad de Psiquiatría Infantil, Hospital Universitario Marqués de Valdecilla, Centro de Investigación Biomédica en Red de Salud Mental, CIBERSAM, Santander (Dr Payá); Servicio de Psiquiatría y Psicología Infanto-Juvenil, Hospital Clinic de Barcelona, CIBERSAM, Barcelona (Dr Castro-Fornieles); Stanley Institute International Mood-Disorders Research Center, 03-RC-003, Hospital Santiago Apóstol de Vitoria CIBERSAM, Vitoria (Dr González-Pinto); Sección de Psiquiatría y Psicología, Hospital Infantil Universitario Niño Jesús, Madrid (Dr Graell); and Reintegra, Neurological Rehabilitation Center, Oviedo (Dr Bombin), Spain.
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Editor's Note: We encourage authors to submit papers for consideration as a part of our Focus on Childhood and Adolescent Mental Health section. Please contact Karen D. Wagner, MD, PhD, at kwagner@psychiatrist.com.