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Five-factor model of schizophrenic psychopathology: how valid is it?

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Abstract Aim of the study was to examine the consistency of the five-factor model of schizophrenic symptoms, assess its validity and evaluate its dimensional factor structure using confirmatory factor (CFA) analysis. A sample of 258 randomly assigned DSM-III R patients with schizophrenic disorders were studied by means of the structured clinical interview for the Greek validated Positive and Negative Syndrome Scale (PANSS) and were rated on its 30 items. Patients' scores were subjected to principal component analysis (PCA) with varimax rotation. Internal consistency for each of the components was determined by the use of Cronbach's alpha. External validity of the model derived was investigated by searching for possible relationships between the components and sociodemographic characteristics with the aid of canonical correlation analysis. Confirmatory factor analysis (CFA) was also performed. Using the scree plot criterion PCA revealed a five-factor model. These factors were interpreted as representing – in a decreasing order of relative importance – the following dimensions of schizophrenic psychopathology: negative, excitement, depression, positive and cognitive impairment. The model was comparable with six previous factor analytic studies. Internal consistency was quite satisfactory whereas external validity was found to be not so powerful. CFA did not show that the proposed model yields an adequate factor structure.

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Introduction

The heterogeneity of schizophrenic symptomatology is well established. Bleuler (1950) described symptoms like loss of attention, volition, affective responsiveness and association as fundamental and always present in the course of schizophrenic illness. He regarded symptoms like hallucinations, delusions and catatonia as accessory and present only during severe relapse. According to Strauss et al. (1974) positive and negative phenomenologies represented distinct pathophysiologies within schizophrenia. In the early 1980s Crow (1980, 1989) hypothesized that syndromes dominated by positive symptoms and syndromes dominated by negative symptoms may reflect separate disorders in schizophrenia with different pathophysiological processess. Andreasen (1982 a, b) described positive and negative symptoms as opposing features which characterize different subtypes.

Although the positive-negative distinction could be indeed valid as it provides a meaningful approach of the disorder, its ability to cover the entire spectrum of schizophrenic psychopathology has been questioned. The development of specific scales for the assessment of positive and negative symptoms has stimulated clinical studies to address this issue.

When scales like the Krawiecka-Manchester Scale (Krawieska et al. 1977; Hyde 1989), the Scale for the Assessment of Negative Symptoms (SANS) and the Scale for the Assessment of Positive Symptoms (SAPS) (Andreasen 1984 a, b) are used, factor analysis studies do not lend support to the dichotomy of positive and negative symptoms but to the existence of more than two symptomatic dimensions underlying the range of schizophrenic symptoms. Most of these studies using factor analysis techniques supported a possible three-factor model (Bilder et al. 1985; Hulhara et al. 1986; Liddle, 1987; Arndt et al. 1991; Gur et al. 1991; Minas et al 1992; Brown and White 1993; Malla et al. 1993; Miller et al. 1993; Andreasen et al. 1995). Bilder et al. (1985), for example, pre-

sented the first model of three factors: positive, disorganization and negative. Liddle also suggested that the primary symptoms of schizophrenia consist of three syndromes: positive, disorganization and negative. A four-factor model was proposed by Peralta et al. (1992) including a negative factor, a delusional-hallucination factor, a disorganization factor, and a bizarre factor. Contrary to the above, Schuldberg et al. (1990) proposed a two-factor solution (negative factor, positive factor mainly psychoticism).

The Positive and Negative Syndrome Scale (PANSS) introduced by Kay and Sevy (1990) is nowadays one of the most used clinical scales worldwide and reflects an approach based on consideration of a broader profile of schizophrenic psychopathology. Recent studies have presented data in favor of five discrete domains of schizophrenic symptomatology (Lepin 1991; Dollfus et al. 1991; Bell et al. 1994; Linsdrom and Von Knorring 1993; Lindenmayer et al. 1995; Lancon et al. 1998). In this study we examined the consistency of the five-factor model using the PANSS on a patient sample composed of a Greek schizophrenic population. A confirmatory factor analysis (CFA) was also performed to evaluate whether the proposed model yields an adequate dimensional factor structure.

Material and methods

Patients

The subjects of this study were selected randomly between October 1995 and April 1996 from the patients admitted to the Athens University Psychiatric Clinic, Eginition Hospital, the Athens Mental Hospital, and a private psychiatric hospital representatives of the inpatient psychiatric population of the greater Athens area. From a total of 516 patients, a sample was drawn using the systematic sampling technique with a sampling interval equal to two and random start at the number two. According to this procedure, 258 patients comprised the study sample. Therefore, the sample was large (50%), and the population of patients with schizophrenic disorder represented from the three psychiatric inpatient settings well.

The sociodemographic and clinical characteristics of the basic sample and the randomly drawn sample are presented in Table 1. Patients were diagnosed using DSM-IIIR criteria on the basis of the Structured Clinical Interview (SCID-R) (Spitzer and Williams 1985) after consensus of L.L. and P.O. Trained clinicians rated the patients independently with the aid of a semistructured clinical interview for the PANSS (SCI-PANSS). The PANSS includes three subscales: a 7-item subscale for positive symptoms, a 7-item subscale for negative symptoms and a 16-item subscale covering general psychopathology. It assesses symptoms using a 7 point-format from 1 = absent to 7 = extreme. All patients were in an acute or a stable stage of the illness and were receiving neuroleptic treatment as well as antiparkinsonian drugs when indicated. They all gave informed consent for participation in the study.

Methods

With the permission of Multi-Health Systems Inc., the PANSS and the SCI-PANSS were translated into Greek by L. Lykouras, A. Botsis and P. Oulis (1997). The inter-rater reliability of the PANSS was tested by eight trained clinicians, who rated independently three videotaped psychiatric interviews conducted with the aid of the SCI-PANSS. The reliability of the PANSS was tested descriptively with the method of the proportion of agreement – within the range of one rating point – between the members of 84 raters pairs formed in this manner (28 pairs for each interview) (Kay et al.

Table 1 Sociodemographic and clinical characteristics

	Basic sample (n = 516)	Randomly drawn sample (n = 258)
Gender		
Male/Female	414/102 80.2%/19.8%	190/68 77.5%/22.5%
Age	31.2 ± 12.0*	31.9 ± 11.1*
Years of education	11.8 ± 3.8**	11.5 ± 3.3**
Family history for schizophrenic disorder in first degree relatives (Yes/No)	70/382 (n = 452)	40/182 (n = 222)
Onset		
Acute/Insidious***	152/298 (n = 450)	72/158 (n = 230)
DSM-IIIR diagnosis	Schizophrenia	
Undifferentiated	173	58
Paranoid	258	142
Disorganized	28	16
Residual	26	14
Catatonic	31	18
Duration of illness (yrs)	9.0 ± 7.5*	9.5 ± 7.8*
≤ 1 year	135	65
1–2 years	105	52
> 2 years	276	141
Duration of hospitalization (months)	32.9 ± 27.8*	33.8 ± 26.9*
Current drugs (mg/day)		
Typical antipsychotics in chlorpromazine equivalents	1290 ± 963* (n = 435)	1220 ± 941* (n = 221)
Atypical antipsychotics		
Clozapine	318 ± 122* (n = 35)	305 ± 105* (n = 15)
Risperidone	11 ± 4* (n = 46)	12 ± 4* (n = 20)

* mean ± SD
** High school educated: 12 years
*** Full symptomatology was manifested within less (acute) or more (insidious) than three months

1987). The mean inter-rater reliability coefficients were 0.91, 0.72 and 0.98 for the Positive, Negative and General, Psychopathology Subscales. Overall the inter-rater reliability of 28 out of the 30 items of the PANSS was found satisfactory or excellent with the exception of the two negative items: emotional withdrawal (0.56) and lack of spontaneity and flow of conversation (0.60). The method employed for obtaining information on the family history of schizophrenic disorders was the Family History-Research Diagnostic Criteria developed by Andreasen et al. (1977).

Data analysis

Patients' scores were subjected to two principal component analyses (PCA) with varimax rotation, the first time by fixing the threshold in eigenvalues at the usual ≥ 1 numerical level, and thereafter, following the suggestion of Lindenmayer et al. (1995), PCA was repeated using the scree plot as the criterion for determining the appropriate number of factors. According to this criterion the researcher visually inspects the scree plot of eigenvalues and retains the factors immediately before the straight line formed by eigenvalues begins (Cattel et al. 1966). After rotation items that loaded nearly equally on more than one component were dropped from further analysis with the exception of items loaded 0.60 or above on one factor and 0.30 to 0.40 on a second. For the item P3 which loaded 0.32 on factor III and 0.54 on factor IV, a theoretical decision was made to assign it to factor IV. The same was the case for the item N7 which loaded 0.35 on factor I and 0.57 on factor V. Internal consistency for each of the components was determined by the use of Cronbach's alpha. External validity of the five-factor model was investigated by searching for possible relationships between the five components and certain sociodemographic and clinical characteristics with the aid of canonical nonparametric correlation analysis. Canonical correlation is a multivariate analysis and represents a useful tool for examining the relationship with multiple dependent variables (Hair et al. 1988). Statistical analysis was performed using the Statistica/W Software Ed. 1998.

As mentioned above, recent studies have presented a five-factor model of schizophrenic psychopathology. The five-factor model suggested by Lindenmayer et al. (1995) and that of ours were evaluated and compared using confirmatory factor analyses (CFA). The software used was the statistical SEPATH Analysis Module Version 5.1 1999. No problems emerged with the Langrange multiplier test. Of the goodness of fit measures, chi-square (appropriate: p: nonsignificant) and the comparative fit index (CFI) were utilized. The latter needs to have a value above 0.9 before the corresponding model can be even considered moderately satisfactory.

Results

PCA analyses

Varimax rotation did not substantially change item loadings in both PCA analyses. The first PCA produced seven components with eigenvalues > 1 accounting for 66.8% of the variance. The analysis revealed that the negative component captured the greatest amount of variance (26.21%). Excitement was the second component and depression the third component (14.7% and 7.2% of the variance, respectively). Positive symptoms and some of general psychopathology formed the fourth (positive 1) and the sixth (positive 2) component (6.45% and 3.6% of the variance, respectively). The item somatic concern was the fifth component explaining an additional 5.3% of the variance. Cognitive impairment was the seventh component accounting for a further 3.4% of the variance and contained cognitive disorganization, difficulty in abstract thinking, stereotyped thinking, disorientation and poor attention.

Table 2 Five-component solution eigenvalues and % of total variance

Component	Eigenvalue	% of total variance	Cumulative %
1. Negative	0.78	26.21	26.21
2. Excitement	4.40	14.65	40.86
3. Depression	2.16	7.20	48.06
4. Positive	1.93	6.45	54.51
5. Cognitive	1.60	5.34	59.85

The second PCA using the scree plot as criterion revealed five components with eigenvalues > 1.5 capturing 59.85% of the variance (Table 2). These components in decreasing order of relative importance were negative, excitement, depression, positive and cognitive impairment. The positive 1 and 2 components extracted in the seven-factor solution appeared as one component (Table 3).

Internal consistency of the five-component model

Cronbach's alpha was estimated for each of the components in order to determine internal consistency. The negative component gave a reliability of a = 0.90, the excitement component a = 0.85, the depression component a = 0.63, the positive component a = 0.75 and the cognitive impairment component a = 0.81.

External validity of the five-factor model

To test the external validity of the five factor model, canonical analysis was used to investigate the possible relationships of the five factors to sociodemographic characteristics and clinical variables. Canonical analysis was carried out on only 222 valid cases due to missing values. The first set comprised the five components and the second set sex, age, duration of illness, years of education, duration of hospitalization and family history for schizophrenic disorders. As can be seen in Table 4, only the first two canonical roots were significant and subsequently these roots were interpreted. With a cutoff correlation of 0.30 as the criterion for interpretation, correlations between variables in the five-component and sociodemographic, sets revealed a negative relationship between age and cognitive component (r = –0.32). Overall, canonical roots 1 and 2 accounted for 81.7% of the variance extracted, 40.9 of which came from the variables in the PANSS component set and 40.8% from the variables in the sociodemographics set. The distribution of canonical weights in Table 5 shows the relevant contribution of each variance to the total variance accounted for by canonical roots 1 and 2.

With a cutoff correlation of 0.30 as the criterion for interpretation, the variables relevant to canonical root 1 in an inferior order of magnitude were excitement compo-

Table 3 Principal component analysis of the 30 items the PANSS. Five-factor model of schizophrenic symptoms. The bold numbers indicate loadings of items included in each particular component

	Negative component	Varimax-rotated component loadings				
		I	II	III	IV	V
N1	Blunted affect	**0.74**	*	*	*	0.21
N2	Emotional withdrawal	**0.78**	*	*	*	0.25
N3	Poor rapport	**0.79**	*	*	*	*
N4	Passive/apathetic withdrawal	**0.80**	*	*	*	0.22
N6	Lack of spontaneity	**0.79**	*	*	*	0.24
G7	Motor retardation	**0.80**	*	0.22	*	*
	Excitement component					
P4	Excitement	*	**0.77**	*	*	*
P7	Hostility	*	**0.77**	0.21	*	*
G4	Tension	*	**0.71**	0.34	*	*
G8	Uncooperativeness	0.24	**0.71**	*	*	*
G14	Poor impulse control	*	**0.74**	*	*	*
	Depression component					
G2	Anxiety	0.40	*	**0.61**	*	*
G3	Guilt feelings	*	*	**0.75**	*	*
G6	Depression	0.21	*	**0.74**	*	*
	Positive component					
P1	Delusions	*	0.22	*	**0.87**	*
P3	Hallucinatory behavior	*	*	0.32	**0.54**	*
P5	Grandiosity	–0.23	*	–0.23	**0.55**	*
P6	Suspiciousness	*	0.32	*	**0.70**	*
G9	Unusual thought content	*	*	*	**0.69**	*
	Cognitive component					
P2	Conceptual disorganization	*	*	*	*	**0.81**
N5	Difficulty in abstract thinking	0.36	*	*	*	**0.67**
N7	Stereotyped thinking	0.35	*	*	*	**0.57**
G10	Disorientation	0.25	*	*	*	**0.55**
G11	Poor attention	0.26	0.29	*	*	**0.67**
	Other PANSS items					
G1	Somatic concern	*	0.33	0.31	*	*
G5	Mannerisms and posturing	0.42	*	*	*	0.42
G12	Lack of judgment and insight	*	0.38	–0.42	0.42	*
G13	Disturbances of volition	0.53	0.25	0.20	*	0.46
G15	Preoccupation	0.50	*	0.21	*	0.43
G16	Active social withdrawal	0.40	0.51	*	0.42	*

Table 4 Chi-square tests with successive roots removed

Root Removed	Canonical R	Canonical R-sqr.	Chi-sqr.	Df	p
0	0.550226	0.302748	131.0439	35	0.000
1	0.367076	0.134745	53.6933	24	0.0004
2	0.244448	0.059755	22.6486	15	0.091
3	0.183421	0.033643	9.4322	8	0.307
4	0.098505	0.009703	2.0915	3	0.553

Table 5 Canonical weights of variable sets on the two roots

	Root 1	Root 2
PANSS Component Set		
Negative	–0.47	–0.48
Excitement	0.71	0.18
Depression	–0.09	0.23
Positive	0.42	–0.93
Cognitive	–0.19	0.69
Sociodemographics Set		
Sex	0.17	–0.39
Age	0.15	–0.68
Years of education	0.36	–0.25
Duration of illness	–0.05	0.32
Duration of hospitalization	–0.51	–0.28
Family history for schizophrenic disorders	–0.29	0.45
Medication	–0.21	0.24

nent (0.71), negative component (–0.47) and positive component (0.42) in the component set, and education (–0.36) and duration of hospitalization (–0.51) in the sociodemographics set (Table 5). Thus, patients with more positive and excitement symptoms, and fewer negative symptoms tended to have higher educational status and shorter duration of hospitalization. The variables relevant to canonical root 2 in the component set were positive

Table 6 Testing models of the PANSS. Estimated parameters and P values

Model derived from Lindenmayer et al. 1995				Model derived from the present study			
Factor	Parameter estimate	P	PANSS item	Factor	Parameter estimate	P	PANSS item*
Positive	0.752	0.000	P_1	Positive	0.740	0.000	P_1
	0.766	0.000	P_3		0.782	0.000	P_3
	0.580	0.000	P_5		0.568	0.000	P_5
	0.795	0.000	P_6		0.805	0.000	P_6
	0.055	0.406	G_9		0.044	0.511	G_9
Negative	0.844	0.000	N_1	Negative	0.894	0.000	N_1
	0.276	0.000	N_2		0.252	0.000	N_2
	0.424	0.000	N_3		0.466	0.000	N_3
	0.402	0.000	N_4		0.372	0.000	N_4
	0.807	0.000	N_6		0.792	0.000	N_6
	0.598	0.000	G_{16}		–0.010	–0.880	G_7
Cognitive	–0.125	0.054	N_5	Cognitive	–0.114	0.078	N_5
	0.793	0.000	P_2		0.210	0.001	N_7
	0.541	0.000	G_5		0.780	0.000	P_2
	0.427	0.000	G_{10}		0.415	0.000	G_{10}
	0.524	0.000	G_{11}		0.527	0.000	G_{11}
Excitement	0.753	0.000	P_4	Excitement	0.774	0.000	P_4
	0.597	0.000	P_7		0.588	0.000	P_7
	0.216	0.001	G_4		0.188	0.005	G_4
	0.313	0.000	G_{14}		0.378	0.000	G_8
					0.316	0.000	G_{14}
Depression	0.402	0.000	G_1				
	0.399	0.000	G_2	Depression	0.498	0.000	G_2
	0.262	0.000	G_3		0.666	0.000	G_3
	0.293	0.000	G_6		0.648	0.000	G_6
	0.717	0.000	G_{15}				

P_1: Delusions; P_2: Conceptual disorganization; P_3: Hallucinatory behavior; P_4: Excitement; P_5: Grandiosity; P_6 Q Suspiciouness; P7: Hostility; N_1: Blunted affect; N_2: Emotional withdrawal; N_3: Poor rapport; N_4: Passive withdrawal; N_5: Difficulty in abstract thinking; N_6: Lack of spontaneity; N_7: Stereotyped thinking; G_2: Anxiety; G_3: Guilt feelings; G_4: Tension, G_5: Mannerisms and posturing, G_6: Depression; G_7: Motor retardation; G_8: Uncooperativeness; G_9: Unusual thought content; G_{10}: Disorientation; G_{11}: Poor attention; G_{14}: Poor impulse control; G_{15}: Preocupation; G_{16}: Active social withdrawal.
*Original PANSS item number

(–0.93), cognitive (0.69) and negative (–0.48) symptoms, and age (–0.68), family history for schizophrenic disorder (0.45) and sex (–0.39), in the sociodemographic set. (Table 5). Thus, patients with more cognitive dysfunction, a lower negative component and a significantly lower positive component tended to be men of earlier age, and an increased incidence of family history for schizophrenic disorder.

Confirmatory factor analysis

Table 6 presents the parameter estimates of the models derived from Lindenmayer et al. (1995) and our study. Table 7 gives goodness of fit information obtained from fitting the two models of the present study (initial and refined) and that of Lindenmayer et al. (1995). The Lindenmayer's five-factor model and the current authors' initial model were compared using the PANSS data from the Greek sample. Both models presented a poor fit (Table 7). In respect to the Lindenmayer's model, the items of unusual thought content and difficulty in abstract thinking appeared to present problems to the model and reduce its fitness index (Table 6). Our initial model also showed similar problems with the above mentioned items in addition to the item of motor retardation (Table 6). With the omission of these three items the CFI was improved but not to a level that can be considered satisfactory (0.61).

Table 7 Confirmatory factor analyses

	x^2	df	P	CFI*
Model derived from Lindenmayer et al. (1995)	1481.82	265	0.000	0.650
Model derived from the present study	1777.17	242	0.000	0.575
Refined model derived from the present study	1283.54	179	0.000	0.611

*Comparative fit index

Discussion

The results of the present study support a five-factor model underlying schizophrenic symptomatology as assessed by the PANSS. Negative, excitement, depression, positive and cognitive impairment symptom domains emerged. The negative component contained five of the originally included symptoms of the negative subscale of the PANSS and disturbances of volition of the general

psychopathology subscale. Most of the items had a quite high loading. The high internal consistency as calculated by Cronbach's alpha suggests that the negative symptoms comprise a homogeneous syndrome. The excitement component was second in order of relative importance. It contained five symptoms, two of which were extracted from the positive subscale and the other three of the general psychopathology subscale of the PANSS. Its internal consistency was high. The depression component was next and contained anxiety, depression and guilt feelings, all of which belong to the general psychopathology subscale of the PANSS. The presence of a depressive dimension independent but coexisting with the negative component is of importance. This means that schizophrenic patients exhibit depressive symptomatology despite the presence of symptoms indicating affective impairment, which is separately identifiable (Siris 1995). However, its internal consistency was relatively low and this may be due to the reduced number of items that retained. The positive component was fourth in order of relative importance and with satisfactory internal consistency as calculated through Cronbach's alpha. It contained the items of delusions, hallucinations, grandiosity and suspiciousness assigned previously in the positive subscale and unusual thought content originally grouped as a symptom of the general psychopathology subscale of the PANSS. A cognitive impairment domain was isolated as fifth component. It contained five symptoms of which conceptual disorganization was previously classified as a positive symptom and difficulty in abstract thinking and stereotyped thinking were originally grouped as negative symptoms. The remaining two items, i.e., poor attention and disorientation, were previously a part of the general psychopathology subscale of the PANSS. Although capturing a modest amount of variance, the cognitive impairment component had high internal consistency and items with high loading. It is clearly a distinct domain of psychopathology but coexisting with the negative component. All but one study proposing the five-factor model and using the PANSS for assessing schizophrenic psychopathology, consistently found four items, namely conceptual disorganization, difficulty in abstract thinking, poor attention and discorientation, with comparable item loadings. It is clear that the emergence of a cognitive impairment domain is in contrast to Crow's formulation (1989) but in line with previous studies (Bilder et al. 1985; Kulhara et al. 1986; Liddle 1987; Arndt et al. 1991; Gur et al. 1991; Peralta et al. 1992; Miller et al. 1993; Andreasen et al. 1995).

Comparison of components across studies

We compared our results with those of studies in which factor analysis techniques were conducted on patients assessed by means of the PANSS. Although all studies outlined below used principal component analyses, the differences in rotation techniques and in the rules for determining the appropriate number of factors do not allow direct comparison of the results. Another problem derives from the limited number of patients in certain studies. It has been suggested that factor analysis needs a minimum ratio of five patients per variable or at least 100 patients for any analysis (Couvert and McNelis 1988). Among other confounding factors are differences in the definition of the sample, the stage of the illness (i.e., chronicity), medication and patient's stay in or out of the hospital.

Lepine (1991) in a French study performed PCA analysis on 331 chronic schizophrenic inpatients which also disclosed five components. Their negative factor had six items common with ours and additionally contained difficulty in abstract thinking, disturbances of volition and active social withdrawal. The excitement component additionally contained lack of judgment and insight but not tension which was part of our excitement factor. The depression component included the same items in addition to somatic concern. The positive factor did not include grandiosity and suspiciousness but the other items were identical and with loadings very close to ours. The cognitive components were almost equivalent in the two studies. The difference was the absence of difficulty in abstract thinking in the Lepine study. In another French study (Dollfus et al. 1991), PCA on 70 psychotic patients assessed by the PANSS yielded a five-factor solution. The total variance explained was 55.98% compared to 59.85% explained in our sample. The first three components were negative, positive and disorganization. According to the authors, the last two components represented an anxiety and a manic-expansive dimension, the latter being similar to the component "excitement" in our study. The discrepancy between Dollfus analysis and most of the studies including ours is the absence of a depressive component with items such as depression and guilt feelings. The authors attribute the lack of depressive symptoms to the broader definition of the sample ("non-affective psychosis") and to the small number of patients. The composition of the negative, positive and disorganization components was similar to our own PCA results. With regard to the manic-expansive dimension, the key difference was the presence of grandiosity which in most of the studies had a certain weight in the positive factor. Bell et al. (1994) performed PCA on an American series of 240 acute and chronic schizophrenic patients assessed by means of the PANSS. Again the results yielded a five-factor solution explaining 57.5% of the variance: negative hostility (corresponding to our excitement component), cognitive, positive and emotional discomfort. The composition of individual components in the Bell study had certain similarities with our own results. A few differences included the presence of active social withdrawal as a negative factor, and the presence of mannerisms and posturing and disturbances of volition as a cognitive factor. Lindström and Von Knorring (1993) conducted PCA on 120 Swedish schizophrenic patients rated by means of the PANSS. The analysis delineated nine components explaining 70% of the variance. After inspection of the results the authors restricted the solution to five components: Negative excited, positive, anxious/depressive and cognitive. In the five factors were subsumed items similar

to our own five-factor solution. With respect to the differences, we note the presence of active social withdrawal as a negative factor and the presence of somatic concern, tension and poor attention as a depression / anxiety factor. Stereotyped thinking was not included in their cognitive component as was the case in ours. Lindenmayer et al. (1995) performed PCA on an American series of 240 schizophrenic patients assessed by the PANSS. Their analysis resulted in a five factor solution: Negative, excitement, cognitive, positive and depression accounting for 57.5% of the variance (ours: 57.85%). Again there were great similarities between their results and ours with regard to the items included in the five-factor solution. Only minor differences were only noted. Among them was the presence of active social withdrawal as a negative factor compared to our own results. Lancon et al. (1998) in a recent French study performed PCA analysis on 205 schizophrenic patients which confirmed the five-dimensional solution. The total variance explained was 57%. Because of the insignificant contribution of items such as stereotyped thinking, mannerisms, poor attention, lack of judgment, disturbances of volition and preoccupation to the constitution of the components, the authors proceeded to a "forced" five-dimensional factor analysis without these items which accounted for 61.9% of the total variance. The composition of the five components (positive, negative, excitement, depression and cognitive) was similar with that in our own study.

Comparison of components across the reviewed studies, despite the above mentioned limitations, shows clear consistencies rather than controversies. All recent studies in which the PANSS was used proposed the five-factor solution. Furthermore, total variance was explained by a similar percentage. Two dimensions distinct but coexisting with the negative component emerged: cognitive impairment and depression. It is also worth noting that several symptoms were consistently found in the same components of the five factor model. However, one could not rule out the possibility that the five-factor solution was due to with the factor structure of the PANSS rather than the illness.

The internal consistency was > 0.7 for all the components with the exception of the depressive component (0.63). The negative component had the highest consistency. The low consistency of the depressive component may be due, at least in part, to the small number of items that constituted this dimension. We tested external validity of the five-factor model by searching for relationships between the five components and sociodemographic and clinical characteristics. The first association included a preponderence of positive and excitement symptoms and a smaller number of negative symptoms relating to an older age, moderate educational level and reduced duration of hospitalization. This type of association signifies a clinical variant without cognitive disturbances, fewer negative symptoms and florid symptomatology. The lack of cognitive impairment allows adequate educational level. Patients with this profile appear to stay hospitalized for shorter periods of time. In the second association, a predominance of cognitive impairment was associated with male gender, extremely small number of positive symptoms, small number of negative symptoms, and the presence of schizophrenia in relatives. This association coincided with those of Lindenmayer et al. (1995) and points to the existence of a subtype of schizophrenia manifested in younger male subjects with a positive family history of schizophrenic disorders and symptoms indicating cognitive impairment predominating in their psychopathology. We consider as limitations to the canonical analysis the non-inclusion of other parameters such as neurobiological markers. In certain studies the role of confounding factors has been examined. For example, Lindenmayer et al. (1995) examined the effect of neuroleptic medication on the five-factor structure of schizophrenic symptomatology as measured by the PANSS. Their results indicated stability of these psychopathological dimensions while on and off neuroleptics. On the same issue, Dollfus and Petit (1995) performed PCA on 57 French-speaking patients at admission and discharge from the hospital (about eight weeks later) to investigate the stability of the dimensions. The authors found that positive and negative components were quite stable and were constituted from the same items both at admission and at discharge. This was the case for the excitement component but the latter acquired somatic concern, anxiety and tension at discharge. The disorganization component existed at both times but its composition varied over time. At admission, the disorganization component existed, whereas at discharge it emerged in a specific depressive component.

Lastly, the adequacy of the five-factor model was examined using CFA. This model even after the omission of three problematic items did not show an adequate fit. The Lindenmayer et al. (1995) five-factor model also failed to reach a satisfactory CFI. Dollfus and Everitt (1998) in a recent study, examined three-, four-, and five-factor models with PANSS derived from previous studies. None of the proposed models met the criteria for an adequate fit, contrary to models with other scales that gave robust results. The relatively small sample size, the cross-sectional design, the different phases of illness (acute, stabilized) might have contributed to the negative results. The lack of measures such as inappropriate affect, the inclusion of items that might be not very relevant and some potential problems in the definition of items may also have influenced the results.

Although the five-factor model was confirmed with satisfactory internal consistency, it did not show an adequate fit by CFA. Inherent problems with the PANSS may have contributed to these negative results

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