Intercorrelation of symptom dimensions in patients with schizophrenia Nesrin Elsaadouni^b, Haitham Elboraie^a, Samah Rabei^a, Ahmed Elboraie^b

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Background

The heterogeneity of schizophrenia symptoms is well documented. The positive and negative distinction is limited to cover the entire spectrum of schizophrenia phenomenology.

Aim

The aim of the study is to find out the major symptom dimensions of phenomenology in a sample of schizophrenic patients.

Materials and methods

We recruited 100 schizophrenic patients. Diagnosis was based on diagnostic and statistical manual criteria. Positive and negative symptoms scale was used to assess schizophrenia symptoms. Patients' scores were subjected to factor analysis with varimax rotation. Internal consistency was determined by the use of Cronbach's α .

Results

Five dimensions (factors) were produced: negative, excitement, positive, depressive, and cognitive dimensions. Internal consistency was quite satisfactory.

Keywords:

intercorrelation, symptom dimentions, schizophrenia

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Introduction

The turning point adopting the dimensional point of view of symptomatology of schizophrenia came perhaps from the study of Crow (1985), who suggested a new inherent typology of schizophrenia, which integrated clinical presentation, pathophysiology, and treatment response in a single model (Jablensky, 2010). Crow hypothesized two syndromes in schizophrenia type1 with positive symptoms and good response to treatment and type 2 with negative symptoms and poor outcome (Csernansky, 2012). In an other work to identify the latent dimensions of schizophrenia phenomenology Liddle (1987) proposed three syndrome models including psychomotor poverty, disorganization and reality distortion (delusion, hallucinations). The three-dimensional model which embraces positive, negative, and disorganized dimensions has been supported by numerous studies (Ventura et al., 2010).

However, numerous later studies have established more than three symptom dimensions. Kay and Sevey (1990) obtained a model which includes four dimensions (of positive, negative, hostile/excited, which and depressed) formed a four-factor pyramidal model. Another factor analysis has produced a fivedimensional model that consisted of: negative, positive, hostile/excited, cognitive, and depression dimension (Wallwork et al., 2012; Kosgi et al., 2015).

A more recent strategy for addressing the heterogeneity of the phenotype in schizophrenia is the dimensional approach. While categories traditionally arise from disease models, dimensions are often derived from the study of normal psychology; studies of dimensional approaches have shown less concern about identifying the brain-behavior relationships. Dimensions define a group of symptoms that cooccur more often than would be expected by chance alone, but the occurrence is noted through statistical techniques such as factor analysis. While categories classify individuals (what the patient is), dimensions classify symptoms (what the patient has). Therefore, dimensions can overlap within a given individual and be additive (Cuthbert, 2014).

The identification of symptom-based dimensions (factors) within the diagnosis of schizophrenia has led to a number of questions. First, has the distribution of the factor scores been examined adequately in schizophrenia? Second, how useful is the dimensional approach in assessing schizophrenia?

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Materials and methods

Study design

This study will be a cross-sectional observational one to fulfill the primary aim of this study through detection and collection of all available symptoms and demographic and some clinical variables and analyzing them statistically.

Subjects

A convenient sample of patients involved in the study consisted of a total number of 100 inpatients and outpatients recruited from Mansoura University Psychiatry Department.

Methods

Clinical assessments

For all patients' thorough history and psychiatric examination using a semi-structured interview were done. Clinical diagnosis of schizophrenia was done and confirmed by another one in an independent evaluation. Then a consensus is reached based on diagnostic and statistical manual criteria.

Psychopathology (symptomatology) assessment

Positive and Negative Syndrome Scale (PANSS) is a 30-item rating completed by the researcher. PANSS is specially developed to assess individuals with schizophrenia and is widely used in the research setting.

This scale was designed to assess three main domains: positive (seven items), negative (seven items), and general psychopathology (16 items) using an operationally defined seven-point scale rating is generally based on information related to the past week (1=none and 7=extreme).

Statistical study

Patient score of PANSS were subjected to factor analysis with a Varimax rotation. Internal consistency was determined by the use of Cronbach's α . External validity of the dimensions derived was investigated by searching for possible correlations between dimensions and demographic and clinical variables by using the Pearson correlation coefficient.

Results

Table 1 presents the mean scores, SD, and range on the individual items of PANSS. Positive symptom items, as concluded from the table the highest obtained scores were on the symptoms of delusions (mean=3.35), followed by hallucination (mean=3.05), and the least obtained score was on the hostility subitem

(mean=2.07). The highest score obtained on the negative symptom items was on the emotional withdrawal item (mean=2.68) and the minimum was the stereotyped thinking (mean=1.95). Furthermore, lack of judgment (mean=3.69) and disturbance of volition (mean=2.88) were the highest obtained score on the general psychopathology items.

The mean PANSS scores of the sample were as follows: PANSS positive subscale is 18.10±6.064 (7.30 score range). PANSS negative subscale is 15.57±8.312 (7–39 score range). PANSS general psychopathology subscale is 36.61±12.277 (16–57 score range).

Table 2 shows the results of orthogonal rotation of the five-factor solution; the interpretation of the factors were based on loading over 0.55.

The first factor (F1) explained 29.11% of total variance. Emotional withdrawal, blunted affect, poor rapport passive social withdrawal, lack of spontaneity of speech and motor retardation were highly loaded (> 0.55) in this factor. It was called *negative dimension*.

The second factor (F2) explained 15.39% of variance and had a high loading from delusion, hallucination, grandiosity, suspiciousness, and unusual thought contents. It was named the positive dimension.

Excitement, hostility, tension, uncooperativeness, and poor impulse control, loading of this factor explained 6.63% of the variance and was named excitement dimension (F3).

Somatic concern, anxiety, guilt feeling, and depression loaded on the fourth factor which explained 6.52% of the variance, and was named the depressive dimension.

The fifth interpreted factor had the same explanatory power (variability=5.20%). This factor in called cognitive (disorganization) dimension.

Table 3 shows factor loading.

Factor loadings: The factor loadings are the correlation coefficients between the variables (rows) and factors (columns). In this study, loadings should be 0.55 or higher to confirm that independent variables identified a priori are represented by a particular factor (Table 4) Variables sharing the same factor loadings were grouped together while factors in which loadings were less than the cut-off score were excluded.

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Symptom	Ν	Minimum score	Maximum score	Mean	SD
P1, delusions	100	1	6	3.35	1.493
P2, conceptual disorganization	100	1	6	2.73	1.196
P3, hallucination	100	1	6	2.65	1.493
P4, excitement	100	1	5	2.39	1.483
P5, grandiosity	100	1	5	2.17	1.280
P6, suspiciousness	100	1	6	2.74	1.548
P7, hostility	100	1	5	2.07	1.174
Positive symptom total score	100	7	30	18.1	6.064
N1, blunted affect	100	1	6	2.89	1.630
N2, emotional withdrawal	100	1	6	3.28	1.705
N3, poor rapport	100	1	6	2.52	1.467
N4, passive social withdrawal	100	1	6	2.69	1.499
N5, difficulty in abstract thinking	100	1	6	2.94	1.408
N6, lack of spontaneity of speech	100	1	5	2.66	1.423
N7, stereotyped thinking	100	1	5	2.45	1.149
Negative symptom total score	100	7	39	19.5	8.312
G1, somatic concerns	100	1	3	2.58	1.924
G2, anxiety	100	1	6	2.19	1.529
G31, guilt feelings	100	1	6	1.79	1.038
G4, tension	100	1	6	2.13	1.353
G5, mannerisms and posturing	100	1	5	1.95	1.167
G6, depression	100	1	5	1.77	1.043
G7, motor retardation	100	1	6	2.75	1.731
G8, uncooperativeness	100	1	7	2.41	1.640
G9, unusual thought content	100	1	6	2.13	1.425
G10, disorientation	100	1	4	3.13	0.917
G11, poor attention	100	1	6	2.42	1.615
G12, lack of judgment	100	1	7	3.69	1.733
G13, disturbance of volition	100	1	6	2.88	1.731
G14, poor impulse control	100	1	6	2.52	1.410
G15, preoccupations	100	1	6	1.86	1.271
G16, active social avoidance	100	1	5	2.36	1.273
General psychopathology total score	100	16	57	38.3	12.277
Total score of Positive and Negative Syndrome Scale	100	31	105	75.9	19.524

The percent of variance gives the ratio, expressed as a percentage, of the variance accounted for by each component, to the total variance in all of the variables. As noted from Table 4, the negative symptom dimension had the highest score while the cognitive dimension had the lowest variations. This means that the stability of the negative symptom component was the weakest, while the cognitive factor component was the strongest and the least variable.

Cronbach's α is a coefficient of reliability. It is commonly used as a measure of the internal consistency or reliability of a psychometric test score for a sample of examinees. Alpha can take on any value less than or equal to one, including negative values, although only positive values make sense. Higher values of α are more desirable, this denotes high reliability and internal consistency. In Table 4, the internal consistency of the negative factor dimension was 0.79 while that of the positive 0.71 and cognitive factors 0.74.

It is concluded from the Table 4 above that their sign was a negative one on correlating the positive and the negative symptom dimension which is expected and proves the validity of the factor analysis, indicating that these variables are correlated in a reversed order; this correlation was of statistical significance indicating that an increase in one variable will decrease the other.

Discussion

The results of factor analysis in this study result in a five-factor model (five dimensions) underlying schizophrenic symptomatology as assessed by the PANSS and using factor analysis. Negative, positive, excitement, depression, and cognitive impairment symptom dimensions emerged.

Symptom	Factor 1 (negative dimension)	Factor 2 (positive dimension)	Factor 3 (excitation dimension)	Factor 4 (depressive dimension)	Factor 5 (cognitive dimension)
P1, delusions	0.531	0.683	0.495	0.090	0.128
P2, conceptual disorganization	0.536	0.066	0.229	0.422	0.552
P3, hallucination	0.517	0.716	0.463	0.121	0.184
P4, excitement	0.123	0.538	0.818	0.236	0.122
P5, grandiosity	0.213	0.689	0.579	0.454	0.404
P6, suspiciousness	0.217	0.728	0.367	0.266	0.044
P7, hostility	0.382	0.406	0.667	0.418	0.481
N1, blunted affect	0.767	0.171	0.270	0.124	0.528
N2, emotional withdrawal	0.831	0.175	0.116	0.152	0.491
N3, poor rapport	0.717	0.062	0.065	0.277	0.544
N4, passive social withdrawal	0.728	0.052	0.094	0.198	0.459
N5, difficulty in abstract thinking	0.589	0.046	0.077	0.293	0.741
N6, lack of speech	0.716	0.035	0.263	0.405	0.486
N7, stereotyped	0.538	0.207	0.263	0.529	0.562

withdrawal					
N3, poor rapport	0.717	0.062	0.065	0.277	0.544
N4, passive social withdrawal	0.728	0.052	0.094	0.198	0.459
N5, difficulty in abstract thinking	0.589	0.046	0.077	0.293	0.741
N6, lack of speech	0.716	0.035	0.263	0.405	0.486
N7, stereotyped thinking	0.538	0.207	0.263	0.529	0.562
G1, Somatic concerns	0.490	0.318	0.317	0.551	0.541
G2, anxiety	0.219	0.380	0.303	0.732	0.293
G31, guilt feelings	0.254	0.315	0.264	0.788	0.443
G4, tension	0.106	0.432	0.640	0.249	0.014
G5, mannerisms and posturing	0.379	0.259	0.396	0.538	0.429
G6, depression	0.330	0.171	0.242	0.567	0.157
G7, motor retardation	0.664	0.213	0.211	0.235	0.255
G8, uncooperativeness	0.547	0.121	0.689	0.418	0.358
G9, usual thought content	0.519	0.609	0.290	0.532	0.370
G10, disorientation	0.501	0.380	0.357	0.532	0.698
G11, poor attention	0.517	0.208	0.287	0.248	0.857
G12, lack of judgement	0.309	0.253	0.012	0.025	0.348
G13, disturbance of volition	0.507	0.007	0.063	0.151	0.404
G14, poor impulse control	0.002	0.319	0.704	0.197	0.229
G15, preoccupations	0.308	0.163	0.274	0.269	0.372
G16, Active social avoidance	0.358	0.198	0.252	0.335	0.310

The bold numbers indicate loadings (of items included) >0.55. Extraction method: maximum likelihood. Rotation method: varimax with Kaiser normalization.

The internal consistency (Cronbach's α value) was more than 0.7 for all the components with the exception of the depressive component (0.69). The negative component had the highest consistency. The lower consistency of the depressive component may be due, at least in part, to the small number of items that constituted this dimension.

We compared our results with those of the studies in which factor analysis techniques were conducted on patients assessed by means of the PANSS. Although most 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.

In this study, six highly significant positive correlations found between the five dimensions are of schizophrenia. They are discussed in a descending manner as to the strength of correlation.

First, negative symptoms are positively correlated with cognitive symptoms (r=0.692). This agrees with Buchanan et al. (1999) who explained negative and

Table 3	Factor loading	a of Positive	and Negative S	Syndrome Scale	items in a	five-factor model

Factorized Positive and Negative Syndrome Scale items	Factor 1 (negative dimension)	Factor 2 (positive dimension)	Factor 3 (excitation dimension)	Factor 4 (depressive dimension)	Factor 5 (cognitive dimension)
Negative component					
N1, blunted effect	0.767				
N2, emotional withdrawal	0.931				
N3, poor rapport	0.717				
N4, passive or apathetic	0.728				
N6, lack of spontaneity	0.716				
G7, motor retardation	0.664				
Positive component					
P1, delusions		0.683			
P3, hallucinatory behavior		0.716			
P5, grandiosity		0.689			
P6, suspiciousness		0.728			
G9, unusual thought		0.609			
Excitement component:					
P4, excitement			0.818		
P7, hostility			0.667		
G4, tension			0.640		
G8, uncooperativeness			0.689		
G14, poor impulse control			0.704		
Depression component					
G1, somatic concern				0.551	
G4, anxiety				0.732	
G4, guilt feelings				0.788	
G4, depression				0.567	
Cognitive component					
P2, conceptual disorganization					0.552
N5, difficulty in abstraction					0.741
N7, stereotyped thinking					0.562
G10, disorientation					0.698
G11, poor attention					0.857
Variance (%)	29.114	15.390	6.634	6.526	5.207
Cronbach's α	0.79	0.71	0.73	0.69	0.75

NB: maximum likelihood estimates the critical parameters, including the divergence between sequences and the transition transversion ratio, by deducing the most likely values to produce the input data while varimax rotation, suggested by Henry Felix Kaiser in 1958, is a popular scheme for orthogonal rotation which cleans up the factors as follows: 'for each factor, high loadings (correlations) will result for a few variables; the rest will be near zero'. Varimax rotation is often used in surveys to see how groupings of questions (items) measure the same concept.

cognitive symptoms by serotonergic inhibition of dopaminergic dorsolateral prefrontal pathway.

Second, positive symptoms are positively correlated with excitation symptoms (r=0.691). This agrees with Kapur and Remington (2001) who explained positive symptoms and hostility by serotonergic release of dopaminergic mesolimbic pathway.

Third, depressive symptoms are positively correlated with positive symptoms (r=0.423). This agrees with the study of Rajkumar (2015) which states a similar finding.

Fourth, depressive symptoms are positively correlated with cognitive symptoms (r=0.431). This agrees with

Buchanan *et al.* (1999) who explained depressive and cognitive symptoms by serotonergic inhibition of dopaminergic dorsolateral prefrontal pathway.

Fifth, depressive symptoms are positively correlated with excitation symptoms (r=0.383). This agrees with the study of Kanchanatawan *et al.* (2018) which states a similar finding.

Sixth, excitation symptoms are positively correlated with cognitive symptoms (r=0.285). This agrees with the study of Kanchanatawan *et al.* (2018) which states a similar finding.

Overall, the findings of the present study suggest that there are five dimensions (factors) underlying

	Table 4	Correlation	between	dimensions	(factors
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	Factor 1 (negative dimension)	Factor 2 (positive dimension)	Factor 3 (excitation dimension)	Factor 4 (depressive dimension)	Factor 5 (cognitive dimension)
Factor	1 (negative dimension)				
r	-				
Р					
Factor	2 (positive dimension)				
r	-0.069	-			
Р	0.497				
Factor	3 (excitation dimension)				
r	0.035	0.621**	-		
Р	0.733	0.000			
Factor	4 (depressive dimension)				
r	0.37	0.423**	0.383**	-	
Р		0.000	0.000		
Factor	5 (cognitive dimension)				
r	0.692**	0.238	0.285**	0.431**	-
Р	0.000	0.017	0.004	0.000	
Total					
r	0.744**	0.498**	0.543**	0.688**	0.792**
Р	0.000	0.000	0.000	0.000	0.000

r, correlation coefficient. r, correlation coefficient and it shows the direction of correlation whether it is in the same or reversed direction, the P value in this case will detect whether both variables increase or decrease together in a significant way. r is always a number between -1 and 1, if it equals zero the variables are not associated (no correlations). NB: correlation between two variables shows that they are associated but not a cause and effect relationship. Correspondence to Correlation is significant at the 0.05 level (two –tailed). **Correlation is significant at the 0.01 level (two-tailed). Bold values statistically significant.

schizophrenia phenomenology with an acceptable degree of reliability and external validity. This may support the view that the dimensional in addition to categorical diagnostic approach may offer an informative method in evaluating schizophrenia patients in the community.

The relatively small size of the sample in the present study, cross-sectional design, and the different phases of illness in the studied patients may have contributed to some limitations of this study.

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Conflicts of interest

There are no conflicts of interest.

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