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Research article

The confirmatory factor structure of neurological soft signs in Nigerians with first episode schizophrenia

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HIGHLIGHTS

- We studied the factor structure of neurological soft signs (NSS) in schizophrenia.
- We used a homogenous sample of Black Africans with first episode of the illness.
- We conducted the first confirmatory factor analysis of the NSS in the population.
- 12 of the 26 NSS in the neurological evaluation scale (NES) loaded into categories.
- A 3 factor model overlapping with functionally meaningful categories best fit the data.

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ABSTRACT

We describe empirically derived categories of NSS in first episode schizophrenia among indigenous Africans. A total of 84 Nigerian patients with the disease were assessed using the neurological evaluation scale. An exploratory factor analysis with orthogonal varimax rotation was first conducted and the factors derived based on a priori criteria were subjected to confirmatory analyses using SPSS 18.0 and AMOS 18.0. We tested four different competing models to identify the structure with the best fit to the data. The relationship of the derived NSS structure with the clinical characteristics of schizophrenia was then explored using the Pearson correlation method. The overall clinical status was assessed using the positive and negative syndrome scale and clinical global impression. Additional assessments included the pre-morbid adjustment scale and calgary depression scale for schizophrenia. A three factor structure in which stereognosis is prescribed to load into a 'perceptual and motor sequencing' category (audio–visual integration, fist-edge palm, rhythm tapping, extinction, right–left confusion) provided the best fit to the data (chi-square goodness of fit test = 1.25; comparative fit index = 0.95; root square means error of approximation <0.05). The other two factors were: 'eye movement' (synkinesis, convergence, gaze impersistence) and 'motor co-ordination and graphaesthesia' (Tandem walk, adventitious flow, graphaesthesia). The signs were associated with severe negative ($r = 0.456$, $p < 0.001$), and disorganization ($r = 0.559$, $p < 0.001$) psychopathologies. NSS in this sample are heterogeneous, but aggregates into three correlated categories with significant overlap with previously described classifications.

1. Introduction

One of the most widely accepted classifications of neurological soft signs (NSS) in schizophrenia is their organization into three domains: sensory integration, motor coordination, and motor sequencing NSS [1]. Abnormalities in frontal release, eye movements, and short term memory are the 'other' frequently observed NSS. While this classification is 'meaningful', it has not been confirmed by empirical methods such as exploratory [2] or confirmatory factor analyses (CFA) [3].

Abbreviations: PMS, perceptual and motor sequencing; EYE, eye movement; MCG, motor co-ordination and graphaesthesia; STS, stereognosis; M_1, uni-dimensional model; M_2, two factor model; M_3, three factor model; IFS, incremental fit statistics; RSMEA, root square means error of approximation; GFI, goodness of fit index; TLI, Tucker-Lewis index; CFI, comparative fit index; IFI, incremental fit index; NFI, normed fit index; AIC, akaike information criterion; CAIC, consistent akaike information criterion; ECVI, expected cross validation index.

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Factor analysis is a standard technique for reducing data sets to underlying consistent sub-sets, which can then be used to find principal variables among many observed variables. Out of a dozen reported factor analyses of NSS in schizophrenia [1–12], only one [6] had been based on a sample from the African continent. That exploratory factor analysis (EFA) was based on a sample composed of 21% white, 71% mixed and 8% Black Africans with first episode schizophrenia. Yet there is no previous CFA of NSS in the African population.

In the background of some reports suggesting that race and ethnicity affects the profile of NSS in schizophrenia [4], it remains unclear if the factor structure of NSS in an indigenous African population with first episode schizophrenia would bear similarities with those reported for Caucasian or mixed samples.

In the present study, we conducted EFA, and the first CFA of the neurological evaluation scale (NES) on a sample of mostly medication naïve Black Africans, of Nigerian ancestry, with first episode schizophrenia. Also investigated was the relationship between the component factor structure and a range of clinical characteristics of the disease.

2. Materials and methods

2.1. Subjects

The study was conducted among patients presenting for biomedical treatment for the first time as out-patients or in-patients at two general hospitals with psychiatric units in Ibadan south-Western Nigeria.

The subjects comprised of mostly anti-psychotic naive patients with first episode schizophrenia, schizo-affective disorders, and schizophreniform disorder (6.0% had less than 12 weeks of lifetime oral antipsychotic exposure). The diagnosis of the relevant disorder was verified using criteria from the diagnostic and statistical manual for mental disorders-fourth edition (DSM-IV) [13]. Patients were eligible if they were aged between 16 and 45 years. The procedure of the study was explained to all eligible patients in either English or the local Yoruba language. Participants were those who provided written consent before interviews were conducted. We excluded patients with previous treatment with long acting depot antipsychotics and those with current substance abuse meeting DSM IV criteria. Also excluded were patients with significant physical illnesses. This was determined from the result of a full physical examination and appropriate laboratory investigations. Patients with mental retardation were excluded based on clinical history alone. On the bases of these criteria we recruited a total of 84 patients consecutively over a period of 26 months, between April 2009 and June 2011. They were cross-sectionally evaluated as far as possible before antipsychotic medications were prescribed. A wash-out period of one week was allowed for the 5 (6.0%) participants who had a lifetime exposure to oral antipsychotics. In the few cases where severity of psychopathology prevented immediate assessment, the evaluation was conducted as soon as patients were deemed well enough to co-operate with the examinations. We obtained baseline information on demographic, personal, medical, and psychiatric history, as well as family history.

Ethical approval for the study was obtained from the University of Ibadan/University College Hospital Joint Ethics Committee.

2.2. Measures

The structured clinical interview for DSM-IV- patients edition (SCID-P) [14] was employed in the recruitment of patients. The SCID-P provides for a standardized assessment that generates DSM-IV diagnoses using a semi-structured interview.

2.3. Neurological assessment

The NSS were evaluated using the 26 items neurological evaluation scale (NES) [15]. The NES include neurological tests such as tandem walk, rapid alternation movements, finger to thumb opposition, the finger-to-nose test, audiovisual integration, stereognosis, graphesthesia, extinction, and right to left confusion, first-ring test, the first-edge-palm test, the Ozeretski test, and rhythmic tapping test. The other signs assessed by the NES include cerebral dominance, short-term memory, frontal release signs and eye movement. The NES items are scored with reference to the descriptive anchors provided on a three-point scale (no abnormality = 0; mild, but definite impairment = 1; marked impairment = 2) with the exception of 'suck' and 'snout' reflexes which are scored 0 or 2. In this study, a neurological abnormality was defined as the rating of 2 on any 1 item on the NES. The tests were administered by a psychiatrist who had been trained in the use of the NES. Each item was assessed according to a fixed order.

2.4. Psychiatric assessment

The severity of the baseline psychopathology was evaluated by administering the positive and negative syndrome scale (PANSS) [16]. The model of the PANSS adopted in this study [17] include factors for 'positive symptoms' (delusions, hallucinations, unusual thought content, suspiciousness and grandiosity), 'negative symptoms' (lack of spontaneity, blunted affect, emotional withdrawals, apathetic social withdrawals, motor retardation, poor rapport and active social avoidance), 'disorganization' (stereotyped thinking, poor attention, disorientation, conceptual disorganization and difficulty in abstraction), 'excitement' (poor impulse control, excitement, hostility, and uncooperativeness), and 'emotional distress' (anxiety, depression, guilt, and tension).

The overall clinical status was assessed using the clinical global impression (CGI-Severity) [18], while pre-morbid adjustments and depression in schizophrenia were explored using the pre-morbid adjustment scale (PAS) [19], and the calgary depression scale for schizophrenia (CDSS) [20], respectively. These measures have been used for the assessments of African patients with schizophrenia in previous studies [21].

In this study, duration of untreated psychosis (D.U.P) was defined as the period in months from the onset of psychotic phenomena to first presentation to the psychiatric unit. In line with previous studies, onset of psychosis was defined as the presence for one week or more of one of the following psychotic symptoms; delusions, hallucinations, marked thought disorder, marked psychomotor disorder, and bizarre, grossly inappropriate and/or disorganized behavior, with a marked deterioration of functioning.

2.5. Statistical analysis

Analyses were conducted using SPSS version 18.0 and AMOS 18.0. Descriptive statistics such as means and standard deviations were used to summarize quantitative variables, while frequencies and proportions were used for discrete variables. EFA was conducted on NES items that were abnormal in more than 10% of the entire sample. Items testing for cerebral dominance were excluded. Factors obtained following initial maximum likelihood exploration were further rotated using the varimax procedure. Factors are reported when they have eigenvalues greater than unity and when they contribute at least 10% to the cumulative variance [2].

A four factor loading was generated in EFA. These factors were given conceptual names based on previously published categories: 'PMS', 'EYE', 'MCG', and 'STS'. Following EFA, maximum-likelihood estimation of CFA was conducted. We considered four competing