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Validated five-factor model of Positive and Negative Syndrome Scale for schizophrenia in Chinese population

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ABSTRACT

The Positive and Negative Syndrome Scale (PANSS) is the most widely used instrument to assess the severity of symptoms of schizophrenia. Most studies have showed that PANSS measures five dimensions of symptomatology of schizophrenia. However, few studies have ever investigated the structure of PANSS in Chinese schizophrenia population. We recruited two large independent study samples including 903 and 942 Chinese schizophrenia patients and examined the underlying structure of PANSS. By building a confirmatory factor analysis (CFA) model based on the factor loadings of the exploratory factor analysis (EFA) and by testing the CFA model in an independent validation sample, we found that PANSS scores consisted of five factors, which were positive factor, negative factor, excitement factor, depression factor, and cognitive factor. The items loaded on these factors were similar to the consensus items published in previous studies except for PANSS items P2 conceptual disorganization, P5 grandiosity, N5 abstract thinking, and G11 poor attention. This difference might be due to the influence of culture on clinical presentation of schizophrenia. By elucidating the structure, symptoms of Chinese schizophrenia patients could possibly be deconstructed and investigated in future studies.

1. Introduction

Positive and Negative Syndrome Scale (PANSS) is one of the most widely used instruments to measure the severity of schizophrenia. In the instrument, a total of 30 items were designed to assess the severity of three prior dimensions of the symptoms: positive syndrome (7 items), negative syndrome (7 items), and general psychopathology (16 items) (Kay et al., 1987). However, Kay and Sevy (1990) later found that the 30 items measured four factors of symptoms by examining the eigenvalue of PANSS. This 4-factor model was named as pyramidical model, and the factors were positive factor, negative factor, excitement factor, and depression factor. Since then, different structures of PANSS have been reported. Peralta and Cuesta (1994) found that the positive and negative factors could be further deconstructed into three independent dimensions: positive, disorganized, and negative symptoms, suggesting a five-factor model of PANSS. Van den Oord et al. (2006) found that six-factor model, which included an additional "withdraw" dimension of symptoms, could fit the observed PANSS data better. Seven-factor model has also been reported by employing exploratory factor analysis of PANSS scores (Emsley et al., 2003).

In spite of the variety of factor models reported, five-factor model of PANSS is the most commonly reported and adopted model in literature (Lehoux et al., 2009). In the model, selected items of PANSS are grouped based on their correlations into five dimensions, which are named as positive factor, negative factor, cognitive factor, excitement factor and depression factor. Although this way of deconstruction of schizophrenia symptomatology is generally accepted, controversies come when deciding which items shall be assigned to each of the five dimensions. Different studies usually report different types of five-factor models, and no model has reached broad congruence to date. Wallwork et al. (2012) have attempted to build a consensus model by assigning only the consistent PANSS items to each of the five factors based on previously published models. The good fit of the model on their dataset and an independent validation dataset suggests that a better model could be achieved by considering the consensus items in previously published models.

The lack of consistency in the specific forms of five-factor model has been partially attributed to methodological reasons, such as factors with cross-loading are not included in constructing the model (Van den Oord et al., 2006). However, by including cross-loading items, the independence of the factors and the fits of the models might be compromised. A lack of validation of the derived model in an independent study sample may also contribute to the inconsistency. We have reviewed a total of 30 published articles on PANSS since 1990, among which only few have validated the models in an

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independent study population. Applying the model on the same dataset from which the model is derived tends to yield good fits, but the generalizability is not guaranteed (van der Gaag et al., 2006a). Thirdly, cultural difference may also affect clinical presentations. Studies have found that Asian patients with schizophrenia are more likely to show auditory hallucination, neglect of activities, loss of appetite, be irritable and more likely to get family supports (Krajewski-Jaime, 1991; Bhugra et al., 1999; Mass et al., 2000; Versola-Russo, 2006). These cultural impacts could possibly introduce variations in the apparent structure of PANSS across studies. Lastly, difference in ethnicity also influences the way of clinical presentation (Lim et al., 2011), which implies that the factor structure of PANSS may also be affected by ethnic difference. In addition, among the 30 reviewed articles, only three are based on Asian population (Kawasaki et al., 1994; Higashima et al., 1998; Kim et al., 2012) and no study has been performed on Chinese population, suggesting that more studies on Asian population are needed to balance the view of the structure of PANSS.

The aim of this study was to investigate the structure of PANSS of Chinese schizophrenia population. To enhance the validity and generalizability of the factor model, we employed two large independent study samples, built a confirmatory factor analysis (CFA) model based on the factor loadings of exploratory factor analysis (EFA) from one sample, and validated the model on the other independent study sample. In constructing the CFA model, we also took into account of 32 previously published models such that only the consensus items were assigned to a factor. The results of this study could help in understanding the structure of the symptomatology of schizophrenia and could also serve as a reference for future studies on PANSS in Chinese schizophrenia population.

2. Methods

2.1. Study samples

Two study samples were used in identification and validation of the factor structure of PANSS of Chinese schizophrenia patients. The first study sample comprised 903 schizophrenia patients recruited in the Institute of Mental Health of Singapore between 2005 and 2008. Patients were included if they were Chinese and if they met SCID-DSM-IV schizophrenia diagnostic criteria. Patients were excluded from the study if they had organic brain disorder or mental retardation. Ethics approvals for the studies were provided by the hospital and regional ethics committees, and participants must provide informed consent to participate in our study. The PANSS was rated by clinicians and research psychologists during a three hour interview of the patients. A total of 12 raters were involved in the exploratory and validation samples, but there were more raters in the second study. All raters were trained on administration of the SCID and PANSS instruments such that the intra-class correlation coefficient was 0.80 or higher. Demographic information including age and gender was also collected during the interview. The second study sample comprised 942 schizophrenia patients recruited from the Institute of Mental Health of Singapore between 2008 and 2012. The inclusion and exclusion criteria were the same as the first study except that majority were English speakers and were less than 55 years old. In elucidating the structure of PANSS, we used the first study sample as the exploratory sample, based on which a model was derived, and we used the second study sample as the validation sample, based on which we validated the fittings of the derived model.

2.2. Literature review

We performed a literature review to retrieve the published five-factor models in English journals since 1990. A total of 30 articles with 32 specified models were identified (Kay and Sevy, 1990; Lindström and Von Knorring, 1993; Bell et al., 1994; Kawasaki et al., 1994; Lindenmayer et al., 1994, 1995a,b; Dollfus and Petit, 1995; Fredrikson et al., 1997; Marder et al., 1997; White et al., 1997; Higashima et al., 1998; Lancon et al., 1998, 1999, 2000; Bunk et al., 1999; Lykouras et al., 2000; Mass et al., 2000; Wolthaus et al., 2000; El Yazaji et al., 2002; Drake et al., 2003; Emsley et al., 2003; Fitzgerald et al., 2003; Lee et al., 2003; Fresan et al., 2005; van der Gaag et al., 2006a, 2006b; Levine and Rabinowitz, 2007; Citrome et al., 2011; Kim et al., 2012; Wallwork et al., 2012). We applied these 32 models on our two independent study samples as well as the combined sample to see whether the models fit the PANSS scores of Chinese schizophrenia patients. These models were also used in our model building process such that only the consistent items in previous models were used in our model construction.

2.3. Model building and validation

In order to reveal the factor structure of the PANSS, we adopted a conventional two-step approach by performing EFA and CFA to identify the factor model. To avoid overfitting, we derived the model based on the exploratory sample, and further validated the derived model in the validation sample. In EFA, we first explored the data by fitting EFA models with 3 to 7 factors on the dataset, which encompass majority of the factor models in literature. Both the fitness and factor loadings of the EFA models were considered in determining the number of factors present in the exploratory sample, such that the model fitted the dataset and the loadings on the factors were large. Once the number of the factors was determined, a CFA model was then constructed based on the method developed by Wallwork et al. (2012) on assigning items to each factor. Particularly, we assigned each item to a factor only if the item had been assigned to the factor in more than 20 among the 32 reviewed studies. The fitness of the CFA model was assessed and validated in the independent validation dataset to ensure the reliability of the model. The final constructed model was then compared and contrasted with previously published five-factor models.

In model building and validation, to better elucidate the nature of the score, all PANSS score was treated as ordinal data in this study. Missing data were also imputed based on full information maximum likelihood algorithm. In model assessment, a model was considered to fit the data if Comparative Fit Index (CFI) and Non-Normed Fit Index (NNFI) were more than 0.900 and Root Mean Square Error of Approximation (RMSEA) was less than 0.080 (Kline, 2010). All analyses were conducted under M-Plus 6.11.

3. Results

3.1. Descriptive statistics of study samples

The descriptive statistics of the study samples are shown in Table 1. Patients in the validation sample were younger than patients in the exploratory sample, but they have more severe symptoms. The proportion of males in the validation sample was also higher than the proportion in the exploratory sample. No PANSS scores were missing in the exploratory sample, and 0.36% of PANSS scores was missing in the validation study sample.

3.2. Determination of the number of factors

We examined the exploratory study sample by fitting the data with 3 to 7 factor EFA models, which encompass majority of the factor models of PANSS in literature. As shown in Table 2, six-factor model fits the data best by considering the fittings of the model and the maximum correlations among the factors, suggesting that there were six factors underlying the PANSS scores. Principal component analysis on the sample correlation matrix also indicated that there

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