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The factor structure and clinical utility of formal thought disorder in first episode psychosis

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ABSTRACT

Background: Formal thought disorder (FTD) is a core feature of psychosis, however there are gaps in our knowledge about its prevalence and factor structure. We had two aims: first, to establish the factor structure of FTD; second, to explore the clinical utility of dimensions of FTD in order to further the understanding of its nosology.

Methods: A cross-validation study was undertaken to establish the factor structure of FTD in first episode psychosis (FEP). The relative utility of FTD categories vs. dimensions across diagnostic categories was investigated.

Results: The prevalence of clinically significant FTD in this FEP sample was 21%, although 41% showed evidence of disorganised speech, 20% displayed verbosity and 24% displayed impoverished speech. A 3-factor model was identified as the best fit for FTD, with disorganisation, poverty and verbosity dimensions (GFI = 0.99, RMR = 0.07). These dimensions of FTD accurately distinguished affective from non-affective diagnostic categories. A categorical approach to FTD assessment was useful in identifying markers of clinical acuteness, as identified by short duration of untreated psychosis (OR = 2.94, $P < 0.01$) and inpatient treatment status (OR = 3.98, $P < 0.01$).

Conclusion: FTD is moderately prevalent and multi-dimensional in FEP. Employing both a dimensional and categorical assessment of FTD gives valuable clinical information, however there may be a need to revise our conceptualisation of the nosology of FTD. The prognostic value of FTD, as well as its neural basis, requires elucidation.

1. Introduction

Language dysfunction plays a central role in the clinical presentation of psychosis. Crow postulated that schizophrenia is the price that man has paid for the development of language and, since Bleuler, loosening of associations has been recognised as a core feature of psychosis (Crow, 1997; Bleuler, 1958). Language disturbances may represent a psychosis endophenotype and disorganised speech may be considered to exist on a continuum (Raballo and Parnas, 2011; Remberk et al., 2012; Roche et al., 2015). Reported estimates of FTD prevalence in mental illness vary widely, depending on clinical assessment tool utilised and the population studied (Pearlson et al., 1989; Marengo and Harrow, 1987). Although there are many possible levels of language disturbance in psychosis only FTD is included in the major diagnostic classification systems (First et al., 2002; World Health Organization, 1992). FTD is not a unitary construct, however, and up to six different domains are identified on factor analysis (Cuesta and Peralta, 1999).

Andreasen described a bipolar "negative" versus "positive" factor structure to FTD and, to a certain degree, these FTD subtypes have distinct clinical and neuro-anatomical correlates (Andreasen, 1979). Negative FTD is quite predictive of poor functional outcome (Andreasen and Grove, 1986; Wilcox et al., 2014), and has been associated with reductions in medial frontal/orbitofrontal cortical grey matter (Sans-Sansa et al., 2013). Conversely, positive FTD may be an indicator or greater symptomatic severity (Roche et al., 2015; Jampala et al., 1989), and may be associated with volume reductions in Wernicke's and Broca's areas (Sans-Sansa et al., 2013). Verbiage disturbance and

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disorganised speech correctly identify up to 91% of schizophrenia versus mania diagnoses, however a two-factor structure does not adequately reflect the full clinical complexity of FTD (Taylor et al., 1994). Other dimensions, such as "idiosyncratic" and "attentional", have more recently been identified and demonstrate some diagnostic validity (Cuesta and Peralta, 1999, 2011a).

Authors of the Diagnostic and Statistical Manual, 5th Edition (DSM-V) emphasise the importance of dimensional assessment of psychopathology (Heckers et al., 2013). The limitations of a categorical approach to diagnosis are well recognised: diagnostic groups have significant overlap in their clinical presentation, management strategies, prognosis, genetic underpinnings and clinical course (Kamphuis and Noordhof, 2009; Owen et al., 2007; Whitty et al., 2005; Bromet et al., 2011; Van et al., 2009). To date most FTD research has investigated only those diagnosed with schizophrenia, often drawing from hospital and institutional samples (Taylor et al., 1994; Berenbaum et al., 1985; Mortimer et al., 1990). Although there has been a move towards investigating FTD in mixed diagnostic samples, the clinical utility of FTD dimensions has received little investigation (Cuesta and Peralta, 2011a). Furthermore, to date there has been no study of FTD in FEP. This is important because this population has had limited exposure to neuroleptics, the long-term effects of which can influence language function (Spohn et al., 1986; Goldberg et al., 2000).

1.1. Aims

To investigate the prevalence and factor structure of FTD in a mixed diagnostic FEP sample. To compare the clinical utility and diagnostic validity of dimensional vs. categorical assessment of FTD.

1.2. Objectives

1. To perform a cross-validation study of the factor structure of FTD, as assessed by the Scale for the Assessment of Positive Symptoms (SAPS) and the Scale for the Assessment of Negative Symptoms (SANS), in a randomly-divided FEP sample (Andreasen, 1984a,b).
2. To establish the prevalence of FTD in a FEP sample.
3. To establish whether dimensional FTD identified through factor analysis contributes to diagnostic validity and clinical utility in excess of categorical FTD assessment. A clinical characteristic possesses utility if it "provides nontrivial information about prognosis and likely treatment outcomes, and/or testable propositions about biological and social correlates" (Kendell and Jablensky, 2003).

2. Materials and methods

2.1. Participant selection

We included individuals aged 16–65 years old who were diagnosed with affective and non-affective FEP by an early intervention in psychosis (EIP) service between February 2006 and July 2014. Participants were referred to the EIP service from general practitioners, outpatient departments and inpatient units in three defined mental health catchment areas in the Dublin Mid-Leinster region of Ireland. This includes a total catchment of 390,000 individuals, and includes referrals from a private psychiatric hospital located within the catchment area.

2.2. Exclusion criteria

Individuals with learning disability and those who had been treated with antipsychotic medication for more than 30 days were excluded from this study.

2.3. Structured clinical assessments

Participants' diagnosis was established with the SCID-IV. The SCID-IV was also used to assess the presence of categorical FTD, which it defines as disorganised speech, with derailment, tangentiality and incoherence given as examples. Severity of FTD and other psychotic symptoms was assessed with the SAPS and SANS. The SAPS includes 8 items typical of positive thought disorder, and the SANS contains 4 items that reflect alogia. SAPS and SANS symptoms are rated on a 6-point scale. Depressive symptomatology was rated with the Calgary Depression Scale for Schizophrenia (CDSS) (Addington et al., 1993). Duration of untreated psychosis (DUP) was estimated with the Beiser Scale, or the SCID if the Beiser Scale was unavailable (Beiser et al., 1993; First et al., 2002).

Assessments were performed by 20 clinicians, 14 of whom were post-membership psychiatry registrars and the remainder of whom were members of allied clinical specialties. Inter-rater training for SCID, SAPS and SANS assessments was completed for every assessor, using live and video-recorded interviews. Agreement on SCID-IV diagnosis was at least 0.82 and all Kappa values for distinguishing schizophrenia spectrum from non-schizophrenia spectrum disorders were 1.0. Intra-class correlation coefficients (ICC) between raters were determined for the SAPS and SANS using two-way mixed model with absolute agreement. ICC may be interpreted as excellent (>0.75), good (0.60–0.74), fair (0.40–0.59) and poor (<0.40) (Cicchetti, 1994). For the SAPS the median ICC was 0.91 (range 0.82–1.0) and for the SANS it was 0.89 (range 0.67–0.99).

2.4. Statistical analysis and handling of data

Statistical analysis was carried out using IBM SPSS Statistics Software Version 20 and IBM Amos Software Version 20 (IBM SPSS, 2011; IBM Amos, 2011). Variables that were not normally distributed were transformed using square root or logarithmic transformation. Following log transformation FTD dimensions remained skewed and, therefore, their original non-transformed values were compared across diagnostic groups using the non-parametric Kruskal Wallis test. Binary logistic regression was used to investigate the predictors of binary dependent variables. Several measures of multicollinearity were assessed including correlation coefficients, the determinant of the correlation matrix, tolerance and variance inflation factor.

A cross-validation approach to factor analysis involves exploratory factor analysis (EFA) in one half of a sample and confirmatory factor analysis (CFA) in the other half (de Vet et al., 2005). The full sample was stratified by diagnosis (schizophrenia, mania and substance-induced psychotic disorder). These diagnoses differ in the quality and frequency of associated FTD and it was important that they were equally distributed in each group (Hoffman et al., 1986; Stone et al., 2013). A split-half sample was randomly selected within each diagnosis category using a random number generator function in SPSS. EFA was carried out on one half of the sample using principal components analysis (PCA) in SPSS. In addition to clinical interpretability, individual factors were chosen based on eigenvalues greater than 1.0, visual inspection of the Scree Plot and communality values exceeding 0.4, using an approach previously employed in this area (Cuesta and Peralta, 2011a). A varimax rotation was used on the initial factors extracted to aid interpretability.

CFA was performed using Amos, with factors extracted using Unweighted Least Squares (ULS), rather than Maximum Likelihood, because the distribution of FTD ratings was non-normal (Cuesta and Peralta, 1999). For ULS analysis, higher Goodness of Fit Index (GFI) values and lower Root Mean Square Residual (RMR) values indicate a better fit of the model. Our sample size (n = 603) satisfied conservative recommendations in relation to required sample size to carry out a factor analysis, whether that is a minimum subject to variable ratio of