



## A rating scale for the assessment of objective and subjective formal Thought and Language Disorder (TALD)



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### ARTICLE INFO

#### Article history:

Received 28 July 2014

Received in revised form 13 October 2014

Accepted 19 October 2014

Available online 17 November 2014

#### Keywords:

Formal thought disorder

Schizophrenia

Mania

Depression

Principal component analyses

### ABSTRACT

Formal thought disorder (FTD) is a core syndrome of schizophrenia. However, patients with other diagnoses, such as mania and depression amongst others, also present with FTD. We introduce a novel, comprehensive clinical rating scale, capturing the full variety of FTD phenomenology including subjective experiences.

The 30-item Thought and Language Disorder (TALD) scale is based on a detailed review of the literature, encompassing all formal thought disorder symptoms reported from the early 20th century onwards. Objectively observable symptoms as well as subjective phenomena were included. Two hundred and ten participants (146 patients ICD-10 diagnoses: depression  $n = 63$ , schizophrenia  $n = 63$ , mania  $n = 20$ ; 64 healthy control subjects) were interviewed and symptoms rated with the TALD, TLC, HAM-D, YMRS and SAPS/SANS. A principal component analyses was performed for the TALD to differentiate sub-syndromes.

The principal component analysis revealed four FTD factors; objective and subjective as well as positive and negative factor dimensions. The correlation analyses with the TLC and the SAPS/SANS FTD sub-scores demonstrated the factor validity for the objective factors. The different diagnoses showed a distinct pattern of symptom severity in each of the factors, with mania patients exhibiting the highest value in the positive, objective dimension.

The scale showed good psychometric results, which makes it a practicable, nosologically-open instrument for the detailed assessment of all FTD dimensions. The results strengthen the importance of subjective symptom assessment reported by the patient.

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### 1. Introduction

Formal thought disorders (FTDs) are present in the majority of psychiatric patients, such as in schizophrenia, mania, depression, organic diseases, and personality disorders. Despite this fact, FTD has traditionally been most closely linked to schizophrenia, since [Bleuler \(1911\)](#) saw “loosening of associations” (“Lockerung der Assoziationen”) ([Bleuler, 1911](#)) as its most fundamental symptom.

Specific rating scales for FTD have been developed. These include self report scales ([Barrera et al., 2008](#)), which lack objective symptoms; others do not capture more subtle subjective, hard to grasp changes of thought processes (e.g. [Liddle et al., 2002](#)). Several scales require the detailed coding of recorded verbal transcripts on paper ([Johnston and](#)

[Holzman, 1979](#); [Liddle et al., 2002](#)), a reliable method, which, however, is extremely time consuming. Again other scales focus primarily on very specific linguistic ([Docherty et al., 1996](#); [Chen et al., 1999](#); [Bazin et al., 2005](#)) or psychodynamic hypotheses ([Johnston and Holzman, 1979](#)), but neglect the broad variety of FTD symptoms.

Thus far, the only FTD rating scale based on a descriptive psychopathological tradition is the ‘Scale for the Assessment of Thought, Language and Communication’ (TLC [Andreasen, 1986](#); [Andreasen and Grove, 1986](#)). In a previous validation study of ours ([Nagels et al., 2013](#)), a trifactorial TLC structure was yielded for its German translation. The factorial structure of the TLC differed across investigations. A range from two ([Harvey et al., 1992](#); [Taylor et al., 1994](#)) or three ([Berenbaum et al., 1985](#); [Andreasen and Grove, 1986](#); [Andreou et al., 2008](#)) to six ([Peralta et al., 1992](#); [Cuesta and Peralta, 2011](#)) factor solutions was reported, which can be ascribed to methodological differences in the statistical analysis (e.g. eigenvalue vs. visual inspection of screeplot) and the diversity of patient groups. A problem with the TLC lies in the

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fact that not all FTD symptoms are included, several of the definitions are somewhat idiosyncratic and no subjective symptoms are coded.

The dimension of subjective FDS has been mostly neglected in the past despite a more recent reminder of their importance for the understanding of the patient's view on the world and self (Parnas et al., 2005; Parnas et al., 2013). In the Bonn Scale for the Assessment of Basic Symptoms (BSABS) (Gross et al., 1987; Klosterkötter et al., 1996), and the Examination of Anomalous Self Experiences (EASE) (Parnas et al., 2005), which focus on prodromal states of schizophrenia, several phenomena referring to subjective alterations in the train of thought are included. The self-report "paper-pencil" rating developed by Barrera et al. (2008) asks for changes in thought and language, allowing only for dichotomous (yes/no) answers. However this is not accompanied by a clinical interview, and is thus likely to lead to misunderstandings regarding the phenomena in question. Since they are often subtle or difficult to describe, a detailed discussion with the patient is necessary for a mutual understanding of the experiences in question. Even though the majority of patients are able to reliably describe their subjectively experienced FTD (Jaspers, 1919; Barrera et al., 2008), self-reported symptoms such as *inhibited thinking* or *blocking* phenomena, amongst others, are not included in the presently available clinical rating scales.

The purpose of the current investigation was to introduce and validate a novel, comprehensive clinical rating scale in the tradition of descriptive psychopathology (Jaspers, 1946) for the assessment of the severity of a wide range of FTD. This was based on an extensive review of the German, British and Anglo-American literature spanning the time from the early 20th century up to the present. The current study thus had three aims: (1) to establish and validate a comprehensive, operationalised clinical rating scale for FTD, including objective and subjective phenomena, (2) to compare the results with existing scales and (3) to evaluate the factorial FTD structure across different diagnoses.

## 2. Method

### 2.1. Generation of definitions

In a thorough and meticulous review process all available FTD symptoms, their definitions and, if available, examples and related phenomena were collected from the early German (Kraepelin, 1899, 1910–1915; Bleuler, 1911, 1916; Jaspers, 1919; Schneider, 1946) and contemporary German, British and US American literature (Goldstein, 1944; Andreasen, 1984a, b; Fish, 1984; Oltmanns et al., 1985; Andreasen, 1986; Andreasen and Grove, 1986; Holzman et al., 1986; Gross et al., 1987; Talbott et al., 1988; Andreasen and Black, 1991; Kaplan and Sadock, 1991; Peralta et al., 1992; Huber, 1994, 2005; Docherty et al., 1996; Chen et al., 1999; Cuesta and Peralta, 1999, 2011; Kaplan and Sadock, 2000; Gordinier and Docherty, 2001; Dörner et al., 2002; Liddle et al., 2002; Arolt et al., 2004; Bazin et al., 2005; McKenna and Oh, 2005; Trabert and Stieglitz, 2007; Barrera et al., 2008; Ebert and Loew, 2008; Möller et al., 2008; Rush et al., 2008; Berger, 2009; David et al., 2009; Gelder et al., 2009; Möller et al., 2009; Semple and Smyth, 2009; Payk, 2010; Scharfetter, 2010; Marengo et al., 1986). In the first step, a total of 119 symptom terms and 224 descriptions were extracted. Secondly, from these terms and descriptions, identical, overlapping, not operationalisable, and antiquated definitions were grouped together. In a third step, within each of these single symptom groups, the definition, which describes the phenomenon in question most accurately and reliably was selected. In most of the cases, the existing definitions were modified and condensed. Some were generated de novo in consensus conferences of the authors. This step was guided by high understandability, descriptiveness, our own clinical experience and the inclusiveness of all potential thought and language related symptoms. A list of original definitions, our modifications and the relevant literature are listed in Appendix II (see Appendix II in the online version). Phenomena rated

objectively through the probands' verbal outputs and those derived from the patients' descriptions as purely subjective phenomena were included. Fourthly, because identical phenomena were termed differently in the literature, the most descriptive term was chosen for each definition. Fifth, exemplar questions to elicit or ask about symptoms were either taken from the literature or generated de novo. Sixth, clinical examples were mostly taken from our own patients or from the literature. Seventh, the graduations of severity were generated (cf. TALD Manual, Appendix I, supplementary material) using our own clinical experience in consensus conferences of the authors. As a general rule for graduation the degree of hindered communication served as guideline. Severity for a FTD phenomenon ranges from 0 (= non present) to 4 (= severe), whereas 1 reflects a doubtful pathological character, which may also occur in healthy people. A comprehensive manual in English and German including general instructions, all FTD phenomena, their definitions, individual examples (including questions), differentiating phenomena and graduation information was generated (cf. Appendix I for the English version; for the German version please contact the authors, see Appendix II for construction of TALD definitions).

### 2.2. Assessors

The raters (M.S., S.G., C.S., M.F., T.H., M.K.) were clinically trained psychiatrists, familiar with the assessment of psychopathological symptoms. All raters were acquainted with the definitions and detailed descriptions given in the manual. Three rater-training sessions were performed including video training sessions of TALD patient interviews. The rating results were compared and jointly discussed afterwards. For the assessment of final interrater reliability, the raters independently scored all rating scales used in this study (TLC, SAPS/SANS, YMRS, TALD, HAMD) (Hamilton, 1960; Young et al., 1978; Andreasen, 1984a, b; Andreasen, 1986) directly after a patient was interviewed. The raters achieved good interrater reliabilities (ICC) for the TLC (.79), SAPS/SANS (.89) and YMRS (.79). The new TALD scale revealed an interrater reliability of .80.

### 2.3. Participants

Patients were recruited and interviewed at the Department of Psychiatry and Psychotherapy, Philipps-University Marburg (in- and outpatients), Department of Forensic Psychiatry, Vitos Haina Forensic Psychiatric Hospital (chronic in- and outpatients) and the Department of Psychiatry, Psychotherapy and Psychosomatics, University of Freiburg (in- and outpatients). Patients met ICD-10 criteria for depressive episode (F32.x, n = 63, f = 29/m = 34), schizophrenia (F20.x, n = 63, f = 18/m = 45) and bipolar disorder, manic episode (F31.0, F31.1, F31.2, n = 20, f = 6/m = 14) (see Table 1). Healthy control subjects (n = 64, f = 36/m = 28) were recruited via postings in local newspapers. They were free of past and current psychiatric or

**Table 1**  
Sample characteristics.

	Group (n = 210)			
	Depression (n = 63)	Schizophrenia (n = 63)	Mania (n = 20)	Healthy (n = 64)
Age	45.84 (14.74)	36.10 (12.52)	45.60 (17.26)	39.03 (12.79)
Education (years)	10.79 (1.65)	10.19 (1.71)	10.90 (1.71)	11.35 (1.48)
TLC	2.70 (4.01)	10.51 (10.95)	15.35 (9.20)	.62 (1.21)
SAPS	5.43 (6.51)	28.16 (23.74)	29.65 (15.86)	.75 (1.60)
SANS	32.22 (21.95)	32.24 (18.43)	9.75 (8.88)	2.42 (3.32)
HAMD	16.29 (7.07)	11.29 (7.27)	5.30 (3.05)	1.45 (2.49)
YMRS	2.37 (3.18)	6.41 (5.85)	16.25 (5.41)	.45 (.96)

Values indicate means and standard deviations (in brackets).

**Table 2**  
Frequencies of thought and language disorders.

Items	N	%
Rumination	125	60.5
Thought interference	102	48.6
Blocking	90	42.9
Expressive speech dysfunction	90	42.9
Tangentiality	85	40.5
Circumstantiality	85	40.5
Pressure/rush of thought	72	34.3
Poverty of thought	67	31.9
Derailment	66	31.4
Inhibited thinking	66	31.4
Restricted thinking	61	29.0
Slowed thinking	61	29.0
Dysfunction of thought initiative and intentionality	61	29.0
Rupture of thought	60	28.6
Logorrhoea	58	27.6
Concretism	58	27.6
Crosstalk	57	27.1
Receptive speech dysfunction	57	27.1
Poverty of speech	50	23.8
Pressured speech	47	22.4
Poverty of content of speech	42	20.0
Dissociation of thinking	28	13.3
Semantic paraphasia	26	12.4
Phonemic paraphasia	26	12.4
Manneristic speech	24	11.4
Perseveration	17	8.1
Neologisms	15	7.1
Verbigeration	5	2.4
Echolalia	3	1.4
Clanging	0	0

Note: Criterion = rating values > 0. Items with low prevalence ( $\leq 5\%$ ) are marked grey.

neurological illnesses, as assessed by a psychiatrist. Psychopathological symptoms were assessed using the TALD, SAPS/SANS, HAM-D and the YMRS in all groups. All patients received antipsychotic medication, antidepressants and/or mood stabilizers.

#### 2.4. FTD assessment and rating procedure

FTD and other psychopathological phenomena were evaluated during a 50-minute clinical interview and were scored immediately afterwards. The presence of subjective phenomena (e.g. inhibited thinking) encompassed the preceding 24 h.

The interview consisted of two different parts. First, the participant was asked about general issues, e.g. topics of everyday life, hobbies etc. Thereafter, a semi-structured part followed, where particular symptoms were explored in more detail (see “Example” and “Question” in the Manual). The formulations were adjusted individually to each patient and situation. In particular, the subjective FTD phenomena were explored in detail. Therefore, the assessor described subjective symptoms with the aid of the provided examples and asked about their presence or absence. If necessary, the rater asked additional questions (e.g. “Are you easily distracted by events happening around you, such as noises for example?”) until the subjective characteristics of the given phenomenon were sufficiently and satisfactorily understood.

In the course of the interview, the clinician also raised more emotional topics or talked about the content of delusions if present, since sometimes certain phenomena only occur in the context of

emotional “stress”. During the interview the patient was given enough time to speak freely for several minutes, when possible, after each question or prompt.

#### 2.5. Statistical analysis

The Statistical Package for Social Sciences (SPSS) Software package was used to perform a principal component analysis (PCA) with varimax rotation. Because of the number of participants ( $n > 200$ ), factor loadings  $< .37$  are not presented, since smaller values should not be considered significant and are therefore not selected to build subscales.

Correlations of FDS measures from the SAPS, SANS and TLC and their relationship to the factors from the TALD were calculated using the regression values for each factor in each participant (for a similar approach see Peralta et al., 1992). The SAPS sub-score values for positive FTD (sub-scale IV.) as well as the negative FTD sub-score (sub-scale II., *Alogia/Paralogia*) were calculated and correlated with the TALD factors. The TLC factor values isolated by means of a previously reported factor analysis (Nagels et al., 2013) were also correlated (Pearsons' correlation coefficient) with the obtained factors of the new TALD scale.

To find group (i.e. diagnosis) specific patterns within the factor structure, a between-group ANOVA was calculated, based on the mean subscale values for each factor, separately.

### 3. Results

#### 3.1. Frequencies of TALD items

First, the frequency of each of the TALD phenomena was calculated. *Rumination* occurred most frequently (60.5%), followed by *thought interference* (48.6%) and *blocking* (42.9%) (see Table 2). On the other hand, *verbigeration*, *echolalia* and *clanging* were rarely observed ( $< 5\%$ ). Due to their low prevalence, the latter three items were discarded from the factor analysis.

#### 3.2. Factorial structure of the TALD

The factor analysis with varimax rotation revealed a four-factorial solution for the 27 TALD items occurring with sufficient frequency ( $> 5\%$ ; see Table 3). A Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity revealed a score of .873 for sampling adequacy, which indicates distinct and reliable factors.

#### 3.3. Internal consistency

The internal consistency derived from the four factors (Cronbach's alpha) was excellent for the first two factors and acceptable for Factor III and Factor IV. It should be noted that the last two factors comprised only three and two items, respectively.

No significant correlations were found between the four TALD factors. Neither inter-item correlations  $> .82$  were found, suggesting a reliable discriminatory power between the items.

#### 3.4. Relation between TLC and TALD sub-scales

The total scores for the TALD and the German TLC version (Nagels et al., 2013) were correlated (Pearsons'  $r = .835$ ,  $p < .001$ ). The correlation analysis between the TLC and the TALD sub-scales revealed a significant relation between the first factors (see Table 4). In a previous study of ours (Nagels et al., 2013), TLC Factor I was identified as a ‘disorganisation’ (Andreasen and Grove, 1986) or positive FTD sub-syndrome.

The subjective TALD factors (II and IV) revealed weak correlations with the TLC sub-scales. TALD Factor II, referred to as the subjective negative FTD sub-syndrome, revealed mild correlations with the

**Table 3**  
Factorial structure of the TLD.

Factor	Eigenvalue	Variance	Cumulative variance	Items	Loadings	Cronbach's $\alpha$
I. Objective positive	7.665	28.39	28.39	Derailment	.848	.923
				Crosstalk	.829	
				Dissociation of thinking	.811	
				Tangentiality	.804	
				Logorrhoea	.786	
				Circumstantiality	.785	
				Semantic paraphasia	.763	
				Pressured speech	.639	
				Manneristic speech	.632	
				Neologisms	.620	
				Phonemic paraphasia	.603	
				Poverty of content of speech	.598	
				Perseveration	.570	
				Rupture of thought	.545	
II. Subjective negative	3.943	14.603	42.993	Restricted thinking	.480	.833
				Poverty of thought	.818	
				Inhibited thinking	.817	
				Dysfunction of thought initiative and intentionality	.769	
				Receptive speech dysfunction	.661	
				Expressive speech dysfunction	.650	
				Rumination	.608	
				Blocking	.459	
				Poverty of speech	.801	
				Slowed thinking	.699	
III. Objective negative	2.305	8.537	51.529	Concretism	.429	.576
				Pressure/rush of thought	.713	
				Thought interference	.685	
IV. Subjective positive	1.686	6.243	57.772			.575

Note: Variance and cumulative variance are presented in %.

negative TLC Factor III. On the other hand, TALD Factor IV was found to correlate with the second TLC factor designated as the 'linguistic control component'. Thus, the subjective factors do catch independent phenomena.

### 3.5. Relation between TALD, TLC and SAPS/SANS sub-scores

The comparison between the German TLC (Nagels et al., 2013), the TALD sub-scales, and the SAPS (Andreasen, 1984b) sub-score scores for FTD revealed highly significant correlations with each of the first factors (see Table 5). The direct comparison, however, revealed a higher correlation coefficient for the Objective Positive FTD Factor of the TALD (.925) as compared to the TLC disorganisation Factor (.825). Similarly, the Objective Negative TALD Factor was found to correlate comparatively higher (.713) with the negative FTD SANS sub-score than the negative Emptiness TLC Factor did (.686).

### 3.6. Relation between factors and diagnoses

A between-group ANOVA for the different groups, based on the mean TALD subscale values for each factor, revealed specific FTD patterns. Thus, positive FTD was mostly found in patients with mania differing significantly from all other groups ( $p < .01$ ). On the other

hand, patients with depression as well as with schizophrenia revealed the highest mean subscale values with respect to the negative FTD dimensions. The subjective mean sub-scale values were highest in the depression group, but they did not differ significantly from patients with schizophrenia.

## 4. Discussion

The purpose of this study was to introduce and validate a comprehensive FTD scale, encompassing an exhaustive range of phenomena. A detailed review of the literature, incorporating both historical and contemporary sources, was carried out. The result was the Thought and Language Disorder (TALD) scale, a 30-item rating scale distinguishing objective and subjective FTD symptoms. A large sample of patients and healthy subjects were interviewed. The scale exhibited good interrater reliabilities as well as excellent validity and internal consistency. The internal structure revealed four different factors suggesting a multi-dimensional FTD structure: positive and negative as well as objective and subjectively reported FTD symptoms. Importantly, the two subjective TALD factors were not captured and the two objective factors only showed a moderate correspondence with the factorial structure of the other scales applied in our study. The TALD therefore offers a new, comprehensive perspective across disorders onto the heterogeneous symptom complex of FTD.

The most important Factor I explained more than one fourth (28.39%) of the total variance and was termed the Objective Positive TALD component. The existence of this sub-syndrome, the 'disorganisation factor', best represented by *derailment* and *crosstalk*, is in agreement with previous FTD studies (Andreasen and Grove, 1986; Harvey et al., 1992; Peralta et al., 1992). A cross-validation approach with the TLC and the FTD components of the SAPS/SANS revealed a correlation with the Objective Positive TALD ratings. This substantiates previous findings of a 'positive' or 'disorganized' component of FTD (Andreasen and Grove, 1986; Peralta et al., 1992; Gordinier and Docherty, 2001; Liddle et al., 2002; Andreou et al., 2008).

The second Factor, designated the Subjective Negative FTD syndrome, was best represented by *poverty of thought*, *inhibited thinking* and *dysfunction of thought initiative and intentionality* phenomena. The relevance

**Table 4**  
Relation between TLC and TALD sub-scales.

	TALD I	TALD II	TALD III	TALD IV
	Objective Positive	Subjective Negative	Objective Negative	Subjective Positive
TLC I Disorganisation	.793**	.150*	-.117	-.072
TLC II Linguistic control	.533**	-.032	.098	.222**
TLC III Emptiness	.057	.257**	.723**	-.012

Pearson:

\*  $p < .05$ .

\*\*  $p < .01$ .



**Table 5**  
Relation between TALD and TLC sub-scales and SAPS/SANS sub-scores.

	TALD I Objective Positive	TALD II Subjective Negative	TALD III Objective Negative	TALD IV Subjective Positive	TLC I Disorganisation	TLC II Linguistic control	TLC III Emptiness
SAPS positive FTD	.925**	.149*	.053	.096	.825**	.443**	.155**
SANS negative FTD	.269**	.309**	.713**	.086	.228**	.153*	.686**

Pearson:

\*  $p < .05$ .

\*\*  $p < .01$ .

and reliability of this introspective dimension was emphasized and described in the literature (Jaspers, 1919). A comparison with other FTD ratings revealed only very weak correlations with both the negative FTD SAPS sub-score, and the 'disorganisation' and 'emptiness factor' of the TLC (Andreasen and Grove, 1986) (for details, see the German TLC translation Nagels et al., 2013). The subjectively experienced negative sub-symptom was not reflected in the clinicians' objective assessment. These subjective negative FTD symptoms are thus uniquely captured by the TALD.

The third factor, referred to as the Objective Negative Factor, mainly consisted of three TALD items *poverty of speech*, *slowed thinking* and *concretism*, with the highest factor loadings found for the first item. This Objective Negative TALD dimension correlated with the TLC 'emptiness factor' as well as with the SANS negative FTD subscale value. Again, higher correlations with the SANS were found for the TALD dimension as compared to the concurrent TLC subscale value.

The Subjective Positive TALD factor, not captured in previous rating scales, included two items, *pressure/rush of thought* and *thought interference*. Here, a weak correlation was found for the TLC 'linguistic control' dimension and none with the SAPS/SANS. Again this result confirms the independence of this TALD factor, not captured with other scales.

The comparison between the TLC and SAPS/SANS-FTD score factor structure (Table 5) revealed a complete cross-correlation for all factors, demonstrating their wide overlap. In contrast, there was an only partial overlap for the TALD and SAPS/SANS-FTD score factors, again indicating that the here introduced new TALD captures a different, wider psychopathological spectrum, particularly in the subjective and negative domains.

The different diagnoses yielded each a singular fingerprint in symptom severity of the four TALD factors. Interestingly, patients with mania, not schizophrenia, demonstrated the highest score for the positive, objective TALD Factor I. This reflects of course the ICD-10 (and DSM 4/5) criteria for the disorders with their reference to positive FTD and the patient structure of our sample. We included patients with bipolar mania in the (sub-) acute phase, and a broad spectrum of patients with subacute and chronic schizophrenia. This is most likely the reason for the higher disorganisation symptom severity in the mania group. This study was not meant to differentiate patients with ICD-10 diagnoses using FTD symptomatology, since this would be tautological. A variety of diagnoses was included in our investigation to capture a broad range of psychopathological phenomena.

## 5. Limitations

Some limitations should be noted. First, the FTD symptoms *verbigeration*, *echolalia* and *clanging* were rare (<5%). They are more common in the highly acute patients, not included in our study. These symptoms represent important psychopathological phenomena that should be considered in future FTD studies, therefore they were included in the TALD scale.

Correlation analysis with external FTD scales yielded some correspondences with our sub-scale values, in particular with the objective syndromes. Therefore, cross-validation with external scales suggested a high validity for the TALD. These results, however, may partly rely

on the high correspondences between identical items loading on the same factor. Nevertheless, comparatively higher correlations were consistently found between the Objective Positive TALD Factor and the positive SAPS FDS score in contrast with the Positive TLC dimension.

The comparability of our results with previous FTD investigations is somewhat limited, since the TLC and SANPS/SANS symptom structure studies mostly focussed on patients with schizophrenia. In the current study the TLC, amongst others, was used as an external validation criterion to elucidate the internal structure of the TALD. The validation for different diagnoses represents one important feature of the TALD scale.

A last remark on the comparability of results between FTD studies in light of their statistical approaches: In the current study, a factor analysis (PCA) with varimax rotation was used to explore the internal structure of the TALD. The visual inspection of Cattell's scree plot yielded a four-factorial solution. Other studies used different approaches such as oblique promax rotations, allowing for correlations between the final factors (Gordinier and Docherty, 2001). Moreover, the eigenvalue criterion (>1.0) has been applied in some studies (Holzman et al., 1986; Peralta et al., 1992; Gordinier and Docherty, 2001; Liddle et al., 2002), leading to a higher number of extracted factors. However, these higher numbers of factors explain only a small amount of the overall variance. Therefore, some factors consisted of just a few items with a low clinical variance and were therefore considered unimportant (Andreasen and Grove, 1986).

## 6. Conclusion

Going beyond existing FTD rating scales, the TALD represents a practicable, comprehensive and reliable tool. It distinguishes itself from the only other existing clinical FTD rating scale in: 1. operationalised definitions, 2. capturing the full variety of FTD symptoms, 3. definitions of symptom severity, 4. directed questions, which allow for an exact coding and separation from other phenomena, 5. examples, 6. the inclusion of subtle subjective FTD symptoms – experienced and described by the patients, 7. excellent psychometric qualities, such as high reliability and validity as well as high internal consistency, and 8. nosological openness.

Previously, using MR neuroimaging, the neural correlates of particular FTD symptoms have been explored. Since the TALD scale is a sensitive tool to differentiate between different FTD symptoms and dimensions, correlation analyses and "symptom catching" methods with brain imaging methods can further elucidate the brain correlates of distinct FTD symptoms in the future (e.g. Horn et al., 2009; Horn et al., 2010; Horn et al., 2012; Kircher et al., 2001; Kircher et al., 2003; Kircher et al., 2005; Kircher et al., 2008; Nagels et al., 2011; Straube et al., 2013).

In a more clinical approach, the TALD scale can serve as a sensitive and comprehensive instrument to assess the frequently reported self-experienced FTD in prodromal patients and in their relatives. Further studies are needed to test the reliability of the scale in the context of other speech-associated impairments, e.g. in aphasia, or dementia. This important – though poorly investigated – dimension of FTD needs further study. The relation between cognitive deficits such as executive dysfunctions, attention and verbal memory, and the prevalence

of FTD sub-syndromes can also shed further light on the complex and heterogeneous nature of FTD phenomenon.

#### Role of funding source

No financial support was provided for the study.

#### Contributors

Tilo Kircher and Arne Nagels designed the study and wrote the protocol. Arne Nagels, Axel Krug and Michael Grosvald managed the literature searches and data analyses. Paul Fährmann, Lena Turner, Mirjam Stratmann, Sayed Ghazi, Michael Frauenheim, Christian Schales, Tobias Hornig and Michael Katzev collected the data and helped with the draft of the manuscript. Arne Nagels, Tilo Kircher and Rüdiger Müller-Isberner wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

#### Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

#### Acknowledgements

Arne Nagels is supported by the DFG (project no. Ki 588/6-1). We wish to thank Maria Gaßmann and Frank Sturm for their support in collecting the data.

#### Appendix I. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.schres.2014.10.024>.

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