Pseudoneurotic symptoms in the schizophrenia spectrum: An empirical study

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ARTICLE INFO

Keywords:
Schizotypal personality disorder
Psychosis
Nonpsychotic symptoms
Self-disorder
Comorbidity
Phenomenology

ABSTRACT

Background: Nonpsychotic symptoms (depression, anxiety, obsessions etc.) are frequent in schizophrenia-spectrum disorders. Twentieth century foundational psychopathological literature claimed that certain nonpsychotic symptoms (here termed pseudoneurotic symptoms) are relatively closely linked with the schizophrenia-spectrum, despite descriptive overlap with symptoms of other diagnoses. In this study, we investigated the association of pseudoneurotic and other nonpsychotic symptoms with the schizophrenia-spectrum as well as a hypothesis about an association of pseudoneurotic symptoms with disorder of basic self.

Methods: The sample (N = 226) comprised patients with non-affective psychosis (N = 119), schizotypal personality disorder (N = 51) and other mental illness (N = 56), who were examined with a comprehensive assessment of lifetime psychopathology. Informed by the literature, we constructed scales targeting pseudoneurotic symptoms and other, more general, nonpsychotic symptomatology.

Results: Pseudoneurotic symptoms aggregated significantly in schizophrenia-spectrum disorders with an Area under the receiver operating characteristic curve of 0.84 (SE 0.03) for classifying patients with schizophrenia-spectrum disorders versus other mental illness. Patients with non-affective psychosis scored slightly, but significantly, higher on the scale targeting general nonpsychotic symptomatology than the other groups. In multiple regression analysis, pseudoneurotic symptoms were predicted by general nonpsychotic symptoms, disorders of basic self, and negative symptoms but not positive symptoms.

Conclusion: The study supports that certain neurotic-like symptoms with specific descriptive features (pseudoneurotic symptoms) are associated with schizophrenia-spectrum disorders. It suggests that pseudoneurotic symptoms are linked with temporally stable schizophrenia psychopathology (disorder of basic self and negative symptoms).

1. Introduction

Patients with schizophrenia-spectrum disorders frequently report symptoms associated with nonpsychotic disorders such as depression, anxiety and obsessive-compulsive symptoms (Buckley et al., 2009). Over the last decade, there has been increasing research interest in this symptomatology, which is usually conceptualized as comorbidity or considered as transdiagnostic symptoms (Castle et al., 2021; Krueger et al., 2018; Veras et al., 2017; Veras and Kahn, 2020). These nonpsychotic symptoms often precede psychosis (Cupo et al., 2021; Hafner et al., 1999; Kvig et al., 2017) and are frequent in first-episode psychosis and at-risk states (Fusar-Poli et al., 2014; Swets et al., 2014; Wilson et al., 2020). Indeed, comorbid depression, anxiety and PTSD have been associated with more severe clinical features and outcomes such as suicidality and there is a lack of evidence regarding adequate therapeutic approaches to these symptoms in schizophrenia (Braga et al., 2013; Buckley et al., 2009; Seow et al., 2016; Uphagrove et al., 2017). Obviously, such phenotypic overlap is a challenge to early
dissociative phenomena), somatization, depression, neurasthenia, hypochondriasis, as well as subjective anxiety and chaotic behavior in regard of interpersonal relations and sexuality. The adjective ‘pseudo-neurotic’ was also used about specific neurotic-like symptoms with features indicating a potential diagnosis of schizophrenia or ‘borderline schizophrenia’ (Rado, 1959; Vanggaard, 1979). Importantly, the notion of pseudoneurotic schizophrenia influenced the US-DK adoption and high-risk studies (Kety et al., 1968; Parnas et al., 1993), which together with other family studies (Parnas et al., 2005a) provided clinical support for the concept of a schizophrenia-spectrum encompassing pseudoneurotic schizophrenia. Subsequently, data from the US-DK studies were used in the formulation of the DSM-III criteria of schizotypal personality disorder (Kendler, 1985). Thus, current diagnostic criteria of schizotypal personality disorder include “obsessive ruminations without inner resistance” (ICD-10) and “excessive social anxiety that does not diminish with familiarity” (DSM-5).

Several studies have found nonpsychotic symptoms such as depression, suicidality and self-harm to be related to disorder of basic self in early psychosis and at-risk states (Haug et al., 2012; Koren et al., 2017; Raballo et al., 2021). Exclusion criteria were clinically dominating alcohol or substance abuse, organic brain disorder, mental retardation, and legal status. The standard assessment in the clinical units included examinations and paraclinical tests to exclude an organic disorder. However, this did not systematically involve a detailed evaluation of past minor head traumas. Moreover, agitated and/or severely psychotic patients could generally not be included due to the lengthy interview schedule. The patients participated on the condition of informed consent and the Danish National Committee on Health Research Ethics approved the study.

The sample (N = 226) includes patients with a DSM-IV/5 main lifetime diagnosis of schizophrenia (N = 108), other non-affective psychosis (N = 11, including delusional disorder, schizoaffective disorder, brief psychotic disorder, and other unspecified schizophrenia spectrum and other psychotic disorder), schizotypal personality disorder (N = 51), major depression (N = 18), other personality disorders (N = 15, including borderline and other specified personality disorder), OCD (N = 12), and other diagnoses (N = 11).

2.2. Assessment

All patients were assessed with a composite interview schedule used in several studies in our group (Handest and Parnas, 2005; Matthysse et al., 2004; Parnas et al., 2011), which all were under the direction of Self-Experience (EASE) (Parnas et al., 2005b), because it was argued on a clinical-conceptual basis that these phenomena have a link to disorder of basic self (Parnas and Handest, 2003). However, this hypothesis has never been empirically investigated.

In this study, we investigate nonpsychotic symptomatology in a diagnostically mixed sample with a large proportion of young patients with early psychosis or schizotypal personality disorder. Based on the psychopathological literature, we a priori delimitate two groups of symptoms. The first group encompasses symptoms, which in twentieth century foundational psychopathological literature have been claimed to be relatively closely linked with schizophrenia-spectrum disorders despite some descriptive overlap with symptoms of nonpsychotic disorders (see the first section above). We designate this group as ‘pseudo-neurotic symptoms’ (without presupposing usage of the diagnostic category of pseudoneurotic schizophrenia). The second group, termed ‘general nonpsychotic symptoms’, includes symptoms regarded in the literature as typical of various nonpsychotic disorders such as depression, anxiety, obsessive-compulsive disorder etc. Our first research aim is to examine lifetime occurrence of pseudoneurotic and general nonpsychotic symptoms in schizophrenia-spectrum disorders compared to a diagnostically mixed group with other mental illness. We hypothesize that pseudoneurotic symptoms aggregate in schizophrenia-spectrum disorders, whereas the general nonpsychotic symptoms will occur with similar lifetime frequency in schizophrenia-spectrum disorders and the group with other mental illness. The second aim is to explore the relation of pseudoneurotic symptoms to general nonpsychotic symptoms, canonical schizophrenia psychopathology (positive and negative symptoms), and subjective anomalies (disorder of basic self). We hypothesize that pseudoneurotic symptoms will be associated with disorder of basic self.
the last author (JP). This instrument comprises a detailed psychosocial history, a description of the illness evolution, family history, the Operational Criteria Checklist (OPCRIT) (McGuffin et al., 1991), which is derived from the Present State Examination (Wing, 1974), expanded with additional items from the Schedule for Affective Disorders and Schizophrenia (SADS-L) (Endicott and Spitzer, 1978), a score sheet of ICD-10 and DSM-IV-5 criteria for schizophrenia-spectrum disorders, the Examination of Anomalous Self-Experience (EASE) (Parnas et al., 2005b), parts of the Bonn Scale for the Assessment of Basic Symptoms (BSABS) (Gross et al., 1987), a mental state examination targeting expressive features (e.g., affect modulation, stereotypies, mannerisms and formal thought disorder) (Vaezer et al., 2005), and the split version of the Global Assessment of Functioning Scale (GAF), which rates global level of symptoms and level of functioning separately (Endicott et al., 1976).

The total duration of the interviews were 3–6 h, often split into several sessions. Nearly all interviews were videotaped, and after each interview the interviewer made a narrative summary of all sections of the schedule. The interview was semi-structured and conversational, encouraging faithful self-description according to standard phenomenological principles (Jansson and Nordgaard, 2016; Jaspers, 1913/1963; Nordgaard et al., 2013). Thus, rating of phenomena was never based on a simple “yes” or “no” answers but required examples provided by the patient. The interviewers (JN, MZ, KES and AR) were all experienced clinicians. Prior to the studies, reliability between interviewers and senior research colleagues was assessed (Nordgaard and Parnas, 2012; Rasmussen et al., 2020; Sandsten et al., 2022a; Zandersen and Parnas, 2019a) with average kappa-values between 0.74 and 0.91 on the EASE and other sections of the assessment (the items used for the pseudoneurotic scale (see next section) were included in this reliability assessment).

Best-consensus lifetime diagnosis according to ICD-10 and DSM-IV/5 was allocated by the interviewer and JP (a senior consultant and clinical researcher) after a meeting evaluating all relevant material (interview summaries, videos, ratings of instruments, and in most cases information from hospital charts, which also contained second informants’ descriptions).

### 2.3. Construction of scales

In order to address our study aims, we constructed two a priori scales from items in the interview schedule informed by the psychopathological literature briefly presented above. The first scale targets pseudoneurotic symptoms, i.e., symptoms that we based on the literature hypothesize to be associated with the schizophrenia-spectrum despite their descriptive overlap with symptoms of nonpsychotic disorders. One item was discarded because it reduced Cronbach’s alpha. The resulting scale includes 16 items rated for their occurrence on a lifetime basis (Table 1). We have described these items in detail in Table S1 in supplementary material. Cronbach’s alpha is 0.60, which we consider acceptable for the aim of the study. The second scale targets lifetime general nonpsychotic symptomatology as defined in research criteria of depressive symptoms, anxiety, substance abuse etc. This scale encompasses 30 items (Table 1) and has a Cronbach’s alpha of 0.72. Several items reduced alpha marginally but were retained because we wanted the scale to reflect a broad range of nonpsychotic symptomatology. In both scales, the items were rated based on lifetime occurrence of the symptom and did not require fulfilling all criteria of ICD or DSM disorders (e.g., lifetime occurrence of panic attacks rather than a diagnosis of panic disorder). Only alcohol and substance use disorders were rated as diagnostic disorders.

To avoid overlap between scales, we used the EASE-10 scale to address disorder of basic self. This scale contains 10 EASE items considered to reflect the prototypical core of disorders of the basic self (see Table S2 in supplementary material). In two previous studies, the EASE-10 has been found to correlate strongly with the total EASE (Koren et al., 2013; Nelson et al., 2012). Because only two of the previous studies included in this sample used the Positive and Negative Syndrome Scale (PANSS), we constructed relevant scales for canonical schizophrenia symptomatology by adding nonoverlapping items selected from the interview schedule in accordance with previous publications (Handest and Parnas, 2005; Nordgaard et al., 2017; Nordgaard and Parnas, 2014) (see Table S2 in supplementary material for the composition and Cronbach’s alpha of these scales).

### 2.4. Statistical analysis

In data analysis, all items were used conservatively, i.e., items scored as “doubtfully present” were recoded as “absent”. For any of the involved scales, the rating of “present” of an item counted one point. In all analyses, we used the DSM-IV-5 lifetime main diagnoses and compared three groups: (1) schizophrenia and other non-affective psychosis, (2) schizotypal personality disorder, and (3) other mental illness.

We explored potential correlations between the pseudoneurotic symptoms scale and demographic variables with Pearson’s correlation and used $r^2$-test to examine if the distribution of subjects could be assumed independent between diagnostic groups. ANOVA was used to compare scores on psychopathology scales across diagnostic groups with Games-Howell and Hochberg post hoc tests. Area under the receiver operating characteristic curve (AUC) was calculated for the pseudoneurotic symptoms and general nonpsychotic symptoms scales. Likewise, sensitivity and specificity values for prediction of schizophrenia spectrum disorders based on different cut-offs were obtained.

We used multiple linear regression to examine relations of psychopathology scales in the schizophrenia-spectrum patients (schizophrenia, non-affective psychosis and schizotypal disorder. N = 170). The

| Table 1 | Psychopathological scales. |
|---------|---------------------------|
| Pseudoneurotic symptoms scale | General nonpsychotic symptoms scale |
| Primary ruminations | Depressed mood |
| Pseudo obsessions | Diminished interest and pleasure |
| Social anxiety | Fatigue or loss of energy |
| Paranoid anxiety | Retardation |
| Diffuse anxiety | Agitation |
| Ontological anxiety | Morning worsening |
| Change in basic mood and emotional responsiveness | Exaggerated feelings of guilt |
| Diminished capacity to cope and increased emotional reactivity | Thoughts of dead or suicide |
| Diminished initiative | Decreased libido |
| Increased appetite or significant weight loss | Increased appetite or significant weight gain |
| Early morning wakening | Hyperomnia |
| Irritable mood | Elevated mood |
| Increased goal-directed activity | Irritable mood |
| Activities with potential harmful consequences | Increased goal-directed activity |
| Decreased need of sleep | Combinations |
| True obsessions (with resistance and insight) | Panic attacks |
| Compulsions | Phobic anxiety |
| Illness anxiety (hypochondriasis) | Illness anxiety (hypochondriasis) |
| Bulimic or anorectic symptoms | Obese |
| Inverted sleep pattern | Increased appetite or significant weight gain |
| Alcohol use disorder | Increased appetite or significant weight gain |
| Cannabis use disorder | Substance use disorder |
| Other substance use disorder | Other substance use disorder |

Cronbach’s alpha = 0.60

Cronbach’s alpha = 0.72

See also Supplementary material S1 and S2.
The pseudoneurotic symptom scale was dependent variable and, as independent variables, the other scales were entered hierarchically into the model in the following order: disorder of basic self (EASE-10), general nonpsychotic symptom scale, negative symptoms and (in a single step) positive symptoms and formal thought disorder. MedCalc version 18.9 was used for binary (diagnostic) classification tests and SPSS version 25 for the other analyses. The significance level was 0.05.

3. Results

Sociodemographic and clinical characteristics are apparent from Table 2. In the group with schizophrenia or other non-affective psychosis, 8 patients had late-onset of psychosis (>40 years). All three groups had a considerable lifetime accumulation of general nonpsychotic symptomatology, but the group with schizophrenia or other non-affective psychosis scored significantly higher than the groups with schizotypal personality disorder or other mental illness (Table 2). Pseudoneurotic symptoms aggregated significantly in schizophrenia-spectrum disorders compared to the group with other mental illness (Table 2).

Furthermore, the scale of pseudoneurotic symptoms had a good AUC of 0.84 (SE 0.03) for classifying patients with schizophrenia-spectrum disorders compared to the group with other mental illness (Fig. 1). Sensitivity was 0.70 (95%CI 0.63–0.77) and specificity was 0.79 (95%CI 0.66–0.88) for a score of 5 or more pseudoneurotic symptoms (See Table S3 for sensitivity and specificity of different cut-off values of the pseudoneurotic scale). The scale of general nonpsychotic symptoms had a very low AUC of 0.58 (SE 0.04) (Fig. 1).

When relations between psychopathology scales were explored in the schizophrenia-spectrum groups with multiple linear regression, we found that pseudoneurotic symptoms were predicted by general nonpsychotic symptoms, disorder of basic self, and negative symptoms.

### Table 2

Descriptives of the sample and symptom scores.

|                | NAP   | SPD   | OMI   |
|----------------|-------|-------|-------|
| Mean (SD)      | Range | Mean (SD) | Range | Mean (SD) | Range |
| Gender, F/M    |       |        |       |           |       |
| Age, years§    |       |        |       |           |       |
| Age at first mental symptom, years§ |       | |
| Never married or cohabiting |       |       |       |           |       |
| Unemployed or not studying |       |       |       |           |       |
| Antipsychotic treatment|       |       |       |           |       |
| Antidepressant treatment|       |       |       |           |       |
| Psychopathological scales |       |       |       |           |       |
| Pseudoneurotic symptoms (0–16) |       |       |       |           |       |
| General nonpsychotic symptoms (0–30) |       |       |       |           |       |
| GAF-S  |       |       |       |           |       |
| GAF  |       |       |       |           |       |

NAP, schizophrenia and nonaffective psychosis; SPD, schizotypal personality disorder; OMI, other mental illness. GAF, Global Assessment of Functioning Scale.

H-test statistic and P-value are from the non-parametric Kruskal-Wallis test for equality of diagnostic groups with Hochberg and Games-Howell post hoc tests. F-test statistic and P-value are from parametric ANOVA test for equality of diagnostic groups with post hoc Mann-Whitney U test. F-test statistic and P-value are from parametric ANOVA test for equality of diagnostic groups with Hochberg and Games-Howell post hoc tests.

NAP > SPD; SPD > OMI; NAP > SPD = OMI; OMI > SPD = NAP.
We will first address the high lifetime-occurrence of general nonpsychotic symptomatology in schizophrenia-spectrum patients. Importantly, nearly all schizophrenia-spectrum patients were diagnosed within the last year. Accordingly, our findings reflect the cumulative occurrence of these symptoms in prodromal and early psychosis as well as schizotypal disorder. Although not directly comparable, our findings are concordant with studies that report high frequency of comorbid DSM-diagnoses of depression, anxiety and OCD in early psychosis and at-risk samples (Fusar-Poli et al., 2014; Wilson et al., 2020). Indeed, nonpsychotic symptoms often motivate help-seeking among patients with early psychosis or at-risk states (Falkenberg et al., 2015; Fusar-Poli et al., 2017; Parnas and Teasdale, 1987). Regarding clinical differential diagnosis, these findings suggest that a schizophrenia-spectrum disorder should be carefully excluded in any relatively young patient presenting in a secondary mental health care setting before a primary nonpsychotic diagnosis can be made. Such a hierarchical approach to the diagnostic process was proposed by Jaspers (Jaspers, 1913/1963) and is reflected in the International Classification of Diseases (ICD)-10 for mental disorders (Henriksen and Nordgaard, 2022). However, studies suggest that current clinical and research approaches to diagnosis frequently overlook or disregard psychotic symptoms in young first-contact patients (Boonstra et al., 2008; Kvig et al., 2017; Molstrom et al., 2020).

Moreover, we found a significant lifetime aggregation of pseudoneurotic symptoms in schizophrenia-spectrum disorders supporting the central hypothesis of the study that pseudoneurotic symptoms are associated with the schizophrenia-spectrum. Although many patients with other mental illness reported a few of these phenomena, patients in the schizophrenia-spectrum had a considerably higher level of these experiences. Indeed, the pseudoneurotic scale achieved a good AUC of 0.84 for classifying patients with a schizophrenia-spectrum disorder. Thus, accumulation of pseudoneurotic phenomena was associated with a schizophrenia-spectrum disorder. Moreover, the level of pseudoneurotic symptoms was associated with lifetime, general nonpsychotic symptomatology among schizophrenia-spectrum patients. Overall, these findings appear concordant with Hoch's clinical observation of a qualitative as well as quantitative constellation of co-occurring or alternating nonpsychotic symptoms in schizophrenia-spectrum patients (Hoch and Polatin, 1949). Furthermore, the associations of pseudoneurotic symptoms with disorder of basic self and negative symptoms suggest that pseudoneurotic symptoms are linked with basic, trait-like (temporally stable) disturbances in the schizophrenia spectrum. Indeed, disorders of basic self possess trait-like characteristics with stability across periods of five to seven years and (Koren et al., 2019; Nordgaard et al., 2017) and longitudinally predict transition to psychosis (Nelson et al., 2012) and schizophrenia-spectrum disorders (Koren et al., 2019; Parnas et al., 2011). Importantly, many pseudoneurotic phenomena were included among the more peripheral items of the Examination of Anomalous Self-Experience (EASE) based on a clinical-theoretical claim about their relation to disorder of basic self. This study corroborates that claim, which also receives support from studies of the phenomenology of single pseudoneurotic phenomena (Rasmussen and Parnas, 2022; Urfer, 2001; Zandersen and Parnas, 2019b). Indeed, we will argue that the notion of disorder of basic self articulates a certain commonality or overall gestalt (Sandsten et al., 2022a) among the diverse pseudoneurotic phenomena that can also be helpful for their clinical recognition (Parnas and Handest, 2003). E.g., diminished first-personal character of experience can manifest in disturbance of the self-agency in the stream of thoughts (primary ruminations, pseudo-obsessions), a weakened bodily self-affection (hypohedonia) and insecure immersion in the world (diminished vitality, diminished initiative, change in basic mood, social anxiety), and disturbances of the sense of being a unified subject (fugue, dissociative depersonalization). Likewise, severe diffuse and pervasive anxiety in schizophrenia has been suggested to reflect an insecurity of the self and its embeddedness in the world (Laing, 1960).

Pseudoneurotic symptoms and their characteristic constellation with numerous co-occurring or alternating nonpsychotic symptoms in schizophrenia-spectrum disorders were historically described in studies of pseudoneurotic schizophrenia (Lingiardi and Boldrini, 2019; Zandersen et al., 2018). However, we do not advocate reintroducing this diagnostic category beyond already established overlapping constructs such as schizotypy or clinical high risk of psychosis. However, we suggest that the notion of pseudoneurotic symptomatic presentation has a potential clinical relevance for differential diagnosis and detection of at-risk states. Furthermore, this construct could inform research addressing nonpsychotic symptomatology in schizophrenia. These symptoms are in contemporary research literature often considered to be transdiagnostic phenomena. In regard of depression in schizophrenia, Birchwood has suggested three distinct pathways: depression as intrinsic to psychosis, depression as a psychological reaction to the diagnosis and its psycho-social implications, and a link with childhood trauma as a transdiagnostic risk-factor of depression (Upthegrove et al., 2017). However,
in the pre-DSM literature, Bleuler and others (Blankenburg, 1971; Bleuler, 1911/1950; Minkowski, 1927) suggested a relation between apparent neurotic symptomatology and more fundamental psychopathological features of schizophrenia such as schizophrenic autism. In our view, the notion of pseudoneurotic symptomatology and presentation has a potential relevance for research exploring pathogenetic pathways between nonpsychotic symptomatology and basic, trait-like disturbances in schizophrenia, particularly disorders of basic self. Furthermore, if the aggregation of pseudoneurotic symptoms in schizophrenia-spectrum disorders and their association with disorders of basic self is further substantiated, particularly in longitudinal studies, pseudoneurotic symptoms could be argued to be psychopathology of the primary illness of a schizophrenia-spectrum disorder rather than comorbid or transdiagnostic phenomena.

There is a lack of studies of treatment of nonpsychotic symptoms in schizophrenia (Braga et al., 2013; Seow et al., 2016; Upthegrove et al., 2017). Our results highlight the heterogeneity of this symptom domain suggesting some caution about expecting that the established treatment approaches towards similar symptoms in nonpsychotic disorders are sufﬁcient among schizophrenia-spectrum patients. We are not aware of studies addressing psychopharmacological or psychotherapeutic treatment of the speciﬁc phenomena included here under the notion of pseudoneurotic symptomatology. However, some potential limitations of cognitive-behavioral therapy have been addressed (Skodlar et al., 2013). We suggest that the possible link between pseudoneurotic presentation and disorder of basic self could potentially inform treatment and clinical care. Particularly, the emerging research in psychotherapeutic approaches to disorder of basic self could be relevant in this context (Skodlar and Henriksen, 2019).

The major strength of this study is the comprehensive assessment of psychopathology, including subjective anomalies, by experienced research clinicians. However, apart from the cross-sectional design, the study also has limitations. First, the original studies were not designed specifically to address the notion of pseudoneurotic symptoms. Therefore, the psychopathological scales are constructed ad hoc from the available items. Thus, the pseudoneurotic scale lacks items addressing pseudoneurotic features of affect, chaotic behaviors, and interpersonal relationships, whereas disturbances related to obsessive-ruminative symptoms, anxiety, dissociative experiences, and depressive symptomatology are better represented. Second, the group with other mental illness was highly heterogenous diagnostically. This, as well as the considerable training required to access the involved psychopathological notions, suggests some caution when generalizing the results to clinical settings. Third, it was not possible to unravel the effects of medication on psychopathology (e.g., second generation antipsychotics) of the literature that suggests that clinical psychiatry and research is in need of cognitive-behavioral therapy (e.g., second generation antipsychotics) of the literature that suggests that clinical psychiatry and research is in need of cognitive-behavioral therapy (e.g., second generation antipsychotics) of the literature that suggests that clinical psychiatry and research is in need of cognitive-behavioral therapy (e.g., second generation antipsychotics). Furthermore, if the aggregation of pseudoneurotic symptoms in the schizophrenia spectrum disorders and their association with disorders of basic self is further substantiated, particularly in longitudinal studies, pseudoneurotic symptoms could be argued to be psychopathology of the primary illness of a schizophrenia-spectrum disorder rather than comorbid or transdiagnostic phenomena.

Role of the funding source

The work was supported by Independent Research Fund Denmark (grant to Andreas Røsen Rasmussen), Velux Foundation (grant to Maja Zandersen), and Novo Nordisk Foundation (grant number NNF20SA0064340; grant to Karl Erik Sandsten). No funding agency influenced any aspect of the current work.

CRediT authorship contribution statement

All authors contributed to the study conception and design. Data collection was performed by Andreas Røsen Rasmussen, Julie Nordgaard, Maja Zandersen, and Karl Erik Sandsten. Analysis was performed by Andreas Røsen Rasmussen. The first draft of the manuscript was written by Andreas Røsen Rasmussen and all authors commented on subsequent versions of the manuscript. All authors read and approved the final manuscript.

Declaration of competing interest

On behalf of the authors, the corresponding author states that there is no conflict of interest.

Acknowledgments

The authors thank all participants and clinical staff.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.schres.2022.11.011.

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