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A combination of self-disturbances and psychotic-like experiences. A cluster analysis study on a non-clinical sample in Poland

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ABSTRACT

We aimed to perform a cluster analysis to investigate the group structure of a combination of psychotic-like experiences (PLEs) and self-disturbances in a non-clinical sample. Non-clinical adults (n = 677) were assessed with the Community Assessment of Psychic Experiences (CAPE), the Davos Assessment of Cognitive Biases Scale (DACOBS) and the Inventory of Psychotic-Like Anomalous Self-Experiences (IPASE). Cluster analysis was conducted based on the positive and negative dimension of CAPE and a total score of IPASE. Four distinct groups were revealed by the cluster analysis. The High Profile group had the highest means, and the Low Profile had the lowest scores of positive and negative subscales of the CAPE and IPASE. The Positive Profile group had a significantly higher level of self-disturbances (in 'Cognition', 'Consciousnesses and 'Somatization' dimensions) from participants with the 'Negative Profile'. The High Profile group had more cognitive biases (i.e., inadequate cognitive inference about internal and external events) related to psychosis as assessed with DACOBS, had the highest means on each IPASE subscale and had a higher level of emotional distress. A combination of high level of PLEs and self-disturbances may capture the highest risk of psychosis in the general population associated with cognitive biases characteristic for psychosis.

1. Introduction

Recently there is a growing research interest in risk for psychosis, and important constructs in this area include psychotic-like experiences (PLEs), self-disturbances and cognitive biases. However, not much is known about the relationship between these constructs. We will briefly review these three constructs before addressing how the current study examines their relationships.

PLEs are defined as experiential phenomenon that lie on the continuum of psychotic symptoms (Linscott and Van Os, 2013; Yung et al., 2009). These experiences range from auditory illusions (e.g., hearing of unusual sounds like banging, clicking, hissing, clapping or ringing in ears), delusional-like ideations (e.g. a feeling as if being persecuted in some way), through subclinical hallucinations or delusions (e.g., attenuated delusions or hallucination, insight often is preserved) to clinically relevant full-blown psychotic symptoms (e.g., distressful delusions or hallucinations with a lack of clinical insight). According to the hypothesis of the continuum (Strauss, 1969; Van Os et al., 2000), there is an extended phenotype of psychosis in the general population and PLEs are one of its behavioral expressions (van Os and Reininghaus, 2016).

There are two major implications of the continuum hypothesis. First, it is expected that the PLEs are observed beyond clinical psychosis. According to this, it was confirmed that the prevalence of PLEs, contrary to rare psychotic disorders, is relatively high in the general population, with a median prevalence rate around 7.2% derived from studies which assessed PLEs using interviews (Linscott and Van Os, 2013). Along with these findings, it was shown that, contrary to

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subclinical or full-blown psychotic symptoms, the vast majority of PLEs measured in the general population are transient (Dominguez et al., 2009; Zammit et al., 2013) and not related to a need for care (Johns et al., 2014) or elevated emotional distress (Loewy et al., 2007). The second implication of the continuum hypothesis is that, as different PLEs may share similar mechanisms (Kelleher et al., 2012), studying PLEs in nonclinical populations, as opposed to full-blown psychosis, allows researchers to model psychotic symptoms without the confounds of clinical research such as medication use or comorbidity. The rationale is that the findings on the mechanisms of the PLEs from the general population studies may be extrapolated to better understand the risk of psychosis.

An overlapping but distinct area of research has been in basic self-disturbance (Schultze-Lutter et al., 2016). From the very beginning of modern psychiatry, it has been suggested that abnormalities in the pre-reflective subjective experience of the self (i.e., minimal self, ipseity) precede the development of schizophrenia spectrum disorders and are a core characteristic of the condition (Bleuler, 1911; Parnas and Henriksen, 2014). Despite phenomenological approach to self-disturbances proposed recently by Parnas and colleagues (Parnas and Henriksen, 2014) is an important contribution to the field, several different ways including early psychiatry, psychoanalysis, existential psychiatry, psychosocial rehabilitation, dialogical psychology and metacognitive approach (see: Lysaker and Lysaker, 2008, for a review) as well as a variety of task-based measures designed to assess disruptions of self-agency, proprioception, and somatosensation, have been applied to study self-disturbances in schizophrenia spectrum disorders (Park and Nasrallah, 2014). The present study focuses on self-disturbances based on the phenomenological tradition, which has its roots in early psychiatry. Contemporary phenomenological analyses have empirically confirmed that disturbances of the minimal self are frequently present in schizophrenia spectrum (Parnas et al., 2003; Parnas and Henriksen, 2014; Parnas and Jansson, 2015; Sass, 2014). A detailed phenomenological analysis of self-disturbances performed by Parnas et al. (2005) allowed the authors to develop the Examination of Anomalous Self-Experience (EASE) interview that captures a wide range of anomalous experiences reflecting self-disturbances. Studies that used the EASE have confirmed that patients with schizophrenia spectrum disorders or patients at ultra-high risk for psychosis exhibit a higher degree of disturbances in the minimal self comparing to controls (Nelson et al., 2012) and other clinical groups (Nelson et al., 2013). In a high clinical risk for psychosis cohort, self-disturbances were found to increase the risk of developing the frank psychotic disorder, particularly schizophrenia spectrum disorders (Nelson et al., 2012).

Intriguingly, recent findings have shown that self-disturbances, as measured with the EASE, are also related to non-clinical PLEs (Koren et al., 2016; Torbet et al., 2015). Furthermore, there is a line of experimental studies that use behavioral tasks capturing self-disturbances (Hur et al., 2014), which corroborate the findings from phenomenological interviews showing self-disturbances are related to schizophrenia spectrum disorders and its continuum. However, the EASE and experimental tasks are demanding tools, and thus are easily used in studies on larger non-clinical samples attempting to investigate the psychometric structure of the relationship between self-disturbances and PLEs in large non-clinical samples (e.g., cluster analysis). Fortunately, recent advances in the field provide a promising self-report questionnaire – Inventory of Psychotic-Like Anomalous Self Experiences (IPASE, Cicero et al. (2017)) - that targets a wide range of self-disturbances related to psychosis. Importantly, preliminary results suggest that the IPASE has satisfactory construct validity, using the EASE as a gold standard comparison ($r = 0.92$ for total scores) (Nelson et al., 2018). Recent studies based on the IPASE have shown that self-disturbances are related to PLEs in a non-clinical population (Gawęda et al., 2018d,b). In general, these findings suggest that self-disturbances are associated with the risk for clinical psychosis and non-clinical PLEs.

Self-report screening for PLEs has the potential to identify people with at-risk states and thus is an important part of early detection strategies for psychosis risk (Ising et al., 2012). However, the presence of PLEs when considered as a stand-alone factor is a limited indicator of the possible further development of psychotic symptoms (Zammit et al., 2013). For instance, studies reported low positive predictive values (1–5%) for self-report PLEs predicting for development of psychotic disorders (e.g., Chapman et al., 1994; Werbeloff et al., 2012; Zammit et al., 2013). In the context of clinical risk states, it has been shown that if additional risk factors are considered, the predictive validity for developing psychosis substantially increases (Cannon et al., 2016). Hence, a better understanding of a combination of different risk factors in addition to PLEs may be of great importance for the improvement of detection strategies in early risk states of psychosis. Our aim in this study was to investigate cluster structure of a combination of PLEs and self-disturbances and their impact on an important risk factor of psychosis – cognitive biases.

Although PLEs, self-disturbances and cognitive biases are correlated these factors constitute distinct constructs. Self-disturbances refer to the changes in the *structure* of prereflective selfhood, which affects implicit first-person quality of consciousness (Nelson et al., 2014b); PLEs refer to phenomena of different, unusual *content* of thinking (i.e., delusional ideations) or perceiving (e.g., hallucinatory experiences); Cognitive biases are inadequate (in a particular context) cognitive processing, interpretation, and inference about internal and external events that underlie dysfunctional behavioral response to the stimuli. Recent correlational studies suggested that these factors constitute different constructs (Gawęda et al., 2018d,b; Koren et al., 2013), however, the structure of combination between these factors is still unknown.

Given the fact that most studies have focused on the different dimensions of PLEs (e.g., negative and positive PLEs), derived clusters refer just to a combination of the dimensions (e.g., high vs. low scores). In general population studies, two major factors - positive and negative - of PLEs (Mark and Toulopoulou, 2016; Stefanis et al., 2002) have been confirmed. Although the multidimensional structure of PLEs is well replicated, in fact, these dimensions often coexist. However, correlational studies often consider positive and negative symptoms separately, and the coexistence between these dimensions is often not recognized. Cluster analysis provides the opportunity to reveal different combinations of the data considered at different dimensions at the same time. If the clusters are indeed distinct groups of people, we would expect them to have differential scores on another important risk factor: cognitive biases.

Psychosis and its risk states are often a combination of different psychopathological dimensions (e.g., anxiety, depression, self-disturbances and psychotic symptoms) (van Rooijen et al., 2017) and other risk factors (e.g., cognitive biases) (Howes and Murray, 2014). Hence, a better understanding of combinations of various factors involved in the risk of psychosis may enhance our knowledge about potentially different risk groups. There are no studies that considered a combination of disturbances of the minimal self, which is an important risk factor for psychosis (Nelson et al., 2014a, 2012) and PLEs (Gawęda et al., 2018d; Koren et al., 2016,2013; Torbet et al., 2015). Furthermore, both self-disturbances and PLEs are related to cognitive biases that are one of the major psychological factors related to clinical (Nelson et al., 2009; Nelson et al., 2014a,b) and non-clinical risk of psychosis (Gawęda et al., 2018d,b). There is a consistent body of research showing the importance of cognitive biases in the development of psychosis. Cognitive biases such as attributional biases (So et al., 2015), external misattribution biases (Johns et al., 2010), jumping to conclusions (McLean et al., 2017) and attention to threat (Prochwicz and Kłosowska, 2017) or threat anticipation (Reininghaus et al., 2016) have been found as cognitive underpinnings of psychosis risk. A better understanding of the structure of combination between different risk factors may foster early detection strategies for risk states (e.g., Cannon et al., 2016).

Therefore, this study aimed to distinguish variants of combinations of self-disturbances and PLEs by performing a cluster analysis which allows the selection of different groups based on the combination of positive and negative PLEs and self-disturbances. Derived groups were then compared on cognitive biases that previous research has found to be related to psychosis risk. Although there were no specific predictions regarding the results of cluster analysis in our study, we anticipated that clustering would produce a four participant groups: a) one with the highest, b) one with the lowest scores in each of the three scales, c) a group with a relatively high level of negative PLEs but lower levels of positive PLEs and self-disorders, and d) a group of relatively low level of negative PLEs but higher levels of self-disorders and positive PLEs. However, we did not predict whether the cluster analysis would result in a distinct group based on the results of the self-disturbances measure. This was an exploratory part of the study. Furthermore, based on prior studies we expected the higher symptom profile groups would have higher cognitive biases.

2. Methods

2.1. Participants

Healthy participants with no history of psychiatric diagnosis were recruited from undergraduate and postgraduate students. A history of clinical diagnosis was screened with a self-report questionnaire prepared for the study, and those who had a history of psychiatric diagnosis, including substance abuse, were excluded. Participants with neurological diseases were also excluded. The final sample consisted of 677 participants (481 females and 196 males) aged between 18 and 30 years ($M = 22.98$, $SD = 2.67$). The local ethics committee approved the study.

2.2. Measures

2.2.1. Psychotic-like experiences (PLEs)

The Community Assessment of Psychic Experiences (CAPE) (Stefanis et al., 2002) is a 42-item self-report questionnaire measuring positive and negative psychotic symptoms and depressive symptoms on a two-dimensional scale. The first dimension measures the frequency of symptoms and the second dimension measures the degree of distress caused by the experience. The positive subscale counts 20 items, the negative subscale – 14 items and the depressive subscale – 8 items. The CAPE has been designed to assess lifetime psychotic experiences in the general population. In this study, the Polish version of the CAPE was used (Gawęda et al., 2015) and our focus in the cluster analysis was only on positive and negative dimensions. In addition, we used depression subscale to test group differences between obtained clusters on emotional discomfort. Cronbach's alpha for the total score calculated in the present sample was 0.91.

2.2.2. Cognitive biases

The Davos Assessment of Cognitive Biases Scale (DACOBS) (van der Gaag et al., 2013) is a self-report scale which measures cognitive biases related to psychosis. The questionnaire contains 42 items to be scored on a 7-point Likert scale. All items are grouped into seven subscales and three clusters related to different types of biases: (I) specifically associated with psychosis: jumping to conclusions bias, belief inflexibility bias, attention to threat bias, external attribution bias, (II) associated with social cognition: social cognition problems, subjective cognitive problems and (III) related to coping strategies: safety behaviors. In the current study, we used the Polish version of DACOBS (Gawęda et al., 2015). Cronbach's alpha calculated for the total score was 0.89.

2.2.3. Self-disturbances

The Inventory of Psychotic-Like Anomalous Self-Experiences (IPASE) (Cicero et al., 2017) is a 57-item self-report questionnaire developed based on the phenomenological description of self-disorders in psychosis (Parnas et al., 2005). All items are grouped into five dimensions, representing qualitatively different aspects of self-disorder: 1) Cognition (e.g., 'I feel like my thoughts are being generated by someone else'); 2) Self-Awareness and Presence ('I feel like my current life is not connected with my life in the future'); 3) Consciousness (e.g. 'I have difficulty telling whether I am experiencing something or just imagining it'); 4) Somatization (e.g. 'I feel like my body has changed') and 5) Demarcation/Transitivism (e.g. 'I wonder whether or not I truly exist'). The authors created all items based on a thorough review of the phenomenological literature related to self-disorder (Møller and Husby, 2000; Parnas and Handest, 2003; Parnas and Henriksen, 2014). Since the Examination of Anomalous Self-Experiences (EASE) is arguably the most well-validated and -explicated measure of self-disturbances, care was taken to make sure all five domains of the EASE were represented in the initial item development of the IPASE. Recently, the scale has been used in studies on psychosis proneness (Cicero et al., 2017) and among schizophrenia spectrum patients (Cicero et al., 2016). We used the Polish version of the IPASE (Gawęda et al., 2018d). Cronbach's alpha for a total score in our sample was 0.96. The very recent study has confirmed construct validity of the IPASE with correlation coefficients to the EASE reaching about 0.9 (Nelson et al., 2018), which suggests the IPASE may be a satisfactory assessment of self-disturbances.

2.3. Statistical analysis

We performed cluster analysis on the Z-scores for the CAPE positive and negative symptom dimensions and the IPASE total score. Cluster analysis is a method of classifying objects into homogenous groups (clusters) based on the selected characteristics they possess. The resulting clusters display high within-cluster homogeneity and high between-cluster heterogeneity (Hair et al., 1998).

We decided to perform the k-means cluster analysis which is a non-hierarchical clustering technique most appropriate when there are specific hypotheses regarding a number of clusters within the sample (Norušis, 2012). The K-means algorithm operates by portioning data into a predefined number of clusters, in which each observation is assigned to the cluster having the nearest mean.

After defining all clusters, we compared group means for all measures used in clustering by conducting an analysis of variance (ANOVA) with Bonferroni correction for multiple comparisons and performed discriminant analysis to additionally investigate the quality of cluster solution. Clusters were also assessed for between-group differences in demographics (gender and age) with chi-square and ANOVA.

Finally, to investigate group differences we performed analyses of variance with a Bonferroni correction on the DACOBS and IPASE subscales. Furthermore, we performed analyses of variance for depressive subscale of the CAPE, as well as for emotional distress associated with the positive and negative symptom. To avoid artificial observations of elevated distress as a result of higher frequency, in group differences analyses on emotional distress associated with positive and negative symptoms we controlled for the frequency of symptoms in the ANCOVA. In case of heterogeneity of variance, we used the Welch's ANOVA with the Games-Howell post-hoc test.

3. Results

3.1. Cluster analysis

Positive PLEs (CAPE positive), negative PLEs (CAPE negative) and self-disorders (IPASE total) were standardized into Z-scores, and k-means cluster analysis of four clusters was performed based on these variables.

The resulting clusters were profiled in the directions we expected that were shown in Fig. 1. The Welch's ANOVA revealed that the four groups differed significantly from each other on all scales: CAPE

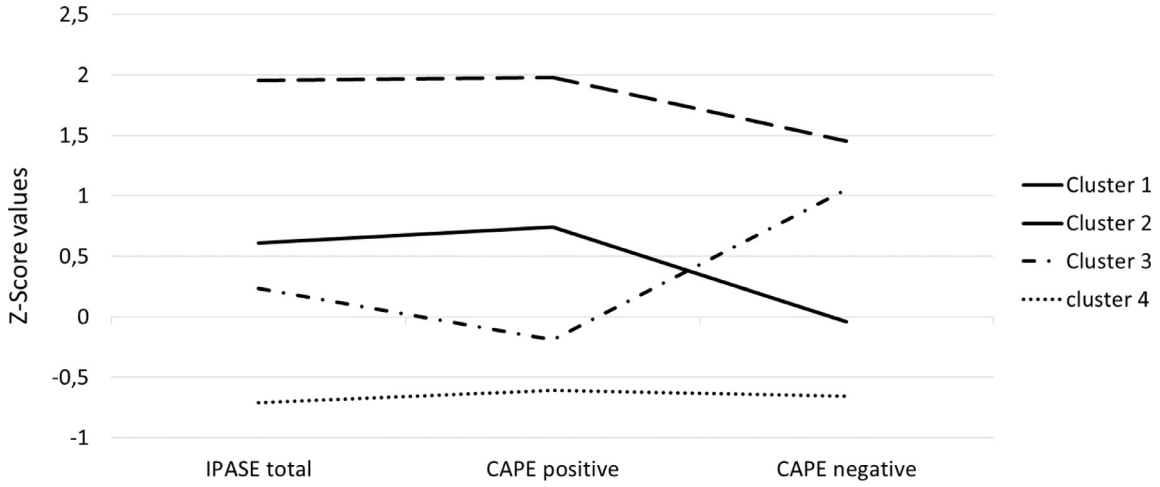

Fig. 1. Profiles of the four clusters.

Table 1
Demographic and defining variables among clusters.

Variable	Total Sample (N = 677)	Cluster 1 "High Profile" (n = 55)	Cluster 2 "Positive Profile" (n = 157)	Cluster 3 "Negative Profile" (n = 135)	Cluster 4 "Low Profile" (n = 330)	F/ X^2	Post-hoc comparison
IPASE total	92.71 (30.84)	152.91 (22.95)	111.54 (21.61)	99.93 (21.63)	70.76 (13.26)	379.72***	1 > 2 > 3 > 4
CAPE positive	29.09 (5.84)	40.64 (4.71)	33.43 (3.93)	27.99 (3.46)	25.55 (3.14)	296.86***	1 > 2 > 3 > 4
CAPE negative	26.03 (5.63)	34.20 (5.03)	25.80 (3.28)	31.95 (3.81)	22.35 (3.30)	281.69***	1 > 3 > 2 > 4
Age, years	22.98 (2.67)	22.33 (2.29)	22.24 (2.54)	22.87 (2.72)	23.49 (2.66)	9.59***	4 > 1, 2
Gender, F/M	481/196	39/16	117/40	91/44	234/96	1.79	–

Note: IPASE — Inventory of Psychotic-like Anomalous Self-experiences Questionnaire; CAPE — Community Assessment of Psychic Experiences Level of significance for post-hoc comparisons was $p < 0.001$ except for pairs:
Cluster 1 and Cluster 3 in CAPE negative with $p = 0.019$.
Cluster 1 and Cluster 4 in age with $p = 0.015$.
*** $p < 0.001$.

positive, F (3, 187)= 296.86; $p < 0.001$), CAPE negative, F (3, 188) = 281.69; $p < 0.001$) and IPASE total, F(3, 178) = 379.72; $p < 0.001$). Results of post-hoc pairwise comparisons with the Games-Howell test as well as means and standard deviations for the total sample and each cluster are presented in Table 1.

In the first cluster mean scores on self-disorders, positive and negative symptoms were at least greater than one standard deviation (*SD*) above the overall sample means (see Fig. 1). In addition, post-hoc comparisons showed that this group was characterized by the highest scores on all three measures (see Table 1). Thus, we named this cluster 'High Profile' (n = 55). The second group was characterized by relatively high levels of positive symptoms and self-disorders (mean scores were at least a half of *SD* above the sample mean) and a moderate level of negative PLEs (mean score within a half of *SD* below the mean of our sample). Due to the predominance of self-disorders and positive psychotic-like experiences over negative PLEs, we called this cluster - 'Positive Profile' (n = 157). The third cluster had a mean score for negative PLEs higher than the sample mean by more than one SD, and moderate levels of self-disorders and positive PLEs (mean scores within half SD of the overall sample means). This cluster was thus termed 'Negative Profile' (n = 135). Regarding the last cluster, a one-way ANOVA with post-hoc comparisons indicated it to have the lowest levels of self-disorders, positive and negative PLEs (all mean scores below half of *SD* for our sample means), relative to the other clusters. We named this group 'Low Profile' (n = 330).

A discriminant analysis based on 4-cluster k-means solution showed clear differences between clusters, Wilks' $\lambda = 0.12$, $p < 0.001$, with 97.3% of participants correctly classified.

The chi-square test found no significant differences in the proportions of males and females between clusters, X^2 (3)= 1.79; $p = 0.616$.

With regard to age, a one-way ANOVA revealed differences between groups, F(3, 673) = 9.59; $p < 0.001$, with Bonferroni post-hoc comparisons indicating that participants in the Cluster 4 were significantly older than participants in the Cluster 1 ($p < 0.05$) and the Cluster 2 ($p < 0.001$).

3.2. Cluster differences in cognitive biases and self-disorders

There were significant differences on all subscales of DACOBS except the 'jumping to conclusions bias' scale (Table 2). In each case, the group with 'High Profile' (Cluster 1) had the highest means, and the group with 'Low Profile' had the lowest. No significant differences between the Cluster 2 ('Positive Profile') and the Cluster 3 ('Negative Profile') in the DACOBS subscales were found. Also, there were no significant differences between the Cluster 1 and the Cluster 3 in 'beliefs inflexibility' subscale.

Similar results were obtained for the IPASE. Participants from the Cluster 1 ('High Profile') had the highest means in each subscale, while scores among the Cluster 4 ('Low Profile') individuals were the lowest. Furthermore, it was found that participants in the Cluster 2 had a significantly higher level of anomalous self-disturbances as measured by three out of five IPASE subscales (except 'Self-awareness and Presence' scale and 'Transitivism/Demarcation' scale) from participants in the Cluster 3.

3.3. Cluster differences in emotional discomfort

Clusters differed significantly regarding depression as measured with Depression subscale from the CAPE F(3, 673) = 148.199, $p < 0.001$. Post-hoc comparisons revealed that Cluster 1 ('High Profile')

Table 2
Group differences on cognitive biases and self-disturbances.

Variable	Total Sample (N = 677)	Cluster 1 "High Profile" (n = 55)	Cluster 2 "Positive Profile" (n = 157)	Cluster 3 "Negative Profile" (n = 135)	Cluster 4 "Low Profile" (n = 330)	F/Welch's F	Post-hoc comparison
DACOBS							
JTC	26.41 (4.51)	27.45 (4.79)	26.66 (4.39)	25.83 (4.29)	26.36 (4.59)	1.90	——
BELINFLE	16.44 (4.27)	18.84 (4.51)	16.71 (4.10)	17.90 (4.13)	15.3 (3.99)	20.69***	1 > 2; 1, 2, 3 > 4
ATTTHREAT	22.47 (5.45)	27.27 (4.81)	24.23 (4.71)	23.34 (5.63)	20.47 (4.93)	42.15***	1 > 2, 3, 4; 2, 3 > 4
EXTERATTRIB	17.68 (5.05)	23.51 (5.07)	18.92 (4.34)	19.01 (4.85)	15.57 (4.24)	63.95***	1 > 2, 3, 4; 2, 3 > 4
SOCCOGPROB	20.56 (5.60)	26.47 (4.34)	22.63 (4.78)	22.77 (5.05)	17.68 (4.66)	88.85***	1 > 2, 3, 4; 2, 3 > 4
SUBCOGPROB	20.11 (6.36)	26.47 (6.02)	21.87 (5.38)	23.10 (5.42)	17.00 (5.47)	70.81***	1 > 2, 3, 4; 2, 3 > 4
SAFETYBEH	10.43 (3.83)	13.11 (4,54)	11.25 (3.95)	10.84 (3.56)	9.41 (3.40)	18.479***	1 > 2, 3, 4; 2, 3 > 4
IPASE							
COGNITION	9.52 (3.43)	15.96 (3.44)	11.55 (3.36)	9.16 (2.50)	7.64 (1.36)	169.55***	1 > 2 > 3 > 4
CONSCIOUSNESS	12.82 (5.03)	20.05 (3.87)	15.78 (3.59)	14.17 (3.93)	9.65 (3.64)	190.35***	1 > 2 > 3 > 4
SELF_AW	35.35 (12.88)	59.36 (11.32)	41.64 (9.60)	39.73 (10.96)	26.56 (5.14)	282.93***	1 > 2, 3, 4; 2, 3 > 4
SOMATIZATION	27.86 (10.12)	45.64 (8.48)	34.73 (8.33)	28.99 (7.47)	21.17 (4.73)	261.30***	1 > 2 > 3 > 4
TRANS/DEMAR	7.64 (2.82)	12.13 (3.35)	8.48 (2.55)	8.44 (2.44)	6.15 (1.67)	103.60***	1 > 2, 3, 4; 2, 3 > 4

Note: DACOBS - Davos Assessment of the Cognitive Biases Scale; JTC - Jumping to conclusions; BELINFLE - Belief Inflexibility; ATTTHREAT - Attention for Threat; EXTERATTRIB – External Attribution; SOCCOGPROB - Social Cognition problem; SUBCOGPROB - Subjective Cognitive problems; SAFETYBEH - Safety behaviors; IPASE — Inventory of Psychotic-like Anomalous Self-experiences Questionnaire; SELF_AW - Self-Awareness and Presence; TRANS/DEMAR - Transitivism/ Demarcation

Level of significance for post-hoc comparisons was $p < 0.001$ except for pairs:
Cluster 1 and Cluster 2 in DACOBS Safety behaviors with $p = 0.042$.
Cluster 1 and Cluster 3 in DACOBS Safety behaviors with $p = 0.007$.
*** $p < 0.001$.

had the highest level of depressive symptoms, following by Cluster 2, 3 and 4 ($p < 0.001$ for all differences). Each cluster differed from each other at $p < 0.001$. At the same time we found that the groups differed significantly regarding distress associated with positive $F(1, 676) = 951.591$, $p < 0.001$ and negative symptoms $F(1, 676) = 767.808$, $p < 0.001$, when controlled for the frequency in these symptoms.

4. Discussion

In the clinical context, it was shown that considering a combination of different risk factors increase the predictive power for the development of full-blown psychosis above the presence of subclinical psychotic symptoms (Cannon et al., 2016; Carrión et al., 2016). However, most of clinical and non-clinical studies do not combine PLEs with other important factors pertaining to the risk states. Hence, our knowledge on the structure of a combination between PLEs and other risk factors for psychosis is limited though, and thus screening strategies for the risk of psychosis often rely only on cut-off scores for the presence of PLEs (Kline and Schiffman, 2014). Self-disturbances and cognitive biases have been considered as an important risk factor for developing psychosis (Gawęda et al., 2018a; Howes and Murray, 2014; Nelson et al., 2012). The present study aimed at providing the cluster analysis of the combination of positive and negative PLEs and self-disturbances in a non-clinical sample. Our purpose was to better understand the cluster structure of a combination of self-disturbances and PLEs. Furthermore, we examined whether obtained clusters (groups) differed in cognitive biases that have been found related to psychosis and self-disturbances.

In general, the cluster analysis resulted in four groups that significantly differed on PLEs and the level of total self-disturbances. As expected, we found that people in the group characterized by the low profile of symptoms were most widely represented (48.74% of total sample), contrary to people with the highest scores of PLEs and self-disturbances (8.12% of total sample). As expected, intermediate states (clusters 2 and 3) were more frequent than the High Profile group but less frequent from the Low Profile group. This is consistent with the psychosis continuum model (Linscott and Van Os, 2013; Van Os et al., 2000, 2009), which predicts that the most severe states are less represented in the general population.

In their study on help-seeking adolescents, Koren et al. (2013) differentiated three at-risk groups based on comprehensive interviews for prodromal symptoms of psychosis and self-disturbances – a group with prodromal symptoms only, a group with self-disorders only and a mixed group. We found a similar percentage of participants with very low risk for psychosis (i.e., low frequency of PLEs and self-disturbances). On the contrary, our cluster analysis did not provide separate groups based on the results on self-disturbances. However, the study by Koren et al. (2013) was based on data analysis which focused on self-disturbances that were considered to be *clinically meaningful* among adolescents actively seeking for help. In our non-clinical study, continuous variables were analyzed, which might impact the results of cluster analysis. In a non-clinical risk study, it is expected that one would find a lower severity of psychopathological dimensions compared to a clinical sample. Furthermore, although PLEs and self-disturbances constitute separate constructs, a relatively strong link has been observed between PLEs and self-disturbances (Cicero et al., 2017; Gawęda et al., 2018d,b), which might also reduce the likelihood of identifying separate groups for high self-disturbances and high PLEs. However, our results suggested that two groups with predominantly high positive PLEs and negative PLEs differed on self-disturbances. More specifically, the Positive Profile group had significantly more self-disturbances related to cognition, consciousness, and somatization compared to the Negative Profile group. This corroborates the results from a previous study showing that positive schizotypy, which also contains PLEs, is associated with more frequent self-disturbances compared to negative schizotypy (Cicero et al., 2017). Our results suggest that these differences in the profiles can be observed even when self-disturbances are included in the cluster analysis along with the PLEs. At the same time, it should be noted however that there were no group differences on self-awareness and transitivism. To date, there is a scarcity of studies addressing the specificity of self-disturbances for positive and negative dimensions of psychosis or PLEs. However, in general, our results suggest that some types of self-disturbances may distinguish the positive and negative profile of the PLEs and at the same time both groups may share some other anomalies of the experiences of self.

Interestingly, although participants in all groups may be considered being at the age of highest risk for developing psychosis and psychotic

experiences (McGrath et al., 2016; Schultze-Lutter et al., 2017), our results revealed that the High Profile and Positive Profile groups were significantly younger than the Low Profile group. This is in line with the studies showing higher prevalence rates of the PLEs among younger individuals (Kelleher et al., 2012; Linscott and Van Os, 2013). It should be noted, however, that although our findings are in line with the tendency for higher PLEs with younger age, we did not investigate adolescents who may be at even higher risk (Schimmelmann et al., 2015).

Furthermore, we aimed at investigating whether obtained clusters (groups) differ in term of an important early risk factor for psychosis - cognitive biases. Our results are in line with previous studies showing an increased number of information processing biases among people at risk for psychosis (An et al., 2010; Gawęda et al., 2018a; Winton-Brown et al., 2015), as well as people with frequent PLEs (Gawęda and Prochwicz, 2015; Gawęda et al., 2018c; Moritz et al., 2017; Prochwicz and Kłosowska, 2017; So et al., 2016, 2015; Warman et al., 2007). Contrary to self-disturbances, the Positive and Negative Profile groups did not differ on cognitive biases. Previous studies found that both negative and positive PLEs are related to similar cognitive biases (Gawęda et al., 2015, 2018c). There were no group differences on a tendency for hasty decisions and inferences (i.e., jumping to conclusions) that is often linked to the risk of psychosis (McLean et al., 2017; Ross et al., 2015). It may suggest that other cognitive biases than jumping to conclusions contribute more to the early non-clinical risk states. The High Profile group differed on all remaining cognitive biases from other groups. Furthermore, as expected (Gawęda et al., 2015, 2018c), people with High Positive (Cluster 2) and High Negative (Cluster 3) profiles had more intensive cognitive biases related to the risk of psychosis. This is in line with previous studies showing attention biases (Prochwicz and Kłosowska, 2017; So et al., 2015), beliefs inflexibility (Buchy et al., 2007; Moritz et al., 2017), social cognitive deficits (Combs et al., 2007), external attributions (Gawęda et al., 2018a; Winton-Brown et al., 2015) as important cognitive factors related to the risk for psychosis both in clinical and non-clinical groups.

4.1. Clinical implications

Although generalization to the clinical context should be approached with caution, the results obtained from models testing risk of psychosis defined according to the frequency of PLEs in non-clinical samples may have some potential clinical implications. Although our sample was recruited from non-help seekers, we found that those classified to the High Profile Cluster experience elevated levels of emotional distress (depressive symptoms and distress associated with positive and negative psychotic-like experiences, even the frequency of these experiences was controlled for). Our results suggest a relatively small sample of the non-clinical population may be considered as being at high non-clinical risk. This is consistent with previous studies on help-seeking (Koren et al., 2013) and non-clinical (Koren et al., 2016) adolescents, in whom about 10% (8 −13%) of participants met the criteria for prodromal symptoms as assessed via clinical interview (the Structured Interview for Prodromal Syndromes). It has also been found (Cicero et al., 2014) that self-reported PLEs correspond to the interview-based measure of subclinical psychotic symptoms in a non-clinical sample. However, only a few people with frequent PLEs fulfilled criteria for being at clinical risk of psychosis. Screening for the *combination* of PLEs and self-disturbances may have some potential to increase the power of detecting people at higher risk of psychopathology. Importantly, our study suggests that, similar to clinical risk states (Fusar-Poli et al., 2016; Polari et al., 2018), the non-clinical risk is not a homogenous construct. Cluster analysis revealed the complex profile of the results, which might be related to the different level of the risk of psychosis. Further studies verifying the clinical status and outcome of participants are required. However, early detection strategies, in particular, those based on self-report measures, may benefit from considering a combination of different risk factors in order to increase predictive validity. Furthermore, higher risk of psychosis is related to the higher tendency of safety behaviors, suggesting that people who experience PLEs and self-disturbances more frequently tend to avoid uncomfortable situations (e.g., social exposition; interpersonal threat). Indeed, our recent study found that safety behaviors are an important factor that distinguishes clinical psychosis and its non-clinical risk states (Gawęda et al., 2018c). Hence, the combination of PLEs, self-disturbances and cognitive biases is promising in early detection and is in accordance to the integrated theoretical accounts for the risk of psychosis (Howes and Murray, 2014).

4.2. Limitations

Before conclusions, methodological limitations and some theoretical issues should be discussed. The self-report screening has some potential in early detection strategies for people at risk for psychosis. The results obtained from a large sample of help-seeking young adults suggest that a meaningful proportion (35%) of patients scoring above the cut-off in the Prodromal Questionnaire (PQ) fulfilled the clinical criteria for ultra-high risk states (Ising et al., 2012). However, it is important to note that our study was limited to the use of self-report measures only and thus we were unable to verify in the clinical interview whether some participants met the criteria for clinical risk of psychosis. Importantly PQ that was used by (Ising et al., 2012) was designed for screening of the clinical risk of psychosis while the CAPE was developed in the purpose of investigating continuum of psychotic experiences in the general population. Furthermore, our study was conducted among healthy individuals who do not seek help. Hence, our classification should be referred directly to clinically-relevant states, and the results should be verified in the clinical context in future studies. It should be however noted that the High Profile group had very similar mean scores on the IPASE as patients at early stages of psychosis from a prior study (Nelson et al., 2018) suggesting that the severity of self-disturbances in this group is comparable to the clinical level. However, positive responses to items measuring PLEs or self-disturbances in self-report screening tools should always be verified with clinical interviews. Otherwise, there is a risk of false positive diagnosis, even when psychotic-like experiences are related to elevated distress in the High Profile Cluster, which may raise ethical issues (i.e., iatrogenic effects). Furthermore, causal relationships between factors cannot be established due to the cross-sectional study design. To date, only some studies have found that cognitive biases precede the exacerbation of PLEs (Lüdtke et al., 2017; Reininghaus et al., 2016). However, bidirectional causality is also possible (e.g., Garety et al., 2007). Longitudinal studies are required to verify whether High Profile cluster of people who combine frequent PLEs and a higher level of self-disturbances are at the highest risk for developing psychotic symptoms in future (i.e., conversion to psychosis).

Along with the above-mentioned methodological limitations, some theoretical issues should also be discussed. Self-report assessment of self-disturbances that we used in the present study refer to the conceptualization of self-disturbances as proposed and operationalized by Parnas et al. (2005) within the EASE interview. It should be noted however that even the phenomenological approach to self-disturbances is influential in the field, some authors also employed experimentally-based (or performance based) approach that captures behavioral expressions of self-disturbances (for a review see: Hur et al., 2014). Although both of these approaches claim to address self-disturbances, there is still no consensus about convergence between subjectively reported anomalous experiences (e.g., IPASE, EASE) and performance-based measures of self-disturbances. Some recent studies suggest a weak convergence between the IPASE and performance-based assessment of self-disturbances in schizophrenia (Klaunig et al., 2018), which suggests that there is still a need for a better theoretical and empirical clarity in the field. Furthermore, still, only limited theoretical

consideration is devoted to the relationship between cognitive biases and self-disturbances and the role of their interplay in the risk of psychosis (Klaunig et al., 2018; Nelson et al., 2014a, b). Similarly, only a limited number of studies have been conducted to investigate the associations between self-disturbances and PLEs. Further theoretical clarification and empirical investigation of the relationship between important risk factors for psychosis would foster early detection and intervention strategies.

4.3. Conclusions

This cluster analysis suggests different sub-groups on the continuum of non-clinical risk for psychosis defined by combinations of the frequency of PLEs and self-disturbances. This suggests that the non-clinical risk is not a homogenous construct. The group with the highest profile may be hypothesized as to be at the highest risk and was found to be characterized by the most severe cognitive biases and self-disturbances. It seems that the group with higher positive PLEs may be discriminated from those with a profile of higher negative PLEs based on some types of self-disturbances. Further longitudinal studies are required to investigate how these variables influence each other over time and provide useful targets for early detection and preventative interventions.

Contributions

ŁG designed the study; KP, DF, AC collected the data; RP, AA, and ŁG performed data analyses; ŁG, DC, and BN interpreted the results; ŁG wrote the first draft of the manuscript; DF, BM, KP, DC, and BN edited the manuscript. All authors approved the final version of the article.

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Conflict of interest

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2019.01.044.

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