The Course of Negative Symptom in First Episode Psychosis and the Relationship with Social Recovery

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Abstract

Aims: To investigate trajectories of negative symptoms during the first 12 months of treatment for first episode psychosis (FEP), their predictors and relationship to social recovery.

Method: 1006 participants were followed up for 12 months following acceptance into Early Intervention in Psychosis services. Negative symptom trajectories were modelled using latent class growth analysis (LCGA) and predictors of trajectories examined using multinomial regression. Social recovery trajectories – also modelled using LCGA – of members of each negative symptom trajectory were ascertained and the relationship between negative symptom and social recovery trajectories examined.

Results: Four negative symptom trajectories were identified: Minimal Decreasing (63.9%), Mild Stable (13.5%), High Decreasing (17.1%) and High Stable (5.4%). Male gender and family history of non-affective psychosis predicted stably high negative symptoms. Poor premorbid adolescent adjustment, family history of non-affective psychosis and baseline depression predicted initially high but decreasing negative symptoms. Members of the Mild Stable, High Stable and High Decreasing classes were more likely to experience stably low functioning than the Minimal Decreasing class.

Conclusions: Distinct negative symptom trajectories are evident in FEP. Only a small subgroup present with persistently high levels of negative symptoms. A substantial proportion of FEP patients with elevated negative symptoms at baseline will achieve remission of these symptoms within 12 months. However, elevated negative symptoms at baseline, whether or not they remit, are associated with poor social recovery, suggesting targeted interventions for service users with elevated baseline negative symptoms may help improve functional outcomes.

Key words: negative symptoms/early intervention/functioning/recovery/longitudinal

1. Introduction

Negative symptoms represent a significant unmet clinical need and the search for effective treatments has received renewed interest in recent years (Kirkpatrick et al., 2006). However, the mechanisms that underpin negative symptoms remain poorly understood. Negative symptoms can be subject to significant fluctuations over time, particularly in the early course of psychosis (Edwards et al., 1999; Ventura et al., 2004). Individuals vary in the stability of their negative symptoms (Kelley et al., 2008) and those with persistently elevated negative symptoms are at highest risk of poor outcome (Husted et al., 1992; Mäkinen et al., 2008). Increased understanding of variation in negative symptom course might help illuminate the mechanisms which underlie negative symptoms.

The prevalence of persistent negative symptoms in first episode psychosis (FEP) remains unclear due to the use of inconsistent criteria for persistence. Moreover, grouping individuals into those with persistent negative symptoms and those without might mask the true complexity of individual variation in negative symptom course. Chen et al. (2013) found that variation in negative symptom course in a cohort of schizophrenia patients was best modelled by four distinct trajectory classes, characterised by differing levels of negative symptoms at baseline and a distinctive pattern of longitudinal change. It is not yet known whether multiple negative symptoms trajectories are similarly evident in FEP. This study examines negative symptom trajectories in a large FEP sample using latent class growth analysis (LCGA), a data-driven approach to identifying patterns of longitudinal change within a heterogeneous population. Predictors of the identified trajectories are then investigated.

This study also explores the relationship between negative symptom course and social recovery. Although the association between negative symptoms during FEP and poor functional outcomes is well established (Evensen et al., 2012; Galderisi et al., 2013), the relationship between the trajectory of an individual's negative symptoms and concurrent change in their functioning has yet to be investigated. Understanding the relationship between negative symptom course and contemporaneous changes in functioning might inform the development of targeted interventions to improve functional outcomes following FEP.

2. Method

2.1. Participants

The sample comprises participants in the National EDEN study: a national evaluation of the impact and cost-effectiveness of Early Intervention in Psychosis (EIP) services in the UK (Birchwood et al., 2014). All individuals accepted into EIP services in Birmingham, Bristol, Cambridge, Cornwall, Lancashire and Norfolk between August 2005 and April 2009 were invited to take part. The Policy Implementation Guide (Department of Health, 2001) provides details of the acceptance criteria for these services and the care they offer. In total, 1027 individuals consented to take part: 80% were followed up at 6 months and 77% at 12 months. National EDEN participants assessed with the Positive and Negative Syndrome Scale (PANSS) at one time point or more (n = 1006) are included in the current study (see Table 1 for sample characteristics and descriptive statistics).

[Insert Table 1]

2.2. Measures

2.2.1. Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987)

Participants were assessed using the PANSS following acceptance into EIP (baseline) and 6 and 12 months later. The PANSS is a 30-item instrument designed to measure the severity of symptoms associated with schizophrenia. Symptom severity over the previous seven days is

assessed by a trained rater following a semi-structured interview with the participant. Each symptom is rated on a 7-point scale from 1 (absent) to 7 (extreme).

2.2.2. Time Use Survey (TUS; Fowler et al., 2009; Short, 2003)

Time spent in 'structured activity' at baseline, 6 and 12 months, as measured by the Time Use Survey (TUS), was used as an index of social recovery. The TUS is a semi-structured interview designed to assess time spent participating in structured activity on average over the previous month. Structured activity is defined as time spent in paid employment, voluntary work, education, childcare, housework, sport and structured leisure activities. The number of hours per week spent engaged in structured activity on average over the previous month was the measure of functioning used to model social recovery trajectories. Social and occupational functioning have been deemed among the most important markers of recovery by experts by both professional (Kane et al., 2003) and lived experience (Pitt et al., 2007). Unlike many measures of functioning employed in psychosis research, the TUS has limited conceptual overlap with negative symptoms, reducing the risk of confounding.

2.2.3. Other Measures Administered at Baseline

Variables hypothesised to be associated with negative symptom course were measured at baseline. Self-reported social and academic adjustment in childhood (up to 11 years) and early adolescence (11 – 15 years) was assessed using the Premorbid Adjustment Scale (PAS; Cannon-Spoor et al., 1982). Duration of untreated psychosis was assessed retrospectively

using the method described by Larsen et al. (1996). DUP was defined as the interval between onset of frank psychosis and commencement of criterion antipsychotic treatment, ascertained using participant report and examination of clinical notes. Continuous data were dichotomised to create a binary DUP variable (long DUP $\geqslant$ 9 months) due to the non-linear relationship between DUP and negative symptoms (Boonstra et al., 2012). The Calgary Depression Scale (CDSS; Addington et al., 1994) was used to measure depression and the Drug Check (Kavanagh et al., 1999) to assess illicit substance use. Family history of non-affective psychosis was ascertained through participant report and diagnoses at baseline obtained from clinical notes.

2.3. Analysis Plan

Since it is now accepted that the factor structure of the PANSS is not well represented by the three original subscales (Kay et al., 2000; White et al., 1997), the PANSS items used to measure negative symptoms in this study were determined using Exploratory Structural Equation Modelling (ESEM; Asparouhov and Muthén, 2009). Whilst much work has been carried out to determine the factor structure of the PANSS in schizophrenia samples, fewer studies have examined its factor structure in FEP samples.ESEM is a factor analytic technique which both allows items to load on multiple factors and provides model fit indices, enabling adequate model fit to be verified. This approach was chosen since it has been argued that free estimation of cross-loadings is necessary to adequately reflect clinical reality and thus obtain satisfactory model fit (van der Gaag et al., 2006; van den Oord et al., 2006). ESEM with geomin rotation was conducted and the adequacy of model fit accessed using

three indices. A five-factor model was specified based on the results of exploratory factor analysis.

The study used latent class growth analysis (LCGA; Nagin, 2005) to identify distinct trajectories of change in negative symptom severity. LCGA is a technique used to identify homogenous sub-groups (latent classes) of individuals with distinct patterns of change over time (Andruff et al., 2009). Missing data were estimated using full information maximum likelihood under the assumption that data were missing at random. Models with increasing numbers of latent classes were fitted to the data and the best model selected according to a number of considerations including fit indices, entropy (a measure of the distinctness of classes), accuracy of posterior classifications (probability that participants were assigned to the correct latent class by the model), parsimony and interpretability (Jung and Wickrama, 2008).

Multinomial regression, with latent class according to the selected LCGA model as the dependent variable, was used to examine predictors of negative symptom course. There were twelve candidate exploratory variables: age at psychosis onset; gender; ethnicity; family history of non-affective psychosis; schizophrenia diagnosis; duration of untreated psychosis; premorbid social adjustment in childhood; premorbid social adjustment in adolescence; premorbid academic adjustment in childhood; premorbid academic adjustment in adolescence; baseline depression; and history of substance use. Only variables that differed significantly between latent classes (according to Pearson's Chi-Squared tests and one-way ANOVAs with Bonferroni correction) were entered into the multinomial regression model. An additional, post-hoc one-way ANOVA was conducted to explore whether members of the

identified trajectory classes differed with respect to the severity of expressive deficit versus withdrawal symptoms (as identified through exploratory factor analysis) at baseline.

Trajectories of social recovery were identified by using LCGA to model hours per week in structured activity as measure by the TUS, as described by Hodgekins et al. (2015b). The social recovery trajectory classes of each member of the identified negative symptom trajectory classes were determined by matching the participants in the current study with those included in Hodgekins et al.'s analysis using their identifier code. A matrix of negative symptom versus social recovery trajectories was constructed and individuals assigned to cells of the matrix according to their trajectory permutation. The independence of the trajectories was tested statistically using Pearson's Chi-Squared test and adjusted standardised residuals of the test examined to interpret the results.

Analyses were conducted using SPSS for Windows, Version 22 (IBM Corp., 2013) and Mplus for Windows, Version 7.1 (Muthén & Muthén, 1998-2012).

3. Results

3.1. Exploratory Structural Equation Modelling

A five-factor model which fit the data adequately (RMSEA = 0.054; CFI = 0.914; TLI = 0.874) resulted in a negative symptoms factor including the items 'Blunted affect', 'Lack of

spontaneity', 'Emotional withdrawal', 'Passive social withdrawal', 'Poor rapport', 'Motor retardation' and 'Active social avoidance'. The mean rating of these items was used to measure negative symptom severity. The identified factor structure was similar to that found in van der Gaag et al.'s (2006) study employing similar methods. Mirroring the findings of van de Gaag et al., 'Active social avoidance' was found to load on both the negative symptoms and affective symptoms factors.

3.2.Negative Symptom Trajectories

LCGA models with increasing numbers of latent classes were fitted to the data. Fit indices, entropy, accuracy of posterior classifications, and the size of each class were compared (Table 2) and the four class model selected. The four-class model (Figure 1) fit the data significantly better than the models with one, two or three latent classes according to all fit indices. Further, each of the four latent classes represented a distinct trajectory with theoretical relevance. Mean posterior probabilities were adequate (> 0.70), indicating high probability of classification to the correct latent class and no latent class was made up of less than 5% of the sample. Although the majority of fit indices suggested that the more latent classes included the better model fit, models with five or more latent classes were rejected for reasons of parsimony and interpretability. Models with five or more latent classes included classes comprising a very small proportion of the sample (less than 5%) and these additional trajectories were not sufficiently unique and distinct to add interpretive value.

[Insert Table 2]

[Insert Figure 1]

3.3.Characteristics of Latent Classes

The class size, unstandardised mean intercept, unstandardised mean gradient, the significance of this gradient (and corresponding p-value) for each trajectory class is presented in Table 3.

[Insert Table 3]

3.4. Predictors of Negative Symptom Course

The four negative symptom trajectory classes were compared on demographic and baseline variables. Descriptive statistics for each class are presented in Table 4.

[Insert Table 4]

Class differences were found in gender ($\chi 2$ (3) = 9.253, p = 0.026), baseline clinical diagnosis (Fisher's Exact Test, p = 0.019), family history of non-affective psychosis (Fisher's Exact Test, p = 0.001), premorbid social adjustment in childhood (F (3, 904) = 5.116, p = 0.002) and early adolescence (F (3, 864) = 7.240, p = <0.001), premorbid academic adjustment in

childhood (F (3, 904) = 7.270, p = <0.001) and early adolescence (F (3, 899) = 10.236, p = <0.001), and baseline depression (F(3, 943) = 11.285, p = <0.001). These variables were entered into a multinomial regression with negative symptom trajectory class as the dependent variable. The Minimal Decreasing trajectory class served as the reference category.

Compared to individuals in the Minimal Decreasing class, those in the High Stable class were more likely to be male (B = -1.04, p = 0.03) and more likely to have a family history of non-affective psychosis (B = -1.18, p = 0.01). Compared to the Minimal Decreasing class, those in the High Decreasing class were more likely have a family history of non-affective psychosis (B = -0.68, p = 0.046) and had higher levels of depression (B = 0.09, p = <0.001). Members of the High Decreasing class also had better premorbid social adjustment during childhood than the Minimal Decreasing Group (B = -2.21, p = 0.004) but poorer premorbid social adjustment in adolescence (B = 2.11, p = 0.003). Full results of the multinomial regression are available as supplementary material.

3.5. Relationships between Negative Symptom Trajectory and Social Recovery

Three functioning trajectories were identified by Hodgekins et al.: (1) low levels of functioning sustained over the course of the study (‘Low Stable’); (2) moderate functioning which increased over the course of the study (‘Moderate Increasing’); and (3) initially high functioning which decreased slightly but remained high (‘High Decreasing’). The trajectories are depicted graphically in Hodgekins et al. (2015b; figure 1). Both the Moderate Increasing

and High Decreasing classes, but not the Low Stable class, were engaging in levels of structured activity within the non-clinical range by 12 months and were therefore deemed to have made a good social recovery (Hodgekins et al., 2015b). Of the participants in the current study, 759 were also included in Hodgekins et al.'s analysis. These participants were assigned to cells of a matrix according to their permutation of negative symptom versus functioning trajectory (Table 5).

[Insert Table 5]

Negative symptom trajectories and functioning trajectories were not independent of one another ($\chi 2 = 57.06$, $p = <0.001$). Those in the High Stable, Mild Stable and High Decreasing negative symptom classes were over-represented in the Low Stable functioning class, indicating that those who followed a trajectory characterised by elevated negative symptoms at baseline, regardless of whether those negative symptoms decreased, were less likely to recover socially within 12 months. The Minimal Decreasing negative symptoms class were more likely to make a good social recovery within 12 months than members of other classes; nonetheless, the majority (56.9%) fell into the Stable Low functioning class. The proportion of each negative symptom trajectory class that made a good social recovery within the study period is presented graphically in Figure 2.

[Insert Figure 2]

4. Discussion

4.1. General Discussion

This study identified four distinct negative symptom trajectories in a large sample of individuals receiving treatment for FEP. Only a small proportion of the sample (5.4%) had persistently high levels of negative symptoms. A further 13.5% of the sample presented with consistently elevated negative symptoms of lesser severity. The mean intercept of both these trajectories was sufficiently high to indicate multiple clinically significant negative symptoms. Membership of the class with the highest levels of persistent negative symptoms was predicted by male gender and family history of non-affective psychosis. In line with previous research linking persistent negative symptoms and poor outcome, those with stably elevated negative symptoms were over-represented among those with poor social recovery.

A trajectory of initially high but decreasing negative symptoms was followed by 17.1% of the sample. This supports a suggestion in the literature that initially elevated negative symptoms often decrease over time (Savill et al., 2015). Those with remitting negative symptoms were distinguished from those with consistently minimal negative symptoms by poorer premorbid social adjustment during adolescence despite better social adjustment during childhood. They were also more likely to have a family history of non-affective psychosis and had higher baseline depression. Despite the remission of their negative symptoms, this trajectory class were less likely to make a good social recovery than those with minimal negative symptoms at baseline. One possible explanation is that functioning disrupted by negative symptoms

takes time to return to optimal levels following remission of those symptoms, resulting in delayed improvement in functioning relative to negative symptoms. Alternatively, given their poor premorbid adolescent functioning, it might be that the poor social recovery of this group is a legacy of low baseline functioning.

Two subdomains of negative symptoms – expressive deficits and withdrawal (avolition/asociality) – have now been established (Liemburg et al., 2013). Therefore, a question arose whether the relative prominence of the two subdomains differed between trajectory classes. However a post-hoc one-way ANOVA revealed no significant differences between trajectory classes in the proportion of expressive deficit versus withdrawal symptoms at baseline ($F = 2.22$, $p = 0.085$), suggesting negative symptom trajectories were not associated with the type of negative symptoms present at baseline.

The majority of the sample (63.9%) presented with consistently minimal negative symptoms. These participants were more likely to recover socially within 12 months than members of other classes. Nonetheless, more than half of this group did not make a good social recovery; whilst negative symptoms might be an important barrier to social recovery in some individuals, they are by no means necessary for poor social recovery.

4.2. Clinical Implications

The results of this study indicate that a substantial proportion of those with elevated negative symptoms at baseline will achieve remission of these symptoms within 12 months. However, even when negative symptoms remit, they are associated with poor social recovery. As such, those who present with elevated negative symptoms on entry to EIP services might benefit from close monitoring of their functioning and the provision of targeted interventions. Given that those with initially high but decreasing negative symptoms were often functioning poorly prior to psychosis, it is perhaps not surprising that they struggle to recover socially after its onset. Further research focusing on emerging negative symptoms and social disability during the prodromal phase would be helpful in understanding how these difficulties develop. It might be that intervention at this early stage – after the onset of non-specific negative symptoms and early signs of social disability but before the emergence of positive symptoms – is warranted (Fowler et al., 2010). Additionally, it might be that it is beneficial to engage the children of parents with psychosis in interventions designed to prevent early social disability.

4.3. Limitations

Although the PANSS is one of the most widely used measures of negative symptoms severity, it has significant limitations, both in its item content and reliance on behavioural observations for the assessment of experiential deficits (Blanchard et al., 2011). Measures developed since data collection for this study began (e.g. the Clinical Assessment Interview for Negative Symptoms (CAINS; Kring et al., 2013)) have sought to address these

limitations; it would be interesting to compare the results of the current study with those of similar future studies that utilise these recently developed negative symptom measures. Similarly, whilst the TUS provides a valuable index of social recovery, it is limited in that it measures only quantity of engagement in activity, not quality of engagement or the personal meaning attributed to it. Considering personal recovery – a concept encompassing connectedness, hope, identity, meaning, and empowerment (Leamy et al., 2011) – in addition to functioning in future research could help minimise this limitation.

Complete PANSS data at all three time points were only available for 63.4% of participants. As previously mentioned, missing data were estimated using full information maximum likelihood under the assumption that data were missing at random (MAR). However, there was evidence that those with lower levels of negative symptoms at baseline were more likely to have missing data: as such, the MAR assumption is not supported. It is arguably preferable for a study of negative symptoms to have higher attrition of participants with lower levels of baseline negative symptoms than vice versa. Nonetheless, since accepting the unsupported assumption that data are MAR introduces bias, the results of the study are in need of replication.

Since participants were assessed at only three time points, the model forms that could be fitted to the data were limited. Further, the follow-up period of the current study was relatively short. Whilst the first 12 months of treatment are an important period for research given EIP services' focus on providing intensive support soon after psychosis onset, it is possible that further trajectories would emerge if participants were followed over a longer period. A longer term follow-up incorporating more frequent assessment would provide a

more nuanced picture of variation in negative symptom course. Since pharmacological treatment and other interventions could be important factors influencing negative symptom trajectories, the impact of treatment variables (including service engagement) on negative symptom trajectories should be explored in future research.

4.4. Conclusions

Distinct negative symptom trajectories can be identified within a FEP cohort. Persistent negative symptoms are observed in only a small proportion; many of those with high levels of negative symptoms at baseline will attain remission of these symptoms within 12 months. However where elevated negative symptoms are present at baseline, whether or not they remit, they are associated with poor social recovery. Further, even those with consistently low levels of negative symptoms mostly do not make a good social recovery following 12 months of EIP.

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Tables:

Table 1. Sample characteristics and descriptive statistics

	Percentage	Mean (SD)	Median (Q_1, Q_3)
Age at Onset	-	20.07 (7.78)	20 (18, 24)
Male Gender	69.1	-	-
			-
Ethnicity			
White British	70.3	-	-
Asian	15.5	-	-
Black	6.8	-	-
Mixed	4.2	-	-
Other	3.3	-	-
Family History of Non-Affective Psychosis	8.9	-	-
Initial Clinical Diagnosis			
Unspecified Psychosis	72.0	-	-
Schizophrenia	10.6	-	-
Bipolar	5.2	-	-
Drug Induced Psychosis	6.7	-	-
Paranoid Psychosis	3.7	-	-
Schizoaffective Disorder	1.7	-	-
Antipsychotic Use at Baseline			
Typical	1.6	-	-
Atypical	78.7	-	-
Both Typical and Atypical	7.9	-	-
No Antipsychotic	12.7	-	-
Antipsychotic Use at 12 Months			
Typical	2.2	-	-
Atypical	76.5	-	-
Both Typical and Atypical	2.3	-	-
No Antipsychotic	18.9	-	-
Baseline PANSS			
Positive Subscale	-	15.28 (6.03)	15 (10, 19)
Negative Subscale	-	14.80 (6.52)	13 (9, 19)
General Subscale	-	32.85 (9.95)	32 (25, 39)
Negative Factor Item Average	-	2.16 (1.00)	1.86 (1.29, 2.86)

PAS Social			
Childhood	-	0.20 (0.21)	0.17 (0, 0.33)
Adolescence	-	0.23 (0.19)	0.17 (0.06, 0.33)
PAS Academic			
Childhood	-	0.26 (0.21)	0.25 (0.08, 0.42)
Adolescence	-	0.36 (0.24)	0.33 (0.17, 0.50)
Baseline Calgary Depression	-	6.30 (5.38)	5 (2, 10)

Note. PANSS = Positive and Negative Syndrome Scale; PAS = Premorbid Adjustment Scale

Table 2. Comparison of LCGA models with two to six latent classes

	2	**3**	**4**	**5**	**6**
AIC	5893.21	5740.96	5639.24	5564.28	5464.70
BIC	5932.52	5795.01	5708.03	5647.81	5562.98
BLRT	0.00	0.00	0.00	0.00	0.00
LMR-LRT	0.00	0.06	0.03	0.13	0.06
Entropy	0.83	0.81	0.79	0.79	0.79
Classification Probabilities	0.96, 0.90	0.84, 0.94, 0.89	0.84, 0.92, 0.91, 0.79	0.89, 0.77, 0.91, 0.83, 0.80	0.83, 0.76, 0.91, 0.84, 0.88, 0.87
Class Size (%)	81, 19	21, 74, 5	14, 64, 5, 17	3, 17, 64, 11, 5	15, 14, 3, 7, 57, 3

Note. AIC = Akaike's Information Criterion, BIC = Bayesian Information Criterion, BLRT = Bootstrap Likelihood Ratio Test, LMR-LRT = Lo–Mendell–Rubin Likelihood Ratio Test. Lower AIC and BIC values indicate superior fit. A significant BLRT or LMR-LRT value is indicative of the model being a better fit than the model with one fewer latent classes. Classification Probabilities = mean posterior probabilities for each class, Class Size = proportion of the sample making up the membership of each class.

Table 3. Characteristics of latent classes

Name	Class size	Unstandardised mean intercept	Unstandardised mean gradient	Significance of gradient
Minimal Decreasing	n = 674 (63.9%)	1.62	-0.17	Sig. (p = <0.001)
Mild Stable	n = 108 (13.5%)	2.19	0.24	Non sig. (p = 0.08)
High Decreasing	n = 174 (17.1%)	3.35	-0.89	Sig. (p = <0.001)
High Stable	n = 50 (5.4%)	3.58	0.05	Non sig. (p = 0.70)

Table 4. Descriptive statistics (mean (SD) unless otherwise indicated) by negative symptom trajectory class.

	Minimal Decreasing (n = 674)	Mild Stable (n = 108)	High Decreasing (n = 174)	High Stable (n = 50)
Age at Onset	19.99 (8.45)	20.65 (5.27)	20.48 (6.54)	18.46 (6.78)
Male Gender	66.9%	77.8%	68.4%	82.0%
White British Ethnicity	70.9%	68.5%	72.4%	58.0%
Family History	6.9%	9.4%	11.5%	25.5%
Schizophrenia Diagnosis	9.8%	10.8%	9.6%	23.4%
DUP ≥ 9 months	27.8%	31.8%	28.3%	26.0%
PAS Social - Childhood	0.19 (0.20)	0.25 (0.25)	0.17 (0.19)	0.27 (0.21)
PAS Social - Adolescence	0.21 (0.18)	0.26 (0.23)	0.26 (0.21)	0.31 (0.17)
PAS Academic - Childhood	0.24 (0.21)	0.34 (0.21)	0.26 (0.19)	0.31 (0.21)
PAS Academic - Adolescence	0.33 (0.24)	0.45 (0.24)	0.41 (0.25)	0.41 (0.21)
Calgary Depression	5.61 (5.03)	7.36 (5.62)	8.04 (5.66)	6.86 (6.60)
Substance Use	66.3%	63.2%	68.5%	55.1%

Note. Family History = Family History of Non-Affective Psychosis; DUP = Duration of Untreated Psychosis; PAS = Premorbid Adjustment Scale.

Table 5. Matrix of intersections between negative symptom trajectory classes and social recovery trajectory classes.

Negative Symptom Trajectory Class	Social Recovery Trajectory Class: ***High Decreasing***	***Moderate Increasing***	***Low Stable***
Minimal Decreasing	n = 44 (9.0%) Significantly over-represented	n = 166 (34.1%) Significantly over-represented	n = 277 (56.9%) Significantly under-represented
Mild Stable	n = 4 (4.2%) Within expected range	n = 12 (12.5%) Significantly under-represented	n = 80 (83.3%) Significantly over-represented
High Decreasing	n = 4 (3.1%) Within expected range	n = 23 (17.6%) Significantly under-represented	n = 104 (79.4%) Significantly over-represented
High Stable	n = 1 (2.2%) Within expected range	n = 2 (4.4%) Significantly under-represented	n = 42 (93.3%) Significantly over-represented

Note. The text in each cell refers to whether the class is over- or under-represented according to the adjusted standardised residual of the relevant Chi-Squared test.

Figures:

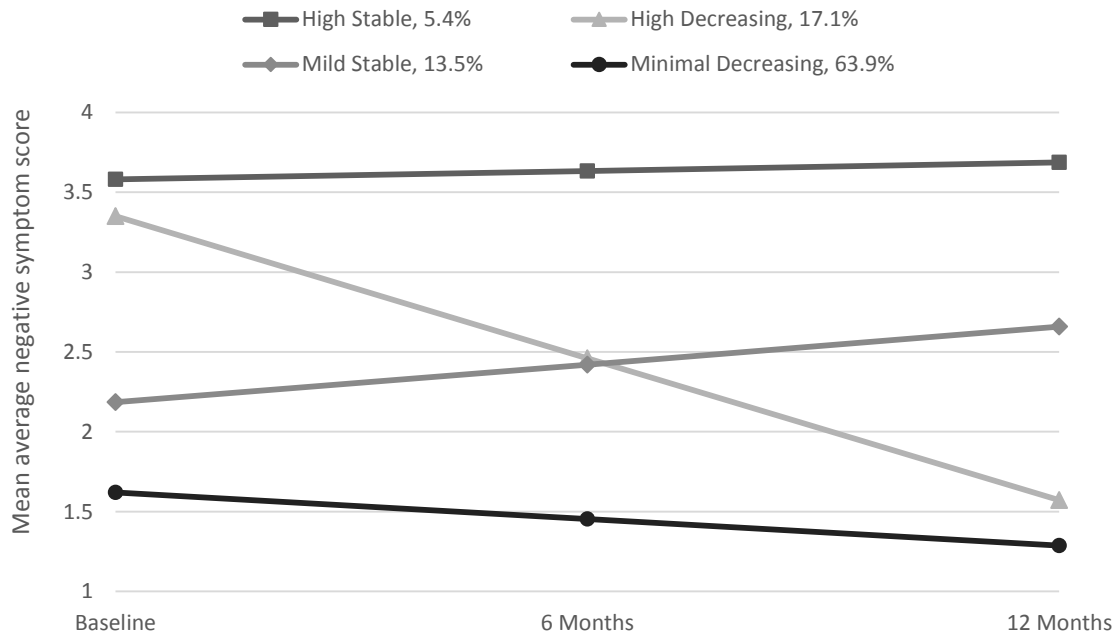

Fig. 1. LCGA with four latent classes: average negative symptom score estimated means

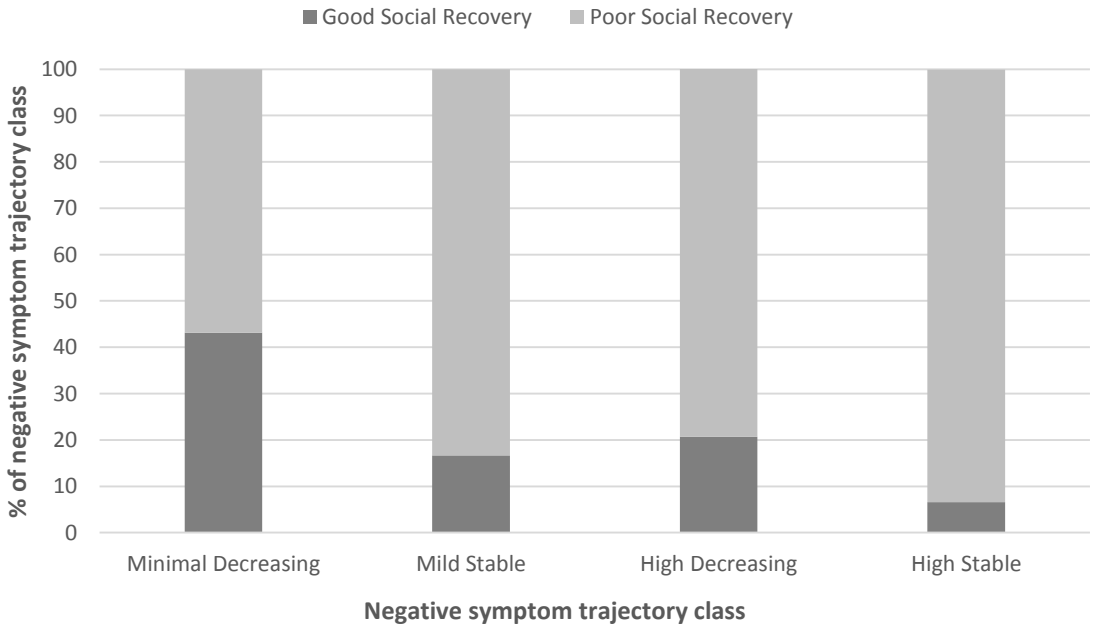

Fig. 2. Proportion of each negative symptoms trajectory class that followed a social recovery trajectory characterised by non-clinical levels of structured activity by 12 months ('Good Social Recovery') versus those with stably low levels of structured activity ('Poor Social Recovery').

Proposed Supplementary Material:

Supplementary Table. Results of multinomial regression investigating predictors of negative symptom trajectories.

	B (SE)	Odds Ratio (95% CI)	P Value
Stable Mild vs. Minimal Decreasing			
Female vs. Male	-0.36 (0.30)	0.70 (0.39 – 1.25)	0.23
Non-Schizophrenia Diagnosis vs. Schizophrenia Diagnosis	0.04 (0.44)	1.04 (0.44 – 2.45)	0.94
No Family History vs. Family History	0.24 (0.48)	1.27 (0.50 – 3.21)	0.62
PAS Social - Childhood	-0.03 (0.84)	0.98 (0.19 – 5.02)	0.98
PAS Social - Adolescence	0.63 (0.84)	1.87 (0.36 – 9.65)	0.46
PAS Academic - Childhood	1.70 (0.90)	5.50 (0.94 – 32.14)	0.06
PAS Academic - Adolescence	0.52 (0.76)	1.68 (0.38 – 7.48)	0.49
Calgary Depression	0.02 (0.02)	1.02 (0.98 – 1.07)	0.35
Stable High vs. Minimal Decreasing			
Female vs. Male	-1.04 (0.48)	0.35 (0.14 – 0.90)	0.03
Non-Schizophrenia Diagnosis vs. Schizophrenia Diagnosis	-0.86 (0.44)	0.42 (0.18 – 1.00)	0.05
No Family History vs. Family History	-1.18 (0.44)	0.31 (0.13 – 0.72)	0.01
PAS Social - Childhood	-0.12 (1.18)	0.89 (0.09 – 8.95)	0.92
PAS Social - Adolescence	2.17 (1.12)	8.79 (0.99 – 78.11)	0.051
PAS Academic - Childhood	0.79 (1.25)	2.21 (0.19 – 25.74)	0.53
PAS Academic - Adolescence	-0.07 (1.08)	0.93 (0.11 – 7.66)	0.95
Calgary Depression	0.05 (0.03)	1.06 (0.99 – 1.12)	0.09
High Decreasing vs. Minimal Decreasing			
Female vs. Male	-0.06 (0.24)	0.94 (0.60 – 1.50)	0.81

Non-Schizophrenia Diagnosis vs. Schizophrenia Diagnosis	0.37 (0.40)	1.45 (0.66 – 3.19)	0.35
No Family History vs. Family History	-0.68 (0.34)	0.51 (0.30 – 0.99)	0.046
PAS Social - Childhood	-2.21 (0.76)	0.11 (0.03 – 0.49)	0.004
PAS Social - Adolescence	2.11 (0.71)	8.26 (2.07 – 33.01)	0.003
PAS Academic - Childhood	-0.26 (0.77)	0.77 (0.16 – 3.67)	0.74
PAS Academic - Adolescence	1.01 (0.62)	2.75 (0.82 – 9.29)	0.10
Calgary Depression	0.09 (0.02)	1.09 (1.05 – 1.14)	<0.001

Note. Model: $\chi 2$ (24) = 92.50, p <0.001. Family History = family history of non-affective psychosis; PAS = Premorbid Adjustment Scale