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Satisfaction with social connectedness as a predictor for positive and negative symptoms of psychosis: A PHAMOUS study

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ABSTRACT

Purpose: This study examines satisfaction with social connectedness (SSC) as predictor of positive and negative symptoms in people with a psychotic disorder.
Methods: Data from the Pharmacotherapy Monitoring and Outcome Survey (PHAMOUS) was used from patients assessed between 2014 and 2019, diagnosed with a psychotic disorder (N = 2109). Items about social connectedness of the Manchester short assessment of Quality of Life (ManSA) were used to measure SSC. Linear mixed models were used to estimate the association of SSC with the Positive and Negative Syndrome Scale (PANSS) after one and two years against $\alpha = 0.01$. Analyses were adjusted for symptoms, time since onset, gender and age. Additionally, fluctuation of positive and negative symptom scores over time was estimated.
Results: The mean duration of illness of the sample was 18.8 years (SD 10.7) with >65% showing only small variation in positive and negative symptoms over a two to five-year time period. After adjustment for covariates, SSC showed to be negatively associated with positive symptoms after one year ($\beta = -0.47$, $p < 0.001$, 95% CI = −0.70, −025) and two years ($\beta = -0.59$, $p < 0.001$, 95% CI = −0.88, −0.30), and for negative symptoms after one year ($\beta = -0.52$, $p < 0.001$, 95% CI = −0.77, −0.27). The prediction of negative symptoms was not significant at two years.
Conclusion: This research indicates that interventions on SSC might positively impact mental health for people with psychosis. SSC is a small and robust predictor of future levels of positive symptoms. Negative symptoms could be predicted by SSC at one year.

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1. Introduction

Social connectedness is important for health outcomes in the general population (Wakefield et al., 2020). Several aspects of social connectedness, such as loneliness, social support or network size have already been subjected to health research. It was shown that loneliness is negatively correlated with physical, mental and cognitive health (Cacioppo and Patrick, 2009; Santini et al., 2016; Ellwardt et al., 2015). Loneliness is also a risk factor for premature mortality, which is comparable in magnitude with obesity and physical inactivity (Ellwardt et al., 2015; Holt-Lunstad et al., 2015).

In mental health, connectedness is defined as an important part of patients' personal recovery. The CHIME is a framework for personal recovery in mental health, which identifies five processes that foster personal recovery: Connectedness, Hope, Identity, Meaning and Empowerment (Leamy et al., 2011). It describes 'Connectedness' as support from others and being part of the community, which is considered an important supportive process in personal recovery (Leamy et al., 2011). In this study, we consider social connectedness a comprehensive term for subjective and objective measures of connectedness on an individual level. Subjective indicators of social connectedness can be defined as satisfaction with social support, satisfaction with the social network and experiencing unmet social needs, operationalized in the construct of loneliness. Objective indicators of social connectedness comprise network size, composition of the social network and frequency of contacts.

Despite intact hedonic experiences of social contact (Oorschot et al., 2013), levels of social connectedness in people with psychotic disorders are often unsatisfactory compared to people in the general population. On an objective level, they generally have smaller networks. A meta analysis showed that the average number of friends of people with a psychotic disorder was 3.4 (Palumbo et al., 2015). In comparison, an average number of 10.6 friends for men and 7.6 friends for women were found in the general population (UK) (Palumbo et al., 2015). On a subjective level, these patients experience higher rates of loneliness (Badcock et al., 2015; Lim et al., 2018) and less satisfaction with social networks (Koenders et al., 2017; Gayer-Anderson and Morgan, 2013). The frequently reported limitations in social connectedness in people with psychotic disorders impede patients in their personal (Garverich et al., 2020), functional (Galderisi et al., 2014) and clinical recovery (Michalska da Rocha et al., 2018). In this study we will focus on satisfaction with social connectedness specifically.

Poor social connectedness is associated with greater mental health risks in people with psychotic disorders (Michalska da Rocha et al., 2018). A recent meta analysis concluded that network size was not associated with positive symptoms, but that a smaller social network was associated with more severe negative symptoms of psychosis (Degnan et al., 2018). Furthermore, another study showed that satisfaction with social support was protective against relapses and fewer hospital admissions in people with schizophrenia (Vázquez Morejón et al., 2018). Moreover, two studies measured the relationship between social satisfaction and positive and negative symptoms in patients with First Episode Psychosis (FEP). Perceived social support predicted fewer positive symptoms in one study (Norman et al., 2005), but neither study found significant effects for negative symptoms (Norman et al., 2005; Bjornestad et al., 2016).

The direction of causality in the relationship between social connectedness and symptoms of psychosis is not clear (Renwick et al., 2017; Kasanova et al., 2018). Studies on social connectedness have shown that fewer positive and negative symptoms are associated with having a larger social network, less feelings of loneliness and a greater sense of being socially supported (Sundermann et al., 2014; Michalska da Rocha et al., 2018; Degnan et al., 2018; Koenders et al., 2017). Some indication for causality is found in studies with FEP in which pre morbid social adjustment is negatively associated with future levels of positive and negative symptoms (O'Keeffe et al., 2019). However, the reversed effect was suggested in a recent study in a clinical high risk population (CHR), which showed that Persistent Negative Symptoms (PNS) were already present in the prodromal phase and were correlated with worse social functioning after two years (Devoe et al., 2020). In yet another study, onset of psychosis was followed by decreased levels of social integration (Killaspy et al., 2014). In conclusion, the relation between social connectedness and clinical symptoms in people with psychotic disorders is not well understood, but may very well be bidirectional (Prince et al., 2018; Lim et al., 2018). Some evidence was found for a self-preserving mechanism, in which loneliness makes people more sensitive to negative interpretations of social cues, leading in turn to more withdrawal (Cacioppo and Patrick, 2009). These effects were found in the general population, but might also play a role in the course of psychotic disorders.

Social connectedness is the modifiable factor of our interest in the bidirectional relationship between social connectedness and symptoms of psychosis. Social network interventions for people with psychosis have shown to be effective at increasing the size of patients' social networks (Anderson et al., 2015). To provide more insight into the relationship between social connectedness and symptoms of psychosis we aim to evaluate satisfaction with social connectedness (SSC) and its longitudinal relationship with positive and negative symptoms in a broad sample of people with psychotic disorders. The results of this study might indicate a positive effect on symptoms of interventions that are focused on SSC, such as family intervention (Pharoah et al., 2010), social skills training (Turner et al., 2017) or peer support (Chien et al., 2019). In the current study, time intervals of one and two years are used, as effects of social connectedness on symptoms can vary depending on the time interval (Salokangas, 1997).

1.1. Aims of the study

In this exploratory study we hypothesize that higher levels of SSC will predict less severe positive and negative symptoms after one and two year follow up. In contrast to previous longitudinal studies which have researched the relationship between SSC and positive/negative symptoms in FEP (Bjornestad et al., 2016; Norman et al., 2005), the current study features a larger sample size and uses a multilevel approach in an SMI sample.

2. Methods

2.1. Design

This study uses routine outcome monitoring data from the Pharmacotherapy Monitoring and Outcome Survey (PHAMOUS) (Bartels-Velthuis et al., 2018). PHAMOUS is an ongoing Dutch cohort study including people with a psychotic disorder in the Northern Netherlands (American Psychiatric Association, 2000; American Psychiatric Association, 2013). This cohort, which started in 2006, involves a yearly screening on physical, mental and social domains. The screening is carried out by trained nurses at the participating psychiatric institutes. The PHAMOUS protocol was approved by the local ethical committee and conducted in accordance with the guidelines of the Declaration of Helsinki (World Medical Association (WMA), 2013). The following PHAMOUS data were used for this study: age, gender, diagnosis, year of first psychosis, symptom severity (PANSS), quality of life (ManSA) and global assessment of functioning (GAF). An elaborate description of the PHAMOUS protocol can be found in Bartels-Velthuis et al. (2018).

2.2. Sample

Patients who participated in the PHAMOUS screenings from January 2014 until December 2018 were included, meaning a maximum of five measurements per participant. Patients were included if they were diagnosed with a psychotic disorder (DSM IV/5, (American Psychiatric

Association, 2000; American Psychiatric Association, 2013)) at entry of the study, were > 18 years old and had participated in two or more screenings. Patients were not eligible to be included in the analysis if their psychotic disorder was induced by drugs or alcohol.

Patients in the PHAMOUS cohort receive yearly invitations to the screenings. Due to non-response and delay of screenings, the interval between two consecutive screenings varies considerably. Therefore, we allowed an interval between two consecutive measurements of minimally 9 months (39 weeks) and maximally 16 months (78 weeks) apart from each other. If two measurements occurred within 9 months, they were analysed as one measurement with the mean of the two data points (scale data) or the first observation between two data points (categorical data). We considered the measurement as missing when two measurements were more than 16 months apart.

2.3. Measures

In this study SSC was constructed from the Manchester Short Assessment of Quality of Life (ManSA) (Priebe et al., 1999), which evaluates quality of life in people with a mental illness. There are 16 items on financial, employment, health and social domains. Overall social network is positively correlated to the ManSA (Björkman and Svensson, 2005). A satisfaction scale is used in 12 items ranging from 1 (could not be worse) to 7 (could not be better). Four items are binary (yes/no). In this paper mean scores on scale items of the ManSA are reported. We selected the following items from the ManSA to operationalize SSC: satisfaction with the number and quality of your friendships (item 15), with the people you live with or with living alone (item 21), with your sex life (item 22), and with your relationship with your family (item 23). We defined SSC as the mean score of these four ManSA items (range 1–7). As the SSC measure was pragmatically constructed from an existing measure for QoL, measures of reliability were applied to evaluate internal consistency. To establish internal consistency Cronbachs' alpha, inter-item correlations and alpha if item deleted were evaluated.

Positive and negative symptoms of psychosis were measured with the Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987). The PANSS is a 30 item structured interview on positive symptoms (7 items), negative symptoms (7 items) and general psychopathology (16 items). All items are clinician rated on a 7 point Likert scale and the total score ranges from 30 to 210. In this study we used the five factor model from Van der Gaag et al. (2006) which identifies five subscales: positive symptoms (POS; range 1–64); negative symptoms (NEG; range 2–69); disorganization (DIS; range 10–70); excitement (EXC; range 8–64); emotional distress (EMO; range 8–64). See Supportive Information S1 for the algorithm of the codes. POS and NEG were used as the outcome measures in the multilevel analyses. PANSS remission criteria were applied to describe the rate of remission in the cohort (see Supportive Information S1) (Andreasen et al., 2005). Due to the aspired one year time interval in the PHAMOUS study, the original criterion of ≥6 months continuity of the remission could not be applied.

2.4. Statistical analyses

Descriptive data were reported for each yearly screening (range: 1–5) using mean values and standard deviations or frequencies and percentages.

In order to examine SSC as an independent one and two year predictor for positive and negative symptoms, a (time lagged) linear mixed effect model with random intercept, Maximum Likelihood estimation and $\alpha = 0.01$ was used. Time was used as repeated measurement (i.e. yearly screening, range: 1–5). Predictive variables were included as one and two year lagged variables (LAG). In contrast with simple regression, multilevel models do not require independent observations. Individuals are measured repeatedly and therefore can contribute multiple times to each LAG. Due to the multilevel structure of the analysis, several time points can serve concurrently as predictor or outcome with a maximum of four time points for LAG 1 and three time points for LAG 2. For each outcome, the following covariance structures were tested for model fit: Diagonal (DIAG), Compound Symmetry (CS), First order Autoregressive (AR1) and Identity (ID). Multicollinearity was examined with the Variance Inflation Factor (VIF). A cut-off score of <4 was used to determine whether multicollinearity would bias the analysis (Hair et al., 2010). Separate models were fit for positive and negative symptoms with a one and two year time lag. For each model, SSC was fit unadjusted as a predictor, and subsequently analysed with adjustment for covariates to analyse the stability of SSC. Outcomes were adjusted for the PANSS subscales, illness duration (Hanlon et al., 2017), gender (Sommer et al., 2020) and age (Thorup et al., 2006). All scale variables were standardized using z scores in order to minimalize the impact of multicollinearity. SSC and positive and negative time lag variables, respectively, were first included as fixed effects and in the final model tested as random effects using model fit parameters (deviance statistic, AIC (Akaike, 1974) and BIC (Schwarz, 1978). Confidence intervals were reported to measure precision of the effect.

Multiple imputations were used to deal with missing data. Linear regression was used for imputing scale data and logistic regression was used for imputing categorical variables. Fifteen imputed datasets were generated with k = 10 and combined using Rubin's rule (Rubin, 2004). To evaluate the impact of the imputation on the results, the delta between the outcomes of the pooled and the original dataset were calculated. A sensitivity analyses on the full model was conducted on the effects of outliers (mean ± 3 SD). All statistical analyses were performed using the Statistical Package of the Social Sciences (SPSS), version 26 (IBM Corp, 2013).

Given the requirements of European privacy law, the dataset is encoded three times by independent institutes. A pseudonymized dataset was released by one of the PHAMOUS investigators (EV) at the Data Science Center of the Rob Giel Research center. Access to this dataset was restricted to JSV, JB and SdJ, who performed the analyses.

3. Results

3.1. Sample characteristics

Demographic and clinical characteristics are presented in Table 1. From the PHAMOUS database population of 6944 patients, 2109 were eligible for this study. A flow diagram is presented in Fig. 1. At first assessment, the mean age was 45.1 (SD = 11.2) and the mean illness duration was 18.8 (SD = 10.7), signifying this is a sample with a

Table 1
Clinical characteristics of the study population.

Total N	2109
Male N (%)	1390 (65.9)
Age Mean (SD)	45.1 (11.2)
Diagnosis N (%)	
Schizophrenia	1532 (72.6)
Schizophreniform disorder	48 (2.3)
Schizoaffective disorder	388 (18.4)
Delusional disorder	60 (2.8)
Other psychotic disorder	81 (3.8)
Illness duration	
Mean years (SD)	18.8 (10.7)
Living situation N (%)	
Independent	913 (43.3)
Independent with partner	224 (10.6)
With family/others	140 (6.6)
Supported housing	409 (19.4)
Long term clinical	305 (14.5)
Other	44 (2.1)
Missing	74 (3.5)
GAF symptoms Mean (SD)	49.9 (13.7)

GAF = Global assessment of functioning.

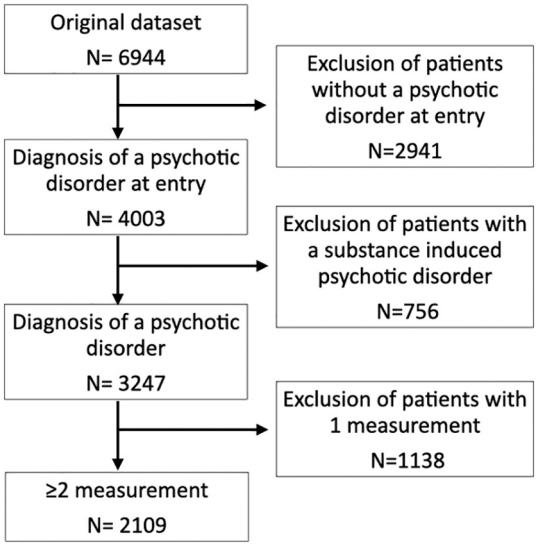

Fig. 1. Flow chart showing the process of applying selection criteria to participants for inclusion in the research.

relatively chronic illness, which is in line with an earlier report on the PHAMOUS database (Bartels-Velthuis et al., 2018).

3.2. Reliability of the SSC measure

Evaluation of the SSC construct showed satisfactory reliability measures. The items showed slightly below good internal consistency with Cronbach's α = 0.67 (Streiner and Norman, 2008). The inter-item correlations were satisfactory, ranging from 0.265 to 0.415 (p < 0.01) (Streiner, 2003). Furthermore, we conducted an analysis on the alpha if item deleted. This showed a range between 0.56 (item 12) to 0.64 (item 13) indicating a lower alpha if items were deleted.

Table 2
Descriptive statistics of the positive and negative syndrome scale, the Manchester assessment of quality of life and satisfaction with social connectedness (SSC).

	Time 1	Time 2	Time 3	Time 4	Time 5
	N = 2109	*N* = 1555	*N* = 1256	*N* = 904	*N* = 416
PANSS mean total score (SD)	52.7 (16.4)	51.0 (15.3)	50.1 (15.4)	50.0 (14.6)	51.3 (15.7)
POS	13.4 (6.2)	12.9 (5.9)	12.8 (6.2)	12.8 (6.1)	13.7 (6.7)
NEG	14.6 (6.3)	14.2 (6.1)	13.6 (6.0)	13.7 (6.0)	13.8 (6.4)
DIS	16.7 (6.8)	16.0 (6.0)	16.0 (6.3)	15.7 (5.4)	15.9 (6.1)
EMO	14.6 (5.2)	14.3 (5.0)	14.1 (5.0)	14.2 (5.2)	14.8 (5.8)
EXC	11.7 (3.9)	11.4 (3.5)	11.1 (3.5)	11.1 (3.4)	11.2 (3.4)
PANSS Remission N (%)	734 (34.8)	500 (32.2)	396 (33.3)	304 (33.6)	126 (30.3)
Missing	503 (23.9)	489 (31.4)	288 (31.9)	288 (31.9)	131 (31.5)
ManSA Mean (SD)	54.2 (11.2)	55.0 (10.7)	55.0 (10.8)	56.2 (10.8)	55.3 (10.9)
SSC	4.9 (1.1)	4.9 (1.1)	4.9 (1.1)	5.0 (1.1)	5.0 (1.1)

PANSS = Positive and Negative Syndrome Scale; POS = Positive Symptoms; NEG = Negative Symptoms; DIS = Disorganization; EMO = Emotional distress; EXC = Excitement factor; ManSA = Manchester Assessment of Quality of Life; SSC = Satisfaction with Social Connectedness.

3.3. Outcomes on PANSS, ManSA and SSC

Mean PANSS total scores over the five year study period ranged from 50.1 to 52.7. These PANSS total scores correspond with a Clinical Global Impression (CGI) score between 2 (borderline mentally ill) and 3 (mildly ill) (Leucht et al., 2005). At entry, 34.8% of the patients complied with all criteria for being in remission of psychosis (Andreasen et al., 2005). The mean POS score was 13.4 (SD = 6.2) and the mean NEG score was 14.6 (SD = 6.3) at entry, indicating minimal symptoms. The mean SSC scores over the five year study period ranged from 4.9 to 5.0 (mostly satisfied) on item level of the ManSA. Descriptive statistics at each time point are presented in Table 2.

3.4. Linear mixed models

With a linear mixed effect model, we estimated the associations of SSC and positive and negative symptoms with a one and two year time lag (LAG). The repeated measurement resulted in $N = 1686$ patients with 3128 LAG one measurements and $N = 1431$ patients with 2164 LAG two measurements. SSC was a small but significant negative predictive factor for positive and negative symptoms after one year and for positive symptoms after two years (Table 3). After adjustment for covariates the beta of SSC LAG one for positive symptoms was $\beta = -0.47$ ($p < 0.001$, 95% CI = −0.70, −0.25) and for LAG two $\beta = -0.59$ ($p < 0.001$, 95% CI = −0.88, −0.30). The adjusted beta of SSC LAG one for negative symptoms was $\beta = -0.52$ ($p < 0.001$, 95% CI = −0.77, −0.27) and for LAG-two $\beta = -0.38$ ($p < 0.05$, 95% CI = −0.72, −0.05).

There were no issues with multicollinearity given that the mean VIF was 1.95 (range: 1.73–2.60). All independent variables were included in the analyses. Compound Symmetry was chosen as the covariance structure, based on values of the deviance statistic and the AIC (Akaike, 1974) and BIC (Schwarz, 1978) information criteria. Inclusion of predictors as random effects rather than fixed effects did not further improve the model. Missing values in the original dataset were present in 58.01% of the cases and in 23.9% of the values. To test the impact of the imputation on the outcome, original data and pooled data were compared (Supportive Information S2). The delta between the pooled effects and the effects of the original dataset across full models varied between $\beta = 0.02$ and $\beta = 0.17$ indicating an adequate imputation. Furthermore, the impact of outliers was tested in a sensitivity analyses on the full models. The β of the delta between the original analysis and the sensitivity analysis ranged between $\beta = 0.03$ and $\beta = 0.04$. There was no impact on the significance levels.

3.5. Post hoc analysis: fluctuation of individual scores

The degree of individual symptom variability over time might impact the analysis. Strong individual symptom fluctuations might result in stronger associations with predictor variables compared to a stable course of symptoms. Therefore, an additional analysis was conducted to evaluate the degree of variation of individual scores on positive and negative symptoms and SSC during the study period. Mean individual fluctuations of year by year SSC scores were analysed using the Root Mean Square Deviation (RMSD). The RMSD analysis showed that in 52.6% of the patients the mean fluctuation on positive symptoms was <1 point, in 20.3% of the patients the mean fluctuation was between 1 and 2 points and in 27.1% of the patients the mean fluctuated >2 points. The results for negative symptoms were comparable: 51.7% of the patients had a mean fluctuation of <1 point, 18.2% had a mean fluctuation between 1-2 points and 30.1% of the patients had >2 points of mean fluctuation. In summary, >65% of the sample had only small fluctuations on both positive and negative symptoms over time. Scores for SSC (range 1–7) showed the following fluctuation levels: 42.9% of the patients showed a mean fluctuation of <0.3 point, in 39.3% of the patients the mean fluctuation was between 0.3 to 0.6 points and 17.8% of the patients showed a mean fluctuation of >0.6 points during the study

Table 3
Predictive value of SSC on Positive and Negative symptoms using z scores in imputed dataset.

	POS, LAG 1 β (95% CI)	POS, LAG 2 β (95% CI)	NEG, LAG 1 β (95% CI)	NEG, LAG 2 β (95% CI)
	N = 1686	N = 1431	N = 1686	N = 1431
SSC	−0.75 (−1.02, −0.47)***	−1.00 (−1.31–0.69)***	−0.74 (−1.03, −0.45)***	−0.67 (−1.02, −0.33)***
+ Symptoms	−0.50 (−0.73, −0.27)***	−0.61 (−0.90, −0.32)***	−0.52 (−0.76, −0.28)***	−0.43 (−0.76, −0.10)*
+ Time since onset	−0.48 (−0.71, −0.25)***	−0.61 (−0.90–0.32)***	−0.54 (−0.78, −0.29)***	−0.41 (−0.74, −0.08)*
+ Gender and age	−0.47 (−0.70, −0.25)***	−0.59 (−0.88–0.30)***	−0.52 (−0.77, −0.27)***	−0.38 (−0.72, −0.05)*

POS = Positive Symptoms; NEG = Negative Symptoms; SSC = Satisfaction with Social Connectedness; Symptoms = Positive Symptoms, Negative Symptoms, Disorganization, Excitement, Emotional distress.
* $p < 0.05$.
*** $p < 0.001$;

period.

4. Discussion

4.1. Main findings

This exploratory study partially confirmed our hypothesis that higher levels of SSC can predict a reduction of future positive and negative symptom scores. The small but significant association with positive symptoms is significant up to two years. For negative symptoms, the association is significant for one year. Notably, a post hoc analysis on positive and negative symptom subdomain scores showed that these scores did not fluctuate more than two points on the PANSS scale for more than two thirds of the sample during the five years of the study period. The limited magnitude of associations might be explained by the relatively long mean illness duration (on average 18.8 years), the mild symptoms with minimal fluctuation over five years and over a third of the patients already in remission during the first assessment (34.8%). Although the associations are small, the large sample size and the use of the multilevel statistics resulted in a robust estimated prediction. Small associations are important to consider in the ongoing development of treatments in a sample with persistent positive and negative symptoms (Haro et al., 2018).

4.2. Previous research

Previous studies have focussed on the association between SSC and a remission of symptoms in first episode psychosis (FEP). A two year longitudinal study ($N = 186$) did not find that a remission of positive and negative symptoms was predicted by perceived social satisfaction (Bjornestad et al., 2016). Another FEP study analysed satisfaction with social support in a three year longitudinal study ($N = 113$). In accordance with the two year longitudinal association found in our study, satisfaction with social support was associated with a reduction of positive symptoms ($r = -0.33$, $p < 0.01$), but not of negative symptoms (Norman et al., 2005). Our sample differs from these previous studies in the longer illness duration, the higher age and the social context (i.e. >25% in supported housing or long term clinical facilities). Furthermore, compared to the abovementioned previous studies, the current study has a larger sample size and therefore a higher ability to detect small correlations.

Besides the impact of social connectedness on symptoms of psychotic disorders, the reversed association was also found (Renwick et al., 2017; Kasanova et al., 2018), suggesting that components are interconnected. One could reason that the complex interplay between social connectedness and positive and negative symptoms is a negative feedback loop directing towards a state of social withdrawal (Velligan et al., 2015; Sarkar et al., 2015). Both positive and negative symptoms are, as such, part of social connectedness in people with psychosis.

4.3. Strengths and limitations

This exploratory study used data from a naturalistic cohort (the PHAMOUS survey) and was originally not designed to quantitively measure the extent of the association between SSC and symptoms of psychosis. However, the predictive associations are a step forward in model development on the relationship between SSC and symptoms of psychosis. Next, the significance levels indicate a relationship but should be further evaluated with validated measures that are able to quantitatively estimate the extent of the association.

The protocol for PHAMOUS cohort study prescribes a yearly screening of its participants. In practice however, screenings are often conducted before or after the yearly time gap. In the current study we were able to compute a minimum and maximum time gap that restricted the time gap of subsequent measures between 39 and 78 weeks and at the same time this prevented conflicting time gaps. Furthermore, this method allowed for missed screenings and for multiple screenings within on time gap.

We constructed SSC for this research by extracting items from the ManSA, which is a frequently used measure for Quality of Life (QoL) in psychosis research. However, the SSC measure was pragmatically constructed from an existing QoL measure (ManSA) and, to our knowledge, not used before in research. Therefore, prior to evaluating the research question, the SSC was evaluated on internal consistency. This resulted in a Cronbach's alpha slightly below the optimal threshold (Streiner and Norman, 2008). However, the high inter-item correlations and the longitudinal relationship with symptoms of psychosis in this study might be preliminary indications of reliability and construct validity. The use of a theoretically derived measure on SSC with evaluations on validity and reliability would add to the strength of the method.

In addition, in a previous study group identification was shown to be negatively correlated to paranoid ideation (Sani et al., 2017), which is highly prevalent in people with psychosis. Group identification was not measured in this study, and therefore its association with positive and negative symptoms could not be identified. Measuring the sense of group identification would add to the strengths of the results.

The current study was conducted in the PHAMOUS cohort where patients receive yearly invitations for screening. Patients with higher scores on positive or negative symptoms are less likely to respond to the yearly PHAMOUS screening invitation. This is shown in the PANSS scores, showing a relatively mild illness profile with very few people at the severe end of the spectrum. Similarly, patients who have benefitted most from psychiatric treatment and no longer experience symptoms are likely to be discharged from specialized mental health care. Consequently, these patients are not invited for the yearly PHAMOUS screening. Results of this study can therefore not be generalized to patients in recovery or with extremely severe symptom profiles.

Measures of social connectedness show discrepancies between objective and subjective levels of connectedness (Giacco et al., 2016). In the current study, a relatively large part of the sample was living alone (43.3%) while patients were mostly satisfied with their social network

SSC (mean 4.9 to 5, mostly satisfied). Possibly, both objective and subjective indicators of social connectedness should be used to predict clinical recovery (Bjornestad et al., 2016).

4.4. Future research

The complex interplay between social connectedness and symptoms in people with a generally long term psychotic disorder could benefit from further research. Longitudinal cohorts give the opportunity to model the course of symptoms over time and adjust for bidirectional effects of symptoms and social connectedness in the more chronic stage of illness, possibly in a structural equation model (SEM). In addition, applying these models in Ultra High Risk (UHR) cohorts makes it feasible to adjust for premorbid effects of social connectedness. This will help to distinguish the impact of premorbid social connectedness on symptoms balanced against loss of social connectedness during the course of illness.

The longitudinal associations of SSC with symptoms are small, however relevant for a population with long term disabilities. Therefore, intervention research on social connectedness with long term follow up is necessary to evaluate the impact of social connectedness interventions on positive and negative symptoms. Interventions should focus on the patient level, such as social skills training (Turner et al., 2017), the network level, such as guided peer support groups (Castelein et al., 2015), or as an integrated intervention on both levels (Vogel et al., 2019). Of interest is a novel intervention called Group 4 Health (G4H) (Haslam et al., 2019) which was informed by the Social Identity Model of Identity Change (SIMIC) (Conneely et al., 2021, Haslam et al., 2021). The G4H intervention showed a reduction in loneliness and social anxiety in people with psychological problems by developing social identity capital in group experiences. A recent review on identity change in people with psychosis presented a framework that could inform the development of new interventions for social identity (Conneely et al., 2021).

Furthermore, apart from clinical recovery, chronically stable patients often have additional treatment goals on functional and personal recovery. Evidence for positive effects of social connectedness is also found on functional and personal recovery (Gayer-Anderson and Morgan, 2013).

In measuring social connectedness group identification might be a promising construct for predicting mental health. Group identification showed to be a better predictor of mental health (in family and an army unit) compared to objective measures of social contact (Sani et al., 2012). This is in line with a study indicating that negative group identity might be a risk for developing schizophrenia (Veling et al., 2010).

The current study showed that satisfaction with social connectedness is a small but robust predictor for decreased severity of positive symptoms after one and two years and for decreased severity of negative symptoms after one year in people with a psychotic disorder. The findings indicate that interventions on social connectedness might positively impact mental health for people with psychosis.

CRediT authorship contribution statement

All authors whose names appear on the submission.

1) made substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data; or the creation of new software used in the work;
2) drafted the work or revised it critically for important intellectual content;
3) approved the version to be published; and.
4) agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Satisfaction with Social Connectedness as a predictor for Positive and Negative Symptoms of Psychosis: a PHAMOUS study.

Availability of data and material (data transparency)

Under the General Data Protection Regulation (GDPR), our data is considered pseudonymized rather than anonymized and is therefore still regarded as personal data.

Given that participants have not given informed consent to have their personal data publicly shared, we are legally and ethically not allowed to publish our dataset.

Data is therefore only available upon request at the Rob Giel Research center (Data Science Center), email e.visser03@umcg.nl or from the project leader (Stynke Castelein, s.castelein@lentis.nl).

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Appendix A. Supplementary data

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