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Social predictors of psychotic experiences in adolescence

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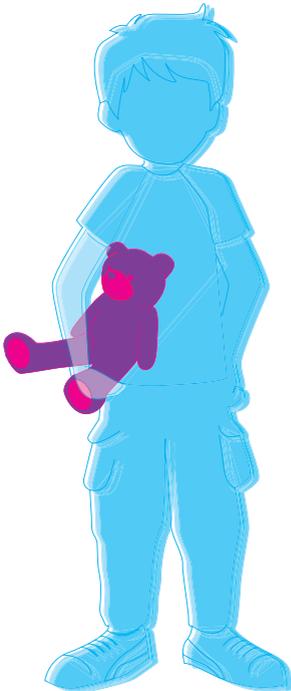
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The Dynamic Association between Social Functioning and Paranoia in Individuals at Ultra-High Risk for Psychosis

CHAPTER 5



Steenhuis, L.A., Booij, S.H., Nauta, M.H., Bartels-Velthuis, A.A., Aleman, A., Vos, M., Pijnenborg, G.H.M. & Wigman, J.T.W. (2019)

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Abstract

Aim

Social functioning is often impaired during the ultra-high risk (UHR) phase for psychosis, yet this does not always predict a transition to psychosis. The aim of this study was to investigate in four UHR individuals separately whether changes in social functioning preceded changes in psychotic experiences (specifically paranoia), or the other way around.

Methods

Four individuals at UHR for psychosis completed a diary application every evening for 90 days. Two items on social functioning ('time spent alone' and 'experienced social support') and two items on paranoia ('suspiciousness' and 'feeling disliked by others') were selected. Time series (T = 90) of each individual were analyzed using vector auto regression analysis (VAR), to estimate the lagged (over 1 day) effect of social functioning on paranoia, and vice versa, and their contemporaneous associations.

Results

There was substantial heterogeneity in the association between social functioning and paranoia for the four individuals, both for the direction and sign (negative or positive). The most consistent finding was that increases in paranoia on a previous day resulted in increases in social functioning on the current day.

Conclusions

The association between social functioning and paranoia differs amongst four UHR individuals. For three out of four individuals, social functioning appeared to manifest itself as a coping mechanism. Therefore, social functioning may not only represent a 'risk factor' for psychotic experiences in UHR individuals, but it may also represent a 'protective factor' in daily life.

5.1 Introduction

Social functioning is often impaired in individuals with psychosis, both in early and more chronic phases (Addington et al., 2008; Couture et al., 2006). Even before a first psychotic episode, during the ultra-high risk (UHR) phase for psychosis, social functioning can be impaired (Addington et al., 2008; Ballon et al., 2007). Importantly, impaired social functioning was found to be predictive of a first psychotic episode (Cannon et al., 2008; Nelson et al., 2013; Velthorst et al., 2009; Yung et al., 2008). However, the exact nature of the association between social functioning and the development of psychosis is complex, and the evidence regarding the question whether social functioning predicts the onset of a first psychotic episode is not always consistent (Brandizzi et al., 2015). Although social functioning was shown to predict transition to psychosis in individual studies, a recent meta-analysis of 42 studies (Schultze-Lutter et al., 2015), led to the conclusion that a social impairment does not significantly increase transition rates to a first psychotic episode in UHR samples, over and above the significant contribution of positive and cognitive basic symptoms. In addition, a substantial number of individuals in UHR samples demonstrate social impairments that persist over time without transitioning to psychosis, while other individuals in UHR samples who do not have a social impairment do transition to psychosis (Brandizzi et al., 2015; Yung, Nelson, Thompson, & Wood, 2010). It is plausible that inter-individual differences underlie the inconsistency found in the UHR state regarding the role of social functioning.

Studies using experience sampling methodology (ESM) have shown that different aspects of social functioning and social context can have a varying (and sometimes contradicting) impact on the expression of psychotic symptoms in psychotic disorders (Delespaul, deVries, & van Os, 2002; Verdoux, Husky, Tournier, Sorbara, & Swendsen, 2003). One of the first ESM studies (Delespaul et al., 2002) demonstrated that in patients with a psychotic disorder, social withdrawal and inactivity may actually be beneficial for decreasing the intensity of hallucinations, whereas social engagement can raise this hallucinatory intensity. In contrast, a different study (Myin-Germeys, Nicolson, & Delespaul, 2001) in patients with a psychotic disorder demonstrated that the presence of family members or friends is protective for delusional experiences, whereas social withdrawal made these more likely to occur. These studies highlight that social functioning is a dynamic and multifaceted concept, and that the direction of the association between psychotic symptoms and social functioning in psychotic disorders may be person-specific.

Novel statistical techniques allow us to better incorporate this large between-individual heterogeneity. Existing ESM studies often use multilevel analysis, which incorporate inter-individual differences but still average individual regression terms for all participants. In order to estimate bidirectional associations separately for each individual and thus to investigate the question whether this directionality can indeed differ within individuals, a within-subject time-series approach is more suitable. In such an approach, all variables can be modeled as both predictors and outcomes for each person individually (Brandt & Williams, 2007). The question of how social functioning is associated with psychotic experiences in the UHR phase could benefit from such an approach, as it could reveal unique insights regarding the UHR stage and might have important implications for clinical interventions.

Although previous ESM studies have examined psychotic symptoms such as hallucinations (Delespaul et al., 2002) or delusions (Myin-Germeys et al., 2001) in patients with psychotic disorders, the current study will assess mild psychotic experiences, specifically paranoia. Given that paranoia is a common psychotic experience present before the first psychotic episode (An et al., 2010; Cannon et al., 2008) and frequently reported on a daily basis in UHR patients (Yung et al., 2003), it is a suitable measure for the daily assessment of psychotic experiences in this sample. Therefore, the current study examined the association between social functioning and psychotic experiences in depth in a sample of four individuals over a period of 90 days, exploring for each individual separately the directionality, temporal dynamics and statistically causal effects of this association. Given the previously ambiguous results with regards to the role of social functioning in the UHR phase (Schultze-Lutter et al., 2015), the current study was explorative and we had no explicit hypothesis regarding the type and direction of the association amongst individuals.

5.2 Materials and Methods

Design

For the current study, the association between social functioning and paranoia was examined in four individuals at ultra-high risk (UHR) for psychosis, as assessed with the CAARMS (Comprehensive Assessment of At-Risk Mental States; Yung et al., 2005). UHR status was confirmed if one of three criteria were met: (i) a genetic risk, (ii) brief limited intermittent psychotic symptoms (BLIPS) or (iii) attenuated positive symptoms (APS), and in the presence of a significant social impairment as assessed with the Social and Occupational Functioning Scale (SOFAS; Goldman, Skodol, & Lave, 1992). Participants were the first four participants to enter the UHR subgroup of the Mapping Individual Routes of Risk and Resilience (MIRORR) study, a 90-day diary study of mental symptoms, stress and experiences in individuals at risk for psychosis. For more information about the MIRORR study, inclusion/exclusion criteria and recruitment procedures, see the study protocol (Booij et al., 2018). To give a short summary, participants were recruited at mental health care facilities in the Netherlands, where they received treatment for a non-psychotic psychiatric disorder. Participants received a package with information on the study, screening questionnaires, and an informed consent form. After providing informed consent, participants were assessed with the mini-SCAN (Nienhuis, Van De Willige, Rijnders, De Jonge, & Wiersma, 2010), and received information on the daily diary procedure. All participants received a personal report of their diary results and a financial compensation. The study was approved by the Medical Ethical Committee of the University Medical Center Groningen (ABR no. NL52974.042.15).

Diary Assessment Application

Participants completed the diary assessment application online on their phone for 90 days. The application generated a text message containing a link to the online diary questionnaires every evening (see study protocol; Booij et al., 2018). One assessment per day was chosen in order to capture the average experiences over one day, without sampling too often. Participants had a time window of 1.5 hours to fill out the diary. It took on average 7 minutes to complete the diary assessment.

Measures

Baseline Assessment. The Comprehensive Assessment of At-Risk Mental States (CAARMS; Yung et al., 2005) and the Social and Occupational Functioning Scale (SOFAS; Goldman et al., 1992) was used to determine the presence of an UHR state. The mini-SCAN (Nienhuis et al., 2010) was used to assess and confirm the presence of a DSM-IV axis-I psychiatric disorder. The Community Assessment of Psychic Experiences (CAPE; Konings, Bak, Hanssen, Van Os, & Krabbendam, 2006) was utilized to assess the frequency and distress of positive psychotic experiences.

ESM Items. Paranoia was assessed in ways similar to previous ESM studies (Myin-Germeys, Delespaul, & van Os, 2005; Oorschot, Kwapil, Delespaul, & Myin-Germeys, 2009; Wigman et al., 2013) on a VAS-scale (from 'not at all' 0 to 'very' 100). The items were "I felt suspicious today" and "Today I had the feeling that others did not like me". Social functioning was assessed as the quantity of social contacts on a given day, on a 7-point Likert scale ("How much was I alone today" from 1 'not at all' to 7 'all day') and as the quality of social contacts on a given day, on a VAS scale ("Did you feel supported today?" from 0 'not at all' to 100 'very').

Statistical Analysis

Vector autoregressive (VAR) modeling was used to analyze the multiple time series of each individual in this study. VAR modeling allows to model a set of regression equations for two or more variables, in this case consisting of social functioning (1. time spent alone and 2. perceived social support) and paranoid psychotic experiences (1. feeling of being suspicious and 2. feeling of being disliked by others). All four variables in this model could be both determinant and outcome, allowing the temporal order of effects to be tested, including bidirectional associations and feedback loops. Each variable was regressed on its own lagged value (e.g. $t-1$) and the lagged values of the other variables. The number of lags in this model was a priori set to one, equivalent to a period of one day. The lagged effect is indicative of a delayed effect of the past day's social functioning on current psychotic experiences over time (and vice versa for the opposite effect). The Likert scale of the item 'Time spent alone' was re-scaled to a 0-100 VAS scale to accommodate the scaling differences between items. Autoregressive Moving Average (ARMA) models were run to confirm that the separate items of social functioning and paranoia measure different aspects of the concepts under study, and were not highly correlated over time. In order to estimate the VAR coefficients, a maximum likelihood estimation with a degrees of freedom adjustment was used, which is recommended for small samples (Lütkepohl, 2005). VAR model assumptions, such as normality, stationarity and no residual autocorrelation (Lütkepohl, 2005), were assessed with diagnostic checks, and if assumptions were not met, they were addressed using methods suggested by Stavrakakis et al., (2015).

Contemporaneous correlations (i.e. associations at the same assessment point) between variables were computed from the residuals in the final model to assess the association between social functioning and psychotic experiences. Granger causality Wald tests (Granger, 1969) were used to test the significance of the directionality of the influence between two time series. It takes into account the joint effect of previous lags of the predictor variable (e.g. social functioning) on the outcome variable (e.g. paranoia), whilst controlling for previous lags of the outcome variable.

Cumulative Orthogonalized Impulse Response analysis (COIRF) was computed to calculate the dynamic effect of social functioning on psychotic experiences, and vice versa (Brandt & Williams, 2007; Rosmalen, Wenting, Roest, De Jonge, & Bos, 2012). Impulse response functions (IRFs) demonstrate the dynamic effect of changes in each of the variables over time, by visualizing the impact of an isolated shock in one variable (e.g. a shock of 1SD in social functioning) to the other variable (e.g. paranoia) over time. IRFs incorporate all estimated parameters of the VAR analysis, including lags and feedback loops. Orthogonalized IRFs (OIRFs) account for both contemporaneous and lagged effects, and assume a pre-defined order of the contemporaneous associations between variables. We tested both orderings of relations and reported the order most in line with the Ganger causality tests (order 1: social functioning \rightarrow psychotic experiences, order 2: psychotic experiences \rightarrow social functioning). Cumulative OIRFs (COIRFs) demonstrate the cumulated impulse of a shock in one variable on another variable over a certain period, in our case three days. The duration of three days was chosen as it was deemed long enough to reflect maintenance of effects, without compromising on reliability of results (the longer the period, the less reliable the effects (Brandt & Williams, 2007)). For the dynamic effects, we assumed a two-tailed alpha level of 0.10 to determine statistical significance (in line with Stavrakakis et al., 2015). For each individual, effect sizes were standardized. Analyses were computed in STATA 15 using the suite of VAR commands (StataCorp, 2017).

5.3 Results Descriptives

Participants in the current sample were two males and two females, ranging between 20 and 31 years of age. Clinical background information for the four participants can be found in Table 1. In Table 2 and Figure 1 descriptive statistics for each participant can be found. There were no clear trends (increasing or decreasing) in social functioning or paranoia for the participants over the study period.

Table 1. *Clinical Background Information for Participants 1 to 4*

	Participant 1	Participant 2	Participant 3	Participant 4
Number of Daily Assessments (max. 90)	87	81	85	82
Diagnoses (mini-SCAN)	depressive disorder	recurrent depressive disorder	depressive episode	depressive disorder and obsessive compulsive disorder
CAPE score (frequency of psychotic experiences – weighted mean item score)	1,20 (average)	1,05 (low)	1,85 (high)	1,30 (average)
Fulfillment of CAARMS criteria	genetic risk + attenuated psychotic symptoms	attenuated psychotic symptoms	genetic risk	attenuated psychotic symptoms
Transition to a psychotic disorder after 1 year	no	no	no	no

Note.

CAPE, Community Assessment of Psychic Experiences; CAARMS, Comprehensive Assessment of At Risk Mental States.

Table 2. *Descriptive Statistics for all Variables for Participants 1 to 4*

Participant	Suspiciousness		Others dislike me		Time spent alone		Experienced social support	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
1	17.71 (5.64)	8.27 – 42.81	15.09 (4.74)	0.72 – 32.01	7.25 (12.97)	0 – 50	55.98 (15.09)	14.71 – 83.45
2	55.20 (26.36)	.36 – 95.28	50.67 (29.45)	0 – 100	51.69 (31.53)	0 – 100	33.56 (30.31)	0 – 88.05
3	45.90 (17.19)	6.69 – 77.24	54.49 (19.34)	0 – 82.89	43.78 (13.95)	0 – 66.67	50.17 (19.28)	17.46 – 99.76
4	59.70 (15.74)	.96 – 86.51	50.06 (13.84)	16.33 – 76.57	28.13 (23.95)	0 – 100	47.90 (19.97)	.06 – 79.78

Note.

All variables were assessed on a VAS-scale (0-100); SD, Standard Deviation.

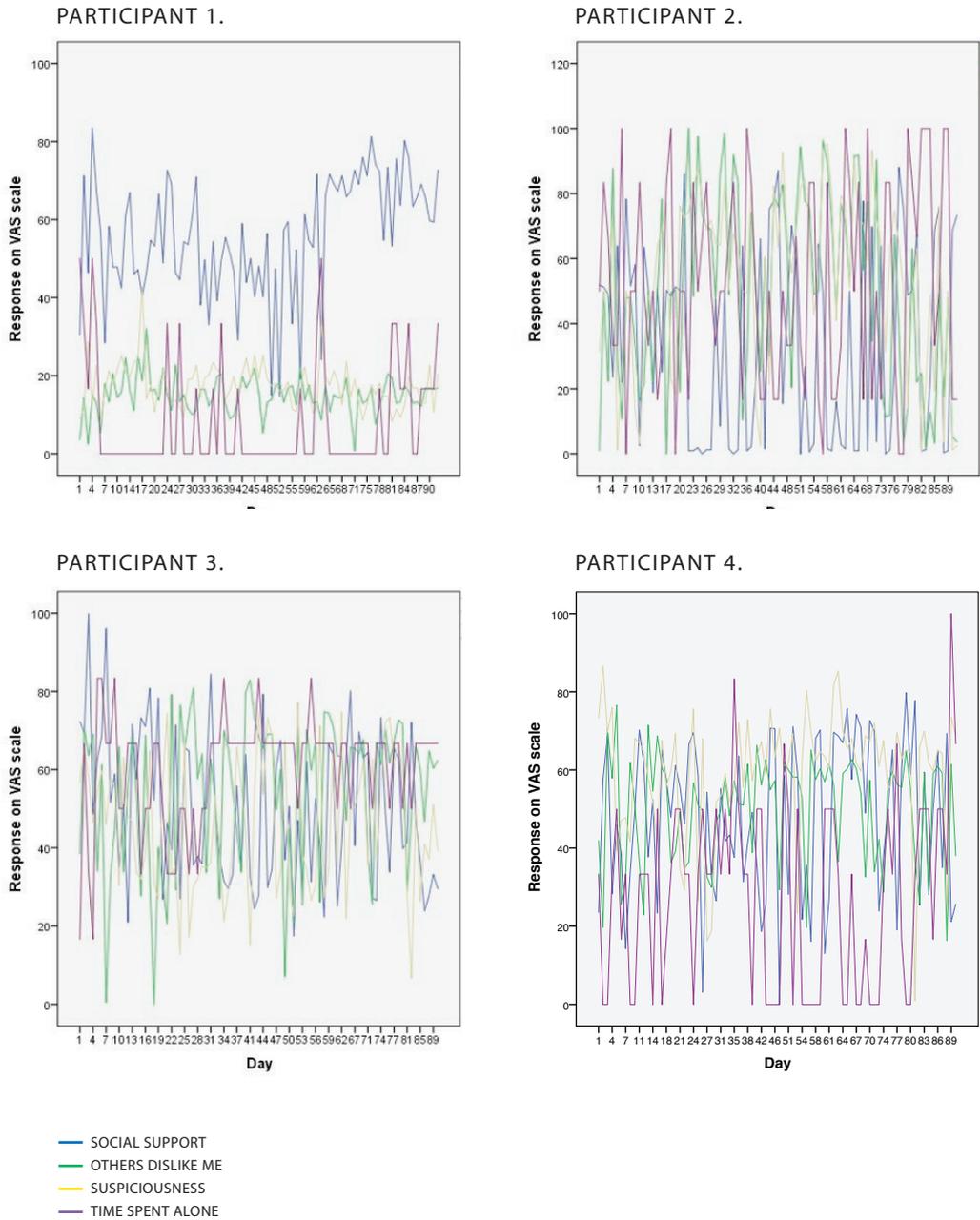


Figure 1. Line plots for each participant depicting variations in daily responses to each item over a period of 90 days

Contemporaneous Associations between Social Functioning and Paranoia

In Table 3, contemporaneous associations (within the same day) between social functioning and paranoia are displayed. For participant 1, there was a significant negative correlation between suspiciousness and experienced social support and time spent alone. Also, there was a significant positive correlation between the feeling of being disliked and the time spent alone. For participant 2, there were no contemporaneous correlations and the variable 'experienced social support' was not tested, as it did not meet the VAR assumption of normally distributed residuals. For participant 3, there was a positive correlation at trend level between suspiciousness and time spent alone. For participant 4, there were no contemporaneous correlations between social functioning and paranoia.

Table 3. Contemporaneous Correlations between Social Functioning (Time Spent Alone and Experienced Social Support) and Paranoia (Suspiciousness and Others Dislike Me)

Participant	Suspiciousness		Others dislike me	
	Time spent alone	Experienced Social support	Time spent alone	Experienced social support
1	0.53 [#]	-0.43*	0.73**	0.06
2	-0.09	-	-0.10	-
3	0.20 [#]	0.08	0.01	-0.01
4	-0.10	-0.01	0.12	-0.33

Note.

[#] $p < 0.10$ (trend-level), * $p < 0.05$, ** $p < 0.01$.

Direction of the Association (Granger Causality)

To test whether changes in social functioning preceded changes in paranoia over a period of one day, or the other way around, Granger causality tests were performed (see Table 4). For participant 1, an increase in suspiciousness (t-1) predicted a decrease in experienced social support (t). For participant 2, the relation between social functioning and paranoia was bi-directional, as an increase in time spent alone (t-1) predicted an increase in the feeling of being disliked by others (t), whereas an increase in the feeling of being disliked (t-1) predicted a decrease in time spent alone (t). For participant 3, an increase in the feeling of being disliked (t-1) predicted less time spent alone (t). For participant 4, an increase in feelings of suspiciousness (t-1) predicted less time spent alone (t), in addition to an increase in experienced social support (t).

Dynamic effects give the opportunity to assess whether the previously found (isolated) associations in the Granger causality tests are maintained over three days' time. Findings are presented in Table 5. To give an example, for participant 1 a 1 SD increase in suspiciousness led

to an (non-significant) increase in time spent alone of 0.20 SD, and a (significant) decrease in experienced social support of 0.41 SD. Overall, there was no lasting effect of social functioning (time spend alone or experienced social support) on paranoia (suspiciousness or others dislike me) in the COIRFs for the four participants. For participants 1 and 4, the effects found in the granger causality test of paranoia (suspiciousness) on social functioning (time spend alone and experienced social support) were maintained in the COIRFs.

Table 4. Granger Causality Tests for both Directions of the Association between Social Functioning and Paranoia from One Day to the Next Day

Participant	1. Causality test = Social functioning → Paranoia	X2	df	Estimate	2. Causality test = Paranoia → Social functioning	X2	df	Estimate
1	-	-	-	-	More suspiciousness → Less experienced social support	6.50**	1	-10.57
2	More time spent alone → others dislike me	3.25#	1	.12 [†]	More feeling that others dislike me → time spent alone	3.30#	1	-.16 [†]
3	-	-	-	-	More feeling that others dislike me → time spent alone	2.88#	1	-.10 [†]
4	-	-	-	-	More suspiciousness → alone More suspiciousness → social support	4.01* 9.65**	1 1	-14.37 18.63

Note.

$p < 0.10$ (trend-level), * $p < 0.05$, ** $p < 0.01$, † Log-transformed; df, degrees of freedom. Dynamic effects (COIRFs) over a period of three days.

Table 5. Orthogonalized Cumulative Impulse Response Functions over a Period of Three Days for the Four Participants

Impulse	Suspiciousness		Others dislike me		Time spent alone		Experienced social support	
Response	Time spent alone	Experienced Social Support	Time spent alone	Experienced Social Support	Suspiciousness	Others dislike me	Suspiciousness	Others dislike me
Participant 1	0.20	-0.41	-0.07	-0.29	-0.19	-0.12	-0.12	-0.14
Participant 2	-0.13		-0.11		0.02	0.09		
Participant 3	0.26	0.07	-0.29	0.05	0.03	-0.14	0.07	-0.16
Participant 4	-0.53	0.49	-0.03	0.08	0.08	-0.15	0.03	0.00

Note.

Bold effect sizes indicate significance at p-level <0.10. Results are presented assuming order 2 of contemporaneous associations: within-day changes in paranoia precede changes in social functioning.

5.4 Discussion

The main aim of this study was to explore if the nature of the association in social functioning and paranoia differs between individuals at UHR for psychosis. The findings confirm the association between social functioning and paranoia manifests itself in different ways for four individuals in the UHR phase for psychosis. Given that it is often indicated that social impairments are present long before the first psychotic episode (Addington et al., 2008; Ballon et al., 2007) and are often associated with a transition to the first psychotic episode (Cannon et al., 2008; Nelson et al., 2013; Velthorst et al., 2009; Yung et al., 2008), one may have expected that previous day changes in social functioning would lead to current day changes in paranoia. This was found only for one participant, namely that increases in time spent alone resulted in increases in the feeling that others disliked this person. At the same time this effect was bidirectional, as the presence of increased feelings of others disliking this person also resulted in a decrease in time spent alone. This individual seems sensitive to social isolation, but also seems to protect themselves by utilizing their social network and seeking out social contact, as to prevent a further increase in paranoia. These associations were no longer present in the COIRF analysis, where the net effect after three days was assessed. Thus, although the literature often states that impaired social functioning represents a 'risk factor' for psychosis (Cannon et al., 2008; Nelson et al., 2013), the current study demonstrates that social functioning may also represent a 'protective factor' in daily life during the UHR phase.

It was examined whether previous day changes in paranoia would lead to current changes in social functioning. This was found for all four individuals. One may expect that increases in paranoia would lead to decreases in social functioning, as it is known that paranoia can cause a person to experience social threat and therefore withdraw themselves (Green & Phillips, 2004). However, only one participant in this study demonstrated that an increase in previous day suspiciousness led to a decrease in experienced social support on the current day, an effect that was maintained over a period of three days. On the contrary, for three participants, previous day increases in paranoia led to current increases in social functioning. This effect was also maintained for one individual over a period of three days, demonstrative of a potentially profound and lasting effect. These findings suggest that for three participants, social interactions may serve as a coping factor. The literature on UHR for psychosis is often focused on the social 'impairment' (Addington et al., 2008; Cannon et al., 2008; Velthorst et al., 2009), but the current study highlights the potential for the social network to also represent a source for boosting and maintaining mental health in the UHR for psychosis phase.

Current treatments for UHR psychosis are effective in treating positive symptoms, but social functioning often remains impaired regardless of treatment (Brandizzi et al., 2015; Van Der Gaag et al., 2012). It therefore appears there is room for improvement in the treatment of a social impairment in the UHR phase for psychosis. A next step would be to investigate whether the found individual patterns are associated with transition to psychosis or an increase in psychotic symptoms. A further step could be to examine the feasibility of using diary assessments in clinical

practice, as this may provide unique insights into individual patterns of psychotic symptoms and social functioning that may not be obvious when using standard assessments. By using diary techniques, it may be hypothetically possible to develop individualized interventions, targeting one aspect (e.g. social contact) to potentially achieve the expected change in another aspect (e.g. paranoia). Such techniques are only just beginning to be explored in clinical practice, and more research is needed to verify the effectiveness of individualized intervention techniques in clinical practice.

To the best of our knowledge, the current study is the first to approach the association between social functioning and paranoia during the UHR phase for psychosis using an idiographic time-series analysis. The time-series design allowed us to examine the association at the individual level and to make inferences about the directionality, temporal dynamics and statistically causal effects of the examined association. Although the design of repeated assessments over a period of 90 days is time-consuming and demanding for the participant, compliance was high and participants were highly motivated to take part in the study. Our study also has some limitations. First, not all aspects of social functioning (e.g. occupational functioning) or psychotic experiences (e.g. delusions) were addressed. Second, due to the design of one-measurement-a-day and the choice for lags of one day (granger causality tests) and three days (dynamic effect sizes), it is possible that we missed variations if these occurred in different time intervals. Third, we did not examine whether the found associations were important for prognosis or transition to psychosis.

To conclude, using an idiographic analytic method it was found that the association between social functioning and paranoia differs amongst four UHR individuals. The current study shows that besides social functioning representing a risk factor in the UHR for psychosis phase, it may also be viewed as a 'protective factor' for psychotic experiences in the daily life of UHR individuals. These findings underline the importance of the social network as a resource for managing psychopathology and the potential it has in helping individuals with distressing experiences. We believe that social functioning deserves more attention as a potential coping mechanism in the UHR phase for psychosis and that this should be explored further in intervention studies for UHR psychosis.

