

# The relationship between childhood abuse and severity of psychosis is mediated by loneliness: an experience sampling study

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# The relationship between childhood abuse and severity of psychosis is mediated by loneliness: an experience sampling study

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## ABSTRACT

**Background:** This study tested the hypotheses that (i) the relationship between a history of childhood abuse and severity of psychosis is mediated by loneliness; (ii) the relationship between loneliness and psychosis is mediated by within-person fluctuations in depressive and anxious feelings.

**Methods:** Fifty-nine individuals with non-affective psychotic disorder rated the intensity of loneliness, positive symptoms, and depressive and anxious feelings during repeated moments in daily life (Experience Sampling Method). Childhood abuse was assessed retrospectively using the 'Childhood Experience of Care and Abuse' interview. To test the mediation hypotheses, a multilevel structural equation modeling paradigm was used.

**Results:** As predicted, the relationship between severity of childhood abuse and positive symptoms was mediated by loneliness ( $b = 0.08$ , 95% CI [0.02, 0.13],  $p = 0.005$ ). In turn, the relationship between loneliness and positive symptoms was mediated by within-person fluctuations in both depressive ( $b = 0.04$ , 95% CI [0.02, 0.06],  $p < 0.001$ ) and anxious ( $b = 0.02$ , 95% CI [0.01, 0.03],  $p = 0.002$ ) symptomatology. Depression was a stronger mediator than anxiety ( $b = 0.02$ , 95% CI [0.00, 0.04],  $p = 0.027$ ).

**Conclusions:** Our findings highlight the role of childhood abuse and loneliness in the severity of psychosis in daily life.

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## 1. Introduction

Childhood abuse is related to an increased risk for psychosis (Arseneault et al., 2011; Bendall et al., 2008; Matheson et al., 2013; Varese et al., 2012). There is also considerable evidence for a dose-response relationship, indicating that cumulative exposure to abuse is related to increased psychosis likelihood (Larkin and Read, 2008; Longden et al., 2016) and severity of symptoms of psychosis, such as hallucinations, delusions, and paranoia (Longden et al., 2016; Read et al., 2005; van Nierop et al., 2014). The social defeat hypothesis posits that this relationship may be explained by the sensitization of the mesolimbic dopamine system (Selten and Cantor-Graae, 2005; Selten

et al., 2013). Indeed, two studies have shown dopamine sensitization in psychotic and non-psychotic individuals who reported a history of childhood abuse (Egerton et al., 2016; Oswald et al., 2014).

Loneliness is thought to represent a consequence of social defeat that may account for the pathway from childhood abuse to psychosis (Shevlin et al., 2015; van Nierop et al., 2014). Studies have shown that abuse during childhood is associated with feelings of loneliness in adulthood (Gibson and Hartshorne, 1996; Merz and Jak, 2013; Murphy et al., 2013) and that patients with psychosis have a six-fold increase in feelings of loneliness compared to healthy individuals (Meltzer et al., 2013). Furthermore, a recent meta-analysis demonstrated a robust positive association between loneliness and severity of positive symptoms (Michalska et al., 2017).

While loneliness previously was mainly interpreted to be a consequence of psychosis, researchers are now shifting towards the idea that loneliness may also be a causal factor in the development of psychosis (Gayer-Anderson and Morgan, 2013; Michalska et al., 2017; van

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der Werf et al., 2010). This is supported by the findings that social isolation precedes the onset of psychosis (Hoffman, 2007) and that patients themselves perceive loneliness as causal to their psychosis rather than consequential (Angermeyer and Klusmann, 1988; Zafar et al., 2008). Perhaps due to sensitization of the mesolimbic dopamine system, a victim of childhood abuse may become more sensitive to subsequent experiences of social defeat, such as loneliness, and reacts with heightened positive symptoms.

Only a few studies have examined loneliness as a mediating factor in the association between childhood abuse and psychosis. One study demonstrated that loneliness mediated the relationship between childhood abuse and diagnoses of several psychiatric disorders, including psychosis (Shevlin et al., 2015). In patients with sub-clinical psychosis, loneliness was found to mediate the relationship between childhood abuse and positive symptoms (Boyd and McFeeters, 2015).

In turn, the relationship between loneliness and psychosis may be explained by depressive and anxious feelings (Jaya et al., 2016; Sündermann et al., 2014). This is supported by prospective studies showing that loneliness is a risk factor for depressive and anxious symptomatology (Cacioppo et al., 2010; Cacioppo et al., 2006; Kramer et al., 2013; Lim et al., 2016) and that symptoms of psychosis are predicted by depressive and anxious feelings (Delespaul et al., 2002; Fowler et al., 2011; Freeman et al., 2005; Häfner et al., 2005; Kramer et al., 2014; Startup et al., 2007).

Here, we test the hypotheses (i) that loneliness in patients with non-affective psychotic disorder mediates the relationship between a history of childhood abuse and severity of psychosis; (ii) that the relationship between loneliness and psychosis is mediated by within-person fluctuations in depressive and anxious feelings.

Feelings such as loneliness, fear, or sadness are by definition momentary state-like experiences the fluctuating nature of which cannot be fully captured by studying between-person data. We therefore employed the Experience Sampling Method (ESM), an intensive repeated-measures diary technique that allows for the investigation of psychopathology in daily life (Hektner et al., 2007; Myin-Germeys et al., 2003).

## 2. Material and methods

### 2.1. Subjects

This study is part of a larger research project (see Weijers et al., 2016) for which 90 patients with a non-affective psychotic disorder (NAPD) were recruited from community treatment teams in the Netherlands (Leiden, Voorhout, Zoetermeer, and Zeist). All subjects gave written informed consent to participate.

Diagnoses of subjects included schizophrenia, schizoaffective disorder, schizophreniform disorder, brief psychotic disorder, delusional disorder, and psychotic disorder not otherwise specified (NOS). Diagnoses were established by psychiatrists prior to participation and were confirmed by researchers using the Comprehensive Assessment of Symptoms and History (Andreasen et al., 1992).

We included subjects of at least 18 years old who were fluent in the Dutch language. The first treatment for psychosis was required to have started between 6 months and 10 years ago. Exclusion criteria were (1) illiteracy, (2) intellectual disability, and (3) substance addiction that necessitated detoxification.

### 2.2. Design

The present study used the ESM, an intensive diary method in which subjects are repeatedly asked to fill out questionnaires in their daily life. We used an electronic device (the 'PsyMate') to collect the responses. Subjects were prompted by a signal ten times a day to fill out (identical) questionnaires on the PsyMate for a total of five days. Previous research has demonstrated the feasibility, reliability, and validity of ESM in

individuals with psychotic disorders (Delespaul et al., 2002; Kimhy et al., 2006; Thewissen et al., 2011).

### 2.3. Materials

#### 2.3.1. Childhood Experience of Care and Abuse (CECA)

We used the 'Childhood Experience of Care and Abuse' (CECA) interview to measure childhood abuse retrospectively (Bifulco et al., 1994). The CECA is a semi-structured interview that assesses the severity of childhood abuse before the age of 17 years. The CECA includes four types of childhood abuse: parental conflict, psychological abuse, sexual abuse, and physical abuse. Abuse was assessed on both frequency and intensity. Frequency was rated on a five-point Likert scale: never (0), rarely (1), incidentally (2), regularly (3), and often (4). Intensity was rated on a four-point Likert scale: none (0), some (1), moderate (2), and marked (3), with the exception of parental conflict, which was scored on a five-point scale that also included violence (4). The severity of each type of abuse was calculated by multiplying frequency with intensity. The sum of the severity scores for the four types of abuse results in a possible total score ranging from 0 to 52. The possible scores for psychological abuse, sexual abuse, and physical abuse range from 0 to 12 and for parental conflict from 0 to 16. For our analyses, the total severity score was divided by five in order to avoid overly small coefficients. Thus, a one-unit increase in the rescaled severity score resembles a five-unit increase in the actual severity score.

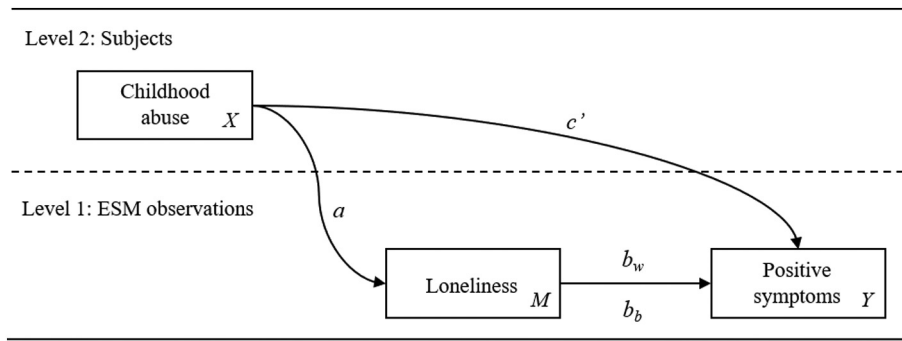
#### 2.3.2. ESM measures

All items were rated on a 7-point Likert scale. The severity of positive symptoms consisted of the average score of seven items that assessed various positive symptoms (hearing voices, feeling unreal, feeling suspicious, being afraid to do something uncontrolled, feeling that others want to hurt him/her, feeling disliked, and thinking that one's thoughts are being controlled by others). Depressive and anxious feelings were assessed by the single items "I feel down" and "I feel anxious". Loneliness was assessed by the single item "I feel lonely", which is a common approach in studies to loneliness (Boyd and McFeeters, 2015; Rook, 1987; Sündermann et al., 2014) and is comparable to more comprehensive measures of loneliness in establishing the relationship with positive symptoms (Michalska et al., 2017). Each ESM variable had a possible score ranging from 1 to 7.

### 2.4. Statistical analyses

Statistical analyses were performed using Mplus (version 8). All tests were 2-tailed with an  $\alpha = 0.05$ . The ESM data have a multi-level structure: multiple observations (Level 1) are nested within subjects (Level 2). Childhood abuse was assessed at Level 2 while the remaining variables were assessed at Level 1 (ESM observations). Traditional methods for assessing mediation are therefore inappropriate, primarily because the assumption of statistical independence of residuals is violated, resulting in underestimated standard errors and inflated Type I errors. In order to take into account the multilevel structure of the data, we used a multilevel structural equation modeling (MSEM) paradigm (Preacher et al., 2010). Advantages of MSEM are the ability to separate between- and within-subject effects, no required assumption of normality, and the use of robust maximum likelihood estimation that can accommodate unbalanced clusters.

Intraclass correlations (ICCs) were calculated to determine eligibility for the proposed mediational models. The ICC resembles the proportion of the between-subject variance relative to the total variance. A 2–1–1 model with random slopes (Preacher et al., 2010) was tested to investigate whether loneliness mediates the relationship between childhood abuse and positive symptoms (see Fig. 1). Next, two 1–1–1 models with random slopes (Preacher et al., 2010) were tested to investigate whether depressive and anxious feelings mediate the relationship between loneliness and positive symptoms. The lower level mediation



**Fig. 1.** Illustration of the 2–1–1 multilevel mediation model predicting positive symptoms from childhood abuse via loneliness.  $X$  = independent variable,  $M$  = mediator,  $Y$  = dependent variable;  $a$  = between-subject effect path  $a$ ;  $c'$  = between-subject direct effect;  $b_w$  = within-subject effect path  $b$ ;  $b_b$  = between-subject effect path  $b$ .

models allow for the investigation of both between- and within-subject effects because all variables were assessed at Level 1 (ESM observations). The between-subject level reflects the average of symptoms between individuals while the within-subject level resembles the fluctuations of symptoms within individuals. Depressive and anxious feelings were also tested in a 1-(1-1)-1 multiple mediator model (Preacher et al., 2010) (see Fig. 2) in order to assess independence and compare the strength of the mediating effects.

### 3. Results

#### 3.1. Sample

Of the 90 subjects recruited, 9 subjects were excluded because they refused or failed to fill out any PsyMate questionnaire and 21 subjects were excluded because they filled out fewer than 20 PsyMate questionnaires, similar to prior studies (Glaser et al., 2006; Lardinois et al., 2011). In addition, one subject was excluded because she refused to answer questions about sexual abuse. Therefore, the final sample consisted of 59 subjects.

There were some missing values for the ESM variables loneliness (20 missing; 1.0%), depression (29 missing; 1.5%), anxiety (18 missing; 0.9%), and positive symptoms (31 missing; 1.6%). We excluded ESM observations that had missing values on at least one variable. After excluding 31 ESM observations, the final data sample consisted of 1896 (1927–31 = 1896) ESM observations.

Table 1 shows the characteristics of the study sample. In total, 43 subjects (72.9%) reported some type of childhood abuse; 34 subjects (57.6%) experienced parental discord, 15 subjects (25.4%) experienced physical abuse, 15 subjects (25.4%) experienced psychological abuse, and 7 subjects (11.9%) experienced sexual abuse. Table 2 depicts the

means, standard deviations, ICC's, and intercorrelations for all study variables.

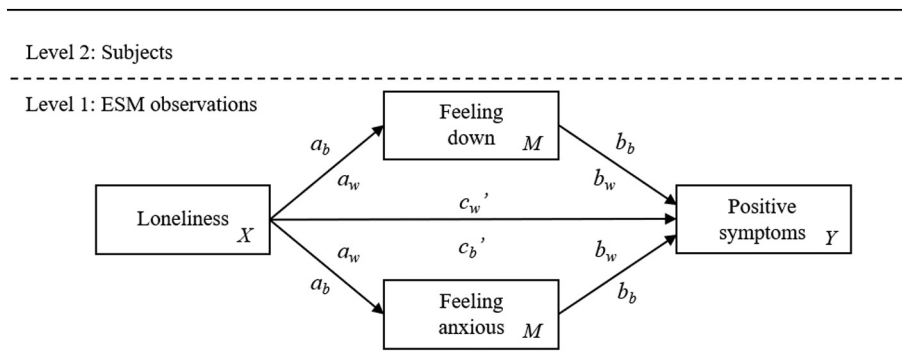
#### 3.2. The mediating role of loneliness

The ICC for the outcome variable positive symptoms indicated that 77.3% of the variance in positive symptoms was attributable to between-subject differences, providing support for the investigation of the 2–1–1 model and between-subject mediational effects.

Subjects who experienced more severe childhood abuse reported higher levels of loneliness ( $a = 0.15$ , 95% CI [0.05, 0.24],  $p = 0.002$ ). In turn, subjects with higher levels of loneliness reported more severe positive symptoms ( $b_b = 0.54$ , 95% CI [0.37, 0.72],  $p < 0.001$ ). Moreover, within-subject levels of loneliness were positively related to severity of positive symptoms ( $b_w = 0.08$ , 95% CI [0.05, 0.12],  $p < 0.001$ ). A test of mediation revealed evidence of an indirect effect of childhood abuse on positive symptoms through loneliness ( $ab = 0.08$ , 95% CI [0.02, 0.13],  $p = 0.005$ ). While controlling for the indirect effect, the direct effect of childhood abuse on positive symptoms was no longer present ( $c' = -0.01$ , 95% CI [-0.11, 0.09],  $p = 0.824$ ).

#### 3.3. The mediating role of depressive and anxious symptomatology

The results of the mediation models for depressive and anxious symptomatology are displayed in Table 3. The ICC for the independent variable loneliness indicated that 41.2% of the variance in loneliness was attributable to between-subject differences and 58.8% to within-subject differences, providing support for the investigation of a 1–1–1 multilevel mediation model and both within- and between-subject mediational effects.



**Fig. 2.** Illustration of the 1-(1-1)-1 multilevel mediation model predicting positive symptoms from loneliness via depressive and anxious feelings.  $X$  = independent variable,  $M$  = mediator,  $Y$  = dependent variable;  $a_b$  = between-subject effect path  $a$ ;  $c_b'$  = between-subject direct effect;  $c_w'$  = within-subject direct effect;  $b_w$  = within-subject effect path  $b$ ;  $b_b$  = between-subject effect path  $b$ .

**Table 1**  
Characteristics of the study sample (N = 59).

Age, <i>M</i> ( <i>SD</i> ), range	31.8 (9.4), 19–57
Sex, n men (%)	34 (57.6%)
CASH DSM-IV diagnosis, n (%)	
Schizophrenia	34 (57.6%)
Psychotic Disorder NOS	10 (16.9%)
Schizoaffective Disorder	10 (16.9%)
Brief Psychotic Disorder	3 (5.1%)
Delusional Disorder	2 (3.4%)
Years since onset of psychotic disorder, <i>M</i> ( <i>SD</i> ), range	5.6 (4.1), 1–22
Childhood abuse severity, <i>M</i> ( <i>SD</i> ), range	10.1 (11.3), 0–43
Parental discord	5.4 (5.9), 0–16
Physical abuse	1.7 (3.5), 0–12
Psychological abuse	1.9 (3.7), 0–12
Sexual abuse	0.3 (0.8), 0–3

Possible ranges for childhood abuse scores: total 0–52, parental discord 0–16, physical abuse 0–12, psychological abuse 0–12, and sexual abuse 0–12.

### 3.3.1. Within-subject effects

Higher levels of loneliness were related to more depressive and anxious feelings ( $ps < 0.001$ ; see Table 3, path  $a_w$ ). In turn, more depressive and anxious feelings were related to more severe positive symptoms ( $ps < 0.001$ , see Table 3, path  $b_w$ ). Tests of mediation revealed indirect within-subject effects of loneliness on psychotic experiences through depressive feelings ( $ab_w = 0.04$ , 95% CI [0.02, 0.06],  $p < 0.001$ ), and anxious feelings ( $ab_w = 0.02$ , 95% CI [0.01, 0.03],  $p = 0.002$ ). There were still within-subject direct effects of loneliness on positive symptoms while controlling for the indirect effect of depressive feelings ( $c'_w = 0.04$ , 95% CI [0.01, 0.07],  $p = 0.005$ ) and anxious feelings ( $c'_w = 0.06$ , 95% CI [0.03, 0.10],  $p < 0.001$ ).

Analyzing depressive and anxious feelings in a multiple mediator model revealed that both depressive feelings ( $ab_{w1} = 0.04$ , 95% CI [0.02, 0.05],  $p < 0.001$ ) and anxious feelings ( $ab_{w2} = 0.02$ , 95% CI [0.00, 0.03],  $p = 0.012$ ) were independent mediators in the relationship between loneliness and positive symptoms. Depression was a stronger mediator than anxiety ( $ab_{w1} - ab_{w2} = 0.02$ , 95% CI [0.00, 0.04],  $p = 0.027$ ).

### 3.3.2. Between-subject effects

On average, subjects with higher levels of loneliness reported more depressive and anxious feelings ( $ps < 0.001$ ; see Table 3, path  $a_b$ ). In turn, subjects with relatively more depressive and anxious feelings reported more severe positive symptoms, but this did not reach significance ( $ps > 0.05$ ; see Table 3, path  $b_b$ ). A formal test of mediation showed no significant between-subject indirect effect of loneliness on positive symptoms through depressive or anxious feelings ( $ps > 0.05$ ; see Table 3, path  $ab_b$ ).

## 4. Discussion

The present ESM study aimed to identify mediational pathways to daily life positive symptoms in individuals with NAPD. Our findings demonstrate that the severity of childhood abuse was associated with increased levels of loneliness and positive symptoms. As hypothesized,

**Table 2**  
Characteristics, intraclass correlation coefficients, and intercorrelations of the study variables.

Variable	ICC	Mean ( <i>SD</i> ), range	Loneliness	Positive symptoms	Depressive feelings	Anxious feelings
Childhood abuse	n/a	2.01 (2.24), 0–8.6	0.32	0.28	0.40	0.26
Loneliness	0.41	2.36 (1.59), 1–7	–	0.71	0.76	0.67
Positive symptoms	0.77	1.82 (0.99), 1–6.3	0.22	–	0.68	0.73
Depressive feelings	0.50	2.41 (1.57), 1–7	0.33	0.36	–	0.81
Anxious feelings	0.52	1.91 (1.33), 1–7	0.24	0.30	0.32	–

The within-subject correlations (N = 1896) are displayed below the diagonal. The between-subject correlations (N = 59) are displayed above the diagonal. ICC = intraclass correlation coefficient. Total childhood abuse scores were divided by 5 in order to avoid overly small coefficients. Possible range for childhood abuse score is 0–10.4; for ESM variables 1–7.

loneliness mediated the relationship between childhood abuse and positive symptoms.

In addition, to the best of our knowledge, this is the first study to reveal that within-person fluctuations in depressive and anxious symptomatology mediate the relationship between loneliness and positive symptoms. More specifically, when individuals were lonelier than their average level of loneliness, they tended to report more severe positive symptoms through increased depressive and anxious feelings (the within-subject indirect effects). Depression was a significantly stronger mediator than anxiety. However, individuals who showed above average levels of loneliness in general did not appear to show above average levels of positive symptoms through depressive or anxious feelings (the between-subject indirect effects).

### 4.1. Comparison to previous findings

Our findings are in line with prior research demonstrating that loneliness mediates the relationship between childhood abuse and a diagnosis of psychosis (Shevlin et al., 2015) and sub-clinical psychotic experiences (Boyda and McFeeters, 2015). The findings support an emerging consensus that individuals with a history of abuse have an increased risk to develop psychosis (Arseneault et al., 2011; Bendall et al., 2008; Matheson et al., 2013; Varese et al., 2012) and are prone to become lonely in adulthood (Gibson and Hartshorne, 1996; Merz and Jak, 2013; Murphy et al., 2013), and confirm the recently established positive association between loneliness and psychotic symptoms (Michalska et al., 2017). Importantly, our study extends previous findings by identifying loneliness as a mediating factor in the context of daily life.

Our results also support previous findings which suggested that loneliness affects psychosis through depression and anxiety (Jaya et al., 2016; Sündermann et al., 2014). However, this effect was not found on a between-person level, which is likely due to reduced power by relying on mean symptom levels. The low accuracy involved in between-person measurements may yield mixed results or conceal effects, whereas within-person analyses take into account fluctuations and individual differences, revealing subtle underlying patterns (Molenaar and Campbell, 2009). We believe that the within-person approach is more appropriate when studying symptoms or emotions, as these are by definition momentary fluctuating experiences. In fact, there is a growing recognition for the importance of within-person data in the field of psychology, especially because most psychological theories postulate intraindividual processes (Collins, 2006; Curran and Bauer, 2011; Hamaker, 2012; Molenaar, 2004). Using a within-person approach, we were able to detect a *relative* effect of loneliness – the effect that occurred when people started to feel more lonely than their “baseline” – that would not have been revealed using a between-person approach.

Our results provide support for the social defeat hypothesis of psychosis aetiology (Selten et al., 2013). Investigating loneliness in the context of dopamine sensitization may be a fruitful venue for future research, as various other social adversities, including childhood abuse (Egerton et al., 2016), hearing impairment (Gevonden et al., 2014), and migration (Egerton et al., 2017) have been related to a sensitized mesolimbic dopamine system. Likewise, as predicted by the social

**Table 3**  
Multilevel mediation models predicting positive symptoms from loneliness via depressive and anxious symptomatology.

	Depression as mediator			Anxiety as mediator		
	Estimate	SE	95% CI	Estimate	SE	95% CI
<b>Within-subject level</b>						
Path $a_w$	0.30***	0.04	0.22, 0.37	0.19***	0.03	0.12, 0.26
Path $b_w$	0.13***	0.02	0.10, 0.17	0.12***	0.03	0.06, 0.17
Path $c_w'$	0.04**	0.02	0.01, 0.07	0.06***	0.02	0.03, 0.10
Path $ab_w$ (= indirect effect)	0.04***	0.01	0.02, 0.06	0.02**	0.01	0.01, 0.03
Path $ab_{w1/w2}$ in 1-(1-1)-1 model	0.04***	0.01	0.02, 0.05	0.02*	0.01	0.00, 0.03
<b>Between-subject level</b>						
Path $a_b$	0.81***	0.12	0.57, 1.05	0.62***	0.118	0.39, 0.85
Path $b_b$	0.15	0.19	-0.22, 0.56	0.38	0.276	-0.17, 0.92
Path $c_b'$	0.30*	0.13	0.05, 0.55	0.26	0.154	-0.04, 0.56
Path $ab_b$ (= indirect effect)	0.12	0.16	-0.19, 0.44	0.23	0.181	-0.12, 0.59
Path $ab_{b1/b2}$ in 1-(1-1)-1 model	0.02	0.12	-0.22, 0.26	0.15	0.121	-0.09, 0.39

The models are random intercept and slope models; Path  $a_b/a_w$  = loneliness → mediator; Path  $b_b/b_w$  = mediator → positive symptoms; Path  $c_b'/c_w'$  = loneliness → positive symptoms; Path  $ab_b/ab_w$  = mediation effect.

\*  $p < 0.05$ .

\*\*  $p < 0.01$ .

\*\*\*  $p < 0.001$ .

defeat hypothesis, the contribution of loneliness to psychosis may biologically be explained by the sensitization of the mesolimbic dopamine system (Howes and Murray, 2014).

#### 4.2. Strengths and limitations

The main strength of our study is the use of momentary and ecologically valid data. Measuring symptoms as they occur in daily life circumvents recall bias and improves generalizability (Myin-Germeys et al., 2009). Another strength is the use of MSEM, a state-of-the-art framework for assessing multilevel mediation (Preacher et al., 2010). This allowed us to separate between- and within-person mediated effects in a robust and unbiased manner. Particularly our focus on within-person processes is a powerful addition to typical between-person research paradigms as we were able to assess how underlying processes unfold within individuals.

Several potential limitations also need to be considered. First, our study depended on retrospective recall of childhood abuse, making it susceptible to recall bias (Newbury et al., 2018). Because of this, some researchers dispute the causal role of childhood abuse in psychosis (Susser and Widom, 2012). However, it seems rather unlikely that recall bias alone would explain the robust association between childhood abuse and psychosis (Cutajar et al., 2010; Kelleher et al., 2013; Morgan and Gayer-Anderson, 2016; Varese et al., 2012). Second, the cross-sectional nature of our analyses precludes time ordering of the variables. This means that it is difficult to conclude that, for example, loneliness leads to future increases of positive symptoms or vice versa. Third, the present study employed self-report instruments. Their validity depends upon the patients' ability to accurately identify and report experiences. A lack of awareness and poor insight may have influenced the validity of self-report scores in some patients (Bell et al., 2007).

#### 4.3. Conclusion

The findings of the present study strongly suggest (i) that loneliness mediates the relationship between childhood abuse and severity of positive symptoms in patients with NAPD; (ii) that the relationship between loneliness and positive symptoms is mediated by within-person fluctuations in depressive and anxious symptomatology.

#### Conflict of interest

All authors declare that they have no conflicts of interest.

#### Contributors

LS designed the study. LS and JG conducted the statistical analyses. LS and JW wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

#### Funding body agreements and policies

None.

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