Psychological Pathways to Paranoia and Psychotic-Like Experiences in Daily-Life: The Mediating Role of Distinct Affective Disturbances

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Background and Hypothesis: Influential models of psychosis indicate that the impact of putative causal factors on positive symptoms might be explained partly through affective disturbances. We aimed to investigate whether pathways from stress and self-esteem to positive symptoms, as well as reversal pathways from symptoms to stress and self-esteem, were mediated through specific affective disturbances across the extended psychosis phenotype. *Study Design:* Using experience sampling methodology, 178 participants (65 high-schizotypy, 74 at-risk mental state, and 39 first-episode psychosis) were assessed on levels of momentary stress, self-esteem, anxiety, sadness, psychotic-like experiences (PLE), and paranoia. Multilevel mediation models were fit to examine indirect effects of each of these pathways. Considering evidence of mediation, each indirect pathway will be combined in a single model to explore their relative contributions. *Study Results:* Anxiety, sadness, and self-esteem mediated the pathways from stress to PLE and paranoia in daily-life. In the pathway to paranoia, sadness, and self-esteem showed larger contributions than anxiety. Pathways from self-esteem to PLE and paranoia were mediated by anxiety and sadness, the later showing a larger contribution. Pathways from symptoms to stress, but not from symptoms to self-esteem, were differently explained by emotional states; sadness lost its mediating effect and anxiety was the most important mediator. Few differences across groups were found. *Conclusions:* This study lends support to psychological models of psychosis that highlight the relevance of affective disturbances in the risk and expression of psychosis. Furthermore, specific influences of different negative emotional states were identified, which could enhance psychological treatments.

Keywords: psychosis/stress/self-esteem/experience sampling/first-episode psychosis/at-risk mental states

Introduction

Unraveling the psychological mechanisms that lead to psychosis is essential for reducing the suffering of people who are impacted by psychotic disorders. Stress has been historically implicated and accepted as a risk factor for psychotic disorders,[1,2] but influential models of psychosis argue that different complex pathways could be acting between stress and psychotic symptoms.[3–8] One pathway to psychosis may involve the interplay of affective disturbances with stress. Myin-Germeys and van Os[8] argued that stress triggered by daily hassles was related to an increase in negative affect, suggesting that increased emotional reactivity to stress may act as a vulnerability factor for positive symptoms of psychosis. However, a range of specific negative mental states falls under the umbrella of negative affect that could be differently interacting with stress in the onset and exacerbation of positive symptoms. Specifically, anxiety, depression, and low self-esteem have been postulated as possible factors that could mediate the path from stress to psychosis.[4,9,10] Studies using experimental designs with nonclinical participants found that anxiety[11] and self-esteem[12] mediated the association of stress and paranoia. Further, Freeman et al[13] showed in patients with persecutory delusions that anxiety and depression partially mediated the association of the "stress of the street" and paranoia. Therefore, it seems critical to disentangle how stress could be interplaying with these specific negative mental states in the pathway to positive symptoms.

In recent years, a significant proportion of research has used the "single symptom" approach.[14,15] This strategy tries to understand the etiology and development of specific core symptoms to minimize the large heterogeneity present in the psychosis phenotype. Following this

approach, relevant models of persecutory delusions have been proposed.[9,16,17] Emotions and low self-esteem have been implicated as casual factors in the development and maintenance of paranoia.[16,18–23] However, the precise mechanisms that explain the link between self-esteem, emotions, and paranoia are still not well understood. Freeman et al[9] proposed that in individuals with persistent negative beliefs about the self, low self-esteem could impact the formation and expression of persecutory delusions through negative emotional states such as anxiety and depression. Some evidence for this indirect path from negative beliefs about the self to paranoia has been reported. Using path analyses, Galbraith et al[24] found in undergraduate students that self-esteem lead to paranoia depending on levels of anxiety and depression. They showed that depression was the strongest mediator, concluding that the effect of anxiety depended on the presence of depression. In contrast, Oliver et al[25] found that anxiety, but not depression, mediated the association between negative schemas and delusional ideation in sample of undergraduate students. Finally, in a large sample of people with schizophrenia, both anxiety and depressive symptoms mediated the path between self-esteem and paranoia,[26] although depression showed a greater mediational effect than anxiety. Thus, the precise role of anxiety and depression in the pathway from self-esteem to paranoia remains to be elucidated. To date, no studies have explored this possible mechanism in samples comprising different stages of the psychosis continuum, nor in the realm of daily-life.

Experience sampling methodology (ESM) is a structured diary technique that repeatedly assesses experiences, such as cognition, affect, symptoms, and contextual factors, in daily-life,[27–29] offering relevant advantages over traditional laboratory assessments.[30–32] For example, ESM allows examination of the interaction of the individual with the environment through repeated assessments of mental experiences in their natural context, offers a fine-grained repeated assessment of psychological experiences, and increases ecological validity.[33–35] ESM studies have made significant contributions to the investigation of putative psychological *mechanisms* underlying the development of psychotic disorders,[36–41] expanding previous findings of traditional laboratory research.[30] However, only a few ESM studies have examined the causal psychological mechanisms that could be interacting in the development of psychosis[37,42–45]; therefore, there is a need to replicate these findings and to explore other relevant putative causal mechanisms, especially in early psychosis samples.[30] Looking at etiological factors of psychosis in at-risk and early stages of the illness should provide both additional and more precise information than that obtained at more developed stages by avoiding many of the confounding effects of illness chronicity, such as stigma, long-term medication effects, and comorbidity with other conditions.[46] To our knowledge, only 1 ESM study has explored the mediation effects of emotional and cognitive factors in the association between stress and psychotic experiences.[42] Using an early psychosis sample, they found that negative affect mediated the link between stress and psychotic experiences, and that the relative contribution of this indirect path was larger compared to other indirect paths involving cognitive factors (threat anticipation and aberrant salience). Given that negative affect may have a key role in the association between stress and psychosis, it would be highly relevant to explore whether specific aspects of affective disturbance (anxiety, depression, and low self-esteem) mediate the path from stress to psychosis, examining the possible differences between them, as well as whether similar pathways are acting across individuals with different levels of expression along the psychosis continuum.

The present study used ESM to test different theory-driven models of the association of stress, affective disturbances, and symptoms in real life and whether these associations held across different levels of expression of the psychosis continuum, that is, high-schizotypy (or psychometric risk for psychosis), at-risk mental states for psychosis (ARMS; clinical risk for psychosis), and first-episode psychosis (FEP). First, we examined whether stress in the moment was associated with positive psychotic-like experiences (PLE) through specific negative mental states of sadness, anxiety, and low self-esteem. To assess the specificity of these different pathways, we tested these models with both paranoia and PLE other than paranoia as separate outcomes (figure 1, diagram 1). A significant indirect effect of stress to PLE and paranoia was expected through all negative mental states. Second, based on claims that self-esteem has a specific causal role in the development of paranoia, we investigated whether low self-esteem would be associated with paranoia through anxiety and sadness (figure 1, diagram 2). We hypothesized that both anxiety and sadness would mediate the pathway from self-esteem to paranoia, although, following the literature reviewed above, a larger effect was expected for sadness. As self-esteem has been also implicated in the development of PLE other than paranoia,[21,47,48] we also tested whether self-esteem was related to PLE through anxiety and sadness. Third, as it has been postulated that the connection between self-esteem and psychopathology may be bidirectional, with self-esteem affecting symptoms and symptoms affecting self-esteem,[49–52] competitive models explored whether the associations of PLE and paranoia with self-esteem were also mediated by sadness and anxiety (figure 1, diagram 4). Similarly, the same bidirectional link between stress and PLE could be hypothesized. Indeed, Barrantes-Vidal et al[53] found that both PLE and paranoia predicted subsequent stress in nonclinical participants. Thus, we also investigated whether the associations of PLE and paranoia with stress were mediated by sadness, anxiety, and self-esteem (figure 1, diagram 3). Finally, we examined
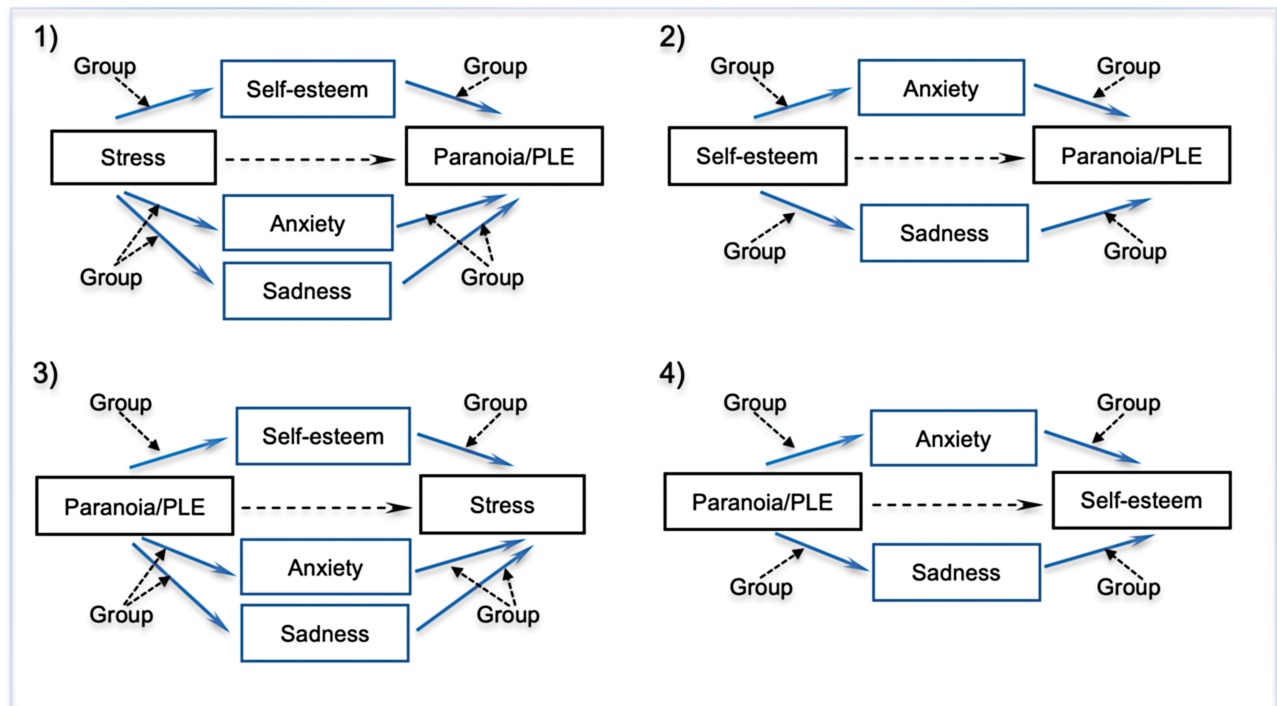
Fig. 1. Diagrams of hypothesized pathways examined in the study. Group variable was only included in the final models examined. *Note*: PLE, psychotic-like experiences.

whether these potential combined indirect pathways varied across samples with high-schizotypy, ARMS, and FEP individuals.

Methods

Participants and Procedure

The sample comprised 178 participants, with 65 high-schizotypy, 74 ARMS, and 39 FEP participants (mean age = 22.0 years, SD = 3.90 years; 53.4% males). The high-schizotypy participants were drawn from the Barcelona Longitudinal Investigation of Schizotypy (BLISS).[53] An initial unselected sample comprised 547 undergraduates from the Universitat Autònoma de Barcelona (UAB) and 261 students from technical training schools in Barcelona. A subsample (214 and 39, respectively) was selected to conduct an in-depth assessment. A detailed description of the sample selection procedure has been provided elsewhere.[54] From this subsample, we selected 65 high-schizotypy participants (49 from UAB and 16 from technical schools) who had standard scores based upon sample norms of at least 1.5 on the positive dimension of the Wisconsin Schizotypy Scales (WSS),[55] the suspiciousness subscale of the Schizotypal Personality Questionnaire (SPQ),[56] or the positive symptom subscale of the Community Assessment of Psychic Experiences (CAPE).[57] None of the university or technical school participants had a psychotic disorder as assessed by the Structured Clinical Interview for DSM-IV (SCID-I).[58]

The ARMS and FEP participants were drawn from a longitudinal study at 4 Mental Health Centres of Barcelona belonging to the Sant Pere Claver Early Psychosis Program.[59,60] The inclusion criteria were ages 14–40 years old and IQ ≥ 75, whereas exclusion criterion was evidence of organically based psychotic symptoms. ARMS specific criteria were based on the Comprehensive Assessment of At-Risk Mental States.[61] FEP patients met DSM-IV-TR[62] criteria for any psychotic disorder or affective disorder with psychotic symptoms assessed by the SCID-I. FEP patients who experienced their first psychotic episode more than 2 years before the assessment were not included. Participants provided written informed consent, conforming to local ethics committee guidelines. The project was developed following the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Experience sampling data were collected on personal digital assistants (n = 137) or smartphones (n = 41) that signaled participants semi-randomly 8 times daily (between 11 AM and 10 PM) for 7 days to complete brief questionnaires. The average number of completed ESM questionnaires did not differ between PDA and smartphones (t = .931, P = .353) and these methods generate comparable data in terms of quantity and quality.[63,64] Participants had up to 15 min after the signal to complete the ESM questionnaires and participants who completed less than a third (<18) of the total questionnaires (56) were excluded from the analyses.[65]

Measures

ESM items were rated on a 7-point Likert scale that ranges from "not at all" to "very much." The complete list of ESM items can be found in Barrantes-Vidal et al.[53] Several studies have employed ESM across the psychosis continuum demonstrating its validity and reliability.[41,44,53,66] Within and between-person reliabilities for ESM indices were computed following Geldhof et al.[67]

Momentary stress was assessed with the item "My current situation is stressful." Momentary self-esteem was measured with the mean of 3 ESM items ("Right now I feel good about myself," "Right now I can cope," and "Right now I feel guilty or ashamed," reversed; within alpha = .53, between alpha = .84). To assess momentary PLE the mean of 8 ESM items were used (eg, "Right now I feel weird," "Since the last beep, I have heard or seen things others could not"; within alpha = .65, between alpha = .88). Momentary paranoia was assessed with the mean of 2 ESM items ("Right now I feel suspicious," "Right now I feel mistreated"; within alpha = .52, between alpha = .81). Finally, anxiety and depressive experiences were measured with the items "Right now I feel anxious (nervous)" and "Right now I feel sad," respectively.

Data Analyses

ESM data have a hierarchical structure in which repeated daily-life ratings (level-1 units) are nested within subjects (level-2 units). Therefore, multilevel structural equation models were employed using Mplus Version 8.[68] Following the recommendation of the Mplus developers, we fit the models using Bayesian estimation.[69] Posterior credible intervals (comparable to frequentist-based CIs) for the parameter estimates were used to determine statistical significance. Supplementary Methods contain a detailed description of these models.

The present study examines 2 types of multilevel mediation analyses to test the independent and simultaneous within-person mediating effects of anxiety, sadness, and self-esteem. First, separate multilevel mediation models were conducted to examine the within-person indirect effects of each pathway independently: (1) with stress as predictor variable, 1 mediator variable for anxiety, sadness, or self-esteem, and 1 criterion variable of PLE or paranoia; and (2) with self-esteem as predictor variable, 1 mediator variable for anxiety or sadness, and 1 criterion variable of PLE or paranoia. Second, in order to evaluate the relative contribution of each mediator simultaneously, and based on evidence of mediation in the previous models, subsequent combined multilevel mediation models were fitted with all statistically significant mediating variables included in the same model.[70] These models also performed a statistical comparison of the indirect effects through the different mediators. Competitive models were also performed to examine whether the association between PLE and paranoia with stress and self-esteem was also mediated by sadness, anxiety, and self-esteem. Similar to previous models, separate multilevel mediation models were conducted to examine the within-person indirect effects of each pathway independently, and then, subsequent combined multilevel mediation models were fitted with all statistically significant mediating variables included in the same model. Finally, multilevel moderated mediation models were employed to examine whether within-person indirect effects varied between the high-schizotypy, ARMS, and FEP groups (level 2 variables).

Results

From the initial sample, 10 participants (5 high-schizotypy, 1 ARMS, and 4 FEP) refused to participate in the ESM assessment or were omitted due to equipment malfunctions. Nine participants (3 high-schizotypy, 2 ARMS, and 4 FEP) completed less than 18 questionnaires and were excluded from the analyses, resulting in a final sample of 178 participants (65 high-schizotypy, 74 ARMS, and 39 FEP). Basic sample characteristics and group comparisons of all variables employed in this study are presented in table 1. Multilevel correlations between all variables employed in this study showed small to moderate magnitudes, except for the correlation between stress and anxiety that was large (supplementary table 1). All subsequent effects reported correspond to effects at the within-person level, which were of primary relevance to the hypotheses.

Results of multilevel mediation analyses examining the within-person indirect effects of pathways from stress to PLE and paranoia through anxiety, sadness, or self-esteem indicated that all the indirect effects were statistically significant when they were examined separately. Similarly, indirect effects of self-esteem on PLE and paranoia through anxiety or sadness were significant when they were examined separately (table 2).

Subsequent multilevel mediational analyses combining the significant within-person indirect effects of each pathway in a single model were performed (table 3). Indirect effects of stress on PLE through anxiety, sadness, and self-esteem all remained statistically significant and the relative contribution of each indirect effect to the model was similar. No differences in the magnitude of indirect effects across groups were found except for the indirect effect through sadness, which was greater in ARMS than in high-schizotypy participants. Likewise, the indirect effects of stress on paranoia through anxiety, sadness, and self-esteem remained statistically significant. However, the relative contribution of sadness and self-esteem was larger than the contribution of anxiety. The specific indirect effect through sadness was greater in ARMS than in FEP and high-schizotypy participants.

In terms of pathways from self-esteem to PLE and paranoia, both anxiety and sadness mediated these associations,

Table 1. Descriptive Data and Comparison of High-Schizotypy, ARMS, and FEP Groups on Study Variables

	High-Schizotypy	ARMS	FEP	Test Statistics		Scheffé/Games-Howell[a]
	$n = 65$	$n = 74$	$n = 39$	$df = 2$	P	
Demographic variables						
Age, mean (SD)	20.83 (1.96)	21.56 (4.02)	24.59 (4.88)	$F = 13.7$	<.001	3 > 1***, 2**
Sex, n (%)				$X^2 = 27.2$	<.001	
Female	47 (72.3)	24 (32.4)	12 (30.8)			
Male	18 (27.7)	50 (67.6)	27 (69.2)			
Immigrant, n (%)				$X^2 = 4.2$	.123	
No	53 (81.5)	63 (85.1)	27 (69.2)			
Yes	12 (18.5)	11 (14.9)	12 (30.8)			
Clinical variables						
DSM-IV-TR psychotic disorder diagnosis, n (%)				—	—	
Schizophrenia and other psychotic disorders	0 (0.0)	0 (0.0)	29 (74.4)			
Depressive disorder with psychotic features	0 (0.0)	0 (0.0)	1 (2.6)			
Bipolar disorder with psychotic features	0 (0.0)	0 (0.0)	9 (23.0)			
DSM-IV-TR current mood episode/disorder[b], n (%)						
Major depressive episode	0 (0.0)	28 (37.8)	15 (38.5)	$X^2 = 33.0$	<.001	
Manic episode	0 (0.0)	0 (0.0)	2 (5.1)	$X^2 = 7.2$	.028	
Mixed episode	0 (0.0)	0 (0.0)	0 (0.0)	—	—	
Hypomanic episode	1 (1.5)	5 (6.8)	2 (5.1)	$X^2 = 2.3$	.318	
Dysthymia	3 (4.6)	0 (0.0)	0 (0.0)	$X^2 = 5.3$	.072	
Current psychopharmacological treatment[b], n (%)				$X^2 =$	<.001	
Yes	2 (3.1)	52 (70.3)	39 (100)	109.2		
No	63 (96.9)	21 (28.4)	0 (0.0)			
Momentary variables[c], mean (SD)						
ESM usable questionnaires	39.5 (9.87)	35.8 (11.12)	34.6 (10.87)	$F = 2.9$	.060	
ESM psychotic-like experiences	1.26 (0.32)	1.59 (0.84)	1.35 (0.48)	$F = 5.5$	.005	2 > 1**
ESM paranoia	1.46 (0.53)	1.92 (1.10)	1.44 (0.63)	$F = 6.7$	.002	2 > 1**, 3*
ESM sadness	1.70 (0.67)	2.05 (1.05)	1.83 (0.87)	$F = 2.7$	.067	
ESM anxiety	2.26 (0.81)	2.29 (1.16)	2.20 (1.20)	$F = 1.0$	.910	
ESM self-esteem	5.42 (0.75)	4.83 (1.02)	5.21 (1.11)	$F = 6.8$	.001	2 < 1**
ESM situational stress	2.46 (1.03)	2.44 (1.22)	2.15 (1.21)	$F = 1.1$	.350	

Note: ARMS, At-Risk Mental State for Psychosis; ESM, experience sampling method; FEP, first-episode psychosis.
Missing values: [b]1.
[a]1. High-schizotypy; 2. ARMS; 3. FEP.
[c]Mean ESM scores for each participant were used.
*P < .05.
**P < .01.
***P < .001.

Table 2. Within-Person Direct and Indirect Effects of Separate Pathways From Stress and Self-esteem to PLE and Paranoia via Anxiety, Sadness, or Self-esteem

	Estimates (SD)	95% CI
Pathways from stress to PLE		
Via anxiety		
Direct effect (stress → PLE)	0.062 (0.004)	0.052 to 0.069
Indirect effect (stress → anxiety → PLE)	**0.028 (0.005)**	**0.017 to 0.038**
Via sadness		
Direct effect (stress → PLE)	0.056 (0.003)	0.049 to 0.062
Indirect effect (stress → sadness → PLE)	**0.027 (0.004)**	**0.020 to 0.035**
Via self-esteem		
Direct effect (stress → PLE)	0.054 (0.003)	0.047 to 0.061
Indirect effect (stress → self-esteem → PLE)	**0.030 (0.004)**	**0.022 to 0.038**
Pathways from stress to paranoia		
Via anxiety		
Direct effect (stress → paranoia)	0.147 (0.007)	0.133 to 0.160
Indirect effect (stress → anxiety → paranoia)	**0.032 (0.008)**	**0.018 to 0.047**
Via sadness		
Direct effect (stress → paranoia)	0.120 (0.006)	0.107 to 0.133
Indirect effect (stress → sadness → paranoia)	**0.051 (0.007)**	**0.037 to 0.066**
Via self-esteem		
Direct effect (stress → paranoia)	0.112 (0.006)	0.099 to 0.125
Indirect effect (stress → self-esteem → paranoia)	**0.058 (0.007)**	**0.045 to 0.073**
Pathways from self-esteem to PLE		
Via anxiety		
Direct effect (self-esteem → PLE)	−0.148 (0.005)	−0.159 to −0.138
Indirect effect (self-esteem → anxiety → PLE)	**−0.026 (0.006)**	**−0.040 to −0.017**
Via sadness		
Direct effect (self-esteem → PLE)	−0.112 (0.007)	−0.122 to -0.098
Indirect effect (self-esteem → sadness → PLE)	**−0.049 (0.007)**	**−0.063 to −0.038**
Pathways from self-esteem to paranoia		
Via anxiety		
Direct effect (self-esteem → paranoia)	−0.303 (0.011)	−0.324 to −0.281
Indirect effect (self-esteem → anxiety → paranoia)	**−0.043 (0.007)**	**−0.056 to −0.027**
Via sadness		
Direct effect (self-esteem → paranoia)	−0.227 (0.011)	−0.246 to −0.207
Indirect effect (self-esteem → sadness → paranoia)	**−0.110 (0.012)**	**−0.132 to −0.089**

Note: PLE, psychotic-like experiences; SD, posterior standard deviations; significant indirect paths (CI does not include zero) are presented in bold.

but the relative contribution of sadness was larger than the contribution of anxiety in both models. In the pathway to PLE the indirect effect via sadness was of greater magnitude in ARMS than in high-schizotypy, whereas in the pathway to paranoia the indirect effect via sadness was greater in ARMS than in FEP and high-schizotypy participants.

Results of competitive reversal models examining the within-person indirect effects of pathways from PLE and paranoia to stress through anxiety, sadness, or self-esteem indicated that all the indirect effects were statistically significant when they were examined separately (supplementary table 2). Similarly, indirect effects of PLE and paranoia on self-esteem through anxiety or sadness were significant when they were examined separately. Finally, subsequent multilevel mediational analyses combining the significant within-person indirect effects of each pathway in a single model were performed (table 4). Indirect effects of PLE and paranoia on stress were significant via anxiety and

self-esteem, but not via sadness. The relative contribution of anxiety was larger than the contribution of self-esteem. In both pathways, the indirect effect via anxiety was of greater magnitude in high-schizotypy than in ARMS and FEP participants, whereas the indirect effect via self-esteem was of greater magnitude in high-schizotypy than in FEP. In pathways from PLE and paranoia to self-esteem both anxiety and sadness mediated these routes, showing sadness a larger relative contribution to the models than anxiety. Differences across groups were found only in the indirect effect of PLE through sadness, which was greater in high-schizotypy than in FEP participants. Supplementary figure 1 displays a schematic representation of the main findings of the study.

Discussion

The present study examined the interplay between theory-driven, putative etiological factors of paranoia and

Table 3. Within-Person Direct and Indirect Effects of Combined Pathways From Stress and Self-esteem to PLE and Paranoia via Anxiety, Sadness, and Self-esteem

	Estimates (SD)	95% CI
Pathway from stress to PLE		
Direct effect (stress → PLE)[a]	0.029 (0.004)	0.024 to 0.037
Specific indirect effects		
Stress → anxiety → PLE[a]	**0.019 (0.004)**	**0.012 to 0.027**
ARMS vs FEP[b]	0.007 (0.008)	−0.008 to 0.024
ARMS vs high-schizotypy[b]	0.016 (0.008)	−0.001 to 0.031
FEP vs high-schizotypy[b]	0.008 (0.009)	−0.009 to 0.032
Stress → sadness → PLE[a]	**0.016 (0.004)**	**0.010 to 0.024**
ARMS vs FEP[b]	0.003 (0.007)	−0.012 to 0.017
ARMS vs high-schizotypy[b]	**0.011 (0.005)**	**0.002 to 0.024**
FEP vs high-schizotypy[b]	0.009 (0.007)	−0.006 to 0.024
Stress → self-esteem → PLE[a]	**0.020 (0.003)**	**0.014 to 0.027**
ARMS vs FEP[b]	0.001 (0.007)	−0.014 to 0.013
ARMS vs high-schizotypy[b]	−0.001 (0.005)	−0.012 to 0.008
FEP vs high-schizotypy[b]	−0.002 (0.007)	−0.015 to 0.013
Contrasts of indirect effects[a]		
Anxiety vs sadness	0.002 (0.005)	−0.008 to 0.011
Anxiety vs self-esteem	−0.001 (0.004)	−0.010 to 0.007
Sadness vs self-esteem	−0.004 (0.005)	−0.012 to 0.006
Pathway from stress to paranoia		
Direct effect (stress → paranoia)[a]	0.082 (0.007)	0.066 to 0.093
Specific indirect effects		
Stress → anxiety → paranoia[a]	**0.015 (0.006)**	**0.004 to 0.029**
ARMS vs FEP[b]	0.015 (0.012)	−0.006 to 0.041
ARMS vs high-schizotypy[b]	0.004 (0.011)	−0.019 to 0.028
FEP vs high-schizotypy[b]	−0.011 (0.012)	−0.035 to 0.010
Stress → sadness → paranoia[a]	**0.034 (0.006)**	**0.023 to 0.048**
ARMS vs FEP[b]	**0.027 (0.013)**	**0.001 to 0.058**
ARMS vs high-schizotypy[b]	**0.021 (0.010)**	**0.002 to 0.045**
FEP vs high-schizotypy[b]	−0.006 (0.011)	−0.026 to 0.017
Stress → self-esteem → paranoia[a]	**0.040 (0.006)**	**0.027 to 0.054**
ARMS vs FEP[b]	0.024 (0.014)	−0.005 to 0.046
ARMS vs high-schizotypy[b]	0.013 (0.012)	−0.009 to 0.037
FEP vs high-schizotypy[b]	−0.009 (0.013)	−0.037 to 0.017
Contrasts of indirect effects[a]		
Anxiety vs sadness	**−0.019 (0.010)**	**−0.039 to −0.001**
Anxiety vs self-esteem	**−0.025 (0.009)**	**−0.045 to −0.008**
Sadness vs self-esteem	−0.006 (0.010)	−0.025 to 0.014
Pathway from self-esteem to PLE		
Direct effect (self-esteem → PLE)[a]	−0.099 (0.007)	−0.112 to −0.086
Specific indirect effects		
Self-esteem → anxiety → PLE[a]	**−0.021 (0.005)**	**−0.030 to −0.012**
ARMS vs FEP[b]	−0.010 (0.009)	−0.026 to 0.009
ARMS vs high-schizotypy[b]	−0.014 (0.008)	−0.027 to 0.001
FEP vs high-schizotypy[b]	−0.004 (0.009)	−0.021 to 0.011
Self-esteem → sadness → PLE[a]	**−0.042 (0.007)**	**−0.057 to −0.029**
ARMS vs FEP[b]	−0.021 (0.015)	−0.047 to 0.010
ARMS vs high-schizotypy[b]	**−0.030 (0.014)**	**−0.055 to −0.003**
FEP vs high-schizotypy[b]	−0.010 (0.015)	−0.043 to 0.015
Contrasts of indirect effects[a]		
Anxiety vs sadness	**0.022 (0.008)**	**0.006 to 0.039**
Pathway from self-esteem to paranoia		
Direct effect (self-esteem → paranoia)[a]	−0.209 (0.013)	−0.231 to −0.184
Specific indirect effects		
Self-esteem → anxiety → paranoia[a]	**−0.032 (0.008)**	**−0.044 to −0.017**
ARMS vs FEP[b]	−0.023 (0.012)	−0.046 to 0.002
ARMS vs high-schizotypy[b]	0.001 (0.012)	−0.021 to 0.024
FEP vs high-schizotypy[b]	0.024 (0.012)	−0.005 to 0.046
Self-esteem → sadness → paranoia[a]	**−0.101 (0.012))**	**−0.123 to −0.075**
ARMS vs FEP[b]	**−0.100 (0.025)**	**−0.148 to −0.050**
ARMS vs high-schizotypy[b]	**−0.058 (0.025)**	**−0.109 to −0.013**

Table 3. Continued

	Estimates (SD)	95% CI
FEP vs high-schizotypy[b]	0.040 (0.023)	−0.006 to 0.082
Contrasts of indirect effects[a]		
Anxiety vs sadness	**0.068 (0.015)**	**0.039 to 0.097**

Note: ARMS, At-Risk Mental State for Psychosis; FEP, first-episode psychosis; PLE, psychotic-like experiences; SD, posterior standard deviations; significant indirect paths, differences across groups and contrast of indirect effects (CI does not include zero) are presented in bold.
[a]Effects estimated without group variable included into the model.
[b]Group variable included as a moderator of both a and b indirect pathways.

positive symptoms (stress and self-esteem) with different negative emotional states in a comprehensive psychosis continuum sample. The results support the existence of mediating pathways from stress to PLE and paranoia through negative mental states of anxiety, sadness, and self-esteem. In contrast, competitive reverse models from symptoms to stress were differently mediated by negative emotions; whereas anxiety had a particularly relevant contribution, sadness lost its mediating effect. We also found consistent evidence of mediating pathways from self-esteem to PLE and paranoia, and from symptoms to self-esteem, through anxiety and sadness, but sadness was the key emotion in accounting for these associations. Finally, findings indicate that these mechanistic pathways work similarly across high-schizotypy, ARMS, and FEP participants, which seems to suggest an etiological and phenomenological continuity across the psychosis continuum.

A key recent ESM study found that negative affect mediates the link between different types of daily-life stress and PLE, underscoring that the effect of this indirect path was superior to indirect paths via threat anticipation and aberrant salience.[42] Our findings in the pathways from stress to PLE through anxiety, sadness, and self-esteem replicate and broaden this study by disentangling the roles of specific emotions, and add support to previous models of psychosis that posited the existence of an affective pathway to psychosis.[4,6–8] It is worth noting that the mediating effect of self-esteem is in line with the self-esteem buffering hypothesis for depression,[71,72] which suggests that high self-esteem buffers the effects of stress on symptoms, whereas low self-esteem boosts the vulnerability to stress.[52] Further studies need to replicate and expand these findings in order to disentangle the specificity of a possible *self-esteem buffering hypothesis for psychosis*, which could be relevant in devising therapeutic strategies integrating both the reduction of risk mechanisms as well as building resilience through, for instance, personal empowerment. Regarding the specific pathway from stress to paranoia, findings also support experimental studies showing the mediating role of anxiety, depression, and self-esteem in this pathway.[11–13] We expand on these studies by showing evidence in daily-life with ecological

validity and across a psychosis continuum sample. The results that self-esteem and sadness were stronger predictors than anxiety in the indirect pathway from stress to paranoia seems to contradict Freeman et al[9] model of persecutory delusions that postulated anxiety as the key emotion in the development of paranoia. We tentatively speculate that the relative similarities between stress and anxiety could lessen the mediating effect of anxiety, although it must be noted that anxiety had a similar contribution to sadness and self-esteem in the pathway from stress to PLE.

This study also revealed possible pathways in the well-established relationship of low self-esteem with paranoia and psychosis. Findings replicate previous studies employing path analysis in nonclinical[24] and chronic schizophrenia samples,[26] indicating that anxiety and sadness mediated the association between self-esteem and paranoia, and suggesting that sadness is an essential emotion in the mechanistic pathway from low self-esteem to paranoia. Furthermore, we replicated findings for positive PLE other than paranoia, which seems to indicate that some theoretical assumptions that Freeman et al made in their model of persecutory delusions[9,73] apply at least in part to positive symptoms broadly. In fact, Freeman's model of persecutory delusions is based on Garety's cognitive model of positive symptoms,[4] and both authors put forth that neurotic processes contribute to the development of positive symptoms of psychosis.[74] Finally, this study yields novel evidence about putative mechanisms of paranoia in natural contexts across different levels of psychosis expression.

Overall, there were few significant differences across psychosis continuum groups in their indirect effects. This suggests that the affective mechanisms underlying psychotic and paranoid traits, experiences, and symptoms are at least partly overlapping, supporting claims of etiological and phenomenological continuity across nonclinical and clinical manifestations of the schizotypy-psychosis extended phenotype—even if they differ in terms of need for care, severity, comorbidity, etc.[46,75] Differences were found only in the pathways that included sadness, with greater indirect effects in ARMS than in other groups, which seems to indicate that sadness may have a critical

Table 4. Within-Person Direct and Indirect Effects of Combined Pathways From PLE and Paranoia to Stress and Self-esteem via Anxiety, Sadness, and Self-esteem

	Estimates (SD)	95% CI
Pathway from PLE to stress		
Direct effect (PLE → stress)[a]	0.324 (0.040)	0.255 to 0.407
Specific indirect effects		
PLE → anxiety → stress[a]	**0.475 (0.059)**	**0.379 to 0.602**
ARMS vs FEP[b]	0.163 (0.093)	−0.049 to 0.334
ARMS vs high-schizotypy[b]	**−0.270 (0.108)**	**−0.498 to −0.068**
FEP vs high-schizotypy[b]	**−0.432 (0.109)**	**−0.624 to −0.209**
PLE → sadness → stress[a]	0.037 (0.030)	−0.019 to 0.097
PLE → self-esteem → stress[a]	**0.220 (0.033)**	**0.158 to 0.283**
ARMS vs FEP[b]	0.105 (0.066)	−0.025 to 0.225
ARMS vs high-schizotypy[b]	−0.122 (0.073)	−0.258 to 0.013
FEP vs high-schizotypy[b]	**−0.224 (0.086)**	**−0.393 to −0.057**
Contrasts of indirect effects[a]		
Anxiety vs self-esteem	**0.256 (0.059)**	**0.155 to 0.372**
Pathway from paranoia to stress		
Direct effect (paranoia → stress)[a]	0.257 (0.022)	0.215 to 0.298
Specific indirect effects		
Paranoia → anxiety → stress[a]	**0.173 (0.028)**	**0.123 to 0.241**
ARMS vs FEP[b]	0.027 (0.041)	−0.065 to 0.099
ARMS vs high-schizotypy[b]	**−0.149 (0.046)**	**−0.244 to −0.059**
FEP vs high-schizotypy[b]	**−0.176 (0.053)**	**−0.278 to −0.069**
Paranoia → sadness → stress[a]	0.020 (0.015)	−0.011 to 0.050
Paranoia → self-esteem → stress[a]	**0.098 (0.017)**	**0.062 to 0.0128**
ARMS vs FEP[b]	0.043 (0.034)	−0.021 to 0.109
ARMS vs high-schizotypy[b]	−0.039 (0.034)	−0.104 to 0.029
FEP vs high-schizotypy[b]	**−0.081 (0.036)**	**−0.157 to −0.016**
Contrasts of indirect effects[a]		
Anxiety vs self-esteem	**0.074 (0.032)**	**0.028 to 0.152**
Pathway from PLE to self-esteem		
Direct effect (PLE → self-esteem)[a]	−0.381 (0.025)	−0.436 to −0.337
Specific indirect effects		
PLE → anxiety → self-esteem[a]	**−0.097 (0.018)**	**−0.132 to −0.066**
ARMS vs FEP[b]	0.001 (0.031)	−0.056 to 0.076
ARMS vs high-schizotypy[b]	0.032 (0.034)	−0.031 to 0.105
FEP vs high-schizotypy[b]	0.032 (0.041)	−0.051 to 0.112
PLE → sadness → self-esteem[a]	**−0.295 (0.030)**	**−0.358 to −0.235**
ARMS vs FEP[b]	−0.085 (0.063)	−0.196 to 0.064
ARMS vs high-schizotypy[b]	0.088 (0.071)	−0.052 to 0.225
FEP vs high-schizotypy[b]	**0.179 (0.083)**	**0.021 to 0.325**
Contrasts of indirect effects[a]		
Anxiety vs sadness	**0.196 (0.034)**	**0.131 to 0.266**
Pathway from paranoia to self-esteem		
Direct effect (paranoia → self-esteem)[a]	−0.237 (0.012)	−0.262 to −0.215
Specific indirect effects		
Paranoia → anxiety → self-esteem[a]	**−0.038 (0.007)**	**−0.052 to −0.026**
ARMS vs FEP[b]	0.012 (0.015)	−0.019 to 0.042
ARMS vs high-schizotypy[b]	0.017 (0.012)	−0.009 to 0.044
FEP vs high-schizotypy[b]	0.006 (0.017)	−0.024 to 0.036
Paranoia → sadness → self-esteem[a]	**−0.149 (0.018)**	**−0.186 to −0.119**
ARMS vs FEP[b]	−0.023 (0.038)	−0.093 to 0.060
ARMS vs high-schizotypy[b]	0.044 (0.036)	−0.031 to 0.107
FEP vs high-schizotypy[b]	0.069 (0.044)	−0.022 to 0.147
Contrasts of indirect effects[a]		
Anxiety vs sadness	**0.110 (0.020)**	**0.074 to 0.148**

Note: ARMS, At-Risk Mental State for Psychosis; FEP, first-episode psychosis; PLE, psychotic-like experiences; SD, posterior standard deviations; significant indirect paths, differences across groups and contrast of indirect effects (CI does not include zero) are presented in bold.
[a]Effects estimated without group variable included into the model.
[b]Group variable included as a moderator of both a and b indirect pathways.

role in the clinical high-risk stages for psychosis and that it could be a key emotion in the putative prodrome of psychosis.

Models from symptoms to stress indicated that anxiety had a particularly relevant contribution, whereas sadness lost its mediating effect, highlighting that these pathways were differently mediated by negative emotions than the reversed pathways. Indeed, symptoms are disturbing experiences that become themselves stressors and, as our findings suggest, this link would be mainly explained through the effect of anxiety. This seems to support a bidirectional model between stress and positive-like symptoms, although not exactly a mirror image as the different effects of the mediators implicated in these pathways indicate. Self-esteem stands as a significant mediator as well, which seems to indicate that experiencing symptoms also boost negative affective and cognitive self-perceptions. It is important to note that the study design does not allow us to easily determine the within-day direction of the effects and therefore no causal inferences can be established regarding the reciprocal impact of stress or self-esteem on symptoms. However, previous ESM studies have shown that positive-like symptoms predicted subsequent levels of stress,[53] self-esteem,[76] and negative emotions,[77] suggesting a vicious cycle between stress, self-esteem, negative emotions, and positive symptoms. Therefore, further longitudinal studies are needed to examine the similarities and differences of causal mechanisms implicated on the putative *vulnerability* and *scar* pathways of positive symptoms, as the differences found between competitive models tested in the present study seem indicate.

Regarding differences across groups in pathways from symptoms to stress and self-esteem, and in contrast to the reversed routes, some indirect effects were greater in high-schizotypy than ARMS and FEP participants, whereas no differences between ARMS and FEP were found. This seems to suggest that the experience of PLE and paranoid experiences in nonclinical participants with high-schizotypy is associated to higher levels of disturbing emotions and creates a greater cognitive dissonance as compared to clinical participants.

The present study is not without limitations. ESM is an intensive protocol assessment based on self-reported repeated measures in which some of the questionnaires are expected to be missed because participants did not hear the beeping signal, or they could not attend the questionnaire at that particular time, which might affect the results obtained in this study. A quarter of the sample of FEP participants included individuals with a diagnosis of affective disorder with psychotic symptoms, which might affect the direct generalization of the findings to populations restricted to schizophrenia spectrum diagnoses. Furthermore, gender differences in the composition of nonclinical and clinical samples may also limit the generalizability of findings. Finally, since putative mediators (anxiety, sadness, and self-esteem) as well as predictors (stress and self-esteem) variables employed in this study are core processes of emotional disturbance and they are closely related, potential interactions between them not examined in this study might have influenced the results obtained.

Conclusions

This study contributes to the understanding of the mechanistic pathways underlying psychosis symptom formation, expression, and maintenance in real-life experience. Findings indicate that the links between putative etiological factors such as stress and self-esteem with paranoia and other PLE are explained in part by the effects of anxiety, sadness, and self-esteem, thus supporting psychological models of psychosis that highlight the relevance of affective disturbances in the onset and expression of psychotic symptoms. Furthermore, these emotions also interact with symptoms in the pathways from symptoms to stress and self-esteem, suggesting a complex *vicious cycle* between putative etiological factors and symptoms, although differently mediated by the indirect pathways. Finally, as these mechanistic pathways work relatively similarly across groups, findings support claims of etiological continuity across nonclinical, subclinical, and clinical manifestations of the psychosis extended phenotype.[78] These findings should enhance psychological treatments by identifying emotional processes that give rise to or exacerbate positive symptoms as targets for intervention. Specifically, real-world interventions using ESM could monitor these experiences and provide interventions to minimize negative emotions and enhance self-esteem in real-world situations.

Conflicts of Interest

The authors have declared that there are no conflicts of interest in relation to the subject of this study.

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