Original article

Emotion regulation as a moderator of the interplay between self-reported and physiological stress and paranoia

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A B S T R A C T

Experience sampling method (ESM) studies have found an association between daily stress and paranoid symptoms, but it is uncertain whether these findings generalize to physiological indicators of stress. Moreover, the temporality of the association and its moderating factors require further research. Here, we investigate whether physiological and self-rated daily stress predict subsequent paranoid symptoms and analyze the role of emotion regulation as a putative moderator. We applied ESM during 24 h to repeatedly assess heart rate, self-rated stress, and subclinical paranoia in a sample of 67 psychosis-prone individuals as measured with Community Assessment for Psychotic Experiences (CAPE). Adaptive and maladaptive emotion regulation was assessed at baseline with the Emotion Regulation Skills Questionnaire (ERSQ-ES) and the Cognitive Emotion Regulation Questionnaire (CERQ). Linear mixed models were used to analyze the data. Heart rate (b = 0.004, p < 0.05) and self-rated stress (b = 0.238, p < 0.001) predicted subsequent paranoia. The reverse effect, paranoia as a predictor of subsequent heart rate (b = 0.230, p = 0.615) or self-rated stress (b = −0.009, p = 0.751) was non-significant. Maladaptive emotion regulation was a significant predictor of paranoia (b = 0.740, p < 0.01) and moderated the path from self-rated stress to paranoia (b = 0.188, p < 0.05) but not the path from heart rate to paranoia (b = 0.005, p = 0.09). Our findings suggest a one-way temporal link between daily stress and paranoia and highlight the importance of emotion regulation as a vulnerability factor relevant to this process.

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1. Introduction

Studies applying an experience sampling method (ESM) have found that individuals with psychosis and those at risk show elevated self-reported negative affect in response to daily hassles, which is commonly referred to as “stress-sensitivity” or “stress-reactivity” [1]. Moreover, ESM studies find self-reported daily stress to be associated with psychotic symptoms in clinical and non-clinical samples [2–6], and in the most recent study, Van Der Steen et al. [7] found that this association is even larger in high risk groups than in patients. Daily stress thus appears to be especially relevant to the development of psychotic symptoms even before the unfolding of the full disorder. However, several issues require further clarification.

One of these issues is related to the operationalization of stress. Researchers using experimental designs to investigate stress-reactivity have widely acknowledged the importance to assess both physiological and psychological parameters of stress [8] in order to gain a fuller understanding of the processes involved. In contrast, most ESM studies are limited to self-reported stress. In one of few ESM studies in the field of psychosis that investigated the activation of the autonomous nervous system (ANS) as a physiological marker of stress, Kimby and colleagues [9] found no evidence for an association between self-reported stress and heart rate. They did, however, find self-reported stress to be associated with other ANS parameters, such as sympathovagal balance. Another ESM study found acute psychosis patients to have an increased heart rate and an altered autonomic variation in comparison to healthy controls [10]. These studies show alterations in physiological stress in the context of daily life in patients with psychosis. They also indicate that physiological stress parameters capture different aspects of stress than self-report. To further corroborate this notion and better understand the link between stress and symptom formation, research on the association between physiological stress, self-reported stress, and psychotic symptoms within a daily life context is required.

Another issue related to the association between daily stress and psychotic symptoms refers to its temporality. So far, there is only limited evidence for the assumption that stress precedes (rather than follows from) psychotic symptoms [11,12]. Moreover,
few ESM studies have aimed to investigate the reversed pathway in which psychotic symptoms trigger stress [7,13,14]. This is surprising as – considering the literature on the distress related to psychotic symptoms [13,15] – a vicious circle, in which stress and symptoms are driving each other can be expected.

Finally, given that we can corroborate the assumption that stress predicts an exacerbation of psychotic symptoms in the earliest stage of disorder formation, the question arises whether we can identify specific factors that make people vulnerable to developing psychotic symptoms in the face of stress. Recent research suggests that deficits in emotion regulation (ER) could constitute a crucial vulnerability factor [16,17]. Compared to controls, individuals with psychosis use more maladaptive and less adaptive ER [18–22]. Furthermore, ER seems to be related to physiological and self-reported stress [23,24]. In a laboratory experimental study, Lincoln et al. [24] found adaptive ER to moderate the association between induced stress and paranoid symptoms, indicating that ER could be a protective factor that prevents stress from translating into paranoid symptoms. However, this assumption needs further corroboration by testing to which extent the habitual use of adaptive or maladaptive ER skills makes people vulnerable to responding to stress with psychotic symptoms in daily life.

Building upon the solid evidence showing that self-reported stress is associated with paranoid symptoms in daily life, the goal of this study was to investigate the temporality of the association between self-reported stress, physiological stress and paranoid experiences, and to identify the moderating value of ER. We expected that self-reported and physiological stress would predict the subsequent report of paranoia over the course of a day. Furthermore, we expected that paranoia would in turn predict the intensity of subsequent self-reported and physiological stress. Finally, we hypothesized that the habitual use of adaptive and maladaptive ER would moderate the path from daily stress to paranoia. Building on the continuum of psychotic symptoms and their associated risk factors [25], we used a community sample with elevated levels of psychotic-like experiences in order to gain insight into the development of subclinical symptoms prior to the full unfolding of the disorder.

2. Methods and materials

2.1. Participants

Participants from previous studies who had consented to be contacted for future projects and first semester psychology students were prescreened for the occurrence of psychotic-like experiences as measured by the Community Assessment for Psychotic Experiences (CAPE) [26]. Potential participants were invited to participate starting from those with highest value and ending with score of eight on the positive syndrome subscale of CAPE, which corresponds to the score of 50th percentile of the large community sample published in Schlier et al. [27]. The acquired sample consisted of 67 individuals (71.6% female, $M_{\text{age}} = 23.01, SD_{\text{age}} = 4.63$). Nine participants reported to have been given a diagnosis of a mental disorder in the past, and 18 participants reported a mental disorder of a family member. The majority of participants (80.6%) were students; 47.8% reported to be working six or more hours per week. Most participants (83.6%) were German nationals. All participants provided written informed consent and were compensated with 10€ per hour or granted credit points.

2.2. Procedure

Baseline assessment took place at Universität Hamburg in Germany. First, an electrocardiogram (ECG) sensor was attached to the participants’ chest and activated. The participants then completed paper-pencil questionnaires. Thereafter, they received Android smartphones that allowed the use of the moviSensXS ESM application (MoviSens GmbH) only. After activating the application, the participants left the laboratory and the ESM assessment phase began. As can be seen in Fig. 1a, the ECG recorded arousal continuously over 24 h. The smartphones were programmed to beep in approximately 20-min-intervals (between 9 AM and 10 PM) resulting in 38 samples over 24 h. The starting and ending time-point of the ESM assessment phase varied across participants, but no participant was subject to any assessments between 10 PM and 9 AM. Participants were instructed to behave as usual, with the restriction that they were not allowed to take a shower or exercise excessively. Fig. 1b illustrates the time references between any two ESM questionnaires. As can be seen, after the beep at any given time-point (t), participants answered questions regarding their stress level since the previous beep (thus for the time-period between t-1 and t). Furthermore, participants answered questions on momentary paranoid symptoms referring to the time-point t.

2.3. Assessment

2.3.1. Psychosis proneness assessment

Psychosis proneness was assessed with the CAPE [26] that captures lifetime psychotic-like experiences. The CAPE is a self-report questionnaire composed of the depressive, negative, and positive syndrome subscales. The scale is constructed with 42 items to be self-rated on a four-point Likert scales ranging from 0 = “never” to 3 = “nearly always”. The CAPE has been found to be a valid and reliable measure of psychosis proneness [28] and to be sensitive in detecting individuals at ultra-high risk for psychosis [29]. The German version of the CAPE has good to excellent internal consistency [27].

2.3.2. Emotion regulation assessment

2.3.2.1. Adaptive ER. In order to capture the comprehensive spectrum of strategies, adaptive ER was measured with a composite score derived from two questionnaires – German version of the emotion specific Emotion Regulation Skills Questionnaire (ERSQ-ES) [30] and the adaptive subscale of the German version of the Cognitive Emotion Regulation Questionnaire (CERQ) [31]. The ERSQ-ES assesses the following adaptive strategies: clarity, understanding, acceptance, tolerance, self-support, willingness to confront situations cuing undesired emotions when necessary to attain personally relevant goals, and modification. The ERSQ-ES measures the use of strategies differentially for stress, anxiety, anger, sadness and shame. The total score used for this study was the mean score of all items relative to the number of emotions. The psychometric properties of the ERSQ-ES were good to excellent in large clinical and non-clinical samples [30]. The following additional adaptive strategies were assessed with the CERQ: acceptance, positive refocusing, focusing on planning, positive reappraisal and putting into perspective. The German version of the CERQ has acceptable to good psychometric properties [31]. The internal consistency of the composite adaptive ER scale consisting of the ERSQ-ES total mean score and CERQ adaptive ER subscale mean score was excellent in our sample, with Cronbach’s $\alpha = 0.92$.

2.3.2.2. Maladaptive ER. Maladaptive ER was assessed with the mean score on the maladaptive ER subscale of CERQ, which includes the strategies self-blame, catastrophizing, rumination/focus on thought, and blaming others. The maladaptive strategies subscale in our sample showed an acceptable internal consistency with Cronbach’s Alpha = 0.703.
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