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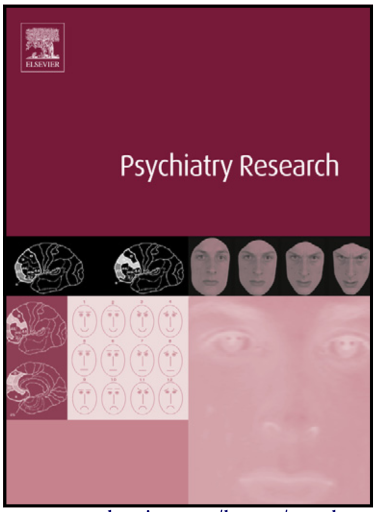

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The impact of neuropsychological functioning and coping style on perceived stress in individuals with first-episode psychosis and healthy controls

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Abstract

Stress is implicated in the development and course of psychotic illness, but the factors that influence stress levels are not well understood. The aim of this study was to examine the impact of neuropsychological functioning and coping styles on perceived stress in people with first-episode psychosis (FEP) and healthy controls (HC). Thirty-four minimally-treated FEP patients from the Early Psychosis Prevention and Intervention Centre, Melbourne, Australia, and 26 HC participants from a similar demographic area participated in the study. Participants completed a comprehensive neuropsychological test battery as well as the Coping Inventory for Stressful Situations (task-, emotion- and avoidance-focussed coping styles) and Perceived Stress Scale. Linear regressions were used to determine the contribution of neuropsychological functioning and coping style to perceived stress in the two groups. In the FEP group, higher levels of emotion-focussed and lower levels of task-focussed coping were associated with elevated stress. Higher premorbid IQ and working memory were also associated with higher subjective stress. In the HC group, higher levels of emotion-focussed coping, and contrary to the FEP group, lower premorbid IQ, working memory and executive functioning, were associated with increased stress. Lower intellectual functioning may provide some protection against perceived stress in FEP.

Key words: stress; cognition; early psychosis; intelligence; working memory; emotion-focussed coping; task-focussed coping.

1. Introduction

Exposure to stress is associated with the development, onset and relapse of psychotic illness (Corcoran et al., 2003; Nuechterlein et al., 1994; Phillips et al., 2006). In individuals with psychosis, perceived stress - the degree to which life events are appraised as stressful - is influenced by a number of environmental and psychological factors, including familial expressed emotion, social support, self-esteem, resilience and self-efficacy (Lukoff et al., 1984; Macdonald et al., 1998; Nuechterlein et al., 1994; Pruessner et al., 2011; Ventura et al., 2004). Coping style, both in response to psychotic symptoms and general life events, also contributes to the degree of stress experienced by individuals with psychosis (Lukoff et al., 1984; Phillips et al., 2009). Coping in response to general life stressors is commonly classified according to task, avoidant and emotional strategies (Endler and Parker, 1990b; Skodol, 1998). Task-focussed coping involves the use of behavioural or cognitive problem-solving techniques when confronted with stress. Avoidance-coping mechanisms involve behavioural or cognitive avoidance, including a reliance on social supports or distraction with unrelated activities to avoid thinking about the stressful situation. Responding to stressful situations with emotional outbursts, self-preoccupation, or fantasy, reflects an emotion-focussed coping style. These coping styles are not mutually exclusive and individuals can display low to high levels of each in various combinations and in response to different situations. Nevertheless, coping styles tend to be conceptualised as enduring or trait-based characteristics (Folkman et al., 1986; Skodol, 1998).

People with psychotic disorders have been observed to display increased emotional reactivity to daily life stressors (Horan et al., 2007; Myin-Germeys et al., 2001) and maladaptive coping mechanisms (Horan and Blanchard, 2003; Horan et al., 2007; Jansen et al., 1998; Macdonald et al., 1998; van den Bosch et al., 1992). They also use fewer task- and more avoidant- and emotion-focussed coping strategies (Horan et al., 2007; Jansen et al., 1998; Macdonald et al., 1998; Phillips et al., 2009; van den Bosch et al., 1992; Ventura et al., 2004), suggesting an impaired or restricted psychological ability to adapt to stress. A similar pattern of coping has been found in young people at ultra-high risk for psychotic disorder (Phillips et al., 2012) and adolescents experiencing persistent subclinical psychotic symptoms (Lin et al., 2011). Greater use of avoidant or emotion-focussed coping has been associated with higher psychological stress (Horan and Blanchard, 2003; Strous et al., 2005) and psychiatric symptomatology, including state anxiety and positive and negative psychotic symptoms (Lysaker et al., 2005; Macdonald et al., 1998; van den Bosch et al., 1992). Contrastingly, the use of task-focussed coping has been associated with lower levels of state anxiety and positive and negative symptoms (Lysaker et al., 2005; Macdonald et al., 1998; van den Bosch et al., 1992).

Neuropsychological abilities - cognitive resources available to perform goal-directed behaviours and conceivably, identify, evaluate and respond to minor and major stressors in daily life - may play a key role in the degree of stress experienced by individuals with psychosis. It is well established that neuropsychological functioning is often impaired in psychotic disorders (Heinrichs and Zakzanis, 1998; Mesholam-Gately et al., 2009). However, surprisingly few studies have examined whether neuropsychological deficits directly contribute to perceived stress or stress reactivity in psychosis. Bak et al. (2008) found a significant weak negative association between IQ and symptom-related distress in individuals with schizophrenia, but executive functioning ability was unrelated. Horan and Blanchard (2003) found that neuropsychological functioning (visual memory) did not significantly contribute to the prediction of negative mood following psychosocial stress in schizophrenia patients. Two studies using the experience sampling method assessing moment-to-moment emotional reaction to daily life stress, also found that neuropsychological functioning was not associated with perceived stress levels in patients with schizophrenia (Morrens et al., 2007;

Myin-Germeys et al., 2002). However, sensitivity to stress (i.e., affective response to stress) was inversely associated with neuropsychological functioning (Morrens et al., 2007; Myin-Germeys et al., 2002). Specifically, participants with the best neuropsychological performances across various domains showed larger decreases in positive affect and larger increases in negative affect in response to daily stress, compared with participants with the poorest or intermediate neuropsychological performances. In the only study to our knowledge that recruited a first-episode psychosis (FEP) sample and healthy controls (HC), a negative relationship between neuropsychological functioning and perceived stress was found in the HC group, but not in the FEP group (Aas et al., 2011).

These limited and inconclusive findings highlight a need for better understanding into the roles that coping style and neuropsychological functioning play in perceived stress in psychotic disorders. With respect to neuropsychological functioning, most studies only investigated the impact of memory and executive functioning on perceived stress (see Aas et al., 2011 for exception). Comprehensive examination of neuropsychological functioning is warranted given the evidence for widespread neuropsychological deficits in psychotic disorders (Mesholam-Gately et al., 2009). Additionally, most of the previous studies were conducted in chronic schizophrenia samples, with the influence of coping and neuropsychological functioning on perceived stress at the outset of psychosis receiving scant attention. The factors influencing perceived stress may vary over the course of illness, with potential adaptations to symptoms and changes in coping and functioning over time (e.g., Strous et al., 2005). Relative to newly-diagnosed patients, people with well-established psychotic disorders will likely have experienced more stressors, relapses and medications, possibly show greater neurocognitive impairments, and have enduring maladaptive coping strategies. Thus, knowledge into the factors influencing stress at different stages of psychotic illness has implications for prognosis and early versus later intervention.

The aim of this study was to examine the impact of neuropsychological functioning and coping style on perceived stress in people with FEP and HC. We hypothesised that better global intellectual functioning, memory and executive functioning would be associated with lower perceived stress in both FEP and HC groups. It was further hypothesised that after accounting for neuropsychological functioning, both emotion-focussed and avoidant-focussed coping would contribute to higher perceived stress, and task-focussed coping to lower perceived stress in both groups.

2. Methods

2.1 Participants

The participants were 34 neuroleptic-naïve or minimally-treated FEP patients, recruited from the Early Psychosis Prevention and Intervention Centre (EPPIC), Melbourne, Australia. Participants were enrolled in a larger study examining stress and hypothalamic-pituitary-adrenal axis functioning in FEP and the relationship with clinical and neuropsychological characteristics (Garner et al., 2011). Inclusion criteria based upon the EPPIC entry criteria, were: (1) aged 15-25 years, (2) experience of a first episode of psychosis, and (3) resident in the EPPIC catchment area (north/north-western suburbs of Melbourne). Exclusion criteria were: (1) >10 days of treatment with any psychotropic medication, (2) IQ<70, or (3) organic brain disorder/significant medical illness. For the current study, only participants who completed the coping and perceived stress measures and neuropsychological assessment were included.

Twenty-six HC participants were recruited from similar socio-demographic areas through advertisements and friends/neighbours of the patient group. Exclusion criteria for controls included a current or past history of psychiatric illness or any psychiatric illness in the immediate family, in addition to the exclusion criteria described for the patient group. The study was approved by the local Human Research and Ethics Committee and written informed consent was obtained from all participants and their parent/legal guardian (if <18 years old).

2.2 Measures

All assessments were conducted by trained research assistants upon entry to the study.

2.2.1 Clinical Assessment

Diagnosis was established in FEP patients according to DSM-IV criteria using the Patient Edition of the Structured Clinical Interview for DSM-IV for Axis I disorders (SCID-I/P) (First et al., 2001). Control participants were administered the Structured Clinical Interview for DSM-IV Non-Patient edition (SCID-I/NP) to confirm inclusion (First et al., 2002).

In FEP participants, severity of positive psychotic symptoms over the previous 2 weeks was measured using the Brief Psychiatric Rating Scale (BPRS), expanded version 4 (Ventura et al., 1993) and negative symptoms were assessed with the Scale for the Assessment of Negative Symptoms (SANS) (Andreasen, 1984). Level of depressive and anxiety symptoms were rated with the Hamilton Depression Rating Scale (HAMD) (Hamilton, 1960) and Hamilton Anxiety Rating Scale (HAMA) (Hamilton, 1959), respectively.

2.2.2 Coping and Perceived Stress Measures

Coping was measured using the adult version of the Coping Inventory for Stressful Situations (CISS) (Endler and Parker, 1990a), a 48-item self-report scale that assesses the ways people react to various difficult, stressful or upsetting situations. Scores for three coping styles are derived: task-focussed, emotion-focussed and avoidance-focussed coping. Higher scores indicate greater use of the particular coping style. The CISS subscales all showed a high level of internal consistency in our sample; Cronbach's α .88-.94 for FEP participants and α .83-.93 for healthy controls.

The Perceived Stress Scale (PSS) (Cohen et al., 1983) was used to examine perceived stress. The PSS is a 14-item self-report scale that assesses individuals' experience of perceived stress over the past month. Participants rate the frequency with which they experience situations in their life as stressful (e.g., "How often have you felt difficulties were piling up so high that you could not overcome them?"). Higher scores indicate higher levels of stress. The total PSS score was used in this study, which has reportedly good internal reliability (Cohen et al., 1983; Hewitt et al., 1992). This was confirmed in our sample, with α = .73 in the patient group and α = .80 in the control group.

2.2.3 Neuropsychological Assessment

The Wide Range Achievement Test-Third Edition (WRAT-3)-Reading subtest Scaled Score (Wilkinson, 1993) was used to estimate premorbid IQ and a two-subtest short-form (Information and Picture Completion) of the WAIS-III (The Psychological Corporation, 1997) was used to estimate current full-scale IQ (Sattler and Ryan, 1999). The reliability and validity of the two-subtest full-scale IQ estimate for individuals aged 16-25 years is high (ranges r=.88-.91 and r=.72-.85, respectively) (Jeyakumar et al., 2004; Sattler and Ryan, 1999).

Neuropsychological assessment was performed with a comprehensive battery designed to assess the neuropsychological domains that have been shown to differ significantly between first-episode or early psychosis/schizophrenia patients and controls (Brickman et al., 2004; Fagerlund et al., 2006; Fitzgerald et al., 2004). The battery included measures of *immediate attention* (Digit Span - digits forward from the Wechsler Adult Intelligence Scale-3rd Edition: WAIS-III (The Psychological Corporation, 1997), *working memory* (Digit Span - digits backwards and Letter-Number Sequencing from the WAIS-III)

(The Psychological Corporation, 1997), *verbal learning and memory* (total paired associate learning and delayed recall from the Melbourne Relational Learning Task: MelRel) (Savage et al., 2002), *verbal fluency* (Controlled Oral Word Association Test: COWAT and animal fluency (Strauss et al., 2006), *executive functioning* ('Twenty Questions Test' from the Delis-Kaplan Executive Function System (D-KEFS) (Delis et al., 2001) and COWAT rule-breaks), and *processing speed and monitoring* (Golden Stroop Colour and Word Test (Golden, 1978) words, colours and interference subtests, and COWAT disinhibitions and repetitions). All tests were administered and scored according to standardized published instructions.

2.3 Statistical Analysis

The assumption of normality was assessed with the Kolmogorov-Smirnov test, with violations noted when appropriate. Continuous data are presented as mean ±standard deviation or ±standard error. Frequencies and percentages were used to describe discrete variables. Independent samples *t*-tests or Pearson's chi-squared analysis (X^2)/Fisher's exact tests (FET) were used to compare demographic variables between FEP patients and HCs. Comparison of neuropsychological performance between patients and controls was also conducted using ANCOVA, controlling for the demographic variables that significantly differed between groups (i.e., years of education, age, premorbid IQ). To explore the cross-sectional associations between neuropsychological performance (including estimated premorbid and current IQ) and total perceived stress, and between coping subscales (task-, emotion- and avoidance-focussed coping) and perceived stress, correlation analysis was first undertaken using Pearson's Product Moment correlation coefficients. Correlational analyses were also undertaken to explore the association between psychotic and affective symptoms and neuropsychological test scores. Given the participants were new FEP cases and most were not yet receiving medication, it was deemed important to determine whether mental state may be impacting on neuropsychological performance. No significant associations were found between psychotic symptoms and performance on neuropsychological tasks (all p>.05); therefore, psychotic symptoms were not taken into account in the subsequent regression analyses (data available upon request). There were three significant associations between affective state and neuropsychological variables, specifically: 1) depression and working memory (Letter-Number Sequencing) (r=.374, p=.032), 2) anxiety and verbal memory (MelRel Delayed Cued Recall) (r=.440, p=.019) and 3) anxiety and inhibitory control (COWAT disinhibitions) (r=.364, p=.037). However, given that depression and anxiety symptoms were highly correlated with the primary outcome of perceived stress (r=.624, p<.001 and r=.526, p=.002, respectively), we did not include affective state in further analyses.

Multivariate linear regression was used to examine if neuropsychological functioning and coping style predicted the total perceived stress outcome. A setwise (hierarchical) regression approach was used for model building. Only significant predictors (p<.05 bivariate correlations) were entered in the regression analysis. In the first step, significant neuropsychological test scores and/or IQ index scores were entered into the model. In the second step, significant coping subscales were added. These models allowed the determination of which sets of variables added significantly to the prediction of perceived stress, as well as establishing the relative importance of individual predictors. Given the relatively small sample size, several regression models were built, each with only one neuropsychological test variable added at step 1 to contain the sample-to-cases ratio and prevent over-fitting of the regression models (Tabachnick and Fidell, 2007). Given the exploratory nature of the study, alpha was set at .05 for all analyses. No adjustments were made for multiple comparisons because they can result in a higher Type II error rate, reduced power, and increased likelihood of missing important findings (Rothman, 1990).

All analyses were conducted separately for the FEP and HC groups. The statistical analyses were performed with IBM® SPSS® Statistics Version 21 (Statistical Package for the Social Sciences, IBM Corporation).

3. Results

3.1 Sample characteristics

Table 1 shows the demographic and clinical characteristics of the FEP and control groups. The groups differed on their place of birth, with a higher percentage of the FEP sample being Australian-born (74% versus 42%, respectively). The FEP participants were younger, t(58)=-2.98; $p<0.01$, and completed significantly fewer years of education than controls, t(58)=-4.33; $p<0.01$. The FEP participants reported a higher mean perceived stress level than controls, t(58)=-4.33; $p<0.01$. The groups did not differ in their use of task- or avoidance-focussed coping. However, emotion-focussed coping style significantly differed between patients and controls, with the former reporting greater use of emotion-focussed coping, t(57)=3.9; $p<0.01$).

There were no significant differences between the groups in current IQ (Table 1). However, the patients had significantly lower premorbid IQ, t(55)=-2.14; $p=0.04$, and performed significantly worse that controls on most neuropsychological tasks except for the following: WAIS-III Digit Span forward ($F_{1,56}=1.8$; $p=0.18$), COWAT total ($F_{1,51}=1.21$; $p=0.27$), animal fluency ($F_{1,50}=0.94$; $p=0.34$), COWAT mistakes ($F_{1,50}=0.001$; $p=0.98$), COWAT repetitions ($F_{1,50}=3.5$; $p=0.07$), COWAT disinhibitions ($F_{1,50}=0.33$; $p=0.50$), and D-KEFS 20 Questions ($F_{1,59}=2.17$; $p=0.15$) (data available upon request).

3.2 Associations between coping style, neuropsychological performance and perceived stress

When examining correlations among coping styles and perceived stress, significant correlations were observed between task-focussed (r=-.43; p=0.01) and emotion-focussed coping strategies (r=.43; p=0.01) and perceived stress in FEP patients. The use of predominant emotion-focussed strategies and less task-focussed strategies in this group was associated with higher levels of perceived stress. In controls, only a positive association between emotion-focussed coping strategies (r=.51; p=0.01) and perceived stress was found, with the use of emotion-focussed strategies being associated with higher perceived stress (Table 2).

With regards to general cognitive functioning, a higher premorbid IQ in FEP patients was associated with higher perceived stress (r=.42; p=0.02). On the contrary, lower premorbid and current IQ in controls was related to higher levels of perceived stress (premorbid IQ r=.59; p<0.01; current IQ r=-.48; p=0.01) (Table 2).

There were several other neuropsychological tasks/domains associated with perceived stress in both groups (Table 2). Better working memory (Letter-Number Sequencing) was related to higher perceived stress in FEP patients (r=.50; p<0.01). In contrast, poorer working memory was associated with elevated perceived stress in HCs, with a significant negative correlation found between Digit Span backward (r=-.40; p=0.04) and Letter-Number Sequencing (r=-.52; p=0.01) and perceived stress. Tests of verbal learning and memory (MelRel delayed cued recall; r=.43; p=0.03) and processing speed and monitoring (Stroop interference r=.37; p=0.04, COWAT disinhibitions r=.38; p=0.03, COWAT rule-breaks r=-.36; p=0.04) were significantly associated with perceived stress in FEP patients. Better performances (except COWAT disinhibitions) were associated with higher perceived stress in the FEP group. Only COWAT rule-breaks (processing speed and monitoring) was significantly associated with perceived stress in controls, r=.55; p=0.01, with worse performances related to higher perceived stress (Table 2).

3.3 Neuropsychological and coping style predictors of perceived stress in FEP patients

Multivariate linear regression was used to determine neuropsychological functioning (significant subtest entered at step 1) and coping style (entered at step 2) predictors of total perceived stress. Six setwise regression models were hierarchically built with only one neuropsychological test variable added at step 1 (see Methods section 2.3). For the first model, premorbid IQ was entered in step 1 and explained a significant proportion of the variability in total perceived stress (R^2_Δ=0.15, $F_{1,33}$=6.15, p=0.02). Coping style (emotion- and task-focussed) entered in step 2 as a set, explained an additional 25.1% significant proportion of the variability in perceived stress (R^2_Δ=0.37, $F_{3,33=}$6.56, p<0.01). When examining the individual contribution of each variable to the final model (Table 3), premorbid IQ (p=0.02) and emotion-focussed coping (p=0.02) were the only significant predictors.

For the second model, Letter-Number Sequencing was entered at step 1 and explained a significant proportion of the variability in total perceived stress (R^2_Δ=0.22, $F_{1,33}$=9.45, p=0.01). As a set, coping style (emotion- and task-focussed) entered in step 2, explained an additional significant proportion of the variability (17.9%) in stress (R^2_Δ=0.36, $F_{3,33=}$6.64, p<0.01). When examining the individual contribution of each variable to the final model Letter-Number Sequencing remained the only significant predictor (p=0.02) (Table 3).

For the third model, MelRel delayed cued recall was entered at step 1. This subtest significantly explained 15% proportion of the variability in total perceived stress (R^2_Δ=0.02, $F_{1,33}$=5.41, p=0.03). Emotion- and task-focussed coping entered in step 2, explained an additional significant 17.3% of the variability in stress (R^2_Δ=0.21, $F_{3,33=}$7.39, p=0.04). None of these variables remained significant predictors when their contribution was examined separately (Table 3).

The Stroop interference score was used to build the fourth model, entered in step 1. It explained 10.9% of the variance in perceived stress (R^2_Δ=0.11, $F_{1,33}$=4.42, p<0.05). Coping subscales entered at step 2 explained an additional 7% significant variance (R^2_Δ=0.22, $F_{3,33}$=3.37, p=0.03). However, none of these variables were predictors for perceived stress when examined separately (Table 3).

A significant contribution by COWAT rule-breaks was observed when it was entered as the neuropsychological variable in step 1 to build the fifth model (R^2_Δ=0.10, $F_{1,33}$=4.36, p<0.05). Emotion- and task-focussed coping styles significantly added 24.3% to the proportion of explained variance in perceived stress (R^2_Δ=0.40, $F_{3,33}$=6.10, p<0.01). However, task-focussed coping remained the only significant independent predictor (p=0.04) (Table 3).

The final model was built entering COWAT disinhibitions at step 1, which significantly explained 11.6% of the variance in stress (R^2_Δ=0.12, $F_{1,33}$=4.93, p=0.03). Coping style (emotion- and task-focussed) added a significant 3.8% of the variance (R^2_Δ=0.26, $F_{3,33}$=4.42, p=0.01), but none of these variables were significant predictors when their contribution was examined separately (Table 3).

3.4 Neuropsychological and coping style predictors of perceived stress in healthy controls

Results of the final five setwise multivariate linear regression models predicting total perceived stress in HCs are shown in Table 4. In the first model, premorbid IQ entered in step 1 explained a significant proportion (32.2%) of the variability in perceived stress (R^2_Δ=0.32, $F_{1,25}$=12.38, p<0.01). Emotion-focussed coping entered in step 2, added a significant 7.6% proportion of the variability in total perceived stress (R^2_Δ=0.37, $F_{2,25}$=8.16, p<0.01). Premorbid IQ was the only significant predictor of perceived stress when the individual contribution of the two variables was examined (p<0.05).

The second model was built using current IQ at step 1 and it explained a significant proportion of the variance of perceived stress (R^2_Δ=0.20, $F_{1,25}$=7.13, p=0.01). Emotion-focussed coping entered in step 2 significantly explained an additional 10.2% of the variance in stress (R^2_Δ=0.27, $F_{2,25}$=5.71, p=.01). However, none of these variables significantly predicted stress when their contribution was isolated.

Digit Span backward was entered as the neuropsychological variable in the third model, explaining a significant 12.5% of the stress variance in step 1 (R^2_Δ=0.12, $F_{1,25}$=4.57, p=.04). Emotion-focussed coping explained a significant additional 15.3% (R^2_Δ=0.37, $F_{2,25}$=8.40, p<.01) of the variance, with both Digit Span backward (p=0.02) and emotion-focussed coping (p<0.01) being significant individual predictors. When Letter-Number Sequencing was entered into a new (fourth) model as the neuropsychological variable in step 1, it explained a significant proportion of the stress variance (R^2_Δ=0.23, $F_{1,25}$=8.85, p=.01). Emotion-focussed coping added a significant 2.2% proportion in step 2 (R^2_Δ=0.37, $F_{2,25}$=8.40, p<.01). Both of these variables were significant individual predictors of total perceived stress (Letter-Number Sequencing p=0.02; emotion-focussed coping p=0.02).

The last model was built entering COWAT rule-breaks in step 1, which significantly explained 26.8% of the variance in stress (R^2_Δ=0.27, $F_{1,25}$=9.77, p=.01). Emotion-focussed coping added an additional significant 2.2% of the variance in step 2 (R^2_Δ=0.40, $F_{2,25}$=9.02, p<.01). Both COWAT rule-breaks (p<0.01) and emotion-focussed coping (p=0.02) individually contributed to perceived stress.

4. Discussion

Consistent with previous research (Corcoran et al., 2003; Nuechterlein et al., 1994; Phillips et al., 2006), the FEP participants in the current study reported significantly higher perceived stress than the HCs. Since stress is implicated in the aetiology and course of psychotic illness, improved understanding of the factors that may contribute to elevated stress in individuals with psychosis will point to important clinical assessment and treatment considerations. To date, the relative impact of neuropsychological functioning and coping style on perceived stress in psychotic disorders has received little examination. Thus, the impact of neuropsychological functioning and coping styles on perceived stress in people with FEP and HCs was investigated. The results of this cross-sectional study supported a role for both factors in contributing to perceived stress; however, the pattern and direction of these predictors differed in the two groups.

4.1 Neuropsychological functioning and perceived stress

We hypothesised that poorer global intellectual functioning, memory and executive functioning would be associated with higher perceived stress in both groups. In the HC group, with the exception of memory functioning, this hypothesis was supported in the final regression models, whereby poorer premorbid IQ, working memory (Digit Span backward and Letter-Number Sequencing) and executive functioning (COWAT rule-breaks) significantly predicted higher perceived stress. Aas et al. (2011) similarly found that poorer executive functioning and working memory were associated with higher levels of perceived stress in HCs. This finding supports the idea that neuropsychological functioning influences the perception and possible response to stressful situations in healthy people, such that lower functioning (specifically, general intellect, ability to hold and mentally manipulate verbal information and simultaneous adherence to multiple procedures) increases one's susceptibility to experience stress.

On the contrary, while premorbid IQ and working memory (Letter-Number Sequencing) also predicted the degree of perceived stress in the FEP participants, it was *higher* performances in these neuropsychological domains that predicted elevated stress. Thus, neuropsychological functioning unexpectedly had the opposite effect on perceived stress in the context of a first psychotic episode. This was in contrast to Aas et al. (2011), who found no relationship between neuropsychological functioning and perceived stress in FEP participants. One important methodological difference between the current study and that of Aas et al. is that participants in the current study were newly-diagnosed FEP cases who were mostly antipsychotic-naive at the time of assessment. Notably, there was no relationship between severity of psychotic symptoms and neuropsychological functioning in the current study, suggesting that the results are not a by-product of acute mental state. However, the findings suggest that FEP participants with higher neuropsychological functioning (specifically premorbid IQ and working memory) experienced increased levels of subjective stress in the weeks leading up to referral and engagement with a FEP service.

One potential explanation of relevance to these findings is a perception of lost potential in individuals with higher premorbid IQ (Lewine, 2005). Neuropsychological capacity may moderate one's appraisal of the life consequences of developing FEP and any associated stressful experiences during this period (Brekke et al., 2001). It is possible that poor psychosocial functioning (e.g., unemployment), which is frequently a central feature of psychotic disorders, is experienced as less stressful for people with neuropsychological deficits (although we did not examine psychosocial functioning in the current study) (Allott et al., 2013; Brekke et al., 2001; Lewine, 2005). Along these lines, Lysaker et al. (2001) found that poorer executive function and verbal memory (combined with a greater reliance on avoidance coping) predicted higher levels of hope in schizophrenia, suggesting that in some cases lower neuropsychological resources may protect an individual with psychosis from stressful experiences. There is also evidence suggesting that poorer insight and mentalizing abilities are associated with lower levels of depression in schizophrenia (Drake et al., 2004; Lysaker et al., 2013a) and these constructs are also associated with neuropsychological functioning (Cooke et al., 2007; Koren et al., 2004; Kurtz and Tolman, 2011) and therefore, may act as proxy protectors against perceived stress. Speculatively, in the wake of a first psychotic episode, lower neuropsychological functioning may be protective by limiting one's ability to perceive and evaluate the implications of life stressors, or because there may be a better match between neuropsychological and psychosocial functioning. Of course these mechanisms require further investigation. Nevertheless, the current findings suggest that new FEP referrals with a higher premorbid IQ (combined with an emotion-focussed coping style; Table 3) and higher working memory, may be particularly vulnerable to stress and may benefit from increased monitoring and stress management strategies.

4.2 Coping style and perceived stress

It was hypothesised that after accounting for neuropsychological functioning, emotion-focussed and avoidant-focussed coping would both be associated with higher perceived stress and task-focussed coping with lower perceived stress in FEP participants and HCs. The FEP group reported using significantly more emotion-focussed coping strategies than the HC group. The groups did not differ significantly in their use of avoidant-focussed or task-focussed coping strategies. This is consistent with previous research showing more maladaptive coping in people with FEP (Macdonald et al., 1998). Moreover, individuals with schizophrenia have been found to especially rely on emotion-focussed coping strategies during psychotic exacerbation as opposed to stabilisation (Strous et al., 2005). This may be consistent with the acute first-episode phase of our sample.

In relation to perceived stress, we found that higher emotion-focussed coping (but not avoidant-focussed coping) was consistently associated with elevated stress in both groups. Furthermore, increased use of task-focussed coping was associated with lower perceived stress in FEP patients. As a set in the hierarchical models, both emotion- and task-focussed coping strategies predicted the degree of perceived stress in the FEP group, which is consistent with previous findings (Horan and Blanchard, 2003; Strous et al., 2005). However, when the individual contribution of coping and neuropsychological variables was examined, coping style (specifically emotion-focussed) was a more consistent predictor of perceived stress in the HC group than the FEP group. This suggests that although coping style and neuropsychological functioning are important predictors of perceived stress in FEP, additional factors need to be considered as previously mentioned, such as social support, expressed emotion, self-esteem, resilience and self-efficacy (Lukoff et al., 1984; Macdonald et al., 1998; Nuechterlein et al., 1994; Pruessner et al., 2011; Ventura et al., 2004). There is evidence indicating that affective traits should also be considered in future studies, as trait negative affectivity is significantly related to coping styles and stress reactivity in schizophrenia (Horan and Blanchard, 2003; MacAulay and Cohen, 2013). Given this cross-sectional study focussed on FEP patients upon entry to a clinical service, future research should endeavour to examine the role of coping and neuropsychological functioning on perceived stress throughout the course of illness and consider additional predictive factors.

4.3 Limitations

The small sample size is a clear limitation of the current study, restricting the type of analyses conducted and number of variables included. For example, we were not able to examine the neuropsychological predictors simultaneously in the regression models. Thus, the neuropsychological results need to be interpreted cautiously, given that significant neuropsychological factors were not examined together. Additionally, given the number of multiple comparisons there is the possibility of Type I errors. Moreover, we could not examine a mediation model, such as neuropsychological functioning mediating the relationship between coping style and perceived stress. This may be important, as previous studies have shown that neuropsychological functioning influences the use of particular coping styles (Lysaker et al., 2004; Lysaker et al., 2005; van den Bosch et al., 1992; Ventura et al., 2004; Wilder-Willis et al., 2002). Also, the HCs were slightly younger and completed fewer years of education than FEP participants. Although scaled scores were used and separate analyses were conducted examining the contribution of those relevant neuropsychological and coping predictors to perceived stress on each group, comparisons between the groups need to be interpreted prudently. The coping and stress measures used in this study are subjectively rated and there is evidence that people with first-episode and prolonged psychosis have difficulties in self-reflection (awareness of own thinking and emotional processes) (Lysaker et al., 2013b; Vohs et al., 2014). This may bias how they describe their experience of and ways of coping with stress. Furthermore, with regards to alternative approaches to assessing coping, metacognitive mastery is a kin construct reflecting how individuals cope with stressors according to mental state awareness and knowledge, and has been associated with coping preferences in schizophrenia (Lysaker et al., 2011). The addition of measures of self-reflection and metacognitive mastery (components of metacognition), including objective analyses (e.g., speech patterns when talking about personally relevant information in the case of metacognitive mastery) and biological/lab-based measures of stress might have enhanced the current findings and would be worth including in future research. As mentioned, previous research has shown that individual differences in affective traits strongly predict coping and stress (Horan and Blanchard, 2003; MacAulay and Cohen, 2013), which was not measured in the current study. Thus, whether neuropsychological or coping styles predict perceived stress after taking these potentially modulating factors into account requires further investigation. Finally, it is important to note that the cross-sectional study design prevents causal interpretations. Longitudinal designs would shed light on the relationships between coping, neuropsychological functioning and stress over the course of illness.

4.4 Clinical implications and conclusions

To the best of our knowledge, this is one of the first studies to show that neuropsychological functioning predicts perceived stress levels in FEP patients. The findings support the assessment of neuropsychological functioning in addition to coping styles in FEP patients presenting for treatment. Measures of perceived stress, coping, premorbid IQ and working memory are relatively quick and easy to administer and may be invaluable for informing the psychological formulation of the role of stress in the young person with psychosis and guide specific interventions. For example, early intervention strategies may focus on stress management fostering the use of effective, alternative coping strategies and expand existing coping repertoires as well as strategies for adapting to a diagnosis of psychosis, particularly for individuals with higher premorbid IQ. In conclusion, both neuropsychological functioning and coping styles are associated with perceived stress in young people with FEP. Further investigation into the mechanisms of their relationships with stress and as the illness progresses is warranted.

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Table 1. *Demographic and clinical characteristics of first-episode psychosis and healthy control groups*

	FEP (*n*=34)		**HC (*n*= 26)**		**Significance**[a]
Demographics					
Age (mean/SD)	20.03	2.56	21.85	2.01	***p < 0.01***
Gender (male/female)	23 / 11		18 / 8		p = 0.99
Years of education (mean/SD)	10.85	1.2	11.92	0.39	***p < 0.01***
Born in Australia (yes/no)	25 / 9		11 /15		***p = 0.02***
IQ					
Premorbid IQ (mean/SD)	97.09	10.90	103.24	10.56	***p = 0.04***
Current IQ (mean/SD)	94.59	12.41	100.81	12.42	p = 0.06
Perceived Stress					
Total PSS Score	34.61	8.53	21.81	6.22	***p < 0.01***
Coping Style (CISS)					
Task-Focussed	51.06	15.51	52.96	10.49	p = 0.58
Emotion-Focussed	52.61	13.69	40.58	8.69	***p < 0.01***
Avoidance-Focussed	50.15	14.01	48.23	9.97	p = 0.56
Psychotic Symptoms					
BPRS Psychotic Scale	14.94	4.05			
SANS Total	22.53	13.75			

[a]Independent-samples *t*-tests were used for comparisons between quantitative measures and chi-square or Fisher's exact tests were used for comparisons between qualitative measures. *Note.* SD = standard deviation; PSS = Perceived Stress Scale; CISS = Coping Inventory for Stressful Situations; BPRS = Brief Psychiatric Rating Scale; SANS = Scale for the Assessment of Negative Symptoms.

Table 2. *Association between coping styles, neuropsychological test performance and perceived stress in first-episode psychosis and healthy control groups*

	Perceived Stress			
	FEP		HC	
Coping Style	***r****	***p***	***r****	***p***
Task-Focussed	-.429	**.014**	-.066	.747
Emotion-Focussed	.433	**.013**	.507	**.008**
Avoidance-Focussed	-.250	.167	-.035	.866
Neuropsychological Test/Domain	***r****	***p***	***r****	***p***
General Intelligence				
Premorbid IQ	.423	**.018**	-.592	**.002**
Current IQ	.273	.125	-.479	**.013**
Immediate Attention				
Digit Span forward	.319	.075	-.167	.416
Working Memory				
Digit Span backward	.306	.088	-.400	**.043**
Letter-Number Sequencing	.495	**.004**	-.519	**.007**
Verbal Learning and Memory				
MelRel total initial pairs	.352	.072	-.160	.434
MelRel Delayed Cued Recall	.430	**.025**	-.024	.906
Verbal Fluency				
COWAT total	.071	.698	-.349	.087
Animal fluency	.212	.243	-.237	.253
Executive Functioning				
D-KEFS 20 questions	.211	.255	-.286	.166
COWAT rule-breaks	-.361	**.042**	.546	**.005**
Processing Speed and Monitoring				
Stroop words	.342	.065	-.162	.430
Stroop colours	.077	.686	-.179	.382
Stroop interference	.372	**.043**	-.362	.069
COWAT repetitions	-.338	.058	-.273	.187
COWAT disinhibitions	.380	**.032**	.109	.603

*Pearson Correlation. Significance set at $p<0.05$; COWAT = Controlled Oral Word Association Test; D-KEFS = Delis-Kaplan Executive Function System.

Table 3. *Results from the final setwise multiple regression models examining predictors of perceived stress in FEP participants*

Variables[a]	Unstandardized Coefficients		Standardized Coefficients			Correlations Colinearity Statistics		
	B	Std. Error	Beta	t	Sig.	Zero-order	Tolerance	VIF
Model 1[b]								
Premorbid IQ	0.284	0.116	0.364	2.439	**0.022**	0.424	0.981	1.020
Task-Focussed Coping	-0.125	0.091	-0.219	-1.374	0.181	-0.403	0.864	1.158
Emotion-Focussed Coping	0.264	0.109	0.384	2.425	**0.023**	0.490	0.874	1.444
Model 2								
Letter-Number Sequencing	0.953	0.370	0.389	2.758	**0.016**	0.496	0.938	1.066
Task-Focussed Coping	-0.150	0.089	-0.264	-1.684	0.104	-0.438	0.866	1.154
Emotion-Focussed Coping	0.189	0.108	0.271	1.746	0.092	0.428	0.881	1.135
Model 3								
MelRel Delayed Cued Recall	1.096	0.686	0.303	1.598	0.124	0.429	0.879	1.137
Task-Focussed Coping	-0.150	0.115	-0.237	-1.304	0.206	-0.321	0.960	1.041
Emotion-Focussed Coping	0.178	0.127	0.261	1.398	0.176	0.376	0.906	1.104
Model 4								
Stroop interference	0.114	0.154	0.174	0.933	0.360	0.375	0.797	1.255
Task-Focussed Coping	-0.207	0.133	-0.333	-1.833	0.079	-0.463	0.839	1.191
Emotion-Focussed Coping	0.160	0.132	0.221	1.207	0.239	0.388	0.827	1.210
Model 5								
COWAT rule-breaks	-1.393	0.696	-0.299	-2.002	0.055	-0.361	0.986	1.014
Task-Focussed Coping	-0.189	0.089	-0.333	-2.135	**0.042**	-0.459	0.905	1.105
Emotion-Focussed Coping	0.219	0.107	0.320	2.047	0.050	0.447	0.906	1.103
Model 6								
COWAT disinhibitions	1.578	2.082	0.137	0.758	0.455	0.381	0.755	1.321
Task-Focussed Coping	-0.176	0.100	-0.310	-1.757	0.090	-0.459	0.798	1.253
Emotion-Focussed Coping	0.207	0.118	0.303	1.755	0.091	0.447	0.836	1.196

[a]Only significant predictors (*p*<.05 bivariate correlations) were entered in the regression analysis, with one neuropsychological test entered per model.
[b]Final regression models (see Methods section 2.3).

Table 4. *Results from the final setwise multiple regression models examining predictors of perceived stress in healthy control participants*

Variables[a]	**Unstandardized Coefficients**		**Standardized Coefficients**			**Correlations Colinearity Statistics**		
	B	**Std. Error**	**Beta**	**t**	**Sig.**	**Zero-order**	**Tolerance**	**VIF**
Model 1[b]								
Premorbid IQ	-0.240	0.114	-0.408	-2.105	**0.047**	-0.592	0.694	1.442
Emotion-Focussed Coping	0.235	0.138	0.331	1.705	0.102	0.557	0.694	1.442
Model 2								
Current IQ	-0.154	0.097	-0.309	-1.598	0.124	-0.479	0.780	1.283
Emotion-Focussed Coping	0.259	0.138	0.363	1.878	0.073	0.507	0.780	1.283
Model 3								
Digit Span backward	-0.099	0.038	-0.408	-2.579	**0.017**	-0.400	1.000	1.000
Emotion-Focussed Coping	0.368	0.113	0.514	3.246	**0.004**	0.507	1.000	1.000
Model 4								
Letter-Number Sequencing	-0.955	0.373	-0.419	-2.561	**0.017**	-0.519	0.939	1.065
Emotion-Focussed Coping	0.289	0.117	0.404	2.467	**0.022**	0.507	0.939	1.065
Model 5								
COWAT rule-breaks	2.311	0.806	0.463	2.866	**0.009**	0.546	0.957	1.045
Emotion-Focussed Coping	0.283	0.114	0.399	2.472	**0.022**	0.496	0.957	1.045

[a]Only significant predictors (*p*<.05 bivariate correlations) were entered in the regression analysis, with one neuropsychological test entered per model.
[b]Final regression models (see Methods section 2.3).