

## Subjective Experience of Cognitive Failures as Possible Risk Factor for Negative Symptoms of Psychosis in the General Population

Stefanie Pfeifer<sup>2</sup>, Jim van Os<sup>2,3</sup>, Manon Hanssen<sup>2</sup>,  
Philippe Delespaul<sup>2</sup>, and Lydia Krabbendam<sup>1,2</sup>

<sup>2</sup>Department of Psychiatry and Neuropsychology, South Limburg Mental Health Research and Teaching Network, EURON, Maastricht University, PO BOX 616 (VIJV1), 6200 MD, Maastricht, The Netherlands; <sup>3</sup>Division of Psychological Medicine, Institute of Psychiatry, De Crespigny Park, Denmark Hill, London SE5 8AF, UK

**Objective:** The aim of this study was to examine whether proneness to subjective cognitive failure (cognitive based mistakes) increases the risk for the development of symptoms of psychosis and to what degree any association was familial. **Methods:** At baseline, the Cognitive Failure Questionnaire (CFQ) and the Community Assessment of Psychic Experiences (CAPE) questionnaire were administered in a general population sample of genetically related individuals ( $n = 755$ ). Individuals scoring high (>75th percentile) or average on the CAPE (between 40th and 60th percentile) ( $n = 488$ ) were reinterviewed with the CAPE and Structured Interview for Schizotypy—Revised (SIS-R) at follow-up (mean interval = 7.7 months, SD = 4.8 months). **Results:** Cross-trait, *within*-relative analysis showed a significant association between the CFQ and the negative dimension, assessed with both the CAPE and SIS-R, whereas no association was found between the CFQ and the positive dimension. Cross-trait, *between*-relative analyses showed no association between the CFQ in one relative and any of the dimensions of the subclinical psychosis phenotype in the other relative. **Conclusion:** Proneness to subjective cognitive failure possibly contributes to the development or persistence of negative symptoms and can be seen as potential risk factor for negative symptoms of psychosis. This overlap is due to individual effects rather than familial liability.

**Key words:** psychosis/negative symptoms/psychosis proneness/cognition/family study/CFQ

<sup>1</sup>To whom correspondence should be addressed; tel: +31-43-3688682; fax: +31-43-3688689, e-mail: l.krabbendam@sp.unimaas.nl.

### Introduction

Subjective cognitive failures are cognitive based mistakes in processes that can normally be achieved without error (eg, accidentally throwing away a new pen and keeping the old one). They refer to common errors that occur in everyday life, such as memory slips (eg, absentmindedness), attention slips (eg, to fail to notice something relevant), and action slips (eg, to perform an unintended action).<sup>1,2</sup> Underlying this definition is the assumption that an individual is capable of performing a certain task but fails because something else interferes with completion of the task.<sup>3</sup> This account of the subjective experience of a cognitive failure is in line with studies that conclude that cognitive failure is unrelated to objective cognitive test performance.<sup>3,4</sup> Proneness to subjective cognitive failure seems to be a stable characteristic, which is expressed across a variety of situations and can be assessed reliably using self-report questionnaires, such as the Cognitive Failures Questionnaire (CFQ).<sup>1</sup> The CFQ measures self-reported frequency of subjective cognitive failures in daily life. Individuals scoring high on the CFQ report higher levels of anxiety and depression, both cross-sectionally<sup>5</sup> and longitudinally.<sup>6</sup> This effect may be particularly evident in combination with exposure to stressful environments,<sup>1</sup> suggesting that individuals scoring high on the CFQ are less successful at developing active coping strategies in dealing with stress.<sup>1,6</sup> The lack of active coping strategies may be explained on the basis of a less effective management of attentional capacity, possibly putting individuals at risk of developing depressive symptoms.<sup>1</sup>

It has also been suggested that a high score on the CFQ reflects a vulnerability to automatic intrusions that interfere with conscious processing. Under stress, these normally benign intrusions may become malevolent.<sup>6</sup> This account of subjective cognitive failure is reminiscent of the role of automatic cognitive biases that laboratory experiments have shown to operate in anxiety and depression.<sup>5,7</sup>

Cognitive accounts of psychosis have increasingly recognized that processes relevant to anxiety and depression may also play a role in psychotic symptom formation.<sup>8–12</sup> For example, individuals with persecutory delusions show an attention and memory bias for threatening information,<sup>13,14</sup> and individuals with hallucinations experience

more intrusive thoughts and find these thoughts more distressing and uncontrollable than psychiatric and healthy control groups.<sup>15</sup> If these cognitive mechanisms which are relevant to anxiety and depression likely also apply to psychotic symptom formation,<sup>8,12</sup> it can be suggested that the associations between subjective cognitive failures on the one hand and anxiety/depression and psychosis on the other can be explained on the basis of a shared mechanism.

Also, individuals with psychosis may have an increased sensitivity to daily life stress<sup>16</sup> as well as less effective coping strategies.<sup>17,18</sup> These processes may well be captured by the construct of cognitive failure, but so far there have been no studies investigating the association between subjective cognitive failure and psychosis. There is evidence that subjective experience of cognitive disturbances predict psychotic symptoms,<sup>19–22</sup> but this refers to the experience of basic symptoms that are phenomenologically close to the positive symptoms of psychosis.

Whereas the lifetime prevalence of psychotic disorders is estimated between 0.5% and 3%,<sup>23–25</sup> there is a growing body of literature suggesting that this may represent only a minor selection of the real prevalence of psychotic symptoms in the general population.<sup>24,26,27</sup> These attenuated symptoms of psychosis share many of the epidemiologic and phenomenological characteristics of the clinical disorder, supporting the notion of continuity between the clinical and the subclinical phenotype.<sup>26</sup>

Longitudinal general population studies are well suited to test the role of cognitive mechanisms in psychotic symptom formation because the association with de novo emergence of symptoms can be assessed and any confounding influence of characteristics related to patient status can be avoided. The first aim of the current study was therefore to investigate the relationship between subjective cognitive failure and subclinical symptoms of psychosis in a longitudinal general population study.

The attenuated symptoms of psychosis tend to cluster within families, both in nonpsychotic relatives of patients with schizophrenia<sup>28,29</sup> and in the general population,<sup>30–32</sup> indicative of familiarity of the subclinical psychosis phenotype, as observed for the clinical phenotype, which can be largely explained by the effect of shared genes.<sup>26</sup> Similarly, a substantial part of the interindividual variation in proneness to subjective cognitive failure can be attributed to genetic factors.<sup>33</sup> This raises the issue of both traits vary as part of the same underlying cause, similar to what has been shown for neurocognition on the one hand and subclinical psychosis on the other.<sup>34,35</sup> This was investigated in the second part of this study.

The Community Assessment of Psychic Experiences (CAPE) and the Structured Interview for Schizotypy—Revised (SIS-R) are 2 useful validated and replicated instruments to assess the subclinical psychosis pheno-

type.<sup>36,37</sup> In the context of the current article, the term “psychosis” refers to the full range of signs/symptoms and deviant experiences observed in cases who receive a “psychotic” diagnosis. The positive, the negative, and the depressive dimensions of the CAPE and the positive, the negative, and the disorganization dimensions of the SIS-R are separate dimensions of the subclinical psychosis phenotype, and there is increasing evidence that these dimensions can be found not only in patients with psychotic disorders<sup>28,38,39</sup> but also in the general population,<sup>32</sup> showing a continuous distribution.<sup>26</sup>

Two approaches were used to investigate the relationship between subjective cognitive failure and subclinical psychosis. First, in a cross-trait, *within*-relative approach, the hypothesis was tested that subjective cognitive failures are associated with the different dimensions of the subclinical psychosis phenotype. Second, in a cross-trait, *between*-relative approach, it was examined whether subjective cognitive failures in one relative are associated with the subclinical psychosis phenotype in the other.

## Method

### *Procedure and Sample*

The Continuum of Mental Disorders Study is a longitudinal family study of the general population in the city of Sittard, The Netherlands.<sup>31</sup> This study has 2 measurement points: T1 and T2, with a mean interval of 7.7 month (SD = 4.8 month, range = 1–26 month) between these 2 measurement occasions.

In order to recruit a representative sample of the general population, 4589 participants between 36 and 65 years were randomly selected and sent a letter in which they and their family members were asked to participate. The total general population sample for T1 comprised 768 participants aged 17–77 years, pertaining to 116 families. Taking into consideration every possible family relationship between subjects, 61.0% of the samples were first-degree relatives, 18.2% second-degree, 6.6% third-degree, and 0.4% fourth-degree relatives; 13.8% of the subjects were married or partners. In accordance with the local medical ethical committee, written informed consent was received from all participants.

At T1, the CFQ and the CAPE were administered. All participants with an average (between 40th and 60th percentile) and a high (above 75th percentile) score on the CAPE at T1 and their family members were asked to participate at T2.

This strategy was aimed at oversampling of individuals with higher levels of psychosis, thus increasing statistical power, while at the same time ensuring that the sample included sufficient individuals with “average” levels of the subclinical psychosis phenotype so as to have sufficient variation along a hypothesized continuum of psychosis.

At T2, participants filled in the CAPE questionnaire, and trained psychologists administered the Dutch version of the SIS-R.<sup>36,40</sup>

The risk set consisted of all subjects who had completed the CFQ at T1 and (a) the CAPE at T1 ( $n = 755$ ), (b) the CAPE at T2 ( $n = 501$ ), and (c) the SIS-R at T2 ( $n = 488$ ).

### Instruments

The CAPE<sup>32</sup> is a self-report questionnaire rating attenuated affective and nonaffective psychotic experiences (for detailed information of the CAPE see <http://www.cape42.homestead.com/>). The CAPE measures, on a dimensional scale, frequency of, as well as distress associated with, these subclinical psychotic experiences. The frequency score is measured on a 4-point scale from “never (1),” “sometimes (2),” “often (3),” to “nearly always (4).” The degree of distress associated with the subclinical psychotic experience is also measured on a 4-point scale with labels ranging from “not distressed (1),” “a bit distressed (2),” “quite distressed (3),” to “very distressed (4).” The CAPE includes dimensions of positive (20 items), negative (14 items), and depressive (8 items) psychotic symptoms associated with the subclinical psychosis phenotype in the general population (see Appendix for example of the 14 negative items of the CAPE). The CAPE provides a total score per dimension by adding up the scores on the frequency question, yielding a total frequency score, and adding up the scores on the distress question, yielding a distress score. A weighted score was calculated for each frequency and for each distress score to account for partial nonresponse.<sup>32,37</sup>

Furthermore, a validated Dutch translation of the CFQ was administered.<sup>5</sup> The CFQ is a self-report questionnaire consisting of 25 items and comprising 4 main subscales: absentmindedness, social interactions, names and words, and orientation.<sup>3</sup> On a 5-point subscale, the participants had to indicate how often they experience subjective cognitive failures. The scale ranges from “never (0),” “very rarely (1),” “occasionally (2),” “quite often (3),” to “very often (4).” Total scores for the CFQ ranged from 0 to 100. A higher score on the CFQ indicates more subjectively experienced cognitive failures.

The SIS-R is a structured interview and is designed to measure the symptoms and signs of the positive, negative, and disorganization dimensions of the subclinical psychosis phenotype. Items can be scored on a 4-point scale from absent (score 0) to severe (score 3). Positive schizotypy covers the symptoms referential thinking, magical ideation, illusions, and suspiciousness (6 items in total). Negative schizotypy contains the symptoms social isolation, social anxiety, introversion, restricted affect, referential thinking, and suspiciousness (8 items in total). Disorganization schizotypy encompasses the signs goal

directness of thinking, loosening of associations, and oddness (in total 3 items).

### Analyses

All analyses were carried out using STATA version 9.2.<sup>41</sup>

First, cross-trait, within-relative linear regression analyses were conducted to investigate, within subjects, the longitudinal association between total score on the CFQ at T1 and each dimension of the subclinical psychosis phenotype at T2. Robust estimates of variance were used, which allow observations that are not independent across groups (ie, families). All analyses were adjusted for the a priori demographical confounders sex, age, level of education, and current drug use. Any significant association was additionally adjusted for the other 2 remaining dimensions of the subclinical psychosis phenotype in order to examine the degree to which the association was reducible to overlap with the other subclinical psychosis dimensions. Analyses of distress associated with the subclinical psychosis dimensions of the CAPE questionnaire were additionally adjusted for the corresponding frequency score. Effect sizes were expressed as the standardized regression coefficient (beta). Linear combination of coefficients (*LINCOM* procedure) was additionally performed in order to test the difference between the different coefficients of the various subclinical dimensions.

In order to examine any specific patterns of associations with psychosis, the 4 subscales of the CFQ were also entered separately in the regression models.

In order to investigate whether any association between the CFQ total score at the T1 measurement and the subclinical psychosis phenotype (measured with the CAPE at T2) was independent of baseline presence of subclinical psychosis symptoms, all associations were adjusted for the corresponding subclinical psychosis dimensions measured with the CAPE at the T1 measurement.

Second, cross-trait, between-relative analyses were conducted in order to examine the associations between the CFQ total score in relative 1 and dimensions of the subclinical psychosis phenotype in relative 2. A dataset was generated that contained all possible pairwise relationships between subjects, either unrelated (ie, no shared genes and not married) or related (either 6.25%, 12.5%, 25%, or 50% shared genes). Married pairs were not included in this dataset in order to avoid confounding due to assortative mating. Interactions were fitted between shared genes, dichotomously defined as any degree of sharing and dimensions of the subclinical psychosis phenotype in relative 2, using the CFQ total score in relative 1 as the outcome variable. All analyses were adjusted for age, sex, level of education, and drug use of both relative 1 and relative 2 and additionally for the corresponding dimension of the subclinical psychosis phenotype in relative 1 as well as the CFQ total score in relative 2. Again, analyses of distress associated

with the subclinical psychosis dimensions of the CAPE questionnaire were additionally adjusted for the corresponding frequency dimension score of relative 1 as well as of relative 2. Robust estimates of variance were used, and effect sizes were expressed as the standardized regression coefficient.

## Results

### *Sample Characteristics*

At T1, the sample consisted of 755 participants (62.0% female) who completed the CAPE questionnaire. The mean age was 46.3 years ( $SD = 12.7$ , range 15–77). Mean education level was 4.7 (1.7) on an 8-point scale ranging from primary education to university degree. Self-reported current drug use was present in 4.2% (range: 0–6 drugs used). Mean total score on the CFQ was 32.7 ( $SD = 11.2$ ). The means of the weighted positive, negative, and depressive dimensions of the CAPE were 1.42 ( $SD = 0.26$ ), 1.62 ( $SD = 0.37$ ), and 1.72 ( $SD = 0.41$ ), respectively. At T2, the sample consisted of 501 participants (60.7% female) (of these, 488 participants [60.4% female] completed the SIS-R). The means of the weighted positive, negative, and depressive dimensions of the CAPE were 1.16 ( $SD = 0.18$ ), 1.56 ( $SD = 0.34$ ), and 1.61 ( $SD = 0.35$ ), respectively. Mean score for the SIS-R positive dimension was 2.15 ( $SD = 2.21$ ), for the negative dimension 2.84 ( $SD = 2.77$ ), and for the disorganization dimension 0.10 ( $SD = 0.52$ ).

### *Cross-trait, Within-Relative Analysis*

*Self-reported Subclinical Psychosis Dimensions.* The results of the longitudinal cross-trait, within-relative analyses showed a significant association between the CFQ total score at T1 and frequency of the positive, the negative, and the depressive dimensions of the CAPE at T2 ( $\beta = .262$ ,  $P = .000$ ;  $\beta = .532$ ,  $P = .000$ ;  $\beta = .540$ ,  $P = .000$ , respectively). Furthermore, a significant association was also found between the CFQ total score at T1 and distress of the positive, the negative, and the depressive dimensions of the CAPE at T2 ( $\beta = .238$ ,  $P = .000$ ;  $\beta = .221$ ,  $P = .000$ ;  $\beta = .105$ ,  $P = .042$ , respectively). The association between the CFQ total score and the frequency of the negative and depressive dimensions was significantly stronger than the association between the CFQ total score and the frequency of the positive dimension ( $t = 4.00$ ;  $P = .000$ , 95% confidence interval [CI] = 1.83–5.37, and  $t = 4.02$ ;  $P = .000$ , 95% CI = 1.89–5.22, respectively). No difference was found between the frequency of the negative dimension coefficient and the depressive dimension coefficient ( $P = .966$ ). After an additional adjustment for the other 2 remaining dimensions of the subclinical

psychosis phenotype, only the association between the CFQ total score at T1 and the frequency and distress of the negative dimension and frequency of the depressive dimension at T2 remained significant (table 1).

The association between the CFQ total score and the negative dimension at T2 was reduced but remained significant even after adjustment for the negative dimension at T1 (frequency:  $\beta = .23$ ,  $P = .000$ ; distress:  $\beta = .112$ ,  $P = .05$ ).

Similarly, the association between the CFQ total score and the frequency of the depressive dimension at T2 was reduced but remained significant after adjustment for the depressive dimension at T1 (frequency:  $\beta = .24$ ,  $P = .000$ ), whereas the association between the CFQ total score and distress disappeared (distress:  $\beta = -.016$ ,  $P = .771$ ).

Comparable to the results of the total CFQ score, the analyses of the 4 CFQ subscales separately showed a similar pattern of results (data not shown).

### *Interview-Based Subclinical Psychosis Dimensions*

The CFQ total score at T1 was significantly associated with the positive dimension and the negative dimension of the SIS-R at T2 ( $\beta = .188$ ,  $P = .002$ , and  $\beta = .355$ ,  $P = .000$ , respectively) but not with the disorganization dimension of the SIS-R at T2 ( $\beta = .012$ ;  $P = .827$ ).

The association between the CFQ total score and the negative dimension was significantly stronger than the association between the CFQ total score and the positive dimension ( $t = 3.38$ ;  $P = .001$ , 95% CI = 0.65–2.456) and the disorganization dimension ( $t = 2.52$ ;  $P = .012$ , 95% CI = 0.667–5.455). No difference between the association of the CFQ total score and the positive dimension and the CFQ total score and the disorganization dimension was found ( $P = .218$ ).

After adjustment of the subclinical psychosis dimensions for each other, only the association between the CFQ total score and the negative dimension remained significant (see table 1).

Again, comparable to the results of the total CFQ score, the analyses of the 4 CFQ subscales separately showed a similar pattern of results (data not shown).

### *Cross-trait, Between-Relative Analyses*

For the cross-trait, between-relative analyses, only participants who participated with their family members at both T1 and T2 were included (566 pairs pertaining to 72 families). In the model of the CFQ total score outcome at T1, there was no significant interaction between the variable shared genes and the frequency of CAPE positive ( $\beta = .0001$ ;  $t = 0.06$ ;  $P = .949$ ), negative ( $\beta = .0009$ ;  $t = 1.00$ ;  $P = .319$ ), and depressive dimensions ( $\beta = .0001$ ;  $t = 0.98$ ;  $P = .326$ ) at T2 nor with the SIS-R positive ( $\beta = -.0018$ ;  $t = -0.64$ ;  $P = .519$ ), negative ( $\beta = -.0029$ ;  $t = -.92$ ;  $P = .356$ ), and disorganization

**Table 1.** Cross-trait, Within-Relative Analysis of the Separate Associations Between the Different Dimensions of the Subclinical Psychosis Phenotype at T2 and Subjective Cognitive Failures at T1

Subclinical Psychosis Dimension	B (SE)	95% CI	<i>P</i>	Standardized $\beta$
Frequency <sup>a</sup>				
CAPE positive dimension	-0.058 (0.507)	-1.056, 0.940	.909	-.005
CAPE negative dimension	3.542 (0.624)	2.313, 4.771	.000	.312
CAPE depressive dimension	3.494 (0.632)	2.250, 4.739	.000	.308
SIS-R positive schizotypy	-0.017 (0.296)	-0.599, 0.566	.955	-.003
SIS-R negative schizotypy	1.536 (0.275)	0.996, 2.077	.000	.373
SIS-R disorganization	-1.524 (1.160)	-3.809, 0.760	.190	-.070
Distress <sup>b</sup>				
CAPE positive dimension	0.453 (0.584)	-0.697, 1.604	.438	.0409
CAPE negative dimension	2.334 (0.822)	0.716, 3.953	.005	.2088
CAPE depressive dimension	-0.593 (0.718)	-2.008, 0.821	.410	-.0536

Notes: All associations adjusted for sex, age, education, drug use and the other subclinical psychosis dimensions. CI, confidence interval; CAPE, Community Assessment of Psychic Experiences; SIS-R, Structured Interview for Schizotypy—Revised.

<sup>a</sup>Adjusted for the frequency score of the other remaining subclinical dimensions.

<sup>b</sup>Adjusted for the distress score of the other remaining subclinical psychosis dimensions and for the corresponding frequency score.

dimensions ( $\beta = -.0012$ ;  $t = -0.74$ ;  $P = .458$ ) at T2. Similarly, there was no interaction between the variable shared genes and the distress of the CAPE positive ( $\beta = -0.003$ ;  $t = -1.60$ ;  $P = .109$ ), negative ( $\beta = -.0004$ ;  $t = -0.317$ ;  $P = .751$ ), and depressive dimensions ( $\beta = -.0002$ ;  $t = -0.184$ ;  $P = .854$ ) at T2.

## Discussion

This study was, to our knowledge, the first general population study, examining the association between proneness to everyday subjective cognitive failures, assessed with the CFQ, a self-report questionnaire, and the subclinical psychosis phenotype within and between relatives. Overall, the results of the cross-trait, within-relative analyses showed a strong and robust positive association between subjective cognitive failure at baseline and frequency of negative symptoms at follow-up, both self-reported (assessed with the CAPE) and interview based (assessed with the SIS-R). A higher level of subjective cognitive failure at baseline also increased the distress associated with these negative symptoms at follow-up. In line with previous literature,<sup>5,6</sup> subjective cognitive failure also showed a positive association with the frequency of self-reported depressive symptoms, although the association with distress related to depressive symptoms was a result of the overlap with the negative dimension. The associations between subjective cognitive failure and the positive dimension, both self-reported and interview based, were reducible to the other subclinical psychosis dimensions. No association was found with the interview-based disorganization dimension.

The associations between subjective cognitive failure and the negative and depressive dimensions were reduced but not nullified after adjustment for the remaining corresponding dimensions of the baseline measurement.

This may suggest that proneness to subjective cognitive failure contributes to the development or persistence of negative and depressive symptoms, independent of their baseline presence, and can be seen as a potential risk factor for developing negative and depressive symptoms associated with psychosis. This rules out the possibility that reverse causality (ie, symptoms interfere with cognitive capacity, and, therefore, more subjective cognitive failures in daily life develop)<sup>5</sup> can explain the observed association.

In the cross-trait, between-relative analyses, no evidence was found for familial continuity between subjective cognitive failure and the subclinical psychosis dimensions, suggesting that the overlap within relatives was due to individual rather than familial liability. Because the results of the cross-trait, between-relative analyses do not substantiate a genetic transmission of the observed overlap between the phenotypes, an alternative explanation would be that psychological mechanisms lie at the basis of the association. Speculatively, individuals with a high level of subjective cognitive failures in daily life may try to avoid situations where the chance of experiencing subjective cognitive failures is increased, eg, in social contacts. Possibly, negative symptoms may develop partly as a result of this avoidance behavior.

Individuals prone to subjective cognitive failure were also more prone to report distress associated with the negative symptoms, independent of their frequency. This is important because recent insights suggest that it is the distress associated with the subclinical psychotic experience that causes transition to need for care status, rather than the mere experience itself.<sup>9,42,43</sup> The fact that individuals with negative symptoms experienced more distress associated with subjective cognitive failures may seem contradictory because negative symptoms are traditionally associated with blunting of affect. However, only

one study actually assessed to what degree negative symptoms are truly associated with emotional reactivity rather than the observable emotional expression. This study, using momentary assessment methodology, showed that patients in fact experienced more intense and more variable negative emotions than controls. In addition, no difference in patterns of affect was found between the blunted and the nonblunted schizophrenia subgroups.<sup>44</sup> These findings indicate that there is a difference between negative symptoms as the observable *expression* of emotions (in virtually all patients associated to a degree with the effects of D2-blocking drugs) and negative symptoms as the *experience* of emotions. Those at risk of negative symptoms may show greater emotional reactivity that is associated with the clinical phenotype of psychotic disorder.

Studies investigating neurocognitive test performance have similarly reported covariation with subclinical psychosis, both in relatives<sup>29,45</sup> and in the general population.<sup>34,46</sup> There is evidence that the overlap between neurocognition and subclinical psychosis has a common genetic basis.<sup>34,35</sup> The current findings did not point to a shared genetic basis for the overlap between subjective cognitive failure and subclinical psychosis. However, this does not point to a discrepancy between this study and previous findings because the construct of subjective cognitive failure assumes that it is unrelated to neurocognitive functioning.<sup>3</sup> More specifically, the findings suggest that the CFQ is associated with the negative domain of psychometric psychosis risk within individuals but not within families. This is an important difference with measures of neurocognition, alterations of which are transmitted together with risk for psychosis from one generation to another.<sup>47</sup> Earlier studies have indicated that the CFQ, as a measure of the experience of cognitive functioning, is not associated with actual cognitive functioning, as measured by tests of neurocognition.<sup>4,48</sup> Therefore, the question rises what area of individual-specific rather than family-specific psychosis liability the CFQ is tapping into. Several related possibilities arise. The fact that the CFQ assesses experience of cognitive functioning indicates that as a construct it is closer to the process of metacognition (thinking about one's cognition) rather than the process of cognitive function itself. Previous work has shown that metacognitive factors are important in the development of symptoms associated with psychotic disorder.<sup>49-51</sup> In agreement with this is work showing that the CFQ is associated with factors such as anxiety and depression or sensitivity to stress.<sup>1,5</sup> Therefore, the current findings of the CFQ suggest that the area of liability involved may be closer to the domain of social cognition than the domain of neurocognition, which do not appear to be strongly correlated with each other (van Hooren S, Versmissen D, Janssen J, Myin-Germeys J, à Campo J, Mengelers R, van Os J, Krabbendam L, unpublished data). The fact that the li-

ability measured with the CFQ is individual specific rather than shared with relatives in the same family suggests that this aspect of metacognition is associated with individual-level environmental exposures such as developmental trauma.<sup>49,52</sup>

According to cognitive models, cognitive disturbances contribute to the development and persistence of psychopathology.<sup>9,53,54</sup> Thus, in panic disorder, the tendency to misinterpret bodily sensations in a catastrophic manner is maintained by selective attention to idiosyncratic threat cues and avoidance behavior that prevents disconfirmation of threat. Likewise, hallucinations and delusions may be conceptualized as intrusive thoughts, which are interpreted in a malevolent way, this interpretation leading to the associated distress and disability.<sup>9</sup> In this light, the fact that the association between subjective cognitive failure and the positive dimension was entirely due to the overlap with the negative and the depressive dimensions of psychosis was not expected. A possible explanation for this finding is that expression of the symptom dimensions of psychosis in the general population is much more attenuated than in clinical samples. This makes it much more difficult to measure the dimensions of psychosis sensitively and to distinguish between them. Accordingly, correlations between the dimensions are larger in the general population compared with clinical samples.<sup>32</sup> Another possible explanation is that the CFQ is not sensitive enough to detect differential cognitive biases associated with specific forms of psychopathology. Although the CFQ contains 3 separate categories (attention, memory, and action) that are supported by factor analyses, all factors are highly related<sup>3</sup> and many items may refer to phenomena involving aspects of all 3 areas (eg, "Do you find you forget appointments?").<sup>5</sup> This is in line with earlier explanations that the score on the CFQ reflects limitations of a general cognitive capacity, which increase in stressful situations.<sup>1</sup> Finally, subjective cognitive failures were assessed with a self-report instrument that may have low sensitivity to detect specific forms of psychopathology, particularly those associated with positive symptoms of psychosis. The lack of sensitivity may explain the absence of an association between the CFQ and positive psychotic symptoms.

Results should be interpreted in the context of several limitations. First, the CFQ reflects a general tendency to everyday subjective cognitive failure. Therefore, it was not possible to elucidate associations between specific cognitive disturbances and the dimensions of the subclinical psychosis phenotype. In order to examine specific cognitive biases, the CFQ as a self-report measure is not suitable and experimental tasks would be required.

Second, the present study could not rule out the possibility that the association between subjective cognitive failure and negative psychotic symptoms is influenced by one common factor, eg, neuroticism. This may be particularly

relevant for associations with the SIS-R negative dimension because the SIS-R does not distinguish between social isolation based on apprehension and social isolation resulting from low social drive.

Third, although some of the explanations offered for the findings involve differential exposure to stress, no measures of stressful circumstances were available for analysis. There is evidence, however, that an increase in stress in daily life in patients with psychotic disorders is associated with an increase of psychotic symptoms, independent of the amount of cognitive impairment of the patients.<sup>55</sup>

Fourth, although it is theoretically plausible to interpret proneness to subjective cognitive failure as a causal risk factor in the development or persistence of negative symptoms of psychosis, this study demonstrated a statistical association and therefore could not prove causality.

Fifth, as a result of carefully conducted analyses in earlier work,<sup>36</sup> the scales of the SIS-R positive and the negative dimensions show a small degree of item overlap. Although this may seem contradictory, earlier work has established that at the level of the general population, higher correlations between the different dimensions may occur than seen in patient samples where correlations are lower, although not orthogonal.<sup>56–58</sup> The reason for the observation of higher correlations in the general population is that in nonclinical samples, expression of psychotic phenomena is much more attenuated, making it more difficult to discriminate between different domains. In contrast, in clinical samples, it is possible that one main symptom overshadows the other symptoms, resulting in reduced correlations between the dimensions.<sup>32,58</sup> The item overlap in SIS-R dimensions should not detract from the overall face validity and clearly different item content of the positive and negative scales. An additional post hoc regression analysis of the “affect expressive” (referential thinking, suspiciousness, and social anxiety) and the “affect restricted” (restricted affect, introversion, and social isolation) items of the negative schizotypy dimension also showed that both contributed equally to the observed association between the CFQ and the negative dimension of the SIS-R (affect expressive:  $\beta = .1354$ ,  $P = .003$ ; affect restrictive:  $\beta = .1348$ ,  $P = .000$ ). These results confirm that the extremes of the clinical phenotype in patients with psychotic disorder do not separate as distinctly when the phenotype is examined at lower levels of intensity in nonpatients.<sup>32,58</sup> In addition, the schizotypy literature has shown that while the dimensions of schizotypy resemble those of schizophrenia, they also contain items that are not typically associated with the symptoms of schizophrenia.<sup>59–63</sup>

Sixth, the relatively small sample size could account for the absence of significant effects in the cross-trait, between-relative analyses. However, the results were not even suggestive of such an effect, whereas a previous study in the same sample did yield evidence for familial

continuity between measures of neurocognition and sub-clinical psychosis.<sup>34</sup>

Finally, our findings are partially based on self-report data, which may yield less precise results, especially in the case of psychosis. However, the fact that the association with the negative dimension was apparent in both analyses suggests that the self-report questionnaire and the interview instrument were equally able to capture this relationship and provides support for the validity of the findings.

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## Appendix Items of the Negative Dimension of the CAPE:

- Do you ever feel that you are not a very animated person?
- Do you ever feel that you are not much of a talker when you are conversing with other people?
- Do you ever feel that you experience few or no emotions at important events?
- Do you ever feel that you have no interest to be with other people?
- Do you ever feel that you are lacking in motivation to do things?
- Do you ever feel that you are lacking in energy?
- Do you ever feel that your mind is empty?
- Do you ever feel that you are spending all your days doing nothing?
- Do you ever feel that your feelings are lacking in intensity?
- Do you ever feel that you are lacking in spontaneity?
- Do you ever feel that your emotions are blunted?
- Do you ever feel that you are neglecting your appearance or personal hygiene?
- Do you ever feel that you can never get things done?
- Do you ever feel that you have only few hobbies or interests?

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