

Associations Among Metacognitive Beliefs, Anxiety and Positive Schizotypy During Adolescence

Martin Debbané^{1,2}, Martial Van der Linden³, Dario Balanzin², Joël Billieux³, Stephan Eliez^{1,4}

¹Adolescence Clinical Psychology Unit, Faculty of Psychology, University of Geneva, Boulevard du Pont d'Arve 40, 1204 Geneva, Switzerland

²Office Médico-Pédagogique Research Unit, Department of Psychiatry, School of Medicine, Switzerland

³Cognitive Psychopathology and Neuropsychology Unit, Faculty of Psychology, Switzerland

⁴Department of Genetic Medicine and Development, School of Medicine, University of Geneva, Geneva, Switzerland

KEYWORDS: Metacognition ; Psychosis ; Schizophrenia ; Adolescence ; Hallucinations

ABSTRACT

The expression of early delusion and hallucination-like symptoms, known as positive schizotypy (PS), holds predictive power for later development of psychotic disorders. However, little is known about the psychological and emotional processes promoting the expression of PS during adolescent development. Our study's objective was to examine the nature of the relationships between adolescent PS and two dimensions previously identified to contribute to adult positive symptoms of psychosis, metacognitive beliefs and anxiety. Using a structural equation modeling design, data from self-report questionnaires measuring anxiety, metacognitive beliefs, and PS were collected from 179 adolescents aged 12 to 19 years. Our results indicate that although metacognitive beliefs significantly influence adolescent PS and anxiety, maladaptive contradictory metacognitive beliefs specifically potentiate positive schizotypal expression in hallucination-prone adolescents. Furthermore, we observe that PS and anxiety entertain reciprocal relationships. These findings suggest that relationships between metacognitive beliefs, anxiety, and PS can already be observed during adolescence.

Psychosis proneness involves an individual's vulnerability to experience psychotic-like symptoms of delusions and hallucinations, also referred to as positive schizotypy (PS) (Rossi and Daneluzzo, 2002). Epidemiological research suggests that early positive schizotypal manifestations hold predictive power for later development of schizophrenia spectrum disorders (Dhossche et al., 2002; Poulton et al., 2000), in their seminal study, Poulton et al. (2000) show that reporting psychotic-like symptoms of delusions and hallucinations at age 11 years increases by 16.4 times the odds of developing a schizophreniform disorder by age 26 years. Ten years after this study, there is still a lack of empirical evidence specifying which emotional and psychological processes could sustain and potentially exacerbate the expression of PS during adolescent development. One way to address this issue is to examine the factors associated with increased manifestations of early PS

during adolescence (Bentall et al., 2007). Longitudinal prospective investigations examining transient auditory verbal hallucinations in adolescents observe that emotional disorders and anxiety-provoking PS symptom content play significant roles in the maintenance of such PS symptoms (Escher, 2004; Escher et al., 2002). This suggests that examining emotional disorders and anxiety appraisal mechanisms might be helpful to understand adolescent PS expression. The meta-cognitive theory of psychopathology (Wells and Matthews, 1994) conceptualizes anxiety appraisal mechanisms such as worry and maladaptive beliefs concerning one's own mental functioning (metacognitive beliefs) as key contributors to the manifestation and maintenance of adult emotional disorders. From a developmental psychopathology framework, it seems warranted to consider meta-cognitive beliefs and anxiety measures because these are found to be associated with early signs of PS (Debbané et al., 2009). In this study, we aimed to evaluate the nature of the relationships between adolescent metacognitive beliefs, anxiety, and PS and to specify the role of each factor in the expression of PS during adolescence.

A number of recent investigations suggest that PS, in its subclinical and clinical forms, is characterized by a cognitive attentional syndrome (CAS), leading the individual to process information in a biased, reductive, and self-serving fashion (Freeman et al., 2002; Garety and Freeman, 1999). Most of these studies have been inspired by the metacognitive theory of psychopathology, conceptualized as the Self-regulatory Executive Function (S-REF) model (Wells and Matthews, 1994, 1996). This model specifies that the CAS consists of worry, rumination, threat monitoring, and coping strategies that produce maladaptive effects. The CAS extends negative processing and emotions and impairs flexibility in executive mental control. This syndrome is driven by two domains of metacognitive beliefs: positive and negative. Positive beliefs, also referred to as beliefs concerning problem solving, such as "Worrying helps me to get things sorted out in my mind," can trigger cognitive coping strategies in the form of "what if ... " statements in an effort to regulate anxiety (Wells, 1999). In adults, exaggerated engagement in positive metacognitive beliefs is associated with the type of worrying seen in anxiety disorders (Wells and Matthews, 1996), whereas in adolescents, positive metacognitive beliefs do not seem to be associated with clinical forms of anxiety (Cartwright-Hatton et al., 2004). Recent data seem to suggest that what makes worry specifically transition into its clinical forms are the negative metacognitive beliefs (Ruscio and Borkovec, 2004; Wells and Carter, 2001). The negative variety of metacognitive beliefs, such as "When I start worrying I cannot stop," are triggered, and the ensuing CAS sensitizes the individual to process anxiety-provoking content, in forms such as maladaptive attention to bodily stress or negative social evaluation cues.

This model has been applied to explaining delusional beliefs and hallucinatory experiences (Morrison, 2001), and studies have demonstrated that metacognitive beliefs are positively correlated with positive symptoms of psychosis. For example, recent studies with schizophrenic patients and adults reporting at-risk mental states for developing psychosis find significantly stronger positive metacognitive beliefs in the presence of firmly held negative metacognitive beliefs for both clinical groups in comparison with controls (Baker and Morrison, 1998; Morrison et al., 2007; Morrison and Wells, 2003).

To date, there has been little research on PS in adolescents, and we aimed to test for possible associations between metacognitions, anxiety, and PS in this group. The consequences associated to CAS are very relevant to the developmental psychopathology of PS because active worry could compound difficulties in attention and executive functions often reported in high-risk youths (Cornblatt et al., 1999; Niendam et al., 2006) and impede the consolidation of emerging self-regulation skills critical to negotiating personal and environmental stressors characteristic of the adolescent period (Steinberg, 1999). In particular, we examined the relationship between anxiety, PS, and metacognitive beliefs. Because metacognitions could contribute to both anxiety and PS, we included all reciprocal links between PS and anxiety in testing a model involving metacognition. We tested models in an overall combined sample and in a subsample of individuals high in PS. This is important because metacognition may be more dysfunctional in the PS group, as reflected by a greater range of beliefs contributing to symptoms that would be consistent with a greater propensity to engage in the CAS.

METHOD

PARTICIPANTS

Two sources of recruitment were used to form a single large sample of adolescents with a wide distribution of PS scores. First, typically developing adolescents recruited in other studies from our research center as control participants to a neurogenetic youth sample (Schaer et al., 2009) took part in the present protocol. These healthy adolescents were recruited from public schools in Geneva and in the community through written advertisement. Adolescents aged 12 to 19 years could voluntarily participate in the study after they provided written parental agreement. They were screened for past or present psychiatric or neurological disorder; adolescents with identified neurological or neurogenetic disorder ($n = 1$), adolescents with psychotic disorders ($n = 0$), and adolescents with missing data ($n = 2$) were excluded.

The other recruitment source came from Geneva's child and adolescent community outpatient psychiatric service (Office Medico- Pédagogique), affiliated to the University of Geneva's Psychiatry Department and to the Canton of Geneva Education Department. Participant recruitment took place immediately after adolescents' initial intake assessment. The principal investigator initiated contact with potential participants by telephone. After research objectives were presented, participant families decided whether they wanted to volunteer for the study. Approximately a quarter of families contacted volunteered for the study (telephone contacts performed = 364). In this sample, 94 adolescents (50 female adolescents, 44 male adolescents) were seeking help at the Office Medico-Pédagogique at time of participation. Clinical diagnoses based on ICD-10 criteria are available in Table 1. Only three participants received medication at time of participation (paroxetine, $n = 2$; methylphenidate, $n = 1$). Because contemporary theoretical models and empirical evidence suggest that anxiety contribute to the expression of PS during adolescence, participants with emotional or conduct disorders were not excluded from this study. However, adolescents with identified neurological or neurogenetic disorder ($n = 3$), with diagnosed psychotic disorders ($n = 1$), or with

missing data ($n = 2$) were excluded.

The final group consisted of 179 adolescents (88 female adolescents, 91 male adolescents). The total sample's mean age was 15.4 ± 1.6 years. Written informed consent was received from all participants and their parents under protocols approved by the institutional review board of the Department of Psychiatry of the University of Geneva Medical School.

MATERIALS

Self-report Measures

Selection of self-report measures prioritized those instruments that have been validated with francophone samples. We further calculated the reliability coefficients for each measure included in the protocol. The subjects individually filled out the self-report questionnaires, and to ensure that all subjects understood the items, a trained clinical psychologist (M. D.) supervised the questionnaire process.

To assess the expression of PS in our sample, the Schizotypal Personality Questionnaire (SPQ) was used (Raine, 1991). To the best of our knowledge, this is the only questionnaire measuring schizotypy that has been validated for a francophone population (Dumas et al., 2000; Raine, 1991) and has been validated with francophone adolescents (Badoud et al., 2011). The instrument yields three main factor scores (cognitive-perceptual, interpersonal, and disorganization) and also lends itself to multiple dimensional analyses in the context of a dimensional approach to schizotypy (Rossi and Daneluzzo, 2002). In this sample, the reliability coefficient (Cronbach alpha) calculated on the SPQ is excellent (0.90). The cognitive-perceptual factor score was used as our main measure of PS.

Along with the SPQ, participants filled out age-appropriate self-report instruments assessing dimensions of anxiety, depression, and metacognitions. We used the Revised Children's Manifest Anxiety Scale (R-CMAS) (Turgeon and Chartrand, 2003) to measure total standard score of anxiety. This measure carries the advantage of having been validated in francophone youths. Finally, the Meta-Cognitions Questionnaire-Adolescent Version (MCQ) (Cartwright-Hatton et al., 2004) was used to assess the adolescents' metacognitive beliefs. This scale contains 30 items asking the participant to rate statements on a 1 to 4 scale, where 1 = "do not agree," 2 = "agree slightly," 3 = "agree moderately," and 4 = "agree very much." The scale yields a total score, and we used two of the five subscale scores (positive beliefs about worry and negative beliefs about uncontrollability and danger). In our analyses, we first included the total score for metacognitive beliefs and then analyzed on the positive and negative beliefs subscales, thought to involve beliefs especially relevant to the expression of hallucinations (Morrison et al., 1995). The MCQ's positive belief subscale includes items such as "I need to worry to stay organized" or "I need to worry in order to work well." The MCQ's negative belief subscale includes items such as "I cannot ignore my worrying thought" or "My worrying could make me go mad." The reliability coefficients (Cronbach alpha) calculated on questionnaires with no missing data are excellent for the R-CMAS (0.86) and the SPQ (0.90). Concerning the MCQ, reliability coefficients are acceptable (MCQ-positive beliefs about worry, 0.74; MCQ-negative beliefs about uncontrollability and danger, 0.75).

Statistical Analyses

Relationships between PS, anxiety, and metacognition were analyzed with structural equation

modeling (SEM) computed with Mplus (Muthèn and Muthèn, 2006) using the maximum likelihood estimator. Three models were computed. The first model (model 1) tests the role of metacognitive beliefs (assessed by the total score on the MCQ) on both positive symptoms and anxiety. In this model, we chose to evaluate reciprocal relationships between anxiety and positive symptoms. Then, we further examined the relationships between positive and negative beliefs, anxiety, and PS in the whole sample. We tested the role of positive and negative beliefs in anxiety and PS. Positive and negative beliefs were allowed to correlate. Following our a priori hypothesis regarding anxiety and PS, we were also interested in examining the reciprocity between PS and anxiety, which we allowed to correlate.

TABLE 1. *Diagnostic Classification for Mental and Behavioral Disorders Following the ICD-10 Nomenclature for Participants Recruited Within the Context of the Outpatient Child Psychiatry Clinic*

Diagnostic Category	Range for ICD-10 Number Codes	of Participants^{a1}
Organic, including symptomatic, mental disorders	F00-F09	0
Mental and behavioral disorders due to psychoactive substance use	F10-F19	2
Schizophrenia, schizotypal, and delusional disorders	F20-F29	0
Mood (affective) disorders	F30-F39	23
Neurotic, stress-related, and somatoform disorders	F40-F49	21
Behavioral syndromes associated with physiological disturbances and physical factors	F50-F59	0
Disorders of adult personality and behavior	F60-F69	9
Mental retardation	F70-F79	0
Disorders of psychological development	F80-F89	2
Behavioral and emotional disorders with onset usually occurring in childhood and adolescence	F90-F99	18
No diagnostic classification		22
Missing information		3

^aComorbid disorders present in six participants.

Parcels of items were used as indicators of each latent variable. Using parcels of items rather than single items to define latent variables has several advantages (see Little et al., 2002, for a review). First, from a psychometric point of view, parcels have greater reliability and a lower likelihood of distributional violation than item-level data do. Moreover, compared with item-level data, SEMs based on parcels are also more parsimonious (as fewer parameters are estimated). For the latent factors dependent on unidimensional scales (SPQ-positive symptoms, R-CMAS, MCQ-positive beliefs, MCQ-negative beliefs), items were assigned by order to one of the parcels (the number of parcels for each latent factor depends of the number of items of the various scales: the minimum number of parcels is 2 and the maximum is 4). No item appeared in more than one parcel. For

example, the first item of the SPQ cognitive-perceptual scale was assigned to the first parcel, the second item was assigned to the second parcel, the third item was assigned to the third parcel, and so on. The procedure differed for the total score of the MCQ because this scale is multidimensional and comprises five subscales. On the basis of the recommendations of Little et al. (2002) about parcelling multidimensional scales, we created parcels by joining items from different facets into item sets. We ensured that each parcel reflected all of the facets of the latent construct (e.g., each parcel comprised items from the five subscales of the MCQ).

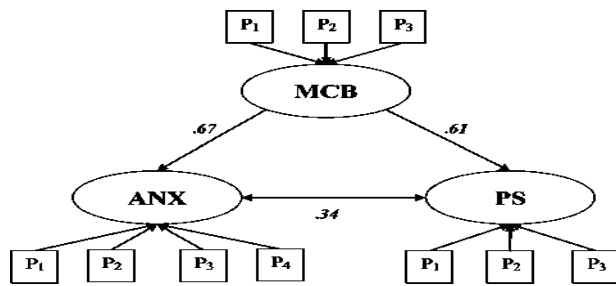
Goodness of fit was tested with the chi-square (χ^2)-to-degrees of freedom (df) ratio. A model can be considered to fit the data well if its χ^2/df ratio is inferior to 2. In addition to the χ^2/df ratio, two other indices that depend on a conventional cutoff (Hu and Bentler, 1999) were also computed: the root-mean-square error of approximation (RMSEA) and the standardized root-mean-square residual (SRMR). The combination of these two indices is valuable because the RMSEA is sensitive to the misspecification of the factor loadings and the SRMR is sensitive to the misspecification of the factor covariances. An RMSEA between 0 and 0.05 indicates a good fit, and one between 0.05 and 0.08 indicates an acceptable fit. An SRMR between 0 and 0.05 indicates a good fit, and one between 0.05 and 0.10 indicates an acceptable fit (Schermelleh-Engel et al., 2003). Many authors have used the comparative fit index (CFI) in confirmatory factor analysis, and we also report this index. A CFI greater than 0.90 is generally interpreted as indicating an acceptable fit. To test single parameters, we adopted the 5% significance criterion (*i.e.*, t value of parameters of 1.96).

RESULTS

Among the 179 participants, 1 had a missing value on the MCQ and was excluded from the analyses. The first model testing the role of metacognition on anxiety and PS (model 1) provided a good description of the data's structure ($\chi^2_{32} = 49.24$, $p < 0.05$; $\chi^2/df = 1.54$; RMSEA = 0.055; SRMR = 0.037; CFI = 0.98). Standardized regression weights for model 1 are illustrated in Figure 1. This model showed that total scores on the MCQ predict both anxiety and PS. Moreover, anxiety and PS were positively and significantly correlated.

Then, a second model was computed to test the role of positive and negative beliefs on anxiety and PS, encompassing the entire sample (model 2, $n = 178$). Model 2 could be considered to have a good fit ($\chi^2_{38} = 57.79$, $p < 0.05$; $\chi^2/df = 1.52$; RMSEA = 0.054; SRMR = 0.033; CFI = 0.98). Standardized regression weights for these two models are presented in Figures 2 (model 2A) and 3 (model 3).

FIGURE 1. *The structural equation model testing the relationship between metacognition, anxiety, and positive schizotypy (model 1). Values of the single-headed arrows reflect significant (at the 0.05 level) standardized regression weights. Value of the double-headed arrow reflects a significant correlation (at the 0.05 level). P1, P2, P3 indicates parcel for a given factor; MCB, metacognitive beliefs—Meta-Cognitions Questionnaire-Adolescent Version total score; ANX, anxiety total standard score from the Revised Children's Manifest Anxiety Scale; PS, positive schizotypy, total score from the cognitive-perceptual subscale from the Schizotypal Personality Questionnaire.*



P₁₂₃ = Parcel for a given factor

MCB = Metacognitive Beliefs - MCQ total score

ANX = Anxiety total standard score from the R-CMAS

PS = Positive Schizotypy, total score from the cognitive-perceptual subscale from the SPQ.

When considering the entire sample (see model 2, Figure 2), the model computed confirms that the negative beliefs subscale of the MCQ predicts both anxiety and PS. Thus, negative beliefs played a role in the occurrence of anxious symptoms. However, no significant relationships (direct and/or indirect) took place between positive beliefs and either anxiety or PS.

POST HOC ANALYSES ON ADOLESCENTS REPORTING HALLUCINATION-LIKE PHENOMENA (HALLUCINATION SUBSAMPLE)

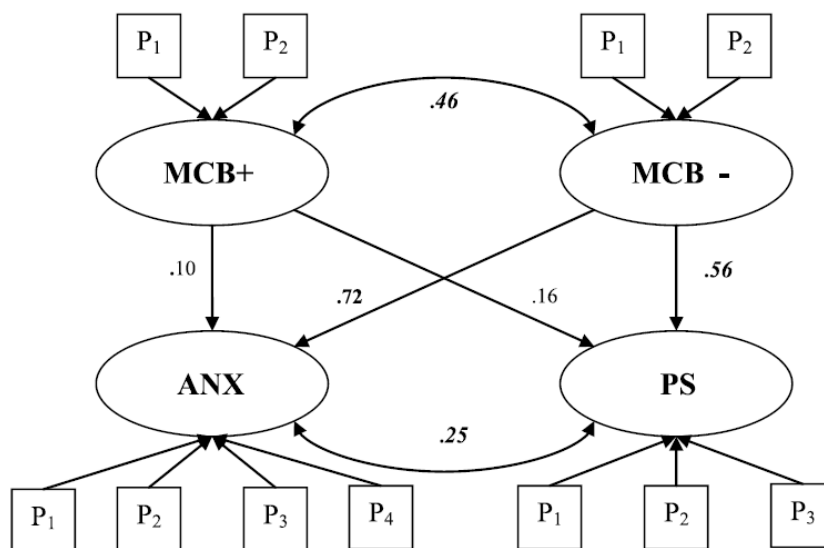
In light of earlier reports on the association between maladaptive contradictory positive and negative metacognitive beliefs with adults' hallucination proneness, we wondered whether the lack of association between PS and positive beliefs about worry in model 2 was a result of not focusing on the hallucination-prone adolescents in our sample. To accomplish this examination, we pulled out the participants' answers on the three items from the SPQ that clearly speak of hallucinatory experiences: question 30, "I often hear a voice speaking my thoughts aloud"; question 40, "Have you ever seen things invisible to other people?" and question 64, "Are your thoughts sometimes so strong that you can almost hear them?" This procedure is consistent with the prospective longitudinal study of Poulton et al. (2000) on children's self-reported positive schizotypal symptoms and their predictive value for adult schizophreniform disorder, which, like other recent studies, used a similar item-based strategy to identify participants having experienced delusion-like and/or hallucinatory-like phenomena (Jacobson et al., 2010; Polanczyk et al., 2010). In our study, participants endorsing one of those three items were included in the hallucination subsample. In total, 54 adolescents (31% of total sample) endorsed at least one hallucination-related item, consistent with previous reports of PS in youth samples (Laroi et al., 2006).

Model 3 is the same as model 2 but is restricted to hallucination-prone adolescents ($n = 54$). Model 3 had an acceptable fit ($\chi^2_{38} = 46.26, p = 0.17; \chi^2/df = 1.22; RMSEA = 0.063; SRMR = 0.055; CFI = 0.97$). As for model 2, the model confirms that negative beliefs are a significant predictor of both anxiety and PS. Furthermore, the positive beliefs subscale of the MCQ significantly predicts PS. Comparison of models 2 and 3 showed that although negative beliefs play a role in PS in participants with or without perceptual anomalies, positive beliefs predict PS only in participants who reported the presence of hallucination-like experiences.

DISCUSSION

This study's structural equation models bring original evidence supporting the role of metacognitive beliefs as developmental factors of adolescent PS. Using structural equation models allowed us to characterize the nature of the relationships between metacognitive beliefs, anxiety, and PS. The models with the best fit indices suggest that metacognitive beliefs independently influence the expression of both anxiety and PS. Furthermore, the models confirm a bidirectional relationship between anxiety and PS, as both factors entertain a reciprocal influence in their respective adolescent expression. The final model provides evidence for the contribution of maladaptive contradictory positive and negative metacognitive beliefs to the expression of PS in adolescents reporting hallucinatory phenomena. Although these data are cross-sectional, they offer original empirical evidence for a psychosis continuum that can potentially be monitored through the early interactions between anxiety, metacognitive beliefs, and early PS during adolescence. We will detail the processes by which meta-cognitive beliefs and anxiety may significantly contribute to the early expressions of PS.

FIGURE 2. The structural equation model testing the relationship between positive and negative metacognitions, anxiety, and positive schizotypy in the entire sample (model 2). Values of the single-headed arrows reflect standardized regression weights (bold italic coefficients are significant at the 0.05 level). Value of the double-headed arrow reflects correlations (bold correlations are significant at the 0.05 level). P_1, P_2, P_3 indicates parcel for a given factor; $MCB+$, Meta-Cognitions Questionnaire-Adolescent Version positive metacognitive beliefs subscale score; $MCB-$, Meta-Cognitions Questionnaire-Adolescent Version negative metacognitive beliefs subscale score; ANX , anxiety total standard score from the Revised Children's Manifest Anxiety Scale; PS , positive schizotypy, total score from the cognitive-perceptual subscale from the Schizotypal Personality Questionnaire.



$P_{1,2,3}$ = Parcel for a given factor.

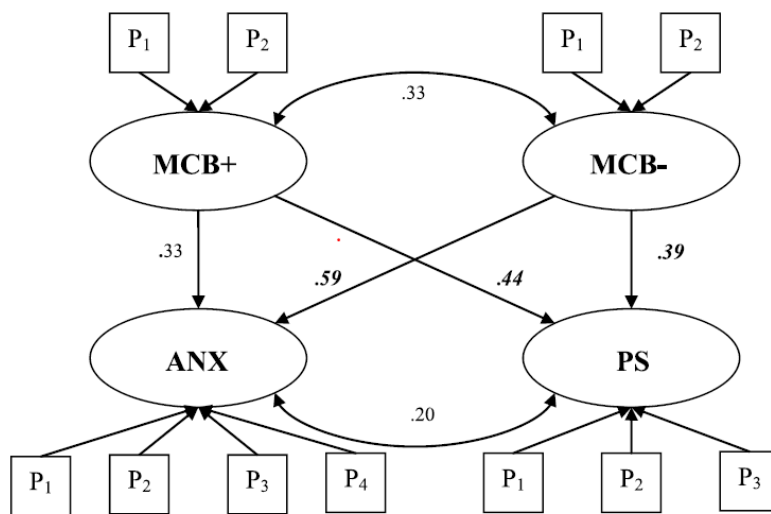
MCB+ = Positive Metacognitive Beliefs, from the MCQ Positive Metacognitive Beliefs subscale score

MCB- = Negative Metacognitive Beliefs, from the MCQ Negative Metacognitive Beliefs subscale score

ANX = Anxiety total standard score from the R-CMAS

PS = Positive Schizotypy, total score from the cognitive-perceptual subscale from the SPQ.

FIGURE 3. The structural equation model testing the relationship between positive and negative metacognitions, anxiety, and positive schizotypy in participants reporting hallucinations (model 3). Values of the single-headed arrows reflect standardized regression weights (*bold italic coefficients are significant at the 0.05 level*). P₁, P₂, P₃ indicates parcel for a given factor; MCB+, Meta-Cognitions Questionnaire-Adolescent Version positive metacognitive beliefs subscale score; MCB-, Meta-Cognitions Questionnaire-Adolescent Version negative metacognitive beliefs subscale score; ANX, anxiety total standard score from the Revised Children's Manifest Anxiety Scale; PS, positive schizotypy, total score from the cognitive-perceptual subscale from the Schizotypal Personality Questionnaire.



P_{1,2,3}= Parcel for a given factor.

MCB+ = Positive Metacognitive Beliefs, from the MCQ Positive Metacognitive Beliefs subscale score

MCB- - Negative Metacognitive Beliefs, from the MCQ Negative Metacognitive Beliefs subscale score

ANX = Anxiety total standard score from the R-CMAS

PS = Positive Schizotypy .total score from the cognitive-perceptual subscale from the SPQ.

Our analyses highlight the direct contribution of metacognitive beliefs to expressions of PS during adolescence. It seems that negative metacognitive beliefs, such as “My worrying could make me go mad,” play a prominent part in this relationship (Debbane et al., 2009). Wells (1999) notes that the

coping strategies triggered by negative metacognitive beliefs rarely completely succeed in resolving disturbing mental content, and this failure may be taken by the individual as further evidence that such content can lead to uncontrollable worrying. It also seems in our analyses that holding negative metacognitive beliefs breeds further anxiety. Indeed, negative metacognitive beliefs signify the individual's important preoccupation with the content of worry (Wells, 1997), which can nourish increased anxiety about one's own thought processes and emotion regulation capacities in youths. Adolescents who entertain such negative beliefs may feel particularly vulnerable in interactions relying on their thought and emotion regulation skills, such as social interactions. Interestingly, a number of reports find that social withdrawal and isolation are highly compatible with heightened schizotypal expression (Birchwood et al., 1998; Iyer et al., 2008). Future research may further address the specific relationship between negative metacognitive beliefs and their role in social isolation that often precede the first episode of psychosis.

Our results further suggest that engaging in both positive and negative maladaptive contradictory metacognitive beliefs may constitute a specific metacognitive pattern associated with hallucination proneness during adolescence. This finding is consistent with empirical evidence observing the conjunction of both positive and negative metacognitive beliefs with high risk for schizophrenia among youths (Morrison et al., 2007) and clinical schizophrenic samples reporting hallucinations (Baker and Morrison, 1998; Morrison and Wells, 2003). From a developmental perspective, we may consider that in adolescents with firmly held negative metacognitive beliefs, their engaging in "what if..." scenarios (positive metacognitive beliefs) constitutes a highly maladaptive coping strategy that may, in parallel, prompt the CAS, rendering them more sensitive to anxiety-provoking content and more susceptible to bring anxious-laden content to the surface and lead to overwhelming anxious mental states. Significant theoretical and empirical work has suggested that social threat (Jones and Fernyhough, 2007) and bullying experiences (Campbell and Morrison, 2007) are specifically associated to the expression of positive symptoms during adolescence in youths. Future research could test the hypothesis linking maladaptive contradictory metacognitive beliefs to adolescent social stress in the emergence of hallucinatory phenomena.

Through the unfolding of PS during adolescence, the role of anxiety certainly seems critical, yet few studies provide data that help to describe how this operates during adolescence. Our findings suggest that anxiety, independently from metacognitive beliefs, influences the expression of schizotypy. In return, our findings further suggest that positive schizotypal cognitions breed anxiety during adolescence. This result is consistent with prospective longitudinal studies reporting how anxiety disorders or anxiety-provoking events, including schizotypal thought content, may be associated with the persistence of adolescent PS and ongoing psychological distress (Escher, 2004; Escher et al., 2002). We note that the anxiety measure used in the current study is usually found to correlate with trait anxiety measures (Southam-Gerow and Chorpita, 2007). We could hypothesize that our anxiety measure tapped into trait vulnerability that is both independent from and interacts with the S-REF (Wells and Matthews, 1994, 1996) function during childhood and adolescence. In parallel, the results suggest that early positive schizotypal cognitions influence the emotional trait expression of anxiety during adolescence. The top-down influence of metacognitive beliefs on adolescent anxiety and PS, together with the reciprocal relationship between anxiety and PS, provides evidence for a dynamic breeding ground for delusion and hallucination-like symptoms, which includes at least three factors: anxiety, metacognitive beliefs, and PS itself. The S-REF model

(Wells and Matthews, 1994, 1996) can be usefully integrated into a developmental psychopathological framework and provide hypothetical cognitive and emotional processes at work in the unfolding of adolescent PS. Indeed, the present results motivate a series of investigations evaluating the consequences of adolescent metacognitive beliefs on cognitive processing, namely, preferential bias for processing threatening stimuli, decreased cognitive flexibility, and enhanced self-confirmation bias, which also represent the cognitive processes sustaining adult positive symptoms of psychosis (Freeman et al., 2002; Garety et al., 2005).

To conclude, the examination of metacognitive beliefs and anxiety is by no means exhaustive of the relevant psychological and emotional factors that can promote the expression of PS during childhood and adolescence. First, our results would also suggest that conceptualizing beliefs about emotion as a metacognitive construct may provide additional force to the metacognitive account of self-regulation (Manser et al., 2011). Indeed, it is feasible that metacognitive beliefs about anxiety itself could promote maladaptive coping mechanisms associated with adolescent PS. Second, an emotional factor such as depression may also contribute to maladaptive appraisals of internal stimuli as well as faulty attributions of malevolent mental contents to external peers or adult figures during adolescence (Simon and Umbricht, 2010). Finally, longitudinal designs examining these psychological and emotional processes with regard to adolescent PS will help to characterize the developmental trajectory of early signs of psychosis in youths and to critically assess their relevance to risk for pathological development during adulthood.

ACKNOWLEDGMENTS

We thank all the participants who kindly volunteered for this study. We extend our special thanks to Serges Djapo Yogwa for his ongoing collaboration and Anne-Laure Bortoli, Christelle Crepin, Sylvie Guller, Bertrand Auckenthaler, and Maude Schneider for help in data management.

DISCLOSURES

This research was supported by research grants to Martin Debbané from the Swiss National Fund for Research (100014135311/1) and the Gertrude Von Meissner Foundation (ME 7871).

The authors declare no conflict of interest.

REFERENCES

Badoud D, Chanal J, Eliez S, Van Der Linden M, Debbané M (2011) Validation study of the French Schizotypal Personality Questionnaire in an sample of adolescents; a confirmatory factor analysis. L'Encephale. 37:299-307.

Baker CA, Morrison AP (1998) Cognitive processes in auditory hallucinations: Attributional biases and metacognition. Psychol Med. 28:1199-1208.

Bentall RP, Fernyhough C, Morrison AP, Lewis S, Corcoran R (2007) Prospects for a cognitive-developmental account of psychotic experiences. Br J Clin Psychol. 46(Pt. 2):155-173.

Birchwood M, Todd P, Jackson C (1998) Early intervention in psychosis. The critical period hypothesis. Br J Psychiatry Suppl. 172:53-59.

Campbell ML, Morrison AP (2007) The relationship between bullying, psychotic- like experiences and appraisals in 14-16-year olds. Behav Res Ther. 45: 1579-1591.

Cartwright-Hatton S, Mather A, Illingworth V Brocki J, Harrington R, Wells A (2004) Development and

preliminary validation of the Meta-cognitions Questionnaire-Adolescent Version. *J Anxiety Disord.* 18:411-422.

Cornblatt B, Obuchowski M, Roberts S, Pollack S, Erlenmeyer-Kimling L (1999) Cognitive and behavioral precursors of schizophrenia. *Dev Psychopathol.* 11: 487-508.

Debbane M, Van der Linden M, Gex-Fabry M, Eliez S (2009) Cognitive and emotional associations to positive schizotypy during adolescence. *J Child Psychol Psychiatry.* 50:326-334.

Dhossche D, Ferdinand R, Van der Ende J, Hofstra MB, Verhulst F (2002) Diagnostic outcome of self-reported hallucinations in a community sample of adolescents. *Psychol Med.* 32:619-627.

Dumas P, Bouafia S, Gutknecht C, Saoud M, Dalery J, d'Amato T (2000) Validation of the French version of the Raine Schizotypal Personality Disorder Questionnaire—Categorical and dimensional approach to schizotypal personality traits in a normal student population. *Encephale.* 26:23-29.

Escher S, Morris M, Buiks A, Delespaul P, Van Os J, Romme M (2004) Determinants of outcome in the pathways through care for children hearing voices. *International Journal of Social Welfare.* 13:208-222.

Escher S, Romme M, Buiks A, Delespaul P, Van Os J (2002) Independent course of childhood auditory hallucinations: A sequential 3-year follow-up study. *Br J Psychiatry Suppl.* 43:s10-s18.

Freeman D, Garety PA, Kuipers E, Fowler D, Bebbington PE (2002) A cognitive model of persecutory delusions. *Br J Clin Psychol.* 41(pt 4):331-347.

Garety PA, Freeman D (1999) Cognitive approaches to delusions: A critical review of theories and evidence. *Br J Clin Psychol.* 38(Pt. 2):113-154.

Garety PA, Freeman D, Jolley S, Dunn G, Bebbington PE, Fowler DG, Kuipers E, Dudley R (2005) Reasoning, emotions, and delusional conviction in psychosis. *J Abnorm Psychol.* 114:373-384.

Hu LT, Bentler PM (1999) Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct Equation Model.* 6:1-55.

Iyer SN, Boekestyn L, Cassidy CM, King S, Joober R, Malla AK (2008) Signs and symptoms in the pre-psychotic phase: Description and implications for diagnostic trajectories. *Psychol Med.* 38:1147-1156.

Jacobson S, Kelleher I, Harley M, Murtagh A, Clarke M, Blanchard M, et al (2010) Structural and functional brain correlates of subclinical psychotic symptoms in 11-13 year old schoolchildren. *Neuroimage.* 49:1875-1885.

Jones SR, Fernyhough C (2007) A new look at the neural diathesis—Stress model of schizophrenia: The primacy of social-evaluative and uncontrollable situations. *Schizophr Bull.* 33:1171-1177.

Laroi F, Van der Linden M, Goeb JL (2006) Hallucinations and delusions in children and adolescents. *Curr Psychiatry Rev.* 2:473-485.

Little TD, Cunningham WA, Shahar G, Widaman KF (2002) To parcel or not to parcel: Exploring the question, weighing the merits. *Struct Equation Model.* 9:151-173.

Manser R, Cooper M, Trefusis J (2012) Beliefs about emotions as a meta-cognitive construct: Initial development of a self-report questionnaire measure and preliminary investigation in relation to emotion regulation. *Clin Psychol Psychother.* 19:235-246.

Morrison AP (2001) The interpretation of intrusions in psychosis: An integrative cognitive approach to hallucinations and delusions. *Behav Cogn Psychother.* 29:257-276.

Morrison AP, French P, Wells A (2007) Metacognitive beliefs across the continuum of psychosis: Comparisons between patients with psychotic disorders, patients at ultra-high risk and non-patients. *Behav Res Ther.* 45:2241-2246.

- Morrison AP, Haddock G, Tarrier N (1995) *Intrusive thoughts and auditory hallucinations: A cognitive approach*. *Behav Cogn Psychother*. 23:265-280.
- Morrison AP, Wells A (2003) *A comparison of metacognitions in patients with hallucinations, delusions, panic disorder, and non-patient controls*. *Behav Res Ther*. 41:251-256.
- Muthen LK, Muthen BO (2006) *Mplus user's guide (4th ed.)*. Los Angeles: Muthen & Muthen.
- Niendam TA, Bearden CE, Johnson JK, McKinley M, Loewy R, O'Brien M, et al (2006) *Neurocognitive performance and functional disability in the psychosis prodrome*. *Schizophr Res*. 84:100-111.
- Polanczyk G, Moffitt TE, Arseneault L, Cannon M, Ambler A, Keefe RS, et al (2010) *Etiological and clinical features of childhood psychotic symptoms: Results from a birth cohort*. *Arch Gen Psychiatry*. 67:328-338.
- Poulton R, Caspi A, Moffitt TE, Cannon M, Murray R, Harrington H (2000) *Children's self-reported psychotic symptoms and adult schizophreniform disorder: A 15-year longitudinal study*. *Arch Gen Psychiatry*. 57:1053-1058.
- Raine A (1991) *The SPQ: A scale for the assessment of schizotypal personality based on DSM-III-R criteria*. *Schizophr Bull*. 17:555-564.
- Rossi A, Daneluzzo E (2002) *Schizotypal dimensions in normals and schizophrenic patients: A comparison with other clinical samples*. *Schizophr Res*. 54:67-75.
- Ruscio AM, Borkovec TD (2004) *Experience and appraisal of worry among high worriers with and without generalized anxiety disorder*. *Behav Res Ther*. 42:1469-1482.
- Schaer M, Debbane M, Bach Cuadra M, Ottet MC, Glaser B, Thiran JP, et al (2009) *Deviant trajectories of cortical maturation in 22q11.2 deletion syndrome (22q11DS): A cross-sectional and longitudinal study*. *Schizophr Res*. 115:182-190.
- Schermelleh-Engel K, Moosbrugger H, Muller H (2003) *Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures*. *Methods of Psychol Res*. 8:23-74.
- Simon AE, Umbricht D (2010) *High remission rates from an initial ultra-high risk state for psychosis*. *Schizophr Res*. 116:168-172.
- Southam-Gerow MA, Chorpita BF (2007) *Anxiety in children and adolescents*. In Mash EJ, Barkley RA (Eds.), *Assessment of childhood disorders (pp. 347-397)*. New York: The Guilford Press.
- Steinberg L (1999) *Adolescence*. Boston: McGraw-Hill, Inc.
- Turgeon L, Chartrand E (2003) *Reliability and validity of the Revised Children's Manifest Anxiety Scale in a French-Canadian sample*. *Psychol Assess*. 15: 378-383.
- Wells A (1997) *Cognitive therapy of anxiety disorders: A practice manual and conceptual guide*. Chichester, UK: Wiley.
- Wells A (1999) *A cognitive model of generalized anxiety disorder*. *Behav Modif*. 23:526-555.
- Wells A, Carter K (2001) *Further tests of a cognitive model of generalized anxiety disorder: Metacognitions and worry in gad, panic disorder, social phobia, depression, and nonpatients*. *Behav Ther*. 32:85-102.
- Wells A, Matthews G (1994) *Attention and emotion: A clinical perspective*. Hillsdale, NJ: Erlbaum.
- Wells A, Matthews G (1996) *Modelling cognition in emotional disorder: The S-REF model*. *Behav Res Ther*. 34:881-888.