Temperament and Character Domains of Personality and Depression

Guest Editors: Toshinori Kitamura, C. Robert Cloninger, Andrea Fossati, Jörg Richter, and Peter R. Joyce
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Editorial
Temperament and Character Domains of Personality and Depression

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The link between personality and depression has long intrigued researchers and clinicians alike. Personality has been viewed as contributing to the onset and course of depression as well as influencing therapeutic choices for depression. Two major current personality theories are the “Big Five,” in which the NEO-PI is used as a measuring instrument, and the Psychobiology Theory of Personality, which uses the Temperament and Character Inventory (TCI) as a measuring instrument. This special issue deals with the latter theory in terms of its interrelations with depression and related conditions.

The last couple of decades have witnessed a great number of research reports on this topic. The association of TCI dimension with diverse types of health problems, and depression in particular, has been reported in the literature. The TCI has also been studied in terms of predicting treatment responses of depressed patients. Genetic and environmental correlates of TCI dimensions are a hot topic among researchers. Hence we believe that the present special issue is very timely.

This issue consists of six reports. K. Josefsson and colleagues, in Finland, present results from a longitudinal study of young Finns. Based on TCI scores at Time 1, the group tried to predict levels of depression 10 years later. They found that both high harm avoidance (HA) and low self-directedness (SD) independently predicted later depression severity. Thus, a prospective population-based design yielded findings that echoed the results of past cross-sectional and clinical treatment studies.

In a two-year follow-up study of a clinical population of depression, J. G. Goekoop and colleagues in the Netherland reported that only the increase in SD (in this two-year period) was related to the decrease in emotional dysregulation symptoms, while the increase in SD was associated with the decrease in HA. This suggests that symptomatic recovery follows reversibility of lowered SD.

People with current depression may be diagnosed with bipolar disorder if they have a lifelong history of manic or hypomanic episodes. Hence the association of TCI profiles with depression should be examined in terms of previous diagnoses of mood disorders. J. A. Harley and colleagues, in New Zealand, relate the results of their South Island Bipolar Study, namely, that high HA scores differentiated people with major depressive disorder (MDD) and those with bipolar disorder (BD) from unaffected relatives of bipolar probands after controlling for the current severity of depression. HA, however, failed to differentiate those with MDD from those with BD. On the other hand, high self-transcendence (ST) differentiated people with bipolar I (major depression with manic episodes) from those with MDD and unaffected relatives, confirming other reports of the importance of self-transcendence in the creativity of people with bipolar disorders.

People with depression are diagnosed with psychotic depression if they show positive symptoms simultaneously. J. G. Goekoop and colleagues in the Netherland in a followup study of clinical samples of depression reported that whereas patients with depression as a whole were characterized by higher HA and lower SD than healthy controls during the acute episode and higher HA after full remission, patients with psychotic depression were characterized by lower cooperativeness and lower reward dependence (RD) in the acute
Depression is often observed among pregnant women. E. Andriola and colleagues, in Italy, present unique preliminary findings on TCI patterns among expectant mothers and their partners. Both groups were characterized by low SD, whereas only expectant mothers were demonstrated to have high HA.

Eating disorders (ED) are often comorbid with depression, and individuals with both conditions are known to be resistant to treatment. A. D. Giovanni and colleagues, in Italy, report a high prevalence of major depression (MD) in outpatients with ED. Compared to patients with ED only, those with ED and MD demonstrated higher anger and eating disorder pathology scores. They were also characterized by high HA and low SD.

C. R. Cloninger hypothesized dopamine, serotonin, and noradrenaline to be biological substrates of novelty seeking (NS), HA, and RD, respectively. Hence it may be of research interest to investigate the temperaments of patients suffering from conditions characterized primarily by deficiencies of these neurotransmitters. Parkinson’s disease (PD) is such an example. PD is known to be caused by dopamine deficiency in cells of the substantia nigra. Pluck and Brown, in the UK, studied PD patients and controls. They found that NS scores correlated with a reaction time measure of attentional orientation to visual novelty, whereas HA scores correlated with anxiety scores. These observations confirm Cloninger’s original hypotheses about attention and learning in NS and HA.

Now that we have identified links between temperament and character domain patterns and depression, we must further investigate what mediates these effects. One possible mediator is coping style. M. Fushimi, in Japan, provides a hint that external locus of control is linked to psychological maladaptive patterns. Such coping styles may be based on personality traits. Other promising candidate mediators include self-esteem and self-efficacy, depressogenic dysfunctional attitudes and thinking errors, lack of social supports and social networks, poor coping reaction (rather than perceived coping styles), and stressful life events induced by specific personal traits.

Deeper insight into the association between personality and depression may contribute to the more efficacious treatment of depression.

Toshinori Kitamura
C. Robert Cloninger
Research Article

An Increase of the Character Function of Self-Directedness Is Centrally Involved in Symptom Reduction during Remission from Major Depression

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Background. Studies with the Temperament and Character Inventory (TCI) in depressive disorders have shown changes (Δ) of the character of Self-Directedness (SD) and the temperament of Harm Avoidance (HA). The central question of this study is which of these two changes is most proximally related to the production of depressive symptoms.

Methods. The start and endpoint data from a two-year followup of 58 depressed patients were reanalyzed. We used the ΔHA and ΔSD scores as well as the Δ scores on three dimensions of psychopathology, called Emotional Dysregulation (ED), Retardation (RET), and Anxiety (ANX). The presence of the main relation between personality and psychopathology was tested in all patients and in four subcategories. The data were analyzed by MANCOVA and Structural Equation Modelling (SEM).

Results. ΔHA and ΔSD correlated negatively, and only ΔSD was related (negatively) to ΔED. This pattern was found in all subcategories. SEM showed ΔHA and ΔSD had an ambiguous causal interrelationship, while ΔSD, ΔRET, and ΔANX had unidirectional effects on ΔED.

Conclusion. The results correspond with a central pathogenetic role for a state-related deficit at the character level in depression. This may have important consequences for investigations of endophenotypes and clinical treatment.

1. Introduction

A change of personality has been found consistently in major depressive episodes [1]. A central question is whether this should be seen as an epiphenomenon or an essential step in the pathogenetic process. The current study focuses on changes of personality and relations with changes in the production of depressive symptoms in the course of remission. In order to allow for a fine-grained analysis of the personality changes involved, and for an optimal detection of relations with dimension(s) of psychopathology, we used multidimensional rating scales. The choice of dimensions for personality and psychopathology to be considered is important in such analyses. This will be discussed here below.

Previous studies of personality in patients with a major depressive disorder have shown that the premorbid personality traits of Neuroticism [2], Harm Avoidance (HA) [1, 3], and Self-Directedness (SD) [3] are related to the life-time risk of a depressive episode. Since Neuroticism is positively correlated with HA and negatively with SD [4], whereas HA and SD are themselves negatively correlated [5–17], these findings suggest that HA and SD represent different aspects of the more global vulnerability or resilience trait, that is nonspecifically covered by the Neuroticism dimensions of several other personality models [18–20]. Since Neuroticism does not predict the time of onset of the depressive episode [21], this global dimension may not be sufficiently differentiated to allow for the detection of the most proximal personality dimension that, in interaction with stress, would be involved in the eventual pathogenesis of the depressive disorder. For this reason, we used the Temperament and Character Inventory (TCI) [5] with its differentiation between SD and HA in this global domain of personality. In order to enhance the chance of finding the dimension that
is most proximally related to the transition from normal to pathological functioning and therefore to the production of depressive symptoms, we used state-related changes.

Changes of personality have been found before to be related to changes of depression in varying degrees of severity, and the findings may vary depending on the use of the measures of personality change. The first to mention are relations between subsyndromal symptom production and changes of Neuroticism immediately above the basal level [22]. In the higher severity range of symptom production changes of Neuroticism have been found to be present [23] but small [24], while highly reproducible changes have been found for the HA and SD dimensions of the TCI [1, 25–28]. The varying frequency of “comorbid” Axis-II diagnoses in patients with major depression [29] could be a third way in which personality changes may be assessed. From the perspective of the TCI, low basic levels of SD are the defining hallmark of personality disorders [30]. As improvement of the level of depressive symptoms has been found to correlate with the change in Axis-II prediction based on this SD score [25], the state-related-reduced SD in depression may be involved in this Axis-II “comorbidity”. These findings support the necessity to differentiate between the dimensions of SD and HA in the studies of the primary and most proximally related factor in the onset and remission of depressive disorders. In the present study we therefore used the change of both dimensions, hypothesizing that either ΔHA or ΔSD would be most directly involved in the production of symptoms in depressive disorders. The analyses were carried out in all depressed patients as well as in four subcategories to test if the relation between the change of personality and change of psychopathology found is a general characteristic of all depressive disorders or just pertains to one or more subcategories.

The phenotypical significance of ΔHA or ΔSD can be derived from the personality model of the TCI and the subscales that are comprised by these dimensions. According to the TCI [5], personality can be conceived as a multidimensional construct comprising higher and lower levels of personal functioning and coping called character and temperament respectively. Whereas character is thought to involve conscious-adaptive information processing, temperament involves automatic adaptation via conditioned response patterns. The model includes three character dimensions called Self-Directedness (SD), Cooperativeness (CO), and Self-Transcendence (ST) and four temperament dimensions called Harm Avoidance (HA), Reward Dependence (RD), Novelty Seeking (NS), and Persistence (PER). HA comprises the subscales or facets of worrying/pessimism, fear of uncertainty, shyness, and fatigability, while low SD results in apathy, a loss of goals or direction, loss of self-striving behaviour, externalizing, and an incongruent second nature. This suggests that either or both changes could be directly involved in the pathogenesis of depression or one or more subcategories in particular.

To optimize the chances of finding relations with specific aspects of major depression, we also used a multidimensional approach to assess psychopathology. This involved the administration of the Comprehensive Psychopathological Rating Scale (CPRS) [31], which enables the assessment of six global dimensions of psychopathology [32] called Emotional Dysregulation (ED), Motivational Inhibition (or retardation (RET), Autonomous Dysregulation (or anxiety (ANX), Motivational Disinhibition (or Mania), Perceptual Disintegration, and Behavioural Disintegration. For the present study we used the three nonpsychotic and nonmanic global dimensions of ED, RET, and ANX. Emotional Dysregulation (ED) is a 20-item scale that comprises 9 of the 10 items of the Montgomery Asberg Depression Rating Scale (MADRS) [33]. Other items of the dimension of ED concern specific neurotic symptoms like compulsive thoughts, phobias, indecision, fatigability, failing memory, reduced sexual interest, reported muscular tension, loss of sensation or movements, derealisation, and depersonalisation [32]. The dimension of RET comprises items of inability to feel, apparent sadness, observed lack of appropriate emotion, reduced speech, and slowness of movement. The dimension of ANX comprises items of inner tension, reduced sleep, reported autonomic disturbances, aches and pains, observed autonomic disturbances signs, and observed muscular tension [32]. We used these global dimensions of psychopathology in the present study as we previously have found combinations of ANX and RET to be specifically involved in the phenotypes of subcategories of depression derived from the melancholic subtype [34]. This method has also enabled the detection of a phenotypic homology between one of these subcategories called depression with above-normal vasopressin concentration [35] and the stress-induced behavioural pattern of the animal model for depression called high anxiety-like behaviour rat [36]. Moreover, the combination of ED and RET appeared to be involved in psychotic depression [37].

As has already been reported previously [1], we investigated the changes of personality and psychopathology in the context of a two-year follow-up study of patients treated for an acute episode of major depression. We used the change scores between the start and the end of this two-year follow-up period. We first analyzed the correlations between the changes of the dimensions of personality and the dimensions of psychopathology by using Pearson’s correlations and MANCOVA. Thereafter, we used Structural Equation Modelling (SEM) to analyze the pathway between personality change and change of psychopathology and at the same time the pathways between the changes of the dimensions of psychopathology. Since the personality dimensions of character and temperament and the dimensions of psychopathology represent different levels of functioning from the conscious conceptual level of character via the temperament level of automatic conditioned behaviour to instinctual response patterns, the results of the present study are discussed from the perspective of the hierarchic organization of brain regions involved in depression. The support for either of two pathogenetic models will be evaluated. These models are based on the hypothesis of a continuity between premorbid temperament, increased temperament score, subsyndromal symptom level, major depressive disorder [38, 39], and the hypothesis of the development of a high-level functional deficit as precondition for the production of depressive
symptoms [40–42]. Since support has been found for high HA as the most general premorbid temperament and for low SD as an additional vulnerability factor for just a subcategory of depression [1], we consider the continuity model to be supported if AHA relates most directly with the change of psychopathology, and the high-level functional deficit model to apply if ΔSD is most directly related to the change of psychopathology.

2. Methods

2.1. Subjects. We used the data set from 58 depressed patients who completed a two-year followup [1]. Mean age was 39.1 (sd = 11.8) years, 40 (69.0%) were female, 35 (60.3%) were outpatients, and 49 (84.5%) were at least partially remitted. Forty-one patients (70.7%) had depression in full remission, 8 patients (13.8%) had depression in partial remission, and 9 (15.5%) still fulfilled criteria for major depressive episode. The level of education was assessed from low education = 1 to level 6 = university or postgraduate. The mean level of education was 3.3 (sd = 1.6).

The group of 58 patients was divided into four subcategories. These subcategories were based on our previous studies of vasopressinergic and noradrenergic mechanisms in depression and subcategories in the field of melancholic or endogenous depression [34] and psychotic depression [37]. These studies have resulted in two subcategories, called Highly Anxious-Retarded (HAR) depression, depression with above-normal plasma AVP concentration (ANA), as well as in support for psychotic depression as a distinct subcategory. In the present study, we eliminated all overlap between these three subcategories. This resulted in the following four subcategories: (1) psychotic depression (according to the DSM-IV-TR) (n = 7), (2) nonpsychotic depression with above-normal plasma AVP concentration (ANA-R) (n = 12), (3) nonpsychotic normal AVP highly anxious-retarded depression (HAR-R) (n = 12), and (4) all other depressed patients (n = 27).

2.2. Assessments

2.2.1. Personality. As in our previous studies on depression [1, 43], we used the Dutch translation [6] of the Temperament and Character Inventory (TCI) [5]. The lists were filled in within 2 weeks after recruitment and every 6 months until 2 years after recruitment. Patients were asked to respond to the items “as if they were in their premorbid state”, to maximally reduce state-dependent changes of response tendency.

2.2.2. Psychopathology. We used three of the six global dimensions of psychopathology assessed by the Comprehensive Psychopathological Rating Scale (CPRS) [31, 32]. These were the basic nonpsychotic and nonmanic dimensions of Emotional Dysregulation (ED), Motivational Inhibition (or psychomotor retardation (RET)), and Autonomic Dysregulation (or somatic anxiety (ANX)). We excluded the manic and two psychotic dimensions because these symptoms dimensions were not supposed to contribute to a large degree to the differentiation between the clinical pictures.

2.3. Statistical Analyses. Pearson’s correlations were used to test the correlation between ΔSD or, ΔHA and, ΔED, ΔRET, or ΔANX. Bonferroni correction was used, and alpha was set at P < 0.0083 to correct for 6 assessments. Two MANCOVAs were used to analyse the dependence of AED, ΔRET, and ΔANX on ΔSD and ΔHA. In these analyses, we changed the positions of the two sets of variables as dependent and independent variables. Sex was used as independent factor, and age and levels of education as covariates in an additional analysis. These analyses were carried out with the SPSS version 18.0.

A combined method was used with partial correlations (PC) and Structural Equation Modelling (SEM) to construct a graph and to analyze the correlation coefficients between the nodes and the weights of the edges, to explore the causal direction of the dependencies found between the changes of all dimensions of personality and psychopathology. This analysis was carried out using TETRAD, a software package for causal analyses provided by Carnegie Mellon University [44].

3. Results

3.1. Means and Δ Scores of HA, SD, ED, RET, and ANX. Table 1 shows means and standard deviations of the scores at start and after 2 years of followup on the personality dimensions of SD and HA and the basic symptom dimensions of ED RET, and ANX. The two personality dimensions and the three dimensions of psychopathology changed significantly over the two years. SD increased while all other dimensions decreased.

3.2. Correlations between ΔSD, ΔHA, ΔED, ΔRET, and ΔANX. Table 2 shows the correlations between the changes of all dimensions of personality and psychopathology used in this study. In all 58 patients, there was a moderately high negative correlation between ΔSD and ΔHA, a moderate negative correlation between ΔSD and ΔED, and a low positive correlation between ΔHA and ΔANX (just lacking statistical significance after Bonferroni correction), while there were moderately high positive correlations between ΔED, ΔRET, and ΔANX. The difference in the strength of the correlations of the latter three scores of the change of psychopathology suggests that the ED functions as the central or common dimension of psychopathological change.

3.3. Dependence of ΔED, ΔRET, and ΔANX on ΔSD and ΔHA, and Vice Versa. MANCOVA (Table 3) with ΔED, ΔRET, and ΔANX as dependent variables and ΔSD and ΔHA as independent variables showed that the relation between change of character (ΔSD) or temperament (ΔHA) and change of psychopathology was restricted to the relation between ΔSD and ΔED. The addition of sex, age, and level of education did not result in a significant relation with any of the two dimensions of personality change. MANCOVA with ΔSD and ΔHA as dependent variables and ΔED, ΔRET, and ΔANX as independent variables (Table 4) shows that the strength of the relation between ΔSD and ΔED increased if
Table 1: Mean scores (standard deviation between brackets) of SD, HA, ED, RET, and ANX at the start and after two years, and their differences, in 58 patients with depression.

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Mean score at start</th>
<th>Mean score at end of 2-year followup</th>
<th>Difference between start and end of followup</th>
<th>P-value of the difference</th>
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<td>SD</td>
<td>58</td>
<td>23.7 (7.0)</td>
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<td>4.74 (7.70)</td>
<td>&lt;0.001</td>
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<td>HA</td>
<td>58</td>
<td>25.4 (5.8)</td>
<td>23.2 (7.4)</td>
<td>−2.16 (6.44)</td>
<td>0.014</td>
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<td>ED</td>
<td>58</td>
<td>52.8 (11.6)</td>
<td>26.6 (16.4)</td>
<td>−26.21 (16.74)</td>
<td>&lt;0.001</td>
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<td>RET</td>
<td>58</td>
<td>8.5 (3.4)</td>
<td>3.8 (3.8)</td>
<td>−4.74 (3.64)</td>
<td>&lt;0.001</td>
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<td>ANX</td>
<td>58</td>
<td>11.3 (4.0)</td>
<td>7.4 (4.5)</td>
<td>−3.90 (4.80)</td>
<td>&lt;0.001</td>
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Table 2: Correlations between the changes of (Δ) the dimensions of personality (Self-Directedness and Harm Avoidance) and the dimensions of psychopathology (Emotional Dysregulation, Retardation, and Anxiety) in all 58 patients (lower left part of the table).

<table>
<thead>
<tr>
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<th>Δ Self-Directedness</th>
<th>Δ Harm Avoidance</th>
<th>Δ Emotional Dysregulation</th>
<th>Δ Retardation</th>
<th>Δ Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ Self-Directedness</td>
<td>−.641</td>
<td>−.463</td>
<td>−.211</td>
<td>−.313</td>
<td>.017</td>
</tr>
<tr>
<td>Δ Harm-Avoidance</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Δ Emotional Dysregulation</td>
<td>.330</td>
<td>.011</td>
<td>.173</td>
<td>.339</td>
<td>.009</td>
</tr>
<tr>
<td>Δ Retardation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δ Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: The dependence of the change of (Δ) Emotional Dysregulation, Δ Retardation and Δ Anxiety on Δ Self-Directedness, and Δ Harm Avoidance in 58 patients assessed over 2 years (F and P values of a MANCOVA).

<table>
<thead>
<tr>
<th></th>
<th>Δ Emotional Dysregulation</th>
<th>Δ Retardation</th>
<th>Δ Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ Self-Directedness</td>
<td>7.54 (0.008)</td>
<td>0.994 (0.323)</td>
<td>0.990 (0.324)</td>
</tr>
<tr>
<td>Δ Harm Avoidance</td>
<td>1.35 (0.715)</td>
<td>0.135 (0.714)</td>
<td>2.048 (0.158)</td>
</tr>
</tbody>
</table>

Table 4: The dependence of the change of (Δ) Self-Directedness and Δ Harm Avoidance on Δ Emotional Dysregulation, Δ Retardation, and Δ Anxiety in 58 patients assessed over 2 years (F and P values of a MANCOVA).

<table>
<thead>
<tr>
<th></th>
<th>Δ Emotional Dysregulation</th>
<th>Δ Retardation</th>
<th>Δ Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ Self-Directedness</td>
<td>9.58 (0.003)</td>
<td>1.43 (0.237)</td>
<td>0.078 (0.781)</td>
</tr>
<tr>
<td>Δ Harm Avoidance</td>
<td>1.88 (0.176)</td>
<td>0.783 (0.380)</td>
<td>2.014 (0.162)</td>
</tr>
</tbody>
</table>

this relation was controlled for the effect of ΔRET and ΔANX on ΔED.

If the differentiation into 4 subcategories was added as fixed factor to this MANCOVA model, then it appeared that the strongest correlation was found in the largest subcategory of all other depressed patients (F = 9.303; P = 0.004) and that not any of the three other subcategories had a significantly deviant correlation. The subcategory of HAR-R depression, which has the lowest SD score after full remission had a nearly significantly higher range for ΔSD (t = 1.877; P = 0.066) than the group of All Other Depressed patients with one patient having a high decrease of SD after 2 years (see Figure 1).

3.4. Pathways Involved in Symptom Production. Structural Equation Modelling (Figure 2) showed that ΔHA and ΔSD were bidirectionally related, suggesting the possibility of a positive feedback loop within the change of personality associated with the production of depressive symptoms. As far as the relation between the two domains of personality change and depressive symptoms is concerned, ΔSD was related uniquely and negatively with ΔED (P = 0.0024), and this involved a causal effect of ΔSD on ΔED, but not vice versa. ΔRET and ΔANX were uninfluenced by ΔHA and ΔSD, and each had a unique positive contribution to ΔED (P = 0.001 and 0.010 resp.). Figure 2 shows the correlations. The Edge Coefficients of the weights of the effects were as follows: ΔHA on ΔSD = −0.32 (SE = 0.13), ΔSD on ΔHA = −0.38 (SE = 0.09), ΔSD on ΔED = −0.58 (SE = 0.18), and ΔRET and ΔANX on ΔED 1.89 (SE = 0.45) and 1.23 (SE = 0.35), respectively.

4. Discussion

4.1. Correlations. As previously reported on data from the same patient sample [1] the present study showed that the mean of the score of the character dimension of SD increased during the two-year followup, while the mean of the score of the temperament dimension of HA showed a decrease. The
present study now in addition showed that the state-related changes of SD and HA were negatively correlated, and that only ΔSD correlated with the change of psychopathology. This ΔSD appeared to correlate uniquely with the change of the psychopathology dimension of ED. Within the domain of psychopathology the changes of all three dimensions (ED, RET, and ANX) appeared to be strongly intercorrelated, with ΔED having the strongest correlations. This suggests that this dimension of ED represents the core of the depressive disorder and that ANX and RET are variably associated dimensions, as has been found in our previous studies on the clinical phenotype of subcategories of depression [35, 37, 45].

4.2. SEM Findings and Support for the High-Level Functional Deficit Model. The bidirectional pathway between ΔSD and ΔHA, combined with the absence of a correlation between ΔHA and any dimension of psychopathology, corresponds with a relatively independent dynamic interaction within the field of personality. As the dimension of HA is thought to represent a conditioned sensitivity for stressful events and SD a learned way to cope with stress conditions [5], this bidirectional relation could reflect a stress-induced vicious circle of the experience of stress, a loss of learned coping, and an increase of the sensitivity for stress conditions. The unidirectional causal pathway between ΔSD and ΔED suggests that the stress-induced loss of SD may function as a central pathogenetic factor for the production and maintenance of depressive symptoms. Since the state relatedness of reduced SD has been found in all of the 4 subcategories in which we divided the whole group of depressive disorders, and ΔSD and ΔED now appeared to be correlated in all these subcategories, this factor appears to be a general characteristic of major depression. The hierarchic structure found by SEM of the relations within the psychopathological domain between ΔED, ΔRET, and ΔANX may correspond with a recent model of activated regions within the hierarchic organization of brain structures involved in the “default resting state” of depression [39].

The results of the present study do not support the model of a continuity between premorbid temperament, increased temperament, subsyndromal symptom level, and major depressive disorder. In contrast, the relation of ΔSD to ΔED corresponds with the classic high-level functional deficit model of mental disorders [41], derived from neuropsychology [40]. While this high level deficit has more recently been claimed to apply specifically to neuropsychological functional deficits of depressive disorders [42], we now found evidence that it may be conceptualized in terms of psychological functioning. According to the classic model, a high-level functional deficit (described as “negative” symptoms) should be the actual pathogenetic factor that functions as the precondition for relatively lower level functions to become disinhibited and to produce the most manifest or “positive” symptoms of the disorder. ΔSD can be conceived as such a high-level functional deficit, and ΔED, ΔRET, and ΔANX as dimensions of psychopathology that result from the disinhibition of lower levels of cerebral organization.

This ΔSD may be a useful target for the translational search for endophenotypes of depressive disorders. This means that the accidentally discovered inability of the HAB rat—an animal model with increased vasopressinergic

![Figure 1: Negative relations (lines corresponding with regression coefficients) between the change of Self-Directedness (ΔSD) and the change of Emotional Dysregulation (ΔED) in 4 subcategories of depression. (1 = psychotic depression, 2 = ANA-R, 3 = HAR-R, and 4 = all other depressed patients).](image-url)

![Figure 2: Pathways assessed by Structural Equation Modelling of relations between change scores over two years for the personality dimensions of Harm-Avoidance (ΔHA) and Self-Directedness (ΔSD), and the dimensions of psychopathology of Emotional Dysregulation (ΔED), Retardation (ΔRET) and Anxiety (ΔANX) in 58 patients with major depression. The numbers represent correlation coefficients, except for the ambiguous relation between ΔSD and ΔHA, which is expressed in terms of the covariance coefficient.](image-url)
activation and increased vulnerability for depression—to activate the Dorso-Medial Prefrontal region that is normally involved in the inhibition of conditioned avoidance behaviour, may be seen as such an endophenotype [46]. In contrast, the hypotheses that the depressive disorder can be conceived as a severe form of the premorbid trait or temperament [38, 47], or as being due to an abnormally increased activation of a network that is also activated by a normal affective response to stress in healthy brains [39], would direct the search for endophenotypes towards regions of the brain that could not be most centrally involved in the pathogenetic mechanism of depression.

Since the diagnosis of an Axis-II disorder depends on low SD [30], and the change of SD during the change of depression has been found to reduce the prediction of an Axis-II diagnosis in a substantial way [25] around the mean of the frequency of the Axis-II diagnosis in depression [27], the present support for a central role of ΔSD in the pathogenesis may result in a revision of the interpretation of this Axis-II diagnosis from a secondary complication or “comorbidity” [29] to a change of personality that is inherently related to the general and central pathogenetic mechanism. This reinterpretation of the clinically obvious and disturbing deficit of Axis-II “comorbidity” will also probably enhance the interest in related neurobiological changes and targets for treatment.

The unidirectional effects from ΔRET and ΔANX on ΔED may be due to several factors. These effects could be inherently related to a sequential pattern of remission in clinical pictures of subcategories of depression with high ANX and/or RET, like HAR depression and psychotic depression [37, 45]. On the other hand, dimensions of RET and ANX could be influenced independently by specific treatments.

4.3. Implications for the Neurobiological Research of SD. The central role for ΔSD in the relation between change of personality and psychopathology, and the negative interaction between ΔSD and HA suggest that the hypofunctional and hyperactive cerebral regions involved in this relation should be investigated in detail. Up to now only evidence has been reported of a relation between the character dimension of SD and “prefrontal function” [48, 49], while HA has been found to be related with more specifically defined regions, like the right Anterior Cingulum [50] and the Subgenual Anterior Cingulate Cortex (SUACC) [51]. Three regions, the Perigenual Anterior Cingulate Cortex (PACC), the (SUACC), and the Ventro-Medial Prefrontal Cortex (VMPFC), have consistently been found to be abnormally activated during a depressive state [39]. This suggests that one should search for neurobiological correlates of ΔSD in a network that complementarily mediates at the highest prefrontal level both the balance between activation and inhibition of conditioned emotional responses and the top-down regulation of the lower-level neurobiological correlates of emotional, instinctual and neuroendocrine states. This network could comprise the already-mentioned Dorso-Medial Prefrontal Cortex (DMPFC), which inhibits emotional and conditioned responses and has been found to be hypofunctional in depressed patients [52]. The same network could also comprise the medial prefrontal/cingulate region that is involved in the inhibition of the glucocorticoid response to stress [53], and the ventromedial prefrontal region [54] that is involved in the extinction memory of conditioned freezing behaviour. A problem with the supposedly reduced function of the DMPFC in depression is that a stress-induced increased activation of this region has been found in depression and that this was found to be associated with HA [55]. This suggests that future studies should carefully delineate in what extent the responses and state-related activities of the DMPFC are related to both SD and HA.

A limitation of the present study is that it only supports the central role of reduced SD in the pathogenesis of depression in the second part of the acute episode during the transition from full pathology to remission. The findings therefore warrant investigations of the first part of the acute episode of depression. Nonetheless the support for a central role of reduced SD in the pathogenesis of depression warrants further research-related prefrontal hypofunction and treatment effects both in man and translational studies of animal models of depression.

References


Research Article

Temperament and Character in Psychotic Depression Compared with Other Subcategories of Depression and Normal Controls

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Background. Support has been found for high harm avoidance as general vulnerability trait for depression and decreased self-directedness (SD) as central state-related personality change. Additional personality characteristics could be present in psychotic depression (PD). Increased noradrenergic activation in PD predicts the involvement of reward dependence (RD).

Methods. The data during the acute episode and after full remission from the same subjects, that we used before, were reanalyzed. The dependence of the 7 dimensions of the Temperament and Character Inventory version 9 on PD, three other subcategories of depression, and a group of normal controls was tested by MANCOVA.

Results. Low RD at both time points, and low Cooperativeness during the acute episode, were found as additional characteristics of PD.

Conclusion. The combination of two premorbid temperaments, high HA and low RD, and the development of a state-related reduction of two character functions, SD and CO, may be the precondition for the development of combined depressive and psychotic psychopathology.

1. Introduction

The relation between personality and depression is complex, because of the many different types of relationships that have been found. Personality characteristics may be operative as premorbid vulnerability traits, pathoplastic traits, reversible state-dependent changes of personality that may have a pathoplastic or pathogenetic function, and even irreversible scars. Moreover, each subcategory of depression could have specific characteristics in one or more of these areas. The present study focuses on trait and state-related characteristics of personality in major depression with psychotic features, hereafter called psychotic depression (PD). As far as we know, this type of investigation has not been carried out before. This is a shortcoming not only from the theoretical perspective, but also from the practical point of view, since particularly vulnerability traits and pathogenetic personality changes could have important therapeutic consequences.

The present study is part of a series of investigations in the same patient sample that aimed at the stepwise development of knowledge of subcategories of depression and of depressive disorders in general, by using (a) a multidimensional description of the complex clinical pictures of subcategories of depression based on global dimensions of psychopathology [1] assessed by the comprehensive psychopathological rating scale (CPRS) [2], (b) multidimensional description of personality characteristics assessed by the Temperament and Character Inventory (TCI version 9) [3], (c) neurobiological characterization by means of plasma concentrations of arginine-vasopressin (AVP), cortisol and norepinephrine (NE), as well as their correlations, (c) family history of depression [4], and (d) a two-year followup.

According to the TCI, personality can be conceived as a multidimensional construct comprising lower and higher levels of personal functioning and coping called temperament and character, respectively [3]. Whereas temperament involves automatic adaptation via conditioned response patterns, character is thought to involve conscious-adaptive information processing. The model comprises four temperament dimensions, called harm avoidance (HA), reward dependence (RD), novelty seeking (NS) and persistence (PER), and three character dimensions, called

...
self-directedness (SD), cooperativeness (CO), and self-transcendence (ST). In the TCI version 9, HA consists of anticipatory worry versus optimism (HA1), fear of uncertainty versus confidence (HA2), shyness versus gregariousness (HA3), and fatigability and asthma versus rigor (HA4). RD consists of sentimentially versus insensitivity (RD1), attachment versus detachment (RD3), and dependence versus independence (RD4). NS consists of exploratory excitability versus rigidity (NS1), impulsiveness versus reflection (NS2), extravagance versus reserve (NS3), and disorderliness versus regimentation (NS4), and PER of one facett called persistence versus irresoluteness. SD consists of acceptance of responsibility for one’s own choices instead of blaming other people and circumstances (SD1), identification of individually valued goals and purposes versus lack of goal direction (SD2), development of skills and confidence in solving problems (resourcefulness) versus apathy (SD3), self-acceptance versus self-striving (SD4), and congruent second nature versus personal distrust (SD5). CO consists of social acceptance versus intolerance (CO1), empathy versus social disinterest (CO2), helpfulness versus unhelpfulness (CO3), compassion versus revengefulness (CO4), and pure-hearted principles versus self-advantage (CO5). ST comprises self-forgetful versus self-conscious experience (ST1), transpersonal identification (i.e., identification with nature) versus self-differentiation (ST2), and spiritual acceptance versus rational materialism (ST3).

Our investigations started by the development of two new subcategories of depression in the field of melancholic or endogenous depression [5]. We first found support for a highly anxious-retarded (HAR) subcategory that was derived from the melancholic subtype according to the DSM-IV. Thereafter, we found support for a subcategory of depression with above-normal plasma arginine-vasopressin (ANA) concentration. At the level of personality characteristics, all patients with depression had increased harm avoidance (HA) after full remission compared with control subjects [6]. Fully remitted patients with HAR and ANA depression appeared to have in addition low self-directedness (SD) and low cooperativeness (CO), respectively, [6, 7]. Depression at large further appeared to be characterized by a state-related reduction of SD and increase of HA [6], while ANA depression in addition had a state-related reduction of reward dependence (RD) [7]. At the neurobiological level we found support for the HAR and ANA subcategories to have a genetic increase of the pituitary vasopressin receptor function and of the vasopressin synthesis, respectively, [5], while untreated depression at large eventually appeared also to have evidence of increased vasopressinergic function [8]. Recently we found the change of the character dimension of SD to be most directly related to the change of depressive symptoms [9]. This implies that rather than high HA, which we assume to be the most general vulnerability trait for depression, the state-related decrease of SD may represent the most general and central pathogenetic step for the actual development of depressive psychopathology.

In the present study we searched for the additional personality characteristics of PD. Most recently we detected an increased concentration of plasma norepinephrine and evidence of increased noradrenergic-vasopressinergic activation in this subcategory [10]. Since measures of noradrenergic function have been associated with RD [11–16], we hypothesized PD to be specifically related with this dimension of temperament.

In this study of PD we used three other subcategories of depression and a group of normative subjects as control groups. As a consequence of the stepwise procedure of our previous investigations, several subcategories that had been developed first appeared to have a small percentage of patients with features that eventually came out to be the defining characteristics of one or more other distinct subcategories. The increased AVP concentration initially found in HAR depression [17] appeared to belong to the defining characteristic of the ANA subcategory [18], and the psychotic features found in HAR as well as in ANA depression appeared to be better conceived to define a distinct subcategory of psychotic depression (PD) than as the phenotype of the severest form of HAR or ANA depression [10]. These results suggest that better delimitations between the subcategories of HAR and ANA depression as well as PD should be made by elimination of the initially accepted overlap. In this study we therefore used these better delimited subcategories, and we tested whether the previously found relations with the HAR and ANA subcategories do still hold after the elimination of overlap.

The data set of the same patient sample that we used before [6] was reanalyzed. We defined 4 subcategories of depression: PD, ANA depression without psychotic features (ANA-R), HAR depression without psychotic features and with normal vasopressin concentration (HAR-R), and the remaining group of all other depressed patients as the fourth subcategory. As before, we used the data of the personality characteristics at time of entrance in the study and after 2 years during full remission. The four depressive subgroups together with a control group of normative subjects were used as fixed factors in a MANCOVA, in which the 7 TCI version 9 dimensions served as the dependent variables, and age and gender as covariates. During the acute episode we hypothesized that HAR-R is not specifically related with any personality dimension [6], and that ANA-R is related with both reduced CO and RD [7]. After full remission, HAR-R was hypothesized to depend specifically on low SD [6], and ANA-R on low CO [7]. We hypothesized that PD is related to RD at least during the acute episode, in which we found the increased plasma NE concentration. The state-relatedness of RD and other dimensions of personality in PD was explored. Eventually, we explored the role of the subscales of the TCI version 9 dimensions that were found to be related to PD, by comparing all four subcategories of depression.

2. Methods

2.1. Patients and Control Subjects. We used the same sample of acutely depressed patients referred to our institute, that we used before in our investigation of the relation between TCI version 9 data and the ANA and HAR subcategories of depression [6, 7]. For the present study we selected the data from the start of the study (t1; n = 78) and after
2 years (17; \( n = 58 \)). The inclusion criteria were major depression (DSM-IV (APA, 2000)) and a score >20 on the Montgomery-Asberg rating scale (MADRS) [19]. All patients were recently referred to the psychiatric institute and referred to the study by the psychiatrist who made the initial diagnosis. After confirmation of the diagnosis by RFPdeW, using a semistandardized interview, the patient was asked to participate in the study. Exclusion criteria were bipolar disorder; treatment with lithium, carbamazepine, or valproate; first episode of major depression at age 60 years or older; alcohol or drug abuse or dependence; pregnancy; clinical evidence of a condition associated with abnormal plasma AVP release, such as the syndrome of inappropriate Secretion of antidiuretic hormone. The noncompleters of the study were just lost in the followup. Those lost and those remaining in the followup did not differ on clinical or demographic parameters (neuroticism, number of previous episodes, duration of current episode, family history of depression, psychotic depression, atypical depression, previous episodes, duration of current episode, family history of depression, psychotic depression, atypical depression, melancholia and anxious-retarded subtype, severity, and age, gender, and education) [20].

The MADRS was used as this scale has been developed from the CPRS and has maximal sensitivity to change in depressed patients. The use of the score >20 was derived from the general rule of thumb at the time of the study to take 1/3 of the maximal scale score for the delimitation of sufficient severity. The MADRS was preferred above the Hamilton rating scale for depression (HAMD) since the MADRS has high unidimensionality [21], and the (HAMD) an insufficiently reproducible factor-structure [22]. The MADRS was preferred above the Beck depression inventory, since the MADRS is less influenced by maladaptive personality traits [23].

Psychotic depression (PD; \( n = 10 \)) was diagnosed according to the DSM-IV-criteria [24]; ANA-R (\( n = 13 \)) was defined by a concentration of plasma AVP > 5.6 pg/mL and [18] and the absence of PD; HAR-R (\( n = 14 \)) was defined by the combination of anxiety and retardation scores ≥ the median [25] and the absence of ANA and PD. The remaining group of all other depressed patients was the fourth depressive subcategory (all other depressed; \( n = 41 \)). After two years of followup (17), 41 of the 58 completers of the followup were in full remission (71%) defined as no more than 2 items of the DSM-IV criteria for major depressive episode during two weeks corresponding with the criteria proposed by Frank et al. [26]. In a previous study using somewhat more rigid criteria, we found 65% to have full remission [27]. In the present study, the DSM-IV criteria for major depression were assessed by using the corresponding CPRS items. The CPRS items were rated from 0 to 6, covering the two weeks preceding the assessment. A score >2 was taken to represent the DSM-IV severity criterion of a symptom being more present than absent. Increased appetite and weight were rated separately. The number of patients in each subcategory at t7 was PD: \( n = 6 \); ANA-R: \( n = 9 \); HAR-R: \( n = 8 \); all other depressed patients: \( n = 18 \).

Normal control subjects (\( n = 86 \)) were selected from a normative sample [28] that was recruited at random from the national telephone book, as described in the study of the relation between the HAR subcategory and personality [6]. For reason of comparibility with our previous studies, the number of control subjects was kept the same. The differences between the scores of these 86 normal controls and the scores of the normative sample by Cloninger et al., [3] (higher HA, lower PER, and lower ST scores compared to Cloninger’s normative sample (HA: 15.4 (7.1) versus 12.6 (6.8), PER: 4.4 (1.9) versus 5.6 (1.9), ST: 11.2 (6.1) versus (19.2 (6.3)), correspond with the data of the full sample of the Dutch validation study [28] and seem to be due to cultural differences. The controls were not investigated for anxiety or depression.

2.2. Personality. In patients and controls we used the scores of the three character dimensions of self-directedness (SD), cooperativeness (CO) and self-transcendence (ST), and the four temperament dimensions of harm avoidance (HA), reward dependence (RD), novelty seeking (NS), and persistence (PER) of the TCI version 9 [3, 28]. Scores of the subscales of these main dimensions were only available in the patient sample.

2.3. Statistical Analysis. The four depressive subgroups (PD, ANA-R, HAR-R, and all other depressed patients) were used together with a control group of normative subjects, as fixed factors in a MANCOVA, in which the seven TCI version 9 scores served as the dependent variables, and age and gender as covariates. For the test of the dependence of PD on RD, we used a \( P \) value of 0.05. To correct for chance effects in case of additional relations between PD and any of the 7 TCI measures we used a \( P \) value of 0.007 in the exploratory analyses. The relations between HAR-R and SD and between ANA-R and CO, that we previously found in the same sample for the HAR and ANA subcategories, were tested by using a \( P \) value of 0.05. The one sample binomial test and one-sample Kolmogorov-Smirnov tests were used to test the homogeneity of the distribution of gender and age, and RD and CO at start and at the end of the followup. The analyses were carried out with the SPSS version 18.0.

3. Results

3.1. Personality Characteristics during the Acute Depressive Episode. Table 1 shows the scores on the 7 TCI version 9 scales at the start of the study, when all patients fulfilled the criteria for major depressive episode. Corresponding with our previous analysis in the same patients sample [6], a MANCOVA with the whole depressed group and the control group as fixed factors, showed that depression (\( n = 78 \)) had significantly increased HA (\( F = 76.625; P < 0.001 \)) and decreased SD (\( F = 92.755; P < 0.001 \)), while CO and RD were nonsignificantly reduced (\( F = 5.118; P = 0.025 \), and \( F = 5.885; P = 0.016 \), resp.). A MANCOVA that used the 4 subcategories of depression and the control group as 5 fixed factors, showed that PD was characterized by low CO (\( t = -2.949; P = 0.004 \)) and low RD (\( t = -2.717; P = 0.007 \), and ANA-R similarly still also had low RD (\( t = -2.718; P = 0.007 \)) with low CO (\( t = -2.237; P = 0.027 \)). All
4 subcategories had high HA ($t = 4.131$, 4.504, 5.804, and 7.945; $P < 0.001$) and low SD ($t = -4.020$, $-4.136$, $-5.493$, and $-6.976$; $P < 0.001$). The high HA and low SD were most strongly present in the group of all other depressed patients.

A similar analysis within the sample of depressed patients showed that PD was characterized by a statistically nonsignificant low score on the dependence subscale of the RD dimension in comparison with the subcategory of all other depressed patients ($t = -1.857$; $P = 0.067$), and low scores on the compassion versus revengefulness ($t = -2.004$; $P = 0.049$) and (nonsignificantly) pure-hearted versus Selfserving subscales ($t = -1.822$; $P = 0.072$) of the CO dimension, while the ANA-R subcategory was characterized by low compassion versus revengefulness ($t = -2.018$; $P < 0.047$) from the CO dimension. Given the fact that 3 subscales could be involved in low RD and 5 subscales in low CO, these relations were not statistically significant after correction for multiple assessment.

### Table 1: Temperament and character (standard deviation between brackets) during the acute depressive episode of psychotic depression (PD), ANA-R depression, HAR-R depression, and all other depressed patients, as well as in healthy controls (***$P < 0.001$; **$P < 0.007$; *$P < 0.05$; P values compared with controls).

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>HA</th>
<th>RD</th>
<th>NS</th>
<th>PER</th>
<th>SD</th>
<th>CO</th>
<th>ST</th>
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<tbody>
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<td>Depressive episode</td>
<td>78</td>
<td>25.4***</td>
<td>14.7</td>
<td>17.7</td>
<td>4.7</td>
<td>23.1***</td>
<td>31.4</td>
<td>10.6</td>
</tr>
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<td>PD</td>
<td>10</td>
<td>24.7***</td>
<td>12.7**</td>
<td>18.9</td>
<td>4.2</td>
<td>23.4***</td>
<td>28.1**</td>
<td>13.8</td>
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<tr>
<td>ANA-R</td>
<td>13</td>
<td>24.1***</td>
<td>12.8*</td>
<td>16.3</td>
<td>5.5</td>
<td>24.1***</td>
<td>29.4*</td>
<td>10.1</td>
</tr>
<tr>
<td>HAR-R</td>
<td>14</td>
<td>26.4***</td>
<td>16.1</td>
<td>16.4</td>
<td>4.9</td>
<td>21.7***</td>
<td>32.6</td>
<td>12.3</td>
</tr>
<tr>
<td>All other depressed</td>
<td>41</td>
<td>25.7***</td>
<td>15.2</td>
<td>18.3</td>
<td>4.6</td>
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<tr>
<td>Healthy controls</td>
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<td>16.1</td>
<td>19.5</td>
<td>4.4</td>
<td>32.3</td>
<td>33.3</td>
<td>11.2</td>
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</table>

4. Discussion

4.1. Personality Characteristics of PD and the General Characteristics of Depressive Disorders. This study confirmed the hypothesis that PD is related to RD. We found that RD was low compared with normal control subjects both during the acute episode and after full remission. This supports that low RD is an additional vulnerability trait for PD. The present study unexpectedly also showed that PD is related with a probably state-dependent reduction of CO. As far as the most general characteristics of depression are concerned, we found that the high HA and state-related reduction of SD found in the whole group of depressed patients [6] were present with the normal control subjects, while RD in PD and CO in ANA-R had not changed very much. These data suggest state-dependent reductions of CO in PD and of RD in ANA-R.
in all four subcategories (PD, ANA-R, HAR-R and all other depressed patients). The high HA in PD after full remission just lacked statistical significance. This is probably due to the low number of fully remitted PD patients, as the HA score had the same high level combined with even a relatively low standard deviation compared with the other subcategories of depression. Despite this low number of PD patients, the combined data strongly suggest that PD is characterized by two premorbid temperamental traits, namely, high HA and low RD, and two state-related changes of character function, involving SD and CO. The nonpsychotic subcategories on the other hand appeared to be characterized only by high RD and CO generally negatively correlated and RD and CO generally low number of fully remitted PD patients, as the HA score just lacked statistical significance. This is probably due to the low number of subjects, as the mean values during the acute episode did not differ much (RD = 12.8; sd = 4.3 versus 12.8; sd = 4.8, and CO = 29.2; sd = 5.6 versus CO = 29.4; sd = 6.1, resp.). The mean of the CO score in the ANA-R subcategory after full remission (CO = 28.4; sd = 3.3) was nearly identical to that of ANA depression (CO = 28.5; sd = 3.4), and the strength of the relation was only weakly reduced (P = 0.007) compared to before the elimination of overlap (P = 0.003) [7]. This may be due to the fact that only two psychotic patients were eliminated from the group of fully remitted patients with ANA depression. In the group of HAR-R patients in full remission we found a mean SD score of 27.3 (sd = 3.8, and CO decreased much lower than that found in the nonrevised ANA subcategory) is presumably due to the lower number of subjects, as the mean values during the acute episode did not differ much (RD = 12.8; sd = 4.3 versus 12.8; sd = 4.8, and CO = 29.2; sd = 5.6 versus CO = 29.4; sd = 6.1, resp.). The mean of the CO score in the ANA-R subcategory after full remission (CO = 28.4; sd = 3.3) was nearly identical to that of ANA depression (CO = 28.5; sd = 3.4), and the strength of the relation was only weakly reduced (P = 0.007) compared to before the elimination of overlap (P = 0.003). The present study further showed that the elimination of overlap between the PD, ANA, and HAR subcategories did not substantially affect our previous findings of specific low character scores of SD and CO after full remission in HAR and ANA depression, and the state-related change of RD in ANA depression. In our previous study ANA-depression had reduced RD (F = 8.466; P = 0.004) and reduced CO (F = 8.052; P = 0.006) during the acute episode compared with the control subjects [7]. The fact that in the present study the same relations with ANA-R were less strong than in the nonrevised ANA subcategory is presumably due to the lower number of subjects, as the mean values during the acute episode did not differ much (RD = 12.8; sd = 4.3 versus 12.8; sd = 4.8, and CO = 29.2; sd = 5.6 versus CO = 29.4; sd = 6.1, resp.). The mean of the CO score in the ANA-R subcategory after full remission (CO = 28.4; sd = 3.3) was nearly identical to that of ANA depression (CO = 28.5; sd = 3.4), and the strength of the relation was only weakly reduced (P = 0.007) compared to before the elimination of overlap (P = 0.003). This may be due to the fact that only two psychotic patients were eliminated from the group of fully remitted patients with ANA depression. In the group of HAR-R patients in full remission we found a mean SD score of 27.3 (sd = 7.6) and a P value of this relation of 0.048. This mean SD value was somewhat lower than that found in the nonrevised HAR depression (SD = 28.4; sd = 7.9) [6], which suggests that the elimination of overlap has resulted in a subcategory with increased validity.

### 4.3. Noradrenergic Mechanism Involved in the Low RD and Decreased CO in PD

As far as we know this is the first report on temperament and character in PD. The finding of the low score on the temperament dimension of RD confirmed the hypothesis that a noradrenergic mechanism is involved in PD. This hypothesis was derived from earlier findings of relations between RD and noradrenergic function [11–16].
The fact that RD was decreased in this psychotically depressed subcategory, while the plasma NE concentration was increased ($P = 4.993; P = 0.023$) [10], could be seen as contrasting with the findings of a positive correlation between RD and concentrations of the main metabolite of NE in urine [15, 16]. However, as the NE concentrations in PD are for a large part above the normal reference value [10], a concentration-dependent inverted U-curve relationship between NE release and the function of the central target regions involved in the affiliative behavior of RD could be involved. As the personality characteristics of PD and ANA-R seem to form mirror images, as far as the RD and CO traits and state-related changes of CO and RD are concerned, the opposite neurobiological mechanisms that we found in PD and ANA-R, namely, a positive NE-APV correlation in PD [10] and a negative AVP-NE correlation in ANA-R [40], could be involved.

These data further support the usefulness of the original concept of the TCI as a scale that corresponds with the sociobiological origins of personal differences. Next to the above mentioned findings in the field of the noradrenergic system, the model is supported by relations between the serotoninergic system and both HA and SD [27], as well as the dopaminergic system and NS [20].

4.4. Comparison between PD and Schizophrenic Disorders. The personality characteristics of high HA and low RD after full remission in PD and state-dependent reductions of the character dimensions of SD and CO, that we found to differentiate PD from other depressive disorders, appear to have some correspondence with the personality characteristics found in schizophrenic patients [41]. The patients in the latter study also had the combination of high HA and low RD, as well as the combination of low SD and low CO. The main differences compared with the PD patients of the present study was an additional high ST in the schizophrenic patients and the probable reversibility of the decreases of SD and CO. The comparison with the results of the present study suggest that the combination of high HA and low RD may constitute a general vulnerability configuration for psychotic disorders, and that the reduced character dimensions of SD and CO may function as the chronic or reversible character deficits that are involved in the actual development of the psychotic dysregulation.

Limitations of the study are the lack of subscale scores of the TCI version 9 in the normal control subjects, as well as the small number of patients with PD. The support for a specific vulnerability trait for the psychotic component of PD may imply that drugs that enhance affiliative behavior could be useful, and that specific psychotherapeutic attention could be directed towards the improvement of this type of behavior.

References


Research Article

Early Life Stress and Child Temperament Style as Predictors of Childhood Anxiety and Depressive Symptoms: Findings from the Longitudinal Study of Australian Children

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Objective. The purpose of this study was to determine whether the relationship between stressful infant environments and later childhood anxiety and depressive symptoms varies as a function of individual differences in temperament style. Methods. Data was drawn from the Longitudinal Study of Australian Children (LSAC). This study examined 3425 infants assessed at three time points, at 1-year, at 2/3 years and at 4/5 years. Temperament was measured using a 12-item version of Toddler Temperament Scale (TTS) and was scored for reactive, avoidant, and impulsive dimensions. Logistic regression was used to model direct relationships and additive interactions between early life stress, temperament, and emotional symptoms at 4 years of age. Analyses were adjusted for socioeconomic status, parental education, and marital status. Results. Stressful family environments experienced in the infant’s first year of life (high versus low) and high reactive, avoidant, and impulsive temperament styles directly and independently predicted anxiety and depressive problems in children at 4 years of age. There was no evidence of interaction between temperament and family stress exposure. Conclusions. Both infant temperament and stress exposures are independent and notable predictors of later anxiety and depressive problems in childhood. The risk relationship between stress exposure in infancy and childhood emotion problems did not vary as a function of infant temperament. Implications for preventive intervention and future research directions are discussed.

1. Introduction

Children as young as three years of age have been shown to meet DSM IV criteria for major depressive disorder [1]. Childhood onset of depressive symptoms has been associated with a distinct pattern of risk factors while childhood depression is itself a major risk factor for the recurrence of depression in adulthood [2, 3]. Among the most well-characterized risk factors are stress exposure (antenatal and perinatal) and patterns of emotion dysregulation in infancy indicated by temperamental dispositions towards avoidance, impulsivity and stress reactivity [4–6]. The determinants of early childhood depressive symptoms are of interest for clinical and preventative interventions. In this study, we will focus on early temperament and stressful life events, separately and in interaction, as predictors of anxiety and depressive problems in early childhood and draw on life course data to examine developmental pathways toward depressive symptoms.

1.1. Childhood Temperament as a Factor in Emotional Regulation. One of the most influential theories of temperament is Cloninger’s model grounded in genetic, psychobiologic, and evolutionary theory which informs a broad theory of personal and moral development as well as vulnerability to psychological disorder [7–9]. The role of temperament in Cloninger’s model is not dissimilar to that of other theories of temperament insofar as temperament is considered to
reflect individual differences in the regulation of experience which emerges early in life and remain moderately stable across development. Temperament is distinct from character which develops in a stepwise manner over the life course, progressively assimilating higher-order cognitive capacities, and experience-dependent social and cultural learning, leading to increasingly sophisticated representations of the self over time. Temperament is a highly heritable platform for such development but remains open to interaction with the environment across development.

Cloninger’s model of temperament is measured using four dimensions: novelty seeking (NS), harm avoidance (HA), reward dependence (RD), and persistence (P) [9]. Novelty seeking refers to a tendency to respond strongly to novel stimuli and to avoid monotony or potential punishment (and has been linked to dopaminergic activity). Harm avoidance is conceptualized as a tendency to show high reactivity to aversive stimuli leading to the inhibition of behavior (and has been associated with serotonergic activity). Reward dependence indicates a tendency to maintain behavior which has previously been associated with reward (and been related to noradrenergic activity). Persistence indicates a tendency towards perseveration of effort despite frustration but has not been linked to a specific monoamine neurochemistry. More recent animal studies have suggested considerable overlap in the monoamine neurochemistries underlying temperament [10, 11] while considerable research is currently emerging on the links between infant temperament and stress exposure in creating risk for anxiety and depressive problems in early childhood as a function of (1) infant temperament (avoidant, impulsive, reactive), and (2) the postnatal environment [17]. Van den Bergh’s review of 14 prospective studies suggested that antenatal maternal stress creates risk for behavioural and emotional regulation problems in children [18]. Theories derived from this body of literature focus on the early development of the HPA axis and the links between HPA dysregulation and vulnerability to anxiety and depressive disorders [19–21].

1.2. Stress in Early Childhood as a Factor in Emotional Regulation. Environmental stresses have been widely investigated as a source of anxiety and depressive problems in children and can be divided into stresses occurring as a result of (1) parental relationship dysfunction, (2) parent-child interaction, (3) socioeconomic disadvantage, or (4) negative life events [16]. Here we focus on negative life events occurring in early life as one of the most consistent predictors of anxiety and depressive problems across the life course. Increasingly, the application of ideas derived from the developmental origin of health and disease (DOHaD) hypothesis is suggesting a higher degree of vulnerability to stressors which occur within the antenatal and early postnatal environment [17]. The consistency of findings on both HA and NS temperament as predictive of anxiety and depressive disorders [19–21].

1.3. Interaction between Infant Temperament and Stress Exposure. Since temperament regulates a child’s personal experience of the external world, response to stressful life events might be expected to vary as a function of temperament style. In principle, temperament should interact with an individual’s appraisal of a given stressor, the degree of stress experienced, efforts to cope with stress, and psychobiological correlations of the response to stress [22]. However, little is known about interaction between infant temperament and stress exposure in creating risk for anxiety and depressive problems in early childhood. Yet temperament can be regarded as a behavioral proxy for heritable differences in stress regulation and is a potentially important driver of sensitivity to social challenges such as family life stressors and maternal depression. Greater knowledge of person-by-environment interactions therefore holds considerable promise for identifying at-risk populations and aligning psychosocial resources for effective and targeted prevention.

1.4. Aims and Hypotheses. The purpose of the study was to examine interaction between infant temperament and stress exposure in the development of anxiety and depressive symptoms in childhood (4- to 5-years) using data from 3425 children participating in the Longitudinal Study of Australian Children (LSAC). Specifically, the aims were to examine prediction of anxious-depressive symptoms in childhood as a function of (1) infant stress exposure, (2) infant temperament (avoidant, impulsive, reactive), and (3)
interaction between infant temperament and stress exposure. We sought to test the hypothesis that both stressful life events experienced in the first year of life and high reactive, avoidant, and impulsive children (high temperament risk) would directly and independently predict anxious-depressive symptoms in children at 4 years of age. We further hypothesized that high reactive, avoidant, and impulsive temperament styles would interact with early life stressors to augment risk anxious-depressive symptoms.

2. Methods

2.1. Study Design and Sample. Data was drawn from the first three waves of the Longitudinal Study of Australian Children (LSAC), a nationally representative study of the growth and development of children in Australia. LSAC was initiated by the Australian Government Department of Families, Housing, Community Services, and Indigenous Affairs. The sampling design and method have been described in Soloﬀ et al. [23]. LSAC used a two-stage cluster sampling design with Australian postcodes (stratiﬁed by state of residence and urban versus rural status) as the primary sampling units. Secondary sampling units were infants born between March 2003 and February 2004 selected from the Australian Medicare database. Random selection of infants within each postcode produced a cohort aged between 3 and 19 months, with all birth months represented. Of those selected infants who were contacted, 5107 parents elected to take part in the ﬁrst wave of LSAC in 2004 (64.2% response rate). Wave two data was collected in 2006, and wave three commenced in 2008. The sample for this current analysis was limited to the 3425 children who had complete data for the Strengths and Diﬃculties Questionnaire delivered in Wave 3 of the study at the 4-5-year time point.

2.2. Procedures. Data was collected from the child’s primary caregiver via face-to-face interview with a trained researcher. 98.6% of primary caregivers were the child’s mother [23]. After each interview, both primary and secondary caregivers completed a self-report questionnaire. The study was approved by the Australian Institute of Family Studies Ethics Committee, and a parent provided written informed consent for every participant.

2.3. Measures

2.3.1. Demographic Data. Mothers were asked to report on their child’s gender and age in months as well as their own age in years, country of birth (Australia/New Zealand versus other), marital status (married versus other), main language spoken at home (English versus other), and employment status (part time/variable work hours versus full time). Social and economic disadvantage was measured using Socioeconomic Indexes for Areas (SEIFA) which is based on Australian census data (Australian Bureau of Statistics, 2001). The index of relative socioeconomic disadvantage uses postcode of residence to determine neighborhood economic status and has been standardized to a mean of 1000 (SD 100), with higher values indicating a greater advantage.

2.3.2. Temperament. This study makes use of a shortened version of the Australian revision of the Toddler Temperament Scale (TTS). This is a highly regarded and frequently used questionnaire which is a psychometrically sound measure of early childhood behaviour [4]. The TTS is a 97-item measure which was ﬁrst implemented in the Australian Temperament Project in 1983. Items in the TTS are typically grouped into six temperament styles which have moderate-to-high internal consistency (alphas = 0.53–0.76) and good test-retest reliability [24]. The shortened TTS used in LSAC includes 4 items each for approach, persistence, and reactivity rated on a six-point scale (alphas = 0.98–0.99). For the current analysis, each temperament style was dichotomized into high/low. These were calculated by dividing the distribution into three equal groups with high scores taken as the top third of the distribution for reactive, and the bottom third of the distribution for persistence (to form “impulsive”) and approach (to form “avoidant”). Risk temperament styles were compared to the remaining two thirds of the distribution. For comparison to Cloninger’s terminology, the TTS dimension of reactive is analogous to novelty seeking, persistence refers to the same dimension and avoidant is analogous to Cloninger’s harm avoidance.

2.3.3. Early Life Stress. At the ﬁrst wave of the study, when children were between 0-1 years of age, parents indicated exposure to adverse life events over the past year. As such this period of time covers the late antenatal period and postpartum period of the child’s life. Participants indicated the exposure to such life events (yes or no) from a list of 13 items which included marital breakdown, serious illness or death of friend or relative, employment or workplace stressors, relationship conﬂict, and substance use. These were summed and dichotomised. Following Rutter’s observations regarding the deleterious impact of cumulative stressful life events, for the current analysis, high-stress environments were considered to be those in which parents indicated that they had experienced two or more of these stressful life events [25].

2.3.4. Anxiety and Depressive Symptoms. Anxiety and depressive symptoms were measured from the emotional symptoms subscale of the Strengths and Diﬃculties Questionnaire (SDQ) [26]. The SDQ is a 25-item measure of behavioral and emotional problems for children aged 4 to 16 years which is widely used and has sound psychometric properties. The anxiety and depressive symptoms scale has ﬁve items which are rated 1 = not true; 2 = somewhat true; 3 = certainly true. The mean of the 5 items is used as a summary score. Items assess anxiety and depressive symptoms of somatic complaints, worried, unhappy or tearful, nervous or lacking conﬁdence, and fearful. In the current study, a dichotomised score (high/low) was created by taking high scores to be those top decile (10%).

2.3.5. Covariates. Information was collected about several factors which may potentially confound the relationship between early life stress and anxiety and depressive symptoms. For this study, we examined differences between
children with and without anxiety and depressive symptoms at 4–5 years of age in terms of gender, family structure (married versus other), and indicators of socioeconomic status (SEIFA score as a continuous measure as described above). We also examined ethnicity as a potential covariate in terms of Australian/New Zealand origin versus other.

2.4. Statistical Analysis. All analyses were performed using the SPSS version 18 (SPSS Inc, Chicago, Ill, USA). Those with missing data on all of the key variables were excluded listwise from the analyses. Population weights were used in all adjusted analyses.

We examined the joint effect of temperament (reactive, persistent, and approach) and early life stress on risk for anxiety and depressive problems in childhood based on the additive scale and using a 2 × 4 table format with a single common reference group [27, 28]. This approach differs from conventional models of interaction based on the multiplicative scale and using at least two reference groups (one for each level of the moderating variable). The 2 × 4 approach provides easily accessible information on the independent and joint effects of each risk factor with respect to a reference group defined by exposure to neither risk factor. We defined four composite exposures: (level 1) high temperamental risk and high social stress (joint effects), (level 2) high temperamental risk and low social stress (temperamental risk only), (level 3) low temperamental risk and high social stress (social risk only), and (level 4) low temperamental risk and low social stress (reference group).

Joint effects were examined by comparing risk associated with the joint exposure to both temperament and social stress factors (level 1) and risk associated exposure to neither factor (level 4, references group). However, joint exposure does not necessarily mean that both temperament and life stress processes are acting together within one causal mechanism. To estimate the percentage of risk due to the combined actions of both exposures, we first summed risks at level 2 (temperamental risk only) and level 3 (early life stress risks only) and then subtracted the background risk (level 4) to obtain the expected risk for no interaction. The difference between the expected risk for no interaction and the observed risk for joint exposure was then divided by the observed risk for joint exposure to represent the % risk attributable to the joint action of both exposures. Interaction is notable when the % risk attributable to joint interaction exceeds 30% [29].

Within each exposure level, we estimated the positive predictive value (PV+) and the attributable risk percent (AR%, also referred to as the attributable fraction in the exposed). PV+ is the probability of reporting problematic anxiety and depressive symptoms given exposure status and provides information of value for prediction of individual level risk. AR% is the proportion of individuals showing anxiety and depressive symptoms within a particular exposure level that is attributable to having that exposure (cf. reference group).

3. Results

3.1. Sample Characteristics. Baseline characteristics were examined from the first wave of the study for those children and parents who reported on anxiety and depressive symptoms at the third wave of the study. Sample characteristics were examined including gender, age of parent and child, parental education, ethnicity, and socioeconomic status. Differences between categorical and continuous data for these variables for the groups with and without anxiety and depressive symptoms were examined. Significant differences were discerned using a Chi square or independent samples t-test as appropriate and results are shown in Table 1. Significant differences were found for mothers of children in the anxiety and depressive symptoms group being slightly younger and less likely to be married.

3.2. Infant Temperament, Infant Stress Exposure and Childhood Anxiety and Depressive Maladjustment. Association between early life stress in the first year of life, child temper-ament at 2 years of age, and anxiety and depressive symptoms at 4 years of age were tested using logistic regression. In the direct model, each variable was entered simultaneously into the regression model, and results are therefore controlled for...
the effect of the other predictors. Risk relationships were observed for all predictor variables (Table 2). Notably, the odds of reporting anxious-depressive symptoms in childhood were doubled in those with high reactive and avoidant temperament styles. More marginal elevations in the odds of reporting childhood anxiety and depressive problems (~20 to 40%) were observed for high impulsivity and stress exposure, respectively. In the second step of the logistic regression analysis, interaction between gender and temperament and gender and stress were examined. There was evidence of an interaction between gender and avoidant temperament in prediction of anxious-depressive symptoms; specifically, that the relationship between avoidant temperament styles and anxious-depressive symptoms was higher for boys than girls. There was no evidence of interaction between gender and either reactive or impulsive styles.

There was no evidence of infant temperament by stress exposure correlations. Tables 3, 4, and 5 show no evidence of interaction between temperament and stress exposure in prediction of anxious-depressive symptoms in childhood for any of the three temperament styles examined; however, interaction between infant reactivity and stress exposure was close to being noteworthy (28%). Odds ratios and PV+ estimates were highly consistent across each risk level: temperament only OR: 1.2–1.9/PV+ 10–12%, social stress only OR: 1.3–1.4/PV+ 9–11%, and interaction OR: 1.9–3.0/PV+ 14–19%. AR% was higher than PV+ in all cases; however, AR% for infant impulsivity was lower than for reactive and avoidant temperaments (19% cf. 47–48%).

4. Discussion

The purpose of the study was to examine independent and interactive effects of early stressful life events and temperament style in the development of anxiety and depressive symptoms in early childhood. Results support the notion that stressful family environments experienced in the infant’s first year of life and high reactive, avoidant, and impulsive temperament styles directly and independently contribute to anxiety and depressive symptoms in children at 4 years of age. However, contrary to expectations, we observed no notable interaction between temperamental and social risks. This study does not support the hypothesis that temperament style creates underlying patterns of individual susceptibility to social risks for later emotional disorders.

The central question in the current paper concerns the possible interaction between environmental factors inducing stress and heritable individual differences in temperament. Both experimental studies in animals and naturalistic studies of children raised in adversity have shown that severe perturbations in the family environment such as maternal deprivation and significant maltreatment can produce derangement of the normal relationships between monoamine neurotransmitters [30, 31]. The current study examines more modest perturbations of the family environment consistent with degrees of early life stress exposure which are relatively common in Western populations.

Temperament is generally understood to refer to emotional or affective aspects of the developing personality [32]. This relationship between emotional regulation and the development of anxiety and depressive symptoms emerged strongly as our two-year-old temperament measures uniquely and independently predicted later mood-related symptoms 4-5-year children. This result confirms the predictive validity and clinical significance of temperament as an early risk factor indicating vulnerability for childhood onset depressive symptoms.

While a number of studies have found associations between Cloninger’s temperament dimension of harm avoidance and depression, these studies have largely been conducted with clinical adult populations [13, 33–35]. The current finding suggests an extension within a child sample of Cloninger’s finding in an adult population sample that HA is predictive of depression [36]. Findings with respect to Cloninger’s novelty seeking (NS), considered here to be analogous to reactivity, have been mixed. While Celikel et al. [13] did report an association between NS and depression, there have been several studies which have not found such an association [37, 38].
Table 3: Odds ratios for anxiety and depressive symptoms at age 4 years attributable to person-environment interaction between early life stress and reactive temperament style.

<table>
<thead>
<tr>
<th>Infant reactivity</th>
<th>Stress exposure</th>
<th>Noncase</th>
<th>Case</th>
<th>OR†</th>
<th>95% CI†</th>
<th>PPV</th>
<th>AR%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
<td>Reference</td>
<td>1405</td>
<td>113</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>ORe†</td>
<td>620</td>
<td>64</td>
<td>1.3 (0.96-1.5)</td>
<td>9%</td>
<td>22%</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
<td>ORp†</td>
<td>360</td>
<td>54</td>
<td>1.9 (1.3-2.6)</td>
<td>13%</td>
<td>47%</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
<td>ORpe†</td>
<td>200</td>
<td>48</td>
<td>3.0 (2.1-4.3)</td>
<td>19%</td>
<td>66%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>2585</td>
<td>279</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additive model of interaction:

\[ \text{OR}_{E} + \text{OR}_{P} - 1 \]

Expected ORpe Departure from expected % of ORpe attributable to the joint action of person and environment

\[ \text{OR}_{pe} - E \]

\[ \frac{\text{DE}}{\text{OR}_{pe}} \]

1 OR: odds ratio, 95% CI: 95% confidence interval, ORe: infant stress exposure, ORp: infant temperament, ORpe: infant temperament and stress exposure, Reference: neither exposure; AR%: attributable risk percent, PPV: positive predictive value.

Table 4: Odds ratios for anxiety and depressive symptoms at age 4 years attributable to person-environment interaction between early life stress and avoidant temperament style.

<table>
<thead>
<tr>
<th>Infant avoidance</th>
<th>Stress exposure</th>
<th>Noncase</th>
<th>Case</th>
<th>OR†</th>
<th>95% CI†</th>
<th>PPV</th>
<th>AR%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
<td>Reference</td>
<td>1182</td>
<td>86</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>ORe†</td>
<td>531</td>
<td>55</td>
<td>1.4 (1.00-2.0)</td>
<td>9%</td>
<td>30%</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
<td>ORp†</td>
<td>584</td>
<td>81</td>
<td>1.9 (1.4-2.6)</td>
<td>12%</td>
<td>48%</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
<td>ORpe†</td>
<td>290</td>
<td>57</td>
<td>2.7 (1.9-3.9)</td>
<td>16%</td>
<td>63%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>2587</td>
<td>279</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Additive model of interaction:

\[ \text{OR}_{E} + \text{OR}_{P} - 1 \]

Expected ORpe Departure from expected % of ORpe attributable to the joint action of person and environment

\[ \text{OR}_{pe} - E \]

\[ \frac{\text{DE}}{\text{OR}_{pe}} \]

1 OR: odds ratio, 95% CI: 95% confidence interval, ORe: infant stress exposure, ORp: infant temperament, ORpe: infant temperament and stress exposure, Reference: neither exposure; AR%: attributable risk percent, PPV: positive predictive value.

Table 5: Odds ratios for anxiety and depressive symptoms at age 4 years attributable to person-environment interaction between early life stress and impulsive temperament style.

<table>
<thead>
<tr>
<th>Group</th>
<th>Infant impulsivity</th>
<th>Stress exposure</th>
<th>Noncase</th>
<th>Case</th>
<th>OR†</th>
<th>95% CI†</th>
<th>PPV</th>
<th>AR%</th>
</tr>
</thead>
<tbody>
<tr>
<td>low/low</td>
<td>low</td>
<td>Low</td>
<td>Reference</td>
<td>1079</td>
<td>94</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>low/high</td>
<td>low</td>
<td>High</td>
<td>ORe†</td>
<td>515</td>
<td>62</td>
<td>1.4 (1.00-2.0)</td>
<td>11%</td>
<td>29%</td>
</tr>
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<td>high/low</td>
<td>high</td>
<td>Low</td>
<td>ORp†</td>
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<td>73</td>
<td>1.2 (0.90-1.7)</td>
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<td>19%</td>
</tr>
<tr>
<td>high/high</td>
<td>high</td>
<td>High</td>
<td>ORpe†</td>
<td>305</td>
<td>50</td>
<td>1.9 (1.30-20.8)</td>
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<td>48%</td>
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<td></td>
<td>2586</td>
<td>279</td>
<td></td>
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</table>

Additive model of interaction:

\[ \text{OR}_{E} + \text{OR}_{P} - 1 \]

Expected ORpe Departure from expected % of ORpe attributable to the joint action of person and environment

\[ \text{OR}_{pe} - E \]

\[ \frac{\text{DE}}{\text{OR}_{pe}} \]

1 OR: odds ratio, 95% CI: 95% confidence interval, ORe: infant stress exposure, ORp: infant temperament, ORpe: infant temperament and stress exposure, Reference: neither exposure; AR%: attributable risk percent, PPV: positive predictive value.
The current findings are interesting to consider in the light of the idea that temperament is one of the relatively stable characteristics to emerge early in the development of personality across the life course [39]. It is also widely acknowledged that temperament interacts with life course factors to moderate continuity and change in personality across development [9, 40]. However, the current study suggests that the very early experience of a moderate level of life stress within the family environment does not substantially interact with the temperament styles measured in the current study. This is consistent with Cloninger’s assertion that temperament is relatively immune from the influence of culture or social experience [41].

It is also to be noted that our results point to an interaction between gender and temperament in prediction of anxiety and depressive symptoms, showing that boys with avoidant temperament are particularly susceptible. In a recent meta-analysis, negative affectivity did not show significant gender differences with the small gender difference in fear ($d = 0.12$) not being sufficient to conclude that boys and girls differ markedly in fearfulness [42]. Our finding that boys with avoidant temperament are more vulnerable than girls suggests that there may be a subset of boys whose avoidant temperament predisposes them to negative social experiences and negative self-appraisal.

Our interest in interaction is based on a desire to understand modifiable factors in early development which could be a target for preventive intervention. Despite marked improvements in knowledge of individual risk factors for childhood anxiety and depressive problems, the efficacy of most universal (school-based) preventive interventions designed to minimize risk exposure remains unremarkable [43]. Targeted approaches to preventive intervention appear to hold greater promise [43]; however, they remain fundamentally limited by a general lack of knowledge about individual differences in sensitivity to stressful life events (person-by-environment interaction). From this applied perspective, the current results suggest that investment should be targeted at developing independent and tailored preventive intervention aimed at minimising risk associated with both temperamental and social risk factors for anxious-depressive symptoms in early childhood. However, further research is needed to identify social exposures that are capable of buffering constitutional factors. Such exposures may well be factors which have a more direct impact on the child such as parental mental health, family conflict, and hostile parenting styles.

This study presented a unique opportunity to test such models in several respects. Very few large population studies in children have the scope to examine the interactions of both life stressors and temperament across early childhood using several different modeling techniques. Sample size also permits robust testing of differences between male and female children in the cohort in a nationally representative sample with relatively low attrition across three waves of data collection. As a population-based study, this also includes inevitable limitations in terms of the use of brief measures of anxiety and depressive symptoms and parental report versions of temperament and life stress variables. The life stress measure can only act as an indicator of environmental events which are assumed to lead to infant stress exposure but without a physiological indicator of stress reactivity; this remains only an assumption. Our study was also based on an assumption that what we regarded as a moderate degree of stress exposure would be sufficient to find both direct and interactive effects. In addition, the study design asked parents to rate stress over the last year while their infants were within their first year, thereby, not enabling a clear demarcation between antenatal and postnatal stressors nor precision in the time of stress exposure. Studies vary widely in terms of the level, timing, and type of infant stress exposure so this suggests that future studies and reviews can examine different timing, levels, and types of infant stress exposure. Finally, it should be noted that we examined anxious and depressive symptoms only at one-time point which does not rule out the possibility that the interaction between early life stress and child temperament may be discerned at a later point in development.

Our emphasis in this study has been to investigate infant stress exposure and temperament as predictors of early childhood indicators of anxiety and depressive symptoms. Major environmental adversity such as maternal deprivation has been repeatedly shown to be capable of overriding temperament. Our findings indicate that temperament styles are considerably stronger predictors of such anxiety and depressive symptoms than exposure to a moderate level of early life stress. We have found that moderate environmental stressors in the family environment as a whole seem to have little or no interaction with temperament and allow for the persistence of temperament influence in early child adjustment. Such findings suggest that temperament requires a “species typical” family social environment in order to influence the direction of child development, but it is also reasonably robust to moderate environmental perturbation. Our findings also suggest a differential susceptible to avoidant temperament as a risk factor for anxiety and depressive symptoms specifically in boys supporting previous findings suggestive of sex-specific gene × environment interactions with temperament operating across the developmental life course [44].

Conflict of Interests

All authors declare that they have no conflict of interests.

Acknowledgments

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FaHCSIA. The authors would like to thank Kate Scalzo and Lynne Millar for their assistance and advice in LSAC data management.

References


[34] M. Hansenne, J. Reggers, E. Pinto, K. Kjiri, A. Ajamier, and M. Ansseau, "Temperament and character inventory (TCI) and


Research Article
The Effects of Temperament and Character on Symptoms of Depression in a Chinese Nonclinical Population

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Objective. To examine the relations between personality traits and syndromes of depression in a nonclinical Chinese population.

Method. We recruited 469 nonclinical participants in China. They completed the Chinese version temperament and character inventory (TCI) and self-rating depression scale (SDS). A structural equation model was used to rate the relation between seven TCI scales and the three SDS subscale scores (based on Shafer’s meta-analysis of the SDS items factor analyses). This was based on the assumption that the three depression subscales would be predicted by the temperament and character subscales, whereas the character subscales would be predicted by the temperament subscales. Results. The positive symptoms scores were predicted by low self-directedness (SD), cooperativeness (C), reward dependence (RD), and persistence (P) as well as older age. The negative symptoms scores were predicted only by an older age. The somatic symptoms scores were predicted by high SD.

Conclusion. Syndromes of depression are differentially associated with temperament and character patterns. It was mainly the positive symptoms scores that were predicted by the TCI scores. The effects of harm avoidance (HA) on the positive symptoms scores could be mediated by low SD and C.

1. Introduction

Depression is the most prevalent mental disorder in many countries. Personality has been extensively studied as a risky factor of depression. One of the most promising theories to understand depression from the personality perspective is Cloninger’s biosocial personality model. This has come from behavioral genetics, neuropharmacology, and psychology, and it gives insight into the etiology of depression [1–3]. This model posits seven personality traits: four temperament dimensions (novelty seeking (NS), harm avoidance (HA), reward dependence (RD), and persistence (P)) and three character dimensions (self-directedness (SD), cooperativeness (C), and self-transcendence (ST)). Temperament is determined by genetic structure and manifests itself as a heritable component of one’s behavior. It refers to reflective emotional reactions. Character refers to self-identity, which is acquired primarily through a socialization process, although recent study also identified a hereditary contribution to the development of character. Character is considered to be evoked by temperament. Such interaction of the two dimensions enhances cognitive learning of an individual’s self-concept throughout the lifespan [4].

There are many reports suggesting that high HA and low SD predict depression [5–12], although other subscales of temperament and character were found to be related to depression in a few studies.

Almost all the studies on the association between personality traits and depression have been performed as if depression is a homogeneous condition. However, factor analyses of depressive symptoms generally noted that depressive symptoms consisted of a few syndromes. Thus, a new paradigm may be required from whether personality trait predicts depression to which personality traits predict
which depressive syndrome. It should also be noted here that research has shown that the constructs of depressive symptoms in clinical and nonclinical populations are qualitatively identical [13]. Difference between clinical and nonclinical populations in depression is symptom severity [14, 15].

Another issue about the studies on the association between depression and personality—particularly temperament and character—is previous investigations treating temperament and character domains simultaneously predicting depression. However, Cloninger has posited that temperament is a set of reflect emotions on which character develops. Thus, it is feasible to speculate that the effects of temperament, if any, on depression may not be direct but be mediated via character. Hence, 0-order correlations between temperament subscale scores and depression scores may be spurious. This point has rarely been studied empirically.

The objective of this paper is to examine the relations between personality traits and syndromes of depression in a nonclinical Chinese population. We paid attention to the mediation of the effects of temperament on depression via character as well as differential association with depressive syndromes.

2. Methods

2.1. Participants and Procedure. The data of the present study came from a population of 486 inhabitants in Beijing City, Shenyang city, and Dalian city (all cities are located in the north eastern area of China). We distributed 500 set of questionnaires and stamped envelopes to office workers of three companies separately in above three cities. Usable questionnaires were returned by 469 participants. They were 235 men and 234 women. Their ages ranged between 18 and 81 years. Men were slightly but significantly (t = 1.98, P < 0.05) older (M = 42.8; SD = 11.7) than women (M = 40.6; SD = 11.9).

2.2. Measures

2.2.1. Temperament and Character. The temperament and character inventory (TCI) [2] was used to assess two aspects of personality—temperament and character. Temperament, which is moderately heritable and stable throughout life, refers to automatic emotional responses to experiences. This includes four dimensions, NS, HA, RD, and P. Character refers to self-perception and individual differences in goals and values that influence voluntary choices, intentions, and the meaning of experiences throughout life. Character, which is also moderately heritable [16] but influenced by sociocultural learning, matures in progressive steps throughout life. This factor includes SD, C, and ST. We used the 144-item Chinese version of the TCI [17]. Each scale of the TCI (NS, HA, RD, P, SD, C, and ST) consists of 20 items. Each item in the original version is rated with a 2-point scale (“yes” or “no”). In this study, items were rated using a 5-point scale (1 = “very unlikely” to 5 = “very likely”). This was because 5-point scales were more suitable for factor analysis compared with two-point scales.

2.2.2. Depression. The self-rating depression scale (SDS) [18] was used to rate depressive mood. It consisted of 20 items selected by the factor analysis. It has been translated into a wide range of languages and its validity and reliability across cultures have been thoroughly assessed. From the time of the original report of the SDS, there have been efforts to evaluate factor structure of the SDS [19–21] and a number of factors structure models have been found.

2.3. Statistical Analysis. We followed the results of Shafer’s [20] meta-analyses of SDS that confirmed three subscales—positive, negative, and somatic symptoms. The positive symptoms subscale includes “enjoy things” (item 20), “feel useful and needed” (item 17), “my life is pretty full” (item 18), “mind is clear as ever” (item 11), “easy to make decisions” (item 16), “hopeful about future” (item 14), “easy to do things” (item 12), “I enjoy attractive men/women” (item 6), and “feel best in morning” (item 2). Negative symptoms subscale includes “have crying spells” (item 3), “feel downhearted, sad, blue” (item 1), “more irritable than usual” (item 15), “restless and cannot keep still” (item 13), “tired for no reason” (item 10), “have trouble sleeping” (item 4), “heart beats faster than usual” (item 9), and “others better off if I were dead” (item 19). Somatic symptoms subscale includes “I am losing weight” (item 7), “eat as much as usual” (item 5), and “trouble with constipation” (item 8).

We tried to create three subscales of the SDS by adding scores of the items belonging to each subscale. However, item 6 of the positive symptoms, items 4, 9, 15, and 19 of the negative symptoms, and item 7 of the somatic symptoms were reversely correlated with other item scores of each total score; thus, they were excluded from the summation to create the subscale.

In order to analyse the relationship of depression syndrome and temperament and character scales, we examined means, SDs, and internal consistency (measured as Cronbach’s alpha coefficient) of all the variables used in this study. We then correlated all of them. We set alpha level at 0.001 rather than 0.05 because of multiple comparisons.

The associations between the depressive and personality scales were studied with the following hypotheses. Because Cloninger hypothesized that character domains would develop based on the temperament domain profiles, we posited that all the temperament scales would predict both the character domain scales and the depressive symptomatology scales. We also posited that the character domain scales would predict the depressive symptomatology scales. Both gender and age of the participant were expected to predict all the personality and depressive symptomatology scales. According to these hypotheses, we created a structural equation model (SEM) (Figure 1).

Statistical analyses were performed using SPSS 18.0 and AMOS 18.0 [22]. The fit of the CFA model was examined in terms of chi-squared (CMIN), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). According to conventional criteria, a good fit would be indicated by CMIN/df < 2, GFI > 0.95, AGFI > 0.90,
Figure 1: The original model. NA: negative affectivity; NS: novelty seeking; HA: harm avoidance; RD: reward dependence; P: persistence; SD: self-directedness; C: cooperativeness; ST: self-transcendence. The correlations among error variables in temperament/character dimensions were not indicated.

CFI > 0.95, and RMSEA < 0.05; an acceptable fit by CMIN/df < 3, GFI > 0.90, AGFI > 0.85, CFI > 0.85, and RMSEA < 0.10 [23].

3. Results

3.1. Characteristics of the TCI and SDS Subscales. Table 1 shows the means, SDs, and internal consistency of all the SDS and TCI scale scores. The Cronbach's alpha coefficients of the three SDS scales ranged between 0.44 and 0.80. Those of the seven TCI scales ranged from 0.41 to 0.81 for the temperament scales and from 0.65 to 0.82 for the character scales.

The correlations between the scales of TCI and SDS are also shown in Table 1. High HA and low SD were significantly correlated only with the positive symptom scores but, unexpectedly reversed with the negative as well as somatic symptoms scores. Among the SDS subscale scores, the positive symptoms scores were inversely correlated with the negative and somatic symptom scores whereas the latter two scores were positively correlated. Among the temperament subscales, NS and HA were inversely correlated with P whereas among the character subscales, SD was correlated positively with C and inversely with ST. Between temperament and character subscales, NS and HA were inversely correlated with SD and C; RD was correlated with C; P was correlated with SD, C, and ST.

3.2. The Relations between Personality and Depression in a SEM Path Analysis. We posited the original model with covariances between error variables of NS and HA with that of P as well as between error variables of C and ST with that of SD because of significant correlations observed in bivariate correlations. This model yielded CMIN/df = 1.8, GFI = 0.996, AGFI = 0.950, CFI = 0.996, and RMSEA = 0.042 (90% CI = 0.000–0.081). These indices suggested a good fit of the model with the data.

In this model (Figure 2), the positive symptoms scores were predicted by low C, SD, RD, and P as well as older age; the negative symptoms scores were predicted only by older age, and; the somatic symptoms scores were predicted by high SD. SD and C were predicted by low NS and low HA; C was predicted by RS as well as female gender; ST was predicted by high NS, HA, and P as well as older age.

4. Discussion

To the best of our knowledge, this study is the first to examine the differential associations of the TCI scales and different syndromes of depression. We also studied this issue taking the proposal of Cloninger into account that character develops based on temperament.

Depression has been thought of as compilation of different symptoms. There were many studies demonstrating several factors of depressive symptoms using a variety of rating instruments. And yet it has been not very common to examine the links of risky factors such as personality traits as in this study after dividing depressive symptoms into discrete syndromes. Our study showed the three depressive syndrome scores—the positive, negative, and somatic symptom scores—had unique links with the TCI subscale scores.
Table 1: Correlations, means, SDs, and internal consistency of the SDS and TCI scores.

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<tr>
<td>Somatic symptoms</td>
<td>0.43***</td>
<td>0.63***</td>
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Note: NA: negative affectivity; NS: novelty seeking; HA: harm avoidance; RD: reward dependence; P: persistence; SD: self-directedness; C: cooperativeness; ST: self-transcendence.

* P < 0.05; ** P < 0.01.
High HA and low SD have usually been reported as associated with depression. However, our study showed that high HA and low SD were linked only with the positive symptoms scores in a bivariate analysis. This suggests that lack of positive mood (such as “enjoy things,” “feel best in morning”) and cognition (“feel useful and needed,” “my life is pretty full,” “mind is clear as ever,” “easy to make decisions,” “hopeful about future,” and “easy to do things”) were associated with this personality trait pattern.

HA is the temperament trait that many studies demonstrated connecting to depression [7, 9, 11, 12, 24–37]. Only a few studies showed contradictory results [38, 39]. However, high HA is not specific to depression. It was reported to be associated with panic disorder [40], social phobia [41], specific phobia [42], obsessive-compulsive disorder [43–45], posttraumatic stress disorder [46], anorexia nervosa [47], bulimia nervosa [46, 48], somatization disorder [49], body dysmorphic disorder [50], schizophrenia [51], primary insomnia [52], pain [53], attention deficit/hyperactivity disorder [54, 55], autism spectrum disorders [54], and anxiety in general [12]. Hence, high HA may be a nonspecific trait for anxiety rather than depression per se. In this study, high HA was linked not to affective syndrome but to cognitive syndrome. Thus, high HA may be a risk factor of cognitive dysfunctioning that in turn makes individual vulnerable to anxiety (such as worrying, pessimism, shyness, and being fearful and doubtful [56]) of different types of psychopathology.

Another unique finding of this study is the lack of a direct link from high HA towards any of the depressive syndromal scores. HA predicted low SD and C that in turn predicted the positive symptoms scores. Thus, low SD and C mediated the effects of HA on the positive symptoms scores.

As in high HA, low SD was also known as a risk factor of depression [7, 9, 11, 12, 24–36]. Yet again, low SD is not a risky factor specific to depression. Low SD was reported to be associated with many other axis I and axis II disorders. In the present study, low SD was linked to lack of positive mood and cognition. Hence, low SD may be a nonspecific risky factor of psychological maladjustment.

Low RD and P were also reported in some studies as a risky factor of depression [12, 24, 27, 29, 34]. In this study, low RD and P were associated only with positive symptoms scores.

The positive symptoms scores were also linked to low C in this study. This was echoed in some previous studies [7, 9, 12, 26–29, 32, 34]. People low in affectionate ties with others may be more likely to feel depressed. Cooperativeness trait insists on coordination, harmony, solidarity, and so on. Low C may mean unsophisticatedness, being inconsonant, or even unsociable, and then can induce poor interpersonal relationship or low social support. Under these conditions, when an individual is hit by a crisis or suffers from a blow, without sufficient or effective social support or emotional platform, he or she may be in the lack of positive mood or cognition.

The uniqueness of the study is the examination of differential links of the TCI subscale scores with the three depressive syndromal scores. Most of the previous studies examined the association of the TCI subscale scores with
the severity of depression as a whole. They rarely studied such association in different syndromes of depression. Our study suggested that while low SD, C, RD, and P predicted lack of positive mood and cognition, none of the TCI subscale scores except SD predicted the negative symptoms scores. Unexpectedly, high SD predicted the severity of the somatic symptoms scores after controlling the effects of all the other variables. This was what we did not expect and could not explain without difficulty. The negative symptoms scores (i.e., “have crying spells,” “feel downhearted, sad, blue,” “restless and cannot keep still,” “tired for no reason”) are thought of as core symptoms of depression and yet were predicted by none of the TCI subscales but by older age. Our study suggested different personality dimensions would predict different syndromes of depression.

Limitations of this study should be considered. This study was cross sectional. Hence the results may not indicate causality. Links posited in the path model were hypothetical and thus may be interpreted in reverse directions. Longitudinal studies following individuals with a set of measurements (e.g., [57]) may clarify the causality issue. Another drawback of this study was heavy reliance on self-report questionnaire. Depression may be better assessed by structured interviews. A third drawback is the fact that we used only nonclinical population. Studies on clinical populations may reveal different findings.

Although we relied on the meta-analysis of Shafer [20] of the SDS factor structure in order to make it easy to make international comparison, it remains to be further studied whether the factor structure of depression symptoms such as those measured by the SDS among a Chinese population would be the same as that reported in the Western countries. For example, the internal consistency was good for the positive symptoms score but fair or even worse for the other two SDS subscale scores. The factor structure of the SDS was reported using a Japanese population [19, 21], out of which Kitamura and colleagues [58] reported the factor structure of the SDS in a fairly large (more than 20,000) population in Japan. An exploratory factor analysis yielded three factors—affective, cognitive, and somatic. Their affective factor included items such as “feel downhearted, sad, blue” (item 1), “have crying spells” (item 3), “heart beats faster than usual” (item 9), “tired for no reason” (item 10), “restless and cannot keep still” (item 13), “more irritable than usual” (item 15), and “others better off if I were dead” (item 19). Thus, this factor corresponds to Shafer’s [20] negative symptoms. Kitamura et al.’s [58] cognitive factor included items such as “hopeful about future” (item 14), “easy to make decisions” (item 16), “feel useful and needed” (item 17), and “my life is pretty full” (item 18). Hence, this factor corresponded to Shafer’s [20] positive symptoms. Kitamura et al.’s [58] Somatic factor included items such as “eat as much as usual” (item 5), “I enjoy attractive men/women” (item 6), and “easy to do things” (item 12). This factor differed from Shafer’s [20] somatic symptoms. Therefore, the factor structures of the SDS in East Asian countries may not be very different from each other as well as from those in Western countries.

Another methodological concern of this study is relatively poor internal consistency of the TCI subscale scores.

Cronbach’s alpha was over 0.70 in HA, P, SD, and ST. Use of personality measures developed in the Western countries such as the TCI should be considered with caution when applying in a non-Western country like China. We used the Chinese version of the TCI which was one of the early versions of the measure. We should use the revised TCI (TCI-R) in a future study.

Finally, we should be very cautious about the robustness of the results. Ideally, we should solicit a larger and representative population in China. A resampling method such as bootstrapping may have to be considered. However, bootstrapping may potentially magnify the effects of unusual features in a data set and is not a magical means to compensate unrepresentativeness of the data [59, page 43].

Taking these methodological shortcomings into consideration, this study suggests that syndromes of depression are differentially associated with temperament and character patterns and that the effects of temperament on depression are mediated through character.

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References


**Research Article**

**Eating Disorders and Major Depression: Role of Anger and Personality**

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This study aimed to evaluate comorbidity for MD in a large ED sample and both personality and anger as clinical characteristics of patients with ED and MD. We assessed 838 ED patients with psychiatric evaluations and psychometric questionnaires: Temperament and Character Inventory, Eating Disorder Inventory-2, Beck Depression Inventory, and State-Trait Anger Expression Inventory. 19.5% of ED patients were found to suffer from comorbid MD and 48.7% reported clinically significant depressive symptomatology: patients with Anorexia Binge-Purging and Bulimia Nervosa were more likely to be diagnosed with MD. Irritable mood was found in the 73% of patients with MD. High Harm Avoidance (HA) and low Self-Directedness (SD) predicted MD independently of severity of the ED symptomatology, several clinical variables, and ED diagnosis. Assessing both personality and depressive symptoms could be useful to provide effective treatments. Longitudinal studies are needed to investigate the pathogenetic role of HA and SD for ED and MD.

1. Introduction

Lifetime comorbidity between Eating Disorders (EDs) and Mood Disorders has been confirmed by several retrospective studies reporting that in Anorexia Nervosa (AN) the prevalence of mood disorders varies between 64.1% and 96% whereas in Bulimia Nervosa (BN) between 50% and 90%. In addition, a substantial part of individuals affected by an ED is likely to be affected also by a mood disorder, and the current comorbidity varies from 12.7% to 68% in AN and is about 40% in BN [1]. Major Depression (MD) is the most prevalent comorbid mood disorder in ED patients, and the severity of depressive symptomatology seems to be related to the ED one [2–5].

In spite of the importance of this topic, most of previous studies on mood in ED were conducted on small samples (e.g., fewer than 30 cases), and the role of age, duration of illness, and weight were not considered. Moreover, ED subtypes and their differences were not carefully classified, particularly Eating Disorder Not Otherwise Specified (EDNOS) [6], and the dimensional assessment of depressive symptomatology was not evaluated in detail. Furthermore, the experience and expression of anger in patients with comorbid depression and ED have been relatively neglected, even though hostility and aggressiveness are commonly reported in ED populations [7, 8].

Indeed anxious/preoccupied behaviors, mood intolerance, and dysthymic traits have been reported in ED patients [5, 9, 10]. Studies conducted with the Temperament and Character Inventory (TCI) [11] have found that ED individuals both in the acute phase [9, 12, 13] and after remission [14–16] performed higher scores of Harm Avoidance (HA) and low scores of Self-Directedness (SD) than healthy controls. Individuals with these personality features are thought to have poorer abilities to cope with stressful life events [9, 13] and, although future studies are needed high HA and low SD have been proposed as potential risk factors for ED and not only consequences of the illness [13]. Various authors have found such alterations of personality dimensions—high HA and low SD—in patients with MD.
[17–19] also after remission [20–22]; hence, it should be noted that the alterations of these traits are not only state dependent, as suggested by some studies [23]. Despite these findings, few studies have examined the personality traits of patients with comorbid ED and MD, after controlling for eating psychopathology and other clinical variables.

With this study we aimed to (a) evaluate the prevalence of a current MD in a large sample of ED patients; (b) assess the prevalence of MD with irritable mood in ED patients; (c) provide data supporting the correlation between MD and ED severity; (d) show possible differences between ED patients with and without MD, independently from the severity of eating symptomatology.

2. Materials and Methods

The sample consisted of 838 patients admitted to the outpatient service of the ED Program of the University of Turin between the 1st of January 2003 and the 31st of December 2010. All subjects were diagnosed with an ED, and the sample was represented by the following subjects: December 2010. All subjects were diagnosed with an ED, Turin between the 1st of January 2003 and the 31st of

2.1. Temperament and Character Inventory (TCI). The TCI [11] is divided into seven dimensions. Four of these assess temperament (Novelty Seeking [NS], Harm Avoidance [HA], Reward Dependence [RD], and Persistence [P]), defined as partly heritable emotional responses, stable throughout life, mediated by neurotransmitters in the central nervous system. The other three dimensions assess character (Self-Directedness [SD], Cooperativeness [C], and Self-Transcendence [ST]), defined as the overall personality traits acquired through experience.

2.2. State-Trait Anger Expression Inventory (STAXI). The 44-item STAXI [26] measures the intensity of anger as an emotional state (State-anger) and the disposition toward anger as a personality trait (Trait-anger). Anger Expression-In (AX-In) measures the suppression of angry feelings. Anger Expression-Out (AX-Out) measures the frequency of the expression of anger toward other people or objects in the environment. Anger Expression Control (AX-Con) measures the control of anger. AX/Ex provides a general index of the expression of anger.

2.3. Beck Depression Inventory (BDI). The BDI [27] is a self-report questionnaire used to assess the severity of symptoms of depression. Clinical euthymia is defined by scores lower than 10. The BDI has been found to be a reliable instrument for assessing depressive symptoms in ED patients.

2.4. Eating Disorder Inventory-2 (EDI-2). The EDI-2 [28] is a self-report measure of disordered eating attitudes and behaviors, as well as of personality traits common to individuals with ED. Eleven subscales evaluate symptoms and psychological correlates of ED.

2.5. Statistical Analysis. Statistical analyses were carried out using Statistical Package for Social Sciences (SPSS) software version 13.0 for Windows (SPSS 13.0 Application Guide. Chicago, SPSS, Inc., 2004). Categorical data were compared using the chi-squared test, and continuous data were analysed using a two-tailed independent t-test. Age, age of onset of the disorder, duration of illness, and Body Mass Index (BMI) were analysed in terms of confounding variables using a Univariate General Linear Model.

A logistic regression analysis was performed to detect personality variables that independently relate with MD. The presence/absence of MD was regarded as a dependent variable. ED diagnosis, duration of illness expressed in months, BMI, age, age of onset of the disorder, presence/absence of irritable mood, and scores on the TCI, EDI-2, and STAXI scales were included as independent variables.

To assess the possible correlation with the depressive state of personality traits we found as significant at the linear regression has been checked the linear correlation (Pearson bivariate) between BDI and personality score and we performed also a MANOVA with personality scores as dependent variables, depressive versus nondepressive group as fixed factor, the BDI score as covariate, an the BDI group interaction.

3. Results

3.1. Sociodemographic and Clinical Features of the Sample. Sociodemographic and clinical features are reported in Tables 1 and 2.

3.2. MD Diagnosis and Depressive Symptomatology. Subjects with MD represent the 19.5% (n = 161) of the sample: 15.3% of AN-R (n = 33), 25.5% of AN-BP (n = 25), 25.3% of BN (N = 56), and 16% of EDNOS (n = 47). Significant differences were found among AN and EDNOS individuals and the other ED subtypes ($\chi^2 = 11.752; P = 0.008$).

Patients with MD did not show any significant difference when compared to those without MD in regard to age, age of onset of the disorder, duration of illness, and BMI
significant di-angry outbursts made up 73% of the sample, with no (see Table 2). The BDI scores of subjects with MD were significantly different from those without this diagnosis (37.1 ± 4.5 versus 11.1 ± 4.8; F = 550.5; P = 0.001), after controlling for age, age of onset of the disorder, duration of illness, and BMI.

The BDI scores of 408 patients (48.7% of the sample) who were not diagnosed with MD were higher than those of the group (χ² = 9.3859; P = 0.02). Considering both the 48.7% of the sample with a BDI score >10 and the 19.5% of MD patients, the total percentage of patients with relevant depressive symptomatology is 68.2%.

Patients with MD, irritable mood, anger attacks, or angry outbursts made up 73% of the sample, with no significant differences among diagnostic subtypes in this regard (χ² = 1.321; P = 0.724). Moreover, subjects with MD obtained more pathological scores on all STAXI subscales, even after controlling for age, age of onset of the disorder, duration of illness, and BMI, than did patients without MD diagnosis (Table 3). Also subject with clinically significant depressive symptoms (BDI > 10) reported higher STAXI scores than patients without such symptomatology (data not shown).

3.3. Eating Psychopathology. After controlling for age, age of onset of the disorder, duration of illness, and BMI, patients with MD showed higher scores on all EDI-2 scales than did those without this diagnosis (Table 4).

3.4. Personality. MD patients performed higher scores than those without MD on the HA scale and lower scores on the RD, SD, and C scales of the TCI, even after controlling for age, age of onset of the disorder, duration of illness, and BMI (Table 5).

3.5. Logistic Regression. The logistic regression model was significant (χ² = 212.7; df: 36; P < 0.001; R-square = 0.454). The state anger STAXI subscale (B = 0.086; Wald = 13.315; P < 0.001), the HA subscale of the TCI (B = 0.05; Wald = 5.85; P < 0.016), the SD subscale of the TCI (B = 0.074; Wald = 8.015; P < 0.005), and Ineffectiveness as measured by the EDI-2 (B = 0.064; Wald = 5.466; P = 0.019)
independently correlated with MD. Age, age of onset, ED diagnosis, BMI, episodes of binge-eating and vomiting per week, irritable mood, and other variables measured by the STAXI, TCI, and EDI-2 were not significant.

3.6. Correlations and MANOVA. BDI scores correlate significantly directly with HA \((r = 0.379; P < 0.001)\) and inversely with \((r = -0.589 \, P < 0.001)\). Using the MANOVA, HA, and SD differences remain significant even when controlled for BDI scores and for the interaction BDI group (HA: \(F = 75.031; \, P < 0.001; \, SD: \, F = 227.362; \, P < 0.001\)). Also the BDI score effect was found significant for both variables (both variables: \(P < 0.001\)).

4. Discussion

4.1. Characteristics of Depressive Symptomatology. Data from the present study reported lower MD rates than other studies; such a difference could be due to participants’ different stages of illness and it should be also noted that we considered only outpatient patients while other studies included inpatients.

Significant differences were demonstrated among diagnostic subtypes; patients with purging behaviours (AN-BP and BN) were more likely to be diagnosed with MD when compared to AN and EDNOS. This association is supported by previous research showing that individuals with purging symptomatology are more likely to show comorbid disorders and greater clinical severity [30, 31]. Also our group in previous studies found a correlation—although not related to diagnosis—with purging symptomatology [5].

Moreover, in our sample MD in ED patients seem typically characterized by irritable mood as measured according to Fava and Kellner criteria [25]. To our knowledge, these results have not been described yet in the literature. We found that depressed ED patients were not inhibited or melancholic, but tended to show angry depression, hostility, aggressiveness, anger attacks, and angry outbursts. In fact, irritability and angry outbursts are approximately twice as prevalent among patients with MD and ED (73%) than among depressed patients without ED, as reported in literature [2, 32]. Results of the STAXI revealed that patients with MD and ED experienced greater difficulty in recognizing, managing, and expressing anger than patients without MD. Also logistic regression considered State Anger as one of the four independent variables correlated to MD diagnosis. Anger problems among those with ED have been well documented in the literature [8, 33, 34], but the role of depressive symptomatology in such difficulties in coping with anger has been rarely considered. Past findings of mood instability deriving from fasting [33], the notorious treatment resistance of ED patients [35], and the presence of self-injurious behaviours [36] highlight other possible sources for angry outbursts and irritability. However, it should be considered the possibility that anger and oppositionalism can originate from depressive symptoms. The importance of evaluating patients with AN and BN for irritable mood is reinforced by the observation that depression and aggressive-ness totally mediate the connection between ED and suicidal behavior [37]. Given the correlations between depression and anger, the construct of an anxiety/aggression-driven depression has been proposed to correlate depressive and angry aspects, both related to low serotonergic function [38, 39]. It is noteworthy that MD in ED shows some peculiarities since the course is often protracted, the MD recovery may depend on ED type, and antidepressants are not likely to be as effective as in patients with MD without the ED [40]. Dysphoric traits could underlie such differences in features and course of illness [41].

Considering the BDI, the 48.7% of the sample obtained scores indicating a clinically significant depressive symptomatology (BDI > 10); this datum should be added to the 19.5% of individuals affected by full MD and therefore the total percentage of individuals with relevant depressive symptoms was 68.2%. Moreover, patients with ED were reported to suffer from a wide spectrum of depressive symptoms [42]. Specific characteristics of MD and such a common depressive symptomatology even not meeting MD full criteria highlight the importance of considering also these psychopathological aspects in assessment, monitoring, and treatment of these disorders.

Moreover, also this larger group of depressed patients reported at the STAXI higher scores than ED patients without depressive symptoms. Therefore, previous considerations regarding the group with both ED and DM about high percentage of irritable mood can be extended to depressed patients without an ED.

4.2. Depressive Symptomatology and Eating Psychopathology. We found that eating psychopathology, as measured by the EDI-2 scales included in this study, was significantly more severe in patients with comorbid ED and MD than in patients with ED without MD. This correlation between a severe depressive symptomatology and ED severity validated the results of previous studies and confirmed expected hypothesis [2, 3, 30]. Moreover it is well known in literature that eating symptoms is also associated with depression in women, even among those with no history of threshold-level eating disorder symptomatology [43].

The presence of MD represented an index of clinical severity and/or an indication of the acuity of the ED. Therefore, diagnostic evaluation for MD in patients suffering from AN or BN should be considered, and psychotherapeutic involvement in treatment planning should be included as appropriate, also because these patients are often hopeless about the possibility of change and this should be carefully considered in treatments [37]. Indeed, Ametller et al. [44] have demonstrated that high BDI scores at the first psychiatric assessment represent one of the independent predictors of hospitalization.

The logistic regression analysis showed that the Ineffectiveness subscale of EDI-2 independently predicted MD in the sample. Low self-esteem represents the common core symptom of ED and depression. Thus it could be hypothesized that ED treatments based on cognitive-behavioral therapies focused on low self-esteem [45] can be effective for ED depressed subjects.
Antidepressants might be effective for treating comorbid ED and depression [46]. However, research suggests that psychopharmacological treatment is effective for BN [47], but is of debatable value for AN [40, 48] even to prevent relapse after weight restoration [49].

4.3. Depressive Symptomatology and Personality. Patients with both ED and MD were characterized by higher HA and lower scores on the RD, SD, and C scales of the TCI.

Logistic regression showed that Harm Avoidance and Self-Directedness remained significant after controlling for personal and several clinical variables. These data are consistent with the results of previous studies that have identified these traits as characterizing ED samples when compared to healthy controls [12]. Other studies have shown that these traits persist after recovery from the ED [50] and that they are altered in adolescents at high risk for developing a clinically significant ED [30]. Both in the acute phase and after remission, also patients with MD but without ED obtained high HA and low SD scores on the TCI [17–23]. In fact, such HA and SD alterations are likely to be both state and trait dependent [51]. Also bipolar euthymic patients showed the same pattern [52]. A recent comprehensive review and meta-analysis of the literature investigated the effects of temperament on vulnerability to depression providing evidence that high HA can be associated both with current depressive symptoms and depressive traits [53]. Interestingly, a significant negative change in HA scores has been reported during treatment, and it can be also related to treatment response and recovery. A minority of studies reported also how low Reward Dependence—another temperament dimension—was associated with depressive symptomatology [53].

This study showed that higher HA and low SD scores were correlated with comorbid MD in ED patients; this correlation was found to be independent of the severity of the ED (as measured by BMI, binge-purging behaviours, and EDI-2 scales), age, age of onset, and duration of illness. Other studies have shown that low SD can predict suicide attempts among ED subjects [35, 54].

ED patients with a personality profile characterized by high HA and low RD, SD, and C represent a subgroup of patients likely to experience feelings of inferiority, inadequacy, unhappiness, anxiety, and dependence [5, 31, 55–57]. It is well known that ED patients with MD represent a substantial group of patients with specific and semi-independent clinical features and that these features require aimed treatments [46, 58].

The cross-sectional design of this study makes it difficult to rule out the possibility that high HA scores represented a risk factor or a “scarring effect” for ED and depression on personality [18, 59]. Otherwise it is well known the issue of state dependency of HA and SD from depressive disorder [51]. However, there is growing evidence that high Harm Avoidance levels could represent a trait aspect contributing to vulnerability both to ED [41] and mood disorders [53], and in the present study with the MANOVA analysis we found that the BDI score does not completely explain the difference in HA and SD scores between depressed and nondepressed groups. Nevertheless, future research is warranted to perform a longitudinal assessment of the general population to compare premorbid personality traits with those associated with both the ED and depression development during adolescence.

This study is limited by the lack of a control group of healthy subjects or of another clinical population, including patients with other comorbid disorders, and by not considering lifetime comorbidity. On the other hand, one strength of this study is the large sample of patients with MD and ED.

5. Conclusions

This study aimed to evaluate comorbidity between ED and MD and the role of personality as predictor of MD in ED. Our data are in line with previous literature since we found a current prevalence of MD of 19.5% with significant differences among diagnostic subtypes since patients with purging behaviours were more likely to be affected by MD. Irritability was found to be a feature of MD in ED with rates of irritability and angry outbursts twice as prevalent among patients with MD and ED (73%) than among depressed patients without ED as reported in the literature. Considering the BDI, the 48.7% of the sample obtained scores indicating a clinically significant depressive symptomatology (BDI > 10). The eating psychopathology, as measured by the EDI-2 scales, was significantly more severe in patients with MD comorbidity. With regard to personality dimensions, patients with ED and MD showed higher Harm Avoidance and lower scores on the Reward Dependence, Self-Directedness, and Cooperativeness scales of the TCI. The personality dimensions of high HA and low SD could be risk factors in the development of Major Depression in ED individuals because the differences between depressed and non-depressed groups remain significant even after controlling for the BDI score and BDI group interaction.

Clinicians should carefully evaluate in patients with Eating Disorders their depressive symptomatology and the role of anger and personality to provide effective treatments tailored to person and not based only on symptomatology [60].

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References


Research Article

Personality Profiles Identify Depressive Symptoms over Ten Years? A Population-Based Study

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Little is known about the relationship between temperament and character inventory (TCI) profiles and depressive symptoms. Personality profiles are useful, because personality traits may have different effects on depressive symptoms when combined with different combinations of other traits. Participants were from the population-based Young Finns study with repeated measurements in 1997, 2001, and 2007 (n = 1402 to 1902). TCI was administered in 1997 and mild depressive symptoms (modified Beck's depression inventory, BDI) were reported in 1997, 2001, and 2007. BDI-II was also administered in 2007. We found that high harm avoidance and low self-directedness related strongly to depressive symptoms. In addition, sensitive (NHR) and fanatical people (ScT) were especially vulnerable to depressive symptoms. high novelty seeking and reward dependence increased depressive symptoms when harm avoidance was high. These associations were very similar in cross-sectional and longitudinal analysis. Personality profiles help in understanding the complex associations between depressive symptoms and personality.

1. Introduction

The biosocial model of personality developed by Cloninger conceptualizes personality as the combination of two interrelated domains: temperament traits reflecting heritable and neurobiologically based differences in behavioral conditioning and character traits reflecting both neurobiological and sociocultural mechanisms of semantic and self-aware learning. Those domains are hypothesized to interact as a nonlinear dynamic system regulating the development of human psychological functions [1, 2].

According to Cloninger et al. [1, 3], temperament is related to heritable variation in automatic responses to environmental stimuli, especially to emotional ones, and is suggested to be involved in a specific neurotransmitter system of the brain. Temperament is characterized by novelty seeking (NS; a tendency toward exploratory activity and intense excitement in response to novel stimuli) that was originally hypothesized to be linked with low basal dopaminergic activity, harm avoidance (HA; a tendency to respond intensely to aversive stimuli and to avoid punishment and novelty) that was originally hypothesized to be linked with high serotonergic activity, reward dependence (RD; a tendency to respond intensely to reward and to learn to maintain rewarded behavior) that was originally hypothesized to be linked with low basal noradrenergic activity, and persistence (P) that has no special neural correlates [3]. However, Cloninger [1] has later acknowledged that the relationship between neurotransmitters and temperament is more complex than the originally postulated.

The three character dimensions include self-directedness (SD), cooperativeness (CO) and self-transcendence (ST), and they reflect differences in higher cognitive functions underlying a person’s self-concept, goals, and values [3]. SD describes the extent to which a person identifies the self as an autonomous individual. Typical people scoring high on SD are responsible, resourceful, and self-accepting [4]. People having low level of SD are blaming, aimless, and self-defeating. Cooperativeness expresses empathy and identification with other people and reflects the ability to cooperate with other people. Highly cooperative persons are tolerant, empathic, and helpful [4], while those scoring
low on CO are prejudiced, insensitive, and hostile. Self-transcendence involves self-awareness of being an integral part of the unity of all things and is related to ones spirituality and universal values [3]. People having high level of ST are characterized as creative, intuitive, and spiritual [4], whereas a person scoring low on ST is typically conventional, analytical, and empirical. While temperament traits reflect stimulus-response characteristics underlying basic emotions, character depicts the maturity and coherent integration of the multiple facets of a person’s personality in pursuit of particular goals and values in life. Together, they constitute personality as a dynamic and adaptive system with which individuals interpret and respond to their environment [3].

The extreme variants of the temperament traits of this dynamic system closely correspond to the traditional descriptions of different personality disorders, while immature character profile is used as a general marker of possible psychopathology [5]. This implies that the underlying structure of the normal adaptive personality traits is basically the same as that of the maladaptive personality traits [3, 6] and that the combinations and levels of traits make the difference between healthy and pathological personality. A combination of high HA and low SD has been convincingly associated with major depression in clinical populations [7–16]. HA has also been shown to modify the treatment effect of antidepressants on major depression [17]. Further, an association between high HA—low SD and depressive mood has been demonstrated in nonclinical samples, too [18–27]. Many of these studies have been based on general population samples [20, 23–27].

In general, it is important to know whether the findings derived from clinical samples can be generalized across healthy population. From the point of understanding the aspects of personality that predispose a person to depression, this is of high importance. TCI character profiles have been used in previous studies to explore the relationship between personality and well-being [28, 29]. However, to our knowledge, there is only one previous study that has used personality profiles to study the association between TCI and depression [30]. This study was cross-sectional, and there were 498 nonclinical participants who were all teachers. Personality profile in this study and in our study is defined as a combination of different personality traits within an individual. It is possible that, for example, the effect of high novelty seeking on an outcome measure is different in people who are low on harm avoidance than in people who are high on harm avoidance. Within individual personality profile is the only way to study this possibility. Gurpegui et al. [30] found that profiles with high harm avoidance or low self-directedness had higher frequency of depressive symptoms than other profiles. Similar results were observed with anxiety, social dysfunction, and somatic symptoms.

Most of the before-mentioned studies are cross-sectional. There is no prospective, longitudinal population-based study to examine whether TCI personality profiles are associated with later depression. One challenge of cross-sectional studies is that temporary depressive mood might temporarily change personality and especially HA scores [27]. However, this is not necessarily true. For example, Cloninger et al. [23] found that all seven TCI-traits are more stable over one year interval than depressive mood. The greater stability of TCI compared to depression has also been reported by Richter et al. [31].

In this study we use temperament and character profiles, that is, a person-centered approach, in explaining the variation of depression. Examining personality profiles instead of single separate trait dimensions makes it possible to understand those processes within an individual that are associated with depression. This gives us more information than just examining differences between individuals using single traits. The present study was taken with a purpose to meet those challenges. We examine how temperament profiles as well as character profiles predict depressive symptoms cross-sectionally and prospectively four and ten years later in a population based cohort-study.

2. Methods

2.1. Participants. The Cardiovascular Risk in Young Finns Study started in 1980. The subjects for the original sample in 1980 (N = 3596) were selected randomly from six different age cohorts in the population register of the Social Insurance Institution, a database covering the whole population of Finland. The design of the study and the selection of the sample have been described in detail by Raitakari et al. [32]. The TCI-measurements for the present study were carried out in 1997. In 1997, the cohorts were 20, 23, 26, 29, 32 and 35 years old. Participants with missing information on any of the temperament and character traits were excluded. Some participants lacked these measures, because they did not fulfill the criteria of having answered a minimum of 50% of the items. Only 2% of the included participants had more than two missing items per one temperament or character trait. Depressive symptoms were measured in 1997, 2001, and 2007. Participants were excluded if they had not answered at least 50% of the depression items. At most, 0.3% of the included participants had more than two missing depression items. Statistical analyses on the relationship between temperament and character traits and depressive symptoms in different years were conducted independently of each other so the participants in each year formed highly overlapping but nonidentical groups. Table 1 shows the frequency distribution of participants each year.

2.2. Measures

2.2.1. Temperament and Character Inventory. We used version 9 of the TCI which has 240 items [33]. Instead of the original true/false response format, we used a 5 point Likert scale with response categories ranging from 1) absolutely false to 5) absolutely true. Temperament dimensions include harm avoidance (HA; 35 items, Cronbach’s $\alpha = 0.92$), novelty Seeking (NS; 40 items, $\alpha = 0.85$), reward dependence (RD; 24 items, $\alpha = 0.80$), and persistence (PS; 8 items, $\alpha = 0.64$). Character dimensions include self-directedness (SD; 44 items, $\alpha = 0.89$), cooperativeness (CO; 42 items, $\alpha = 0.91$), and self-transcendence (ST; 33 items, $\alpha = 0.91$).
2.2.2. Tridimensional Temperament and Character Profiles. We followed the example of previous studies in forming the tridimensional personality profiles [2, 4, 30]. Temperament profiles consist of the eight possible combinations of high and low scores of novelty seeking, harm avoidance, and reward dependence. Character profiles consist of the eight possible combinations of high and low scores of self-directedness, cooperativeness, and self-transcendence. High and low scores were defined for all dimensions by median split.

As our aim was to capture the effects of extreme personality traits (high versus low), we decided to exclude participants with average temperament or character profile as was done in two previous studies [28, 29]. Average people form their own group, are usually flexible, and they do not demonstrate extreme characteristics [5]. Removing average people can be useful, because it reduces noise when studying the effect of extreme personality traits. A participant was labeled as average if he or she was in the middle third of the distribution for all three temperament traits or all three character traits. The final distribution of the profiles is shown in Table 1.

2.2.3. Persistence. Originally, persistence was not included in the tridimensional temperament profiles [2, 4]. However, persistence has been found in previous studies to be associated with depressive symptoms [23, 25]. This is why we decided to analyze Persistence as an independent dimension.

2.2.4. Mild Depressive Symptoms and Depressive Symptoms. Mild depressive symptoms were assessed using a modified version of Beck’s depression inventory [34] in 1997, 2001, and 2007. In the original version of the BDI, subjects were asked to choose between one of four alternative descriptions of 21 items, with the descriptions of each item ranging from minimal to severe symptoms of depression. In the present study, the participants were asked to rate the second mildest descriptions of the original 21 items (e.g., “I often feel sad”) on a five-point scale ranging from totally disagree (1) to totally agree (5). For instance, an original BDI item could have the following four response options: (0) I do not feel sad, (1) I feel sad, (2) I am sad all the time and I cannot stand it. In our modified version we would select response option (1) and ask the participants to rate their agreement with it on a five-point Likert scale. Originally, these second mildest descriptions of the original 21 items were selected because they were expected to most accurately measure depressive symptoms among the normal population. Scale reliability was $\alpha = 0.91$.

In addition to mild depressive symptoms, in 2007 depressive symptoms were assessed using Beck’s depression inventory-II (BDI-II). It measures self-reported depressive symptoms in adolescents and adults according to DSM-IV criteria for diagnosing depressive disorders [35]. Scale reliability in our data was $\alpha = 0.92$. Each of the 21 items is rated on a four-point scale ranging from 0 to 3 and the total sum-score can range from 0 to 63. Scores from

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**Table 1: Frequency distribution of TCI profiles.**

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperament</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NHR—sensitive</td>
<td>210 (186/24)</td>
<td>166 (152/14)</td>
<td>158 (147/11)</td>
<td>158 (147/11)</td>
</tr>
<tr>
<td>NHR—explosive</td>
<td>177 (92/85)</td>
<td>112 (64/48)</td>
<td>107 (59/48)</td>
<td>107 (59/48)</td>
</tr>
<tr>
<td>NHR—passionate</td>
<td>310 (226/84)</td>
<td>245 (186/59)</td>
<td>231 (172/59)</td>
<td>231 (172/59)</td>
</tr>
<tr>
<td>NHR—adventurous</td>
<td>249 (100/149)</td>
<td>166 (73/93)</td>
<td>149 (74/75)</td>
<td>149 (74/75)</td>
</tr>
<tr>
<td>nHR—cautious</td>
<td>240 (197/43)</td>
<td>193 (159/34)</td>
<td>200 (172/28)</td>
<td>200 (172/28)</td>
</tr>
<tr>
<td>nHR—methodical</td>
<td>316 (155/161)</td>
<td>258 (128/130)</td>
<td>241 (121/120)</td>
<td>239 (121/118)</td>
</tr>
<tr>
<td>nhR—reliable</td>
<td>180 (108/72)</td>
<td>139 (88/51)</td>
<td>144 (93/51)</td>
<td>144 (93/51)</td>
</tr>
<tr>
<td>nhr—dependent</td>
<td>220 (74/146)</td>
<td>163 (56/107)</td>
<td>174 (62/112)</td>
<td>174 (62/112)</td>
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<tr>
<td><strong>Character</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>SCT—creative</td>
<td>336 (251/85)</td>
<td>268 (211/57)</td>
<td>254 (202/52)</td>
<td>253 (202/51)</td>
</tr>
<tr>
<td>ScT—organized</td>
<td>344 (192/152)</td>
<td>255 (149/106)</td>
<td>265 (157/108)</td>
<td>265 (157/108)</td>
</tr>
<tr>
<td>sCT—fanatical</td>
<td>87 (52/35)</td>
<td>75 (48/27)</td>
<td>61 (40/21)</td>
<td>61 (40/21)</td>
</tr>
<tr>
<td>sCt—moody</td>
<td>181 (147/34)</td>
<td>141 (122/19)</td>
<td>147 (122/25)</td>
<td>147 (122/25)</td>
</tr>
<tr>
<td>sCt—dependent</td>
<td>94 (64/30)</td>
<td>76 (49/27)</td>
<td>75 (55/20)</td>
<td>75 (55/20)</td>
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<tr>
<td>scT—disorganized</td>
<td>346 (210/136)</td>
<td>248 (167/81)</td>
<td>233 (155/78)</td>
<td>232 (155/77)</td>
</tr>
<tr>
<td>sct—depressive</td>
<td>325 (150/175)</td>
<td>242 (108/134)</td>
<td>235 (114/121)</td>
<td>235 (114/121)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1902 (1138/764)</td>
<td>1442 (906/536)</td>
<td>1404 (900/504)</td>
<td>1402 (900/502)</td>
</tr>
</tbody>
</table>

In 1997 and 2001, depressive symptoms were assessed by the modified version of the BDI only (see methods for details). In 2007 depressive symptoms were assessed by both the original BDI-II and modified BDI NHR = sensitive; NHR = explosive; Nhr = passionate; Nhr = adventurous; nHR = cautious; nHR = methodical; nhR = reliable; nhR = independent.

SCT = creative; ScT = organized; ScT = fanatical; ScT = autocratic; sCT = moody; sCt = dependent; scT = disorganized; scT = depressive.
was in line with the criteria used with modified depressive symptoms scale assessing milder depressive symptoms.

2.3. Statistical Analyses. Analysis of variance (ANOVA) was used to examine differences between personality profiles. Sex and birth year were controlled when analyzing the profile differences. Possible profile × sex and profile × birth year interactions with depression scores were examined each year, but they were all nonsignificant in all the measurements. Profile comparisons were based on estimated marginal means, which were adjusted for sex and birth year. These adjustments were made because the original profiles were based on median scores unadjusted for sex and birth year. Bonferroni correction was used to correct for the multiple comparisons. We also used LSD-correction (equal to individual t-tests) when comparing different profiles. Persistence was studied using linear regression analysis and correlation coefficients. All analyses were conducted using SPPS for Windows version 18.

3. Results

3.1. Mild Depressive Symptoms (Modified BDI). Figure 1 shows the standardized mild depressive symptoms scores in 1997, 2001, and 2007 in the eight character profiles measured in 1997. Analysis of variance revealed highly significant differences between the profile groups in 1997 ($F = 164.69$, $P < .001$), 2001 ($F = 51.85$, $P < .001$), and 2007 ($F = 40.03$, $P < .001$). Bonferroni corrected comparison between groups showed that in all three measurement years the four profiles low on self-directedness (sct, scT, sCT, and sCT) had more frequently mild depressive symptoms than three profiles high in self-directedness (SCT, SCt, and ScT). The fanatical profile (ScT) was an exception; in all three measurement years fanatical people had more frequently mild depressive symptoms than organized (SCT) people.

Figure 2 shows the standardized mild depressive symptoms scores in 1997, 2001, and 2007 in the eight temperament profiles measured in 1997. Analysis of variance revealed highly significant differences between the profile groups in 1997 ($F = 97.53$, $P < .001$), 2001 ($F = 35.39$, $P < .001$), and 2007 ($F = 29.41$, $P < .001$). Bonferroni corrected comparison between groups showed that in all three measurement years the four profiles high on harm avoidance (nHR, nHr, NHR, and NHr) had more often mild depressive symptoms than the four profiles low on harm avoidance (nhR, nhR, NHR, and NHr). Also, the adventurous profile (NhR) exhibited more mild depressive symptoms in all three measurement years than reliable (nHR) profile.

3.2. Depressive Symptoms (BDI-II). Figure 3 shows the depressive symptoms sum scores in year 2007 in the eight character profiles measured in 1997. Analysis of variance revealed highly significant differences between the profile groups ($F = 15.41$, $P < .001$). Bonferroni corrected comparison between groups showed that three profiles high on self-directedness (SCT, SCt, and ScT) had less frequently

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0 to 13 represent “minimal” depression, scores from 14 to 19 are “mild”, scores from 20 to 28 are “moderate”, and scores from 29 to 63 are “severe” [35]. We also formed a dichotomous variable which grouped participants into those with at least mild depression (BDI-II) and those with minimal depression. This dichotomous depression variable was used in logistic regression analysis to evaluate the relative risk for depression in different temperament or character profiles.

Although BDI-II is a sum score, some participants with missing items were not removed. This was done because for a depressed person it is possible to be categorized as depressed with fewer than maximum number of items. Also, the percentage of participants with missing items was very small and the “answered at least 50% of the items” criteria...
depressive symptoms than the three profiles low on Self-directedness (sct, scT, and sCT). Fanatical people (ScT) were again an exception; the fanatical profile did not differ significantly from any other character profile.

Figure 4 shows the depressive symptoms sum-scores in 2007 in the eight temperament profiles measured in 1997. Analysis of variance revealed highly significant differences between the profile groups ($F = 15.16, P < .001$). Bonferroni corrected comparison between groups showed that the four profiles high on harm avoidance (nHR, nHr, NHR, and NHr) had more frequently depressive symptoms than the three profiles low on harm avoidance (nhr, nhR, and NHR). In addition, the sensitive profile (NHR) had more frequently depressive symptoms than the methodical (nHr) profile.

3.3. Pairwise Comparison of Depressive Symptoms Scores in Different TCI-Profiles. Table 2 shows the pairwise profile comparisons for each TCI profile configuration for depressive symptoms. The comparisons show the effect of being high or low on a given trait when the other traits are held constant. The comparisons revealed the strong effect of harm avoidance and self-directedness on depressive symptoms. In all the comparisons people high on harm avoidance reported more frequently depressive symptoms than people low on harm avoidance. Also, in all the comparisons people high on self-directedness reported less frequently depressive symptoms than people low on Self-directedness.

Other TCI-traits showed more mixed results. In most comparisons, people high on cooperativeness reported less frequently mild depressive symptoms (BDI-M) than people low on cooperativeness. However, cooperativeness did not have a significant effect on depressive symptoms (BDI-II) in 2007. Also, novelty seeking seemed to increase self-reported depressive symptoms. In all the comparisons people high on novelty seeking reported more frequently depressive symptoms than people low on novelty seeking. Not all the comparisons were significant but the trend was clear and consistent. Those having high novelty seeking reported more frequently high levels of depressive symptoms (BDI-II) especially when harm avoidance was high compared to those with low novelty seeking. Results were less clear for reward dependence. Those having high reward dependence reported less frequently higher levels of mild depressive symptoms (BDI-M) especially in 1997 and 2001 but in 2007 it did not have much significant effect. Also, Reward Dependence did not affect reported depressive symptoms (BDI-II). High self-transcendence consistently increased the probability of high reported depressive symptoms when both self-directedness and cooperativeness were high (SCT versus ScT). Mean difference in depressive symptoms between high and low self-transcendence was also consistently rather large when only self-directedness was high (ScT versus ScT) but due to the small $N$ in the profile groups, the mean difference was not significant in three of the four measurements.

3.4. TCI-Profiles in 1997 Predicting BDI-II Depression in 2007. Table 3 shows the frequency of depression (BDI-II) in personality profiles in 2007. “No depression” means that a person’s depressive symptoms score is at most 13. “Depressed” means that a person’s depressive symptoms score is at least 14. The percentage of depressed people is higher (All %) in all those profiles where harm avoidance is high than in those where harm avoidance is low. Interestingly, in addition to harm avoidance, reward dependence, and novelty seeking seem to contribute to the frequency of depression; sensitive people (NHR) are more frequently depressed (All %) than methodical (nHr), explosive (NHR), or cautious (nHR) people. According to the odds ratios, methodical people (nHr) are not significantly more frequently depressed than reliable (nHR) people. Sensitive people (NHR) have over 5-times higher odds of being depressed and also explosive (NHR) and cautious (nHR) people have over 3 times greater odds to be depressed than reliable (nHR) people. The number
Table 2: Pairwise comparison of depressive symptom scores between groups of various temperament and character profiles.

<table>
<thead>
<tr>
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<tbody>
<tr>
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<tr>
<td><strong>Novelty Seeking</strong></td>
<td></td>
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</tr>
<tr>
<td>NHR versus nHR</td>
<td>.283</td>
<td>.140</td>
<td>.159</td>
<td>2.074</td>
</tr>
<tr>
<td>NHR versus nHr</td>
<td>.101</td>
<td>.163</td>
<td>.211</td>
<td>1.728</td>
</tr>
<tr>
<td>NhR versus nhR</td>
<td>.137</td>
<td>.129</td>
<td>.196</td>
<td>.424</td>
</tr>
<tr>
<td>Nhr versus nhr</td>
<td>.247</td>
<td>.040</td>
<td>.136</td>
<td>.549</td>
</tr>
<tr>
<td><strong>Harm Avoidance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NHR versus NhR</td>
<td>1.072</td>
<td>.719</td>
<td>.786</td>
<td>4.912</td>
</tr>
<tr>
<td>NHR versus nHr</td>
<td>.905</td>
<td>.737</td>
<td>.667</td>
<td>3.420</td>
</tr>
<tr>
<td>NhR versus nhR</td>
<td>.926</td>
<td>.728</td>
<td>.823</td>
<td>3.262</td>
</tr>
<tr>
<td>Nhr versus nhr</td>
<td>1.051</td>
<td>.800</td>
<td>.593</td>
<td>2.241</td>
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<tr>
<td><strong>Reward Dependence</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>NHR versus NhR</td>
<td>.152</td>
<td>.225</td>
<td>.050</td>
<td>.831</td>
</tr>
<tr>
<td>NHR versus nHr</td>
<td>.319</td>
<td>.207</td>
<td>.169</td>
<td>.660</td>
</tr>
<tr>
<td>NhR versus nhR</td>
<td>.334</td>
<td>.219</td>
<td>.001</td>
<td>.485</td>
</tr>
<tr>
<td>Nhr versus nhr</td>
<td>.210</td>
<td>.147</td>
<td>.229</td>
<td>.536</td>
</tr>
<tr>
<td><strong>Self-directedness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCT versus sCT</td>
<td>−.968</td>
<td>−.766</td>
<td>−.456</td>
<td>−2.480</td>
</tr>
<tr>
<td>SCt versus sCt</td>
<td>−1.146</td>
<td>−.798</td>
<td>−.725</td>
<td>−3.515</td>
</tr>
<tr>
<td>sCT versus scT</td>
<td>−.944</td>
<td>−.684</td>
<td>−.608</td>
<td>−2.487</td>
</tr>
<tr>
<td>sCt versus scT</td>
<td>−1.076</td>
<td>−.837</td>
<td>−.744</td>
<td>−3.537</td>
</tr>
<tr>
<td><strong>Cooperativeness</strong></td>
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<td></td>
</tr>
<tr>
<td>SCT versus ScT</td>
<td>−.328</td>
<td>−.239</td>
<td>−.215</td>
<td>−.967</td>
</tr>
<tr>
<td>SCt versus sCt</td>
<td>−.355</td>
<td>−.203</td>
<td>−.245</td>
<td>−.535</td>
</tr>
<tr>
<td>sCT versus scT</td>
<td>−.305</td>
<td>−.157</td>
<td>−.367</td>
<td>−.975</td>
</tr>
<tr>
<td>sCt versus scT</td>
<td>−.286</td>
<td>−.242</td>
<td>−.264</td>
<td>−.558</td>
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<tr>
<td><strong>Self-transcendence</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>SCT versus ScT</td>
<td>.244</td>
<td>.162</td>
<td>.289</td>
<td>1.133</td>
</tr>
<tr>
<td>SCt versus sCt</td>
<td>.217</td>
<td>.197</td>
<td>.259</td>
<td>1.564</td>
</tr>
<tr>
<td>sCT versus scT</td>
<td>.066</td>
<td>.129</td>
<td>.020</td>
<td>.098</td>
</tr>
<tr>
<td>scT versus sct</td>
<td>.085</td>
<td>.044</td>
<td>.588</td>
<td>.514</td>
</tr>
</tbody>
</table>

BDI_M = modified Beck’s depression index; BDI = original Beck’s depression index. Comparisons based on LSD-adjusted marginal means in ANOVA.

Results are adjusted for sex and cohort.

NHR = sensitive; NHr = explosive; NhR = passionate; Nhr = adventurous; nHR = cautious; nHr = methodical; nhR = reliable; nhr = independent.

SCT = creative; SCt = organized; ScT = fanatic; Sc = autocratic; sCT = moody; sCt = dependent; scT = disorganized; sc = depressive.

of men in certain profiles is not large but still the difference between the most frequently depressed profile (NHR, 45.5%) and least frequently depressed profile (nhR, 3.9%) in men is very large in terms of depression frequency. Both in men and women sensitive (NHR) people have the highest frequency of depression. Cautious women (nHR) are rather often depressed (19.8%) but this is not true for cautious men (7.1%).

Also the character profiles show differences in depression frequency. Except for the fanatic (ScT) profile, people high on self-directedness (SCT, SCt, and ScT) belonged less frequently in depressed group than people low on self-directedness (sCT, scT, sCt, and sCT). If self-directedness and Cooperativeness are held constant (e.g., SCT versus SCt in Table 3) in all the contrasts the profile higher on self-transcendence is more frequently depressed (All %). Fanatical men and women (SCT) were more frequently depressed than other profiles high on Self-directedness, and, in men, fanatical profile was most often depressed (19.0%). According to percentages, disorganized (sCT) or depressive (scT) women were more frequently depressed than disorganized or depressive men, respectively. According to the odds ratios, fanatical people (SCT) and those low on self-directedness (sCT, ScT, sCt, and scT) were more often depressed than organized (SCT) people. Disorganized people (scT) were the most frequently depressed group according to the odds ratios.

3.5. The Relationship between Depressive Symptoms and Persistence. The linear relationship between Persistence and
Table 3: Results of logistic regression where temperament or character profile was the independent variable and binary BDI-II depression score (not depressed = 0 and >13 = 1) the dependent variable.

<table>
<thead>
<tr>
<th>Model</th>
<th>Gender</th>
<th>All %</th>
<th>Women %</th>
<th>Men %</th>
<th>Odds ratio (All)</th>
<th>CI (All)</th>
<th>P (All)</th>
<th>Odds ratio (women)</th>
<th>CI (women)</th>
<th>P (women)</th>
<th>Odds ratio (men)</th>
<th>CI (men)</th>
<th>P (men)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHR—sensitive</td>
<td>Women</td>
<td>25.9</td>
<td>24.5</td>
<td>45.5</td>
<td>5.78</td>
<td>2.58–12.95</td>
<td>.000</td>
<td>4.74</td>
<td>1.90–11.78</td>
<td>.001</td>
<td>20.01</td>
<td>3.06–130.92</td>
<td>.002</td>
</tr>
<tr>
<td>NHR—explosive</td>
<td>Women</td>
<td>17.8</td>
<td>16.9</td>
<td>18.8</td>
<td>3.89</td>
<td>1.63–9.31</td>
<td>.002</td>
<td>3.09</td>
<td>1.06–9.04</td>
<td>.040</td>
<td>6.71</td>
<td>1.33–33.75</td>
<td>.021</td>
</tr>
<tr>
<td>NHR—passionate</td>
<td>Women</td>
<td>6.1</td>
<td>5.8</td>
<td>6.8</td>
<td>1.06</td>
<td>.43–2.59</td>
<td>.907</td>
<td>.89</td>
<td>.31–2.53</td>
<td>.822</td>
<td>1.60</td>
<td>.27–9.28</td>
<td>.603</td>
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<tr>
<td>nHR—cautious</td>
<td>Women</td>
<td>18.0</td>
<td>19.8</td>
<td>7.1</td>
<td>3.65</td>
<td>1.63–8.17</td>
<td>.002</td>
<td>3.62</td>
<td>1.46–9.01</td>
<td>.006</td>
<td>1.98</td>
<td>.26–15.22</td>
<td>.511</td>
</tr>
<tr>
<td>nHR—methodical</td>
<td>Women</td>
<td>11.3</td>
<td>12.4</td>
<td>10.2</td>
<td>2.23</td>
<td>.98–5.07</td>
<td>.057</td>
<td>2.11</td>
<td>.78–5.69</td>
<td>.139</td>
<td>2.54</td>
<td>.54–12.04</td>
<td>.240</td>
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<tr>
<td>nHR—reliable</td>
<td>Women</td>
<td>5.6</td>
<td>6.5</td>
<td>3.9</td>
<td>reference</td>
<td>reference</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nHR—independent</td>
<td>Women</td>
<td>6.3</td>
<td>8.1</td>
<td>5.4</td>
<td>1.21</td>
<td>.47–3.12</td>
<td>.694</td>
<td>1.29</td>
<td>.37–4.43</td>
<td>.691</td>
<td>1.32</td>
<td>.25–6.91</td>
<td>.743</td>
</tr>
<tr>
<td>SCT—creative</td>
<td>Women</td>
<td>7.5</td>
<td>8.4</td>
<td>3.9</td>
<td>1.58</td>
<td>.75–3.34</td>
<td>.231</td>
<td>1.73</td>
<td>.72–4.12</td>
<td>.218</td>
<td>1.00</td>
<td>.17–5.70</td>
<td>.997</td>
</tr>
<tr>
<td>SCT—organized</td>
<td>Women</td>
<td>4.5</td>
<td>5.1</td>
<td>3.7</td>
<td>reference</td>
<td>reference</td>
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</tr>
<tr>
<td>SCT—fanatical</td>
<td>Women</td>
<td>14.8</td>
<td>12.5</td>
<td>19.0</td>
<td>3.59</td>
<td>1.43–8.99</td>
<td>.006</td>
<td>2.72</td>
<td>.84–8.86</td>
<td>.096</td>
<td>6.48</td>
<td>1.44–29.16</td>
<td>.015</td>
</tr>
<tr>
<td>SCT—autocratic</td>
<td>Women</td>
<td>4.5</td>
<td>5.5</td>
<td>3.8</td>
<td>1.06</td>
<td>.39–2.90</td>
<td>.914</td>
<td>1.08</td>
<td>.28–4.26</td>
<td>.908</td>
<td>.93</td>
<td>.20–4.31</td>
<td>.924</td>
</tr>
<tr>
<td>SCT—moody</td>
<td>Women</td>
<td>18.4</td>
<td>18.9</td>
<td>16.0</td>
<td>4.43</td>
<td>2.15–9.11</td>
<td>.000</td>
<td>4.44</td>
<td>1.90–10.38</td>
<td>.001</td>
<td>6.45</td>
<td>1.06–20.44</td>
<td>.032</td>
</tr>
<tr>
<td>SCT—depressed</td>
<td>Women</td>
<td>20.7</td>
<td>23.9</td>
<td>14.3</td>
<td>5.56</td>
<td>2.86–10.81</td>
<td>.000</td>
<td>6.16</td>
<td>2.75–13.80</td>
<td>.000</td>
<td>4.72</td>
<td>1.43–15.56</td>
<td>.011</td>
</tr>
<tr>
<td>sCT—depressive</td>
<td>Women</td>
<td>14.5</td>
<td>17.5</td>
<td>11.6</td>
<td>3.83</td>
<td>1.92–7.62</td>
<td>.000</td>
<td>4.01</td>
<td>1.69–9.50</td>
<td>.002</td>
<td>3.56</td>
<td>1.12–11.31</td>
<td>.031</td>
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</table>

Depression measured by Beck’s original depression index (BDI-II).
Odds ratio and P value based on binary logistic regression where depression (0 or 1) was the the outcome and personality profile the predictor. Odds ratios based on combined sample of men and women cohort and sex were controlled in the regression analysis.
Birth year was not controlled when calculating the percentages.
Depressive symptoms was explored using correlation coefficients and linear regression. Correlations between Persistence and mild depressive symptoms in 1997, 2001, and 2007 were \(-.07\), \(-.01\), and \(.00\), respectively. Correlation between persistence and depressive symptoms (BDI-II) in 2007 was \(.02\). Only the correlation with mild depressive symptoms in 1997 was significant at \(.05\) level.

Table 4 shows the results of linear regression analysis for persistence predicting depressive symptoms. The association between persistence and depressive symptoms was negative in 1997 and positive in 2001 and 2007. Three of the seven regression coefficients for persistence were statistically significant. Persistence explained, at best, 0.4% of the variation in depressive symptoms.

4. Discussion

The most important findings of this study were the effect of novelty seeking and reward dependence temperament traits on depressive symptoms in addition to harm avoidance, and the increased probability for BDI-II depression (Table 3) of the fanatical character profile (sCt) despite having high self-directedness. Sensitive people (NHR) had more frequently depressive symptoms (BDI-II) than methodical people (nHR) although both had high harm avoidance. In addition, the current results confirmed the findings of previous studies about the strong impact of high harm avoidance and low self-directedness on the frequency of depressive symptoms (e.g., [7–10, 23]). High level of depressive symptoms could be predicted with high harm avoidance and low self-directedness strongly and consistently both cross-sectionally and over time. Our results also confirmed the findings of previous studies according to which persistence was positively associated with depressive symptoms when baseline depressive symptoms are controlled [23, 25].

The use of personality profiles led to an important finding: the effect of harm avoidance and self-directedness on depressive symptoms depends on the configuration of the other temperament and character traits. It is interesting to contrast our results with those of Gurpegui et al. [30] who also used TCI personality profiles in their nonclinical psychopathology study although they used the short version of TCI (TCI-125) and a true/false response format which reduces variance compared to a five-point Likert-scale. The differences found by them in depressive symptoms scores between personality profiles were mostly due to harm avoidance and self-directedness. People with sensitive (NHR), explosive (Nhr), or methodical (nHR) temperament profile had more frequently depressive symptoms than others. Also, people with moody (sCt), dependent (sCt), disorganized (scT), or depressive (scT) character profiles had more frequently depressive symptoms than others. Other TCI-trait besides HA and SD did not have a consistent significant effect on depressive symptoms. Our results are different in this aspect, because we found that all seven TCI-trait had at least some effect on the frequency of depressive symptoms between different profiles.

From the temperament profiles sensitive (NHR) temperament was the best predictor of BDI-II depression 10-years later, increasing the risk to almost 6-fold. Also having explosive (Nhr) or cautious (nHR) temperament profile increased the risk of BDI-II depression to over 3-fold. Regarding the character traits, disorganized (sCt) individuals had over 5-times greater risk to become depressed compared to organized (SCt) persons. Also, moody (sCt), depressive (scT), fanatical (ScT) or dependent (sCt) character profiles predicted over threefold risk of later BDI-II depression. Thus those having disorganized (sCt) character and sensitive (NHR) temperament profile might be most vulnerable for future depression. Also, fanatical people (ScT) had an increased risk for BDI-II depression even though they were high on self-directedness. Fanatical people can be characterized as independent and paranoid, and being projective of blame [36].

Novelty seeking and reward dependence, in turn, did not have a consistent effect on BDI-II depression in 2007 when harm avoidance was low. However, when harm avoidance was high, both high novelty seeking and high reward dependence increased the probability for having BDI-II depression. Sensitive people (NHR) were most likely to be depressed according to BDI-II. Sensitive people respond intensely to aversive (HA) and novel (NS) stimuli, and to social reward and punishment (RD). This combination seems to make them especially vulnerable to depression.

Temperament traits, especially harm avoidance, might be related to emotional vulnerability to depression, whereas character traits, especially self-directedness, might be associated with executive cognitive functions that protect a person from depression [23]. However, high harm avoidance is associated with a wide range of psychopathology and it is not typical only of depression [30]. All in all, it seems that individuals with depression are likely to be both anxiety-prone (i.e., high in harm avoidance) and immature (i.e., low in self-directedness). Maturity refers to the character configuration typical of healthy middle-aged individuals, which is characterized by high Self-directedness and high Cooperativeness [2, 3, 28, 29]. It is consistent with what is described as healthy or health-promoting personality traits, as proposed for DSM-V [37].

Cooperativeness, self-transcendence, reward dependence, and novelty seeking also had an impact on depressive symptoms in addition to harm avoidance and self-directedness. Cooperativeness was negatively associated with mild depressive symptoms cross-sectionally and over four and ten years. However, cooperativeness was not significantly associated with BDI-II depressive symptoms over ten years. This is in line with previous research which has found that cooperativeness is cross-sectionally associated with depression but does not predict later depression [23]. However, our results show that cooperativeness is negatively associated with mild depressive symptoms over time but not with more severe self-reported depressive symptoms.

Using personality profiles proved to be useful in examining the effect of Self-transcendence on depressive symptoms. When self-directedness was low, self-transcendence, by itself, did not have a significant effect on depressive symptoms. However, when self-directedness was high, Self-transcendence was positively associated with the mean levels of depressive symptoms. This might explain why some
earlier studies have found a positive association between Self-transcendence and depression [7, 10, 14] and some have not found an association [11, 27].

The previous studies regarding the role of novelty seeking or reward dependence as a predictor of depression are contradictory. Some studies have found that novelty seeking is negatively associated with depression [7, 15, 26, 31] while some studies have reported a positive association [14, 19]. Similarly, in some studies reward dependence has been found to be negatively associated with depression [14, 21] but not in all [11]. Our results suggest that the association between novelty seeking and depressive symptoms is positive but the magnitude depends on the personality profile. High novelty seeking was a significant predictor of high levels of BDI-depressive symptoms (Table 2) only when harm avoidance was high. As regards to reward dependence, our results suggest that it is negatively associated with mild depressive symptoms but not significantly with BDI-II depressive symptoms, thus giving support to the previous findings.

Another key finding of our study was that the association between temperament and character traits and depressive symptoms might depend on the definition of depressive symptoms themselves. For example, when mild depressive symptoms were used as a depressive symptoms measure, the effect of novelty seeking was quite similar in all personality profiles. However, when BDI-II depressive symptoms were used as a depressive symptoms measure, novelty seeking was significantly associated with depressive symptoms only in the profiles with high harm avoidance. Furthermore, reward dependence was negatively associated with mild depressive symptoms but positively associated with BDI-II depressive symptoms when harm avoidance was high. In addition, cooperativeness was consistently positively associated with mild depressive symptoms but not with BDI-II depressive symptoms.

The temperament and character profiles were associated with depressive symptoms cross-sectionally and also four or ten years later. This is an important finding since it implies that cross-sectional analyses focusing on the association between personality and depressive symptoms give valuable information and predictions can be made using them. TCI profiles identified depressive symptoms both cross-sectionally and prospectively. However, it is not clear what the clinical significance of this finding is. A replication of this study is needed using clinically verified depression as an outcome instead of depressive symptoms.

Our study was not without limitations. Cloninger’s theory sees personality as an adaptive system where the temperament traits interact, and where the outcomes of temperament are modified by the maturity levels of character traits. Temperament and character are not independent of each other, implying that when we assess temperament we also assess character to some extent. Therefore, our temperament and character profiles do not represent pure temperament or character but a combination of both. It would be extremely interesting in future studies to explore the combined temperament × character profiles. This, however, leads to $8 \times 8 = 64$ different profiles which means that a large number of participants is needed to avoid profiles with zero or only a few participants. The associations between temperament traits and depression risk may also depend on social and environmental circumstances [39], and the association between character and well-being might be influenced by culture [29]. This context-specificity implies that the associations between personality and depression

<table>
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<tr>
<td></td>
<td>$B$ (SE)</td>
<td>$P$</td>
<td>$\Delta R^2$</td>
<td>$B$ (SE)</td>
</tr>
<tr>
<td></td>
<td>Persistence</td>
<td>−.11 (.04)</td>
<td>.10</td>
<td>.004</td>
</tr>
<tr>
<td>Step 2</td>
<td>Persistence</td>
<td>.07 (.04)</td>
<td>.042</td>
<td>.001</td>
</tr>
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</table>

$\Delta R^2$ = change in $R^2$ compared to the model with only control variables.

Step 1 = effect of persistence when sex and birth year were controlled. Step 2 = effect of persistence when sex, birth year, and mild depressive symptoms in 1997 were controlled.

BDI-M = mild depressive symptoms (see Section 2). BDI-II = depressive symptoms measured by BDI-II.
might be, at least partly, culture specific and not fully generalizable from one country to another.

Given the longitudinal design, some associations might have been affected by selective study attrition. We tried to lower the probability for this possibility by not requiring all the participants to have full data in all the measurement years which makes the study sample less selective. In addition, both personality and depressive symptoms were self-rated. It is possible that personality affects a person’s depressive symptoms rating or vice versa. The clinical significance of our results is questionable, since it cannot be said how many of the participants would fill the criteria for a clinical depression diagnosis. It is also questionable if causal attributions can be inferred from our study, since we did not control for baseline depressive symptoms. Nevertheless, our study gives a rather comprehensive picture of the association between personality profiles and depressive symptoms. Our aim was not to predict depressive symptoms per se but to identify the differences between TCI profiles in the frequency of depressive symptoms.

5. Conclusions

In summary, we have shown the importance of personality profiles in studying the vulnerability to depressive symptoms cross-sectionally and over time. We showed that in addition to disorganized (sCt) character profile carriers, also those having moody (sCt), depressive (sCt), fanatical (ScT), or dependent (sCt) character profiles are vulnerable to developing BDI-II depression. Especially the fanatical profile is interesting since high self-directedness usually protects a person from depression. From temperament traits it seems that it is not high harm avoidance alone, rather it is high harm avoidance combined with other high temperament traits that increases frequency of depressive symptoms. The reason for this is not clear but it might refer to inner conflicts in the person’s motivational systems, that is, a combination of anxiousness and a preference for novelty and social rewards. Those having sensitive (nHr), explosive (nHr) or cautious (nHR) temperament profiles are in increased danger to have BDI-II depression. Interestingly, the methodical (nHR) profile has only slightly increased risk for BDI-II depression although their harm avoidance is high. Our results highlight the importance of the interaction of harm avoidance and self-directedness with the other TCI traits when assessing the risk for depressive symptoms.

References

Depression Research and Treatment


Research Article

Cognitive and Affective Correlates of Temperament in Parkinson’s Disease

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Parkinson’s disease (PD) patients display low novelty seeking scores on the Tridimensional Personality Questionnaire (TPQ), which may reflect the low dopamine function that characterizes the disease. People with PD also display raised harm avoidance scores. Due to these and other observations, a “parkinsonian personality” has been suggested. However, little is known about how these features relate to cognitive and affective disorders, which are also common in PD. We examined links between TPQ scores and performance on an attentional orienting task in a sample of 20 people with PD. In addition, associations between TPQ and depression and anxiety scores were explored. It was found that novelty seeking scores were significantly correlated with a reaction time measure of attentional orienting to visual novelty. Harm avoidance scores were significantly correlated with anxiety, but not depression scores. These findings extend our understanding of how temperament interacts with cognitive and affective features of the disorder.

1. Introduction

Parkinson’s disease (PD) is primarily considered a neurological disease that produces movement disorders. However, patients with PD also tend to show a range of cognitive and psychiatric symptoms. In addition, a particular “parkinsonian personality” has often been described, which appears to be premorbid to neurological symptoms [1, 2] and may therefore be a temperament feature of the disease. At present, the extent to which such personality features contribute to the cognitive and affective components of the disease is poorly understood.

The primary pathology in the brains of PD patients is the loss of dopamine-producing cells in the substantia nigra [3]. Physiologically, the importance of the substantia nigra is in its dopaminergic projections to the striatum, which is one of the three main dopamine systems in the brain [4]. In PD patients, dopamine levels in this area have been observed to be only 10% of the normal level [5]. Therefore, PD is often considered as a disease that provides a model of low dopamine function in the human brain. Consequently, PD is of particular interest when considering theories that include the functional significance of dopamine.

One such theory, Cloninger et al.’s psychobiological approach to personality [6–9], posits that dopamine systems in the brain are the biological substrate of the temperament trait of novelty seeking. This “tridimensional” approach to personality measurement also proposes two further traits; harm avoidance (linked to serotonin) and reward dependence (linked to noradrenaline) [6]. However, later factor analytic studies revealed a fourth minor factor called persistence, which had formally been part of reward dependence [8]. Following the confirmation of the genetic structure of these four temperament dimensions, additional personality features were identified by Cloninger and colleagues which mature in adulthood. In fact, three additional character dimensions have been proposed which are influenced by insight learning, these are self-directedness, cooperativeness, and self-transcendence [9]. This psychobiological model of temperament and character has continued to evolve and is supported from a range of clinical and neuroscientific studies [7]. In particular, physiology-based research has
focused on the temperament dimensions of novelty seeking, harm avoidance, and reward dependence, due to their supposed genetic basis and neurochemical substrates. It is of course reductionist and an over simplification to equate a personality trait directly with a single neurotransmitter substance. There is a large degree of cross-over between the different circuits and systems in the brain, and highly complex neurotransmitter interactions at the cellular level [10]. Nevertheless, it is accepted that PD is primarily a dopamine deficiency disorder [11] and that novelty seeking is more closely linked to dopamine function than any of the other neurochemical systems [12]. Therefore, in regard to PD, it is the temperament trait of novelty seeking which has received particular research attention. Indeed, patients with PD have been shown to display significantly lower novelty seeking scores in PD patients [13]. In a follow-up study, the role of dopamine was confirmed by the finding that 18 F Dopa striatal uptake in PET scans correlated with novelty seeking scores in PD patients [14]. Further research has confirmed this link between low novelty seeking and PD [15, 16].

The distinctive personality of PD patients has been recognized for many years. As early as 1880, Charcot had described low motivation in patients with PD [17]. In addition, patients with PD have been described as displaying “premature social ageing.” This was based on the observation that many PD patients have few friends, reduced social involvement, few hobbies, and often prefer to spend time on solitary tasks [18, 19]. Furthermore, it has long been noted that PD patients are more likely to be nonsmokers than the general population. From this, it has been suggested that premobidly, PD patients are less hedonic or more self-controlled than the average person [2].

Cognitive impairments, particularly involving frontal lobe function are also widely described in PD [20, 21]. However, it is possible that the cognitive impairments are in part manifestations of the parkinsonian personality profile. Recently it has been noted that frontal lobe-associated cognitive task performance correlates with personality variables in patients with PD, and it has been suggested that both may reflect a common mechanism [22]. In this respect, novelty seeking may be of particular interest, as it is partly defined as “a heritable bias in the activation or initiation of behaviours such as frequent exploratory activity in response to novelty” [9]. It could therefore be suggested that novelty seeking would be associated with orientation and attention in cognitive tasks. Indeed, it has been shown that there are significant correlations between novelty seeking scores and performance of visual attention tasks in healthy individuals [23]. In particular, orientation to novelty has traditionally been considered as crucial to adaptation and action within a changing environment [24]. We may therefore hypothesise that impaired performance of cognitive tasks involving attention to novelty, will be linked to personality factors in patients with PD, in particular, novelty seeking.

Affective disorders are also common in patients with PD. Anxiety has been shown to be more prominent in PD than in healthy samples [25]. However, it is unclear whether this is a response to, or a symptom of, the disease itself. While anxiety varies with motor fluctuations and correlates with disease progression [26], this could be viewed as either indicating a neurobiological or a reactive mechanism. In support of a neurobiological cause is the observation that high levels of anxiety are linked to a serotonin transporter gene polymorphism in patients with PD [27]. Higher levels of depression were also found to be linked to the gene polymorphism, highlighting the fact that anxiety in PD tends to be comorbid with depressive symptoms, and that both may have a serotonergic basis.

Considering depression in PD, different studies have produced different estimates of its prevalence and a variety of theories are available to explain its occurrence. Prevalence estimates have varied between 4% and 70% [28]. It is known that serotonergic function is impaired in PD [29], and this is a likely neurochemical substrate of affective aspects of the disease [30]. For example, it has been shown using transcranial sonography that there are morphological changes to the serotonergic dorsal raphe in depressed but not nondepressed PD patients [31].

Serotonergic function is also thought to underlie Cloninger’s temperament feature of harm avoidance. In addition to the previously described association between PD and low novelty seeking, it is perhaps not surprising then that a relationship between PD and high harm avoidance scores has also been described, an observation that the authors attribute to the presence of depression [32]. Indeed, harm avoidance scores have been found to positively correlate with depression severity in patients with PD [33]. Nevertheless, the relationship between harm avoidance and depression in PD is not well understood.

In this investigation we sought to examine the relationship between the personality dimension of harm avoidance and affective symptoms in patients with PD. We hypothesised that within a sample of PD patients, harm avoidance scores would be correlated with depression and anxiety scores. Furthermore, to examine the relationship between visual attention and the trait of novelty seeking in the same sample, we developed a method to measure how novel visual events influence attention. This was an adaptation of the attentional cueing paradigm [34], a reaction time task often used in experimental psychology. In the standard version, arrowheads presented at the centre of a display facilitate response times to stimuli that later appear at the cued location. Although such tests are widely used, they do not involve orientation to visual novelty. We used a version that we adapted ourselves in which visual novelty was manipulated so that its influence on attention could be measured with reaction times. We hypothesised that within our sample of PD patients, the trait of novelty seeking would be correlated with task performance.

2. Method

2.1. Participants. A total of 20 PD patients participated in this study, 11 of these were female. All were patients of the National Hospital for Neurology and Neurosurgery in London, and the diagnoses of idiopathic PD were made by a consultant neurologist specialising in movement disorders.
The mean age of the patients was 68.5 years (SD = 9.4). The sample had a mean Hoehn and Yahr [35] stage of 1.9 (range 1–4), indicating a wide range of disease progression. Thirteen healthy control subjects also participated; all were volunteers who responded to advertisements. Ten of the control subjects were female. The mean age of the control sample was 69.7 years (SD = 9.1). There was no significant difference between the patients and controls for age ($t(31) = .38, P = .710$).

2.2. Materials and Apparatus. For the assessment of personality, the Tridimensional Personality Questionnaire was employed [6]. This measures three personality dimensions, novelty seeking, harm avoidance, and reward dependence. The hospital anxiety and depression scale was employed to measure severity of affective symptoms [36]. Although this is a brief measure, it is well suited to the current study as it was originally developed for use with medical outpatient samples [37] and has been validated for use with PD patients [38]. To administer the experimental task, a laptop computer with a colour 12.1” LCD monitor was used. The experimental task was implemented with the Visual Basic programming language. Details of the task are given below.

2.3. The Experimental Task. To measure attention to novelty, participants were required to make a simple button press response to a white dot appearing on the laptop screen. This white dot appeared either to the left or right of a central cross. A pair of coloured shapes always appeared 200 msecs before the white dot, one on either side of the central cross (see Figure 1). These two coloured shapes appeared simultaneously and always in the same two locations. One of the shapes was always a light brown square. The other shape was varied such that a totally novel, different coloured shape, would often be substituted for the previous shape. The substitutions occurred randomly every four to seven trials. The coloured shapes always appeared as background to the target white dot. Therefore a typical trial involved the simultaneous display of two coloured shapes, one to the left and one to the right, followed one fifth of a second later by the target white dot, in front of one of the coloured shapes. The participants’ task was to press the button as soon as they saw the white dot.

The location of the shape stimuli alternated randomly left to right, independently of the side that the target white dot would appear on. The shapes were therefore irrelevant to task performance, as shifting attention to either would confer no advantage in predicting the location of the white dot. However, if orientation of attention is influenced spontaneously then participants may orient their attention to the novel stimuli that is being displayed. If they did, and the white dot appeared there (200 msecs later), this might produce faster response times as their attention is already at the correct location. Conversely, if they spontaneously orient their attention to the novel stimuli (the coloured shape) and the white dot target appears on the other side (it is a 50 : 50 chance) then response times would likely be slowed as their attention has been diverted to the wrong location.

On 14% of the trials the target stimulus was not shown and a three-second delay was inserted before the next trial began. This was done to stop participants getting into the habit of just pressing the button each trial, as some were “blanks” they had to wait until the white dot appeared before pressing the button. If the response button was pressed on those “blank” trials where no target white dot was present, the computer emitted a tone and the word “error” was displayed on the screen.

After each trial the shape stimuli and white dot target disappeared and there was a one-second delay before the start of the next trial. Reaction times and number of errors were automatically recorded to a computer file. A visual representation of the temporal sequence of events in a typical trial is shown in Figure 1.

2.4. Procedure. All participants were contacted by telephone and an appointment made for their research participation. The assessment was conducted in the participant’s own home. All participants contributed data on the novelty attention task performance; however, clinical data on affective symptoms and personality data was only collected on the PD patients. All participants provided informed and written consent, and the project was approved by the local research ethics committee.

PD patients were interviewed after an overnight withdrawal (approximately 11 hours) of their antiparkinsonian medication to ensure that they were in a hypodopaminergic state. During the interview, basic demographic and clinical information was collected. Next, the experimental task was administered. Participants sat approximately 70 cm from the laptop screen. In each location, dim lighting was employed to enhance the visibility of the display. One finger of the dominant hand was held over a microswitch and the participant was told to press the button as quickly as possible whenever they saw a white dot appear either to the left or right of the central cross. They were told to try and keep their
fixation on this cross but that coloured shapes would appear in the background and that these would change occasionally. Responses were made via a button pad linked to a digital timing card in the computer. Input from the key was sampled at the rate of 1000 Hz. Two blocks of trials were performed. Each block involved 40 novel stimuli. There were 200 trials in each block. Each block took approximately 8 minutes to complete. Other cognitive assessments were performed which are not reported here.

2.5. Statistical Analyses. For all continuous data, the normality of distribution assumptions was verified with Kolmogorov-Smirnov one sample tests. Parametric tests were used with normally distributed variables and nonparametric equivalents when data was nonnormally distributed. To compare RTs on the novelty attention task, a mixed model ANOVA was used. For all statistically significant effects in the ANOVA calculations, estimates of effect sizes are reported as partial Eta squared statistics. Where t-tests were employed, effect sizes are reported as Cohen’s d. To assess associations between variables and test our main hypotheses, Pearson bivariate correlation statistics were employed. For all inferential statistics, a value of $P < .05$ (two-tailed) was taken to indicate significance. All calculations were performed with PASW Statistics 18 [39].

3. Results

The novelty attention task is analysed first, followed by tridimensional personality questionnaire scores and hospital anxiety and depression scale scores. Finally, associations between the various measures are considered, as well as associations with disease progression.

For the novelty attention task, data from the first seven trials in each block were excluded, as they did not involve a novel change of stimulus. In addition, trials that occurred immediately after a withheld response were excluded. To control for anticipatory responding or lapses of attention, RTs of less than 100 msecs or more than 1000 msecs were excluded. From the remaining datasets, averages were calculated for the location of the target (either in conjunction with the repetitive or novel stimuli) and for the level of novelty. Level of novelty was defined as the number of times that the participant had seen the shape, including the current trial. Therefore, level of novelty ranged from 1–7, with 1 being a shape that was displayed for the first time. For each participant there were more data points for level of novelty 1–4 than for 5, 6, or 7. For this reason, mean rather than median averages were used to summarise the raw data as these are considered more appropriate for unequal datasets [40].

Response times in all conditions for all participants are shown in Table 1. To analyse the effect of novelty on response times, data was entered into a mixed model ANOVA, with group as a between subjects factor, within subject factors were location (novel or repetitive) and level of novelty (how often the novel shape had been presented). In order to compare the effect of novelty, the data points were averaged to provide three main groups of novelty level, when the novel shape first appeared, the mean of the responses for the 2nd and 3rd presentation, and the mean of the 4th to 7th presentations. The response times using these groupings are shown in Figure 2 and were analysed as described above. There was no main effect of group ($F (1,31) = 2.14, P = .154$) and the interactions involving group membership were all non-significant. There was a main effect of location ($F (1,33) = 9.40, P = .004, \text{partial Eta}^2 = .223$) and of novelty ($F (2,62) = 4.31, P = .018, \text{partial Eta}^2 = .122$). The first presentation resulted in response times approximately 9 msecs slower than either the second set (novelty level 2 and 3) or the third set (novelty level 4, 5, 6, and 7). The exact mean RT values in msecs were 408, 399, and 399, respectively. A planned contrast was performed to compare RTs when the novel stimulus was first presented with the combined 2nd and 3rd presentation RTs, the difference was statistically significant, $F (1,31) = 9.26, P = .005, \text{partial Eta}^2 = .230$. However, the difference in RTs from the 1st presentation to the combined 4th, 5th, 6th, and 7th presentations was not statistically significant.

Table 1: Response times (and SDs) in milliseconds for the PD and control participants in the novelty attention task.

<table>
<thead>
<tr>
<th>Level of novelty</th>
<th>Parkinson’s Novel</th>
<th>Parkinson’s Repetitive</th>
<th>Control Novel</th>
<th>Control Repetitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>417 (85)</td>
<td>425 (85)</td>
<td>377 (60)</td>
<td>383 (63)</td>
</tr>
<tr>
<td>2</td>
<td>409 (90)</td>
<td>416 (83)</td>
<td>370 (54)</td>
<td>380 (60)</td>
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<tr>
<td>3</td>
<td>411 (95)</td>
<td>415 (89)</td>
<td>361 (47)</td>
<td>371 (58)</td>
</tr>
<tr>
<td>4</td>
<td>420 (92)</td>
<td>416 (88)</td>
<td>372 (59)</td>
<td>380 (56)</td>
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<tr>
<td>5</td>
<td>409 (94)</td>
<td>416 (96)</td>
<td>368 (60)</td>
<td>386 (69)</td>
</tr>
<tr>
<td>6</td>
<td>398 (96)</td>
<td>418 (89)</td>
<td>375 (69)</td>
<td>382 (71)</td>
</tr>
<tr>
<td>7</td>
<td>406 (99)</td>
<td>418 (92)</td>
<td>366 (55)</td>
<td>371 (55)</td>
</tr>
</tbody>
</table>

“Novel” indicates when the target appeared in conjunction with the novel stimuli and “Repetitive” indicates when it appeared in conjunction with the repetitive stimuli. The level of novelty ranges from when a novel shape was shown for the very first time (1) to when it had been shown 7 times.
Table 2: Correlation coefficients and P values for the associations between temperament dimensions in the PD sample with cognitive and affective measures.

<table>
<thead>
<tr>
<th></th>
<th>RT difference</th>
<th>Depression</th>
<th>Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novelty seeking</td>
<td>-.505, P = .023</td>
<td>.004, P = .987</td>
<td>-.116, P = .625</td>
</tr>
<tr>
<td>Harm avoidance</td>
<td>-.238, P = .313</td>
<td>.309, P = .186</td>
<td>.508, P = .022</td>
</tr>
<tr>
<td>Reward dependence</td>
<td>.001, P = .996</td>
<td>-.378, P = .100</td>
<td>-.436, P = .055</td>
</tr>
</tbody>
</table>

Figure 2: Comparison of the PD and control participants for response times when the target stimuli appeared in the repetitive or novel location and by how many times the novel stimuli had been presented (level of novelty).

3.1. Anxiety-Depression Scores and Temperament. The PD sample had a mean novelty seeking score of 13.9 (SD = 4.8), the mean harm avoidance score was 18.7 (SD = 7.3), and the mean reward dependence score was 16.8 (SD = 4.0). On examination of the HADS scale scores, it was found that the mean score for depression was 4.8 (SD = 3.5, range = 1–15) and the mean score for anxiety was 7.3 (SD = 4.4, range = 2–19). Using the standard cut score of 8 [36], 3/20 (15%) of the PD patients would be considered as probable cases of depressive disorder. Similarly with the same cut score for anxiety, 8/20 (40%) of the PD patients would be considered as probable cases of anxiety disorder. Independent group t-tests revealed that there were no significant differences for anxiety or depression scores when male PD participants were compared with the female participants. Although there were no statistically significant sex differences for novelty seeking or reward dependence, it was found that the female PD patients had significantly higher levels of harm avoidance (female mean = 22.1, SD = 7.0, male mean = 14.4, SD = 5.5; t(18) = -.266, P = .016, d = 1.23).

To test our hypotheses that harm avoidance scores would be associated with depression and anxiety scores in the PD patients, correlation coefficients were calculated. These are shown in Table 2. It can be seen that there was a significant positive association between harm avoidance and anxiety severity scores; however, no significant association was detected with depression severity scores. There were no significant correlations between novelty seeking scores and depression or anxiety scores. The association between reward dependence and anxiety was approaching, but did not reach statistical significance. To further examine the relationship, those cases scoring above the cut scores for depression and anxiety were identified. Their TPQ scores are compared with those scoring below the cut scores in Figure 3. It can be seen that those PD participants scoring positive for probable anxiety disorder scored higher than the other patients for harm avoidance, and that this difference was statistically significant, t(18) = 3.53, P = .002, and d = 1.70. Furthermore, the same participants scored lower on reward dependence, a difference that was also statistically significant, t(18) = -2.37, P = .029, and d = 1.06. There was no significant difference for novelty seeking scores. A similar pattern of differences is seen when comparing those with and without probable depression. The three patients with probable depression appeared on visual inspection to score higher on harm avoidance and lower on reward dependence. However, no inferential statistical analysis was attempted due to the small sample size (3 versus 17).

Returning to the novelty attention task, Figure 2 shows that there is a tendency for RTs to be larger for the 1st presentation of the novel stimuli than the combined 2nd and 3rd presentation RTs. This is true for the conditions in
which the target stimuli appeared in either the repetitive or novel location, but particularly in the latter. Indeed, for the full sample, mean response times when the novel stimuli was first presented (in conjunction with the target) were approximately 9 msecs longer than for when it was presented the 2nd/3rd time (401.7 msecs (SD = 77) compared to 392.6 msecs (SD = 80)). As described above, this difference is statistically significant, and implies that the presence of a novel stimulus produces a measurable effect on responding. The difference between these two RTs could therefore indicate an overall effect of novel stimuli on responses. To test our hypothesis that attention to novelty would be correlated with novelty seeking, the difference between 1st presentation and the combined 2nd and 3rd presentation response times when the target appeared in conjunction with the novel stimuli were calculated for each patient. The correlations between this difference statistic and temperament dimensions on the TPQ are also shown in Table 2. It can be seen that there was a significant negative correlation between novelty seeking and the RT difference statistic, indicating that patients with high novelty seeking scores had smaller difference statistics. There were no significant correlations with the other temperament dimensions of harm avoidance and reward dependence.

Finally, the effect of disease severity on temperament, affective and cognitive performance scores was investigated. The median Hoehn and Yahr disease severity score [35] was 2 (range 1–4), this was used to divide the PD sample into those with relatively early progression (stages 1 and 1.5, unilateral symptoms only, n = 8) and those with more advanced disease (stages 2–4, bilateral symptoms, n = 12). It was found that there were no significant differences between the groups for any of the temperament dimensions, anxiety, depression, or the difference statistic used to measure the impact of novelty on attention. This was true even if a higher disease progression cutoff was selected which compared the six most advanced cases with the 14 less advanced cases.

4. Discussion

We found a relationship between the underlying concept embodied in the definition of novelty seeking and an experimentally derived measure of responses to visual novelty. We have previously shown that novelty seeking scores are associated with efficiency of parallel visual processing in a healthy control sample [23]. However, in the current study a cognitive association has been demonstrated which directly links to novelty, and in a sample of PD patients, individuals considered to be low on the trait of novelty seeking. Although in our own PD sample we found no specific evidence for low novelty seeking scores. Nevertheless, the finding of low novelty seeking among patients with PD has been demonstrated previously [13–16].

Using the custom-designed attentional task, it was found that both the PD and control participants displayed a significant novelty-related location effect. That is, responses were generally faster when the target appeared in conjunction with the novel stimulus. The procedure is therefore capable of measuring the influence of novel visual events on response times. It was also found that there was a significant level of novelty effect. That is, responses tended to be relatively faster on 2nd and 3rd (combined) and 4th to 7th (combined) presentations of the novel stimulus relative to the 1st presentation. This effect occurred whether the target appeared in conjunction with the novel or repetitive stimulus. It is not possible to definitely say whether this effect occurred because the novel stimuli slowed or enhanced responses. However, we can assume that the novel stimulus was able to attract attention, which consequently influenced RTs. Similar effects have been observed in other cognitive experimental procedures when novel elements “pop-out” and familiar items “sink-in” to the display [41]. There was also a main effect of target location. Response times in general were significantly faster when the target appeared in conjunction with the novel, relative to the repetitive, stimuli. In the paradigm of attentional cueing developed by Posner [34], faster response times at a cued location are taken to indicate that attention is orientated to the location prior to the presentation of the target, hence faster response times. The current findings show that novelty can act to unconsciously cue attention to a spatial location. This supports the theory of novel “pop-out” which argues that novel visual elements attract rapid covert shifts in attention [41, 42].

In order to obtain a single measure of the effect of the novel stimulus on responding, the difference between response times from the 1st presentation and combined 2nd-3rd presentations for targets appearing in conjunction with the novel event were calculated. This gives a simple measure of the impact of novelty on the performance of individual participants. When this statistic was compared to personality dimensions with the Tridimensional Personality Questionnaire, it was found that there was a significant negative correlation with novelty seeking. Those patients with low novelty seeking scores showed the highest impact of novelty on the responses. Novelty seeking is considered to be a trait dependent on dopaminergic tone [6] and has been found to be lower in PD patients compared to controls [13]. The negative correlation therefore seems to be paradoxical in that it may have been hypothesised that high novelty
seeking individuals would show the highest impact of the novel stimuli. However, it may be that as low novelty seeking predisposes to lower behavioural responses to novelty, the initial presentation of the novel stimulus produced inhibited responding. When the level of novelty was reduced (2nd–3rd presentation) responding was returning to normal therefore giving a larger difference on the impact of novelty.

The current study found that harm avoidance scores were significantly higher in female patients with PD than male patients. We also found that harm avoidance was positively and significantly correlated with anxiety scores in our PD sample. This contributes to findings that there is a link between the temperament trait of harm avoidance and anxiety [43]. More surprising was our failure to find a link between depression and harm avoidance scores, as this link is commonly reported in nonneurological samples. One explanation maybe that depression in PD is somewhat different in its manifestation than general depression. For example, it has been argued that depression in PD is indicative of a more advanced and widespread neurodegenerative illness [44, 45]. Furthermore, it has been observed that symptom profiles and responses to antidepressant medication are different in depressed patients with PD compared to general depressed patients, suggesting a different underlying pathological mechanism [30]. However, levels of depression were generally low in our PD sample, with only 15% scoring in the range of probable clinical depression, and this is an alternative explanation for our lack of association with harm avoidance scores.

5. Conclusions

Temperament traits in people with PD may be associated with aspects of cognitive performance and with affective disorder. In particular, we provide evidence that harm avoidance may be more linked to the presence of anxiety than to depression in people with PD. The trait of novelty seeking, which is thought to have low expression in PD, was found to be associated with performance of a cognitive task involving orientation to visual novelty. These findings extend our understanding of how temperament interacts with other manifestations of PD.

References


Research Article
The Relationship between Personality and Depression in Expectant Parents

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Several studies assessed the relationship between depression and dimensions of temperament/character using the Cloninger’s model of personality and the TCI-R. The aim of this study is clarify the relation between depression and personality in men and women who are expecting a baby. The Temperament and Character Inventory—Revised Form and the Beck Depression Inventory were administered to 65 pregnant women and 37 husbands during the last quarter of pregnancy. ANOVAs showed that pregnant women had higher levels of depression, reward dependence, and self-transcendence than the expectant fathers. Hierarchical Multiple Regression Analysis in the pregnant women group showed that harm avoidance and self-directedness were significant predictors of the level of depression. In the expectant fathers, only self-directedness was a significant predictor of depression. Low TCI-R self-directedness is a strong predictor of depression in expectant parents regardless of gender, and high TCI-R harm avoidance is an additional predictor of depression in expectant mothers.

1. Introduction

The relationship between personality and mood disorders must be considered from multiple points of view because of the complexity of the development of both depression and personality. On one hand, personality features may be an antecedent influence on depression. There is evidence that personality influences the risk of depression as a predisposition or as an early attenuated expression of later disorder [1, 2]. On the other hand, current mood state can influence how people describe their personality [3].

Cloninger et al. [4, 5] developed a psychobiological model in which personality is comprised of both temperament and character traits. There are four dimensions of temperament in Cloninger’s model: Harm Avoidance (HA) involves the inhibition of behavior by anxiety-provoking stimuli; Novelty Seeking (NS) involves the activation of behavior by desire to explore novelty or complexity, as well as excitability by frustration and boredom; Reward Dependence (RD) involves need for social approval and attachment; Persistence (P) is related to perseverance in behavior despite frustration and fatigue. Hence temperament involves individual differences in basic emotional impulses, such as fear (related to high HA), anger (related to high NS), disgust (related to high RD), and ambition (related to high P). There are advantages and disadvantages to both high and low extremes of temperament, and conflicts in motivation may arise when the same situation, such as expecting a baby, presents both potential difficulties and potential rewards. Consequently, the basic emotional drives of temperament are regulated by three character traits in Cloninger’s model of personality development. Self-directedness (SD) is a persons’ ability to self-regulate their behavior in accordance with chosen goal and values, so that they are responsible, purposeful, and resourceful. Cooperativeness (C) is the ability to get along with other people by being tolerant, emphatic, helpful, and forgiving. Self-Transcendence (ST) is a person ability to identify with nature and the world as a whole, so that a person seeks to understand what is beyond their individual human existence and is able to sublimate and
act altruistically. Strong development of each of the three character dimensions has been shown to promote health and happiness generally [6]. Cloninger’s Temperament and Character Inventory—Revised Form (TCI-R) is one widely used self-report measure of personality and it assessed the temperament and the character according to the Cloninger’s model [7].

Several studies have assessed the relationship between dimensions of temperament/character and depression using the TCI in clinical samples [3, 8–11] and among students [12, 13].

A number of studies have shown that HA is positively correlated with depressive mood [2, 3, 10, 11, 14]. In particular, the HA subscales, HA1 (Anticipatory Worry) and HA4 (Fatigability), are more strongly correlated with mood than the other subscales [13, 15]. The relationship between depression and NS overall is inconsistent [8, 16], but there is clear evidence of a negative correlation between the subscale NS1 (Exploratory Excitability) and depressive symptoms [8, 11, 17]. Regarding RD, high levels of RD have been found to protect against the development of depression [11]. For SD, Peirson and Heuchert [13] found a significant negative correlation between SD subscales and mood, whereas Hansenne et al. [8] found no difference on SD scores between subjects with and without depression. Recently, one study found a negative correlation between SD and depression in a clinical sample after different treatments [3]. Most research has shown that low SD is associated with depression [2, 11, 18]. The C subscale Social Acceptance may be influenced by mood [8, 17].

It is also important to highlight that no studies validate the relationship between temperament and depression in the general population during specific life situations, such as pregnancy. Although the presence of depression during and after pregnancy is currently considered a risk factor for the development of pathology in the child [19], few studies are available in the literature about the influence of temperamental characteristics of pregnant women on depression. Some data is available about the postpartum period, however. For example, Josefsson et al. [20] investigated whether women with postpartum depression differ in personality traits from healthy postpartum women. Results showed that HA and ST scales were higher, while SD and C were lower, in women with postpartum depression than the control group.

This study is the first step of a longitudinal research aimed to identify predictors (temperament and mood) of family functioning/parenting style evaluated at 6 months, 1 year, and 3 years from child’s birth. The aim of this first phase of our longitudinal study is to evaluate the relationship between depression and personality in men and women who are expecting a baby. In particular, we are interested in understanding how the pregnancy condition influences the mood of both the pregnant woman and her husband.

2. Method

2.1. Participants. 102 expectant parents participated to the study: 65 pregnant women and 37 husbands. Eighteen husbands of pregnant women did not participate at the prenatal courses from which the sample was recruited and ten husbands did not agree to participate to the study.

The mean age is 34.11 years for the women group (sd = 4.55) and 36.70 for the men group (sd = 4.99). Women were all primiparas and Caucasian; pregnant adolescents and single mothers were excluded from the sample.

All socioeconomic classes were represented in the sample: all subjects reported their socioeconomic status according to seven categories from 1 to 7 to determine the educational level and the profession of subjects (SES) [21].

The characteristics of participants are summarized in Table 1.

2.2. Materials. The Temperament and Character Inventory—Revised Form (TCI-R) [7] is a self-report 5-point Likert scale, with 240 items. The questionnaire is used for the evaluation of personality according to the psychobiological model of Cloninger et al. [4, 5]. The Beck Depression Inventory (BDI) [22] is a 21-question multiple-choice self-report inventory for measuring the severity of depression in terms of its affective, physiological, and cognitive features.

2.3. Procedure. The sample recruited volunteers during prenatal courses in the Obstetrical Unit of an Italian Clinical Hospital. Subjects completed the TCI-R and BDI in the last quarter of pregnancy.

The questionnaires were administrated during one session of the prenatal course that was conducted by a psychologist. Subjects gave their written informed consent, although the questionnaires were anonymous.

2.4. Statistical Analysis. The two groups, pregnant women and their husbands, were compared on socio-demographic characteristics (age, education, occupation, and socioeconomic status).

In order to evaluate differences on depression level and temperament characteristics between women and men, Analysis of Variance (one way ANOVA) was performed between the two groups on Beck and TCI scores.

Moreover, correlations (Pearson r) were calculated between age, Beck score, and all TCI scales, respectively on women and men samples. Subsequently, Hierarchical Multiple Regression Equations were computed, separately for pregnant women and their husbands, to reveal predictive relationships between temperament/character characteristics and depression level according to gender. Specifically, the Beck score was considered as the dependent variable, while age, TCI temperament scales (HA, RD, NS, and PS), and TCI character scales (SD, C, and ST) were included as predictors.

3. Results

ANOVA revealed significant differences between women and men on age (F = 7.15, P = .01), but there were no differences in SES (F = .29; P = .59). There were significant differences between men and women on education (Chi² = 6.86; P = .03) but not on occupation (Chi² = 7.43; P = .11).
Table 1: Characteristics of participants.

<table>
<thead>
<tr>
<th>Demographic data</th>
<th>Gender (F; M)</th>
<th>Age in years: Men group (M; SD)</th>
<th>Age in years: Women group (M; SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>65; 37</td>
<td>36.70; 4.99</td>
<td>34.11; 4.55</td>
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<tr>
<td>Education women group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
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</tr>
<tr>
<td>Secondary school</td>
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<td></td>
</tr>
<tr>
<td>University</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education men group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary school</td>
<td>15</td>
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<td></td>
</tr>
<tr>
<td>University</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Occupation: women group</td>
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</tr>
<tr>
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<td>40</td>
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<tr>
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<td>14</td>
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<tr>
<td>Housewife</td>
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<td>Student</td>
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<td>Unemployed</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Occupation: men group</td>
<td></td>
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<td></td>
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<tr>
<td>Employee</td>
<td>22</td>
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<td></td>
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<tr>
<td>Self-employed worker</td>
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<td>Housewife</td>
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<td></td>
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<tr>
<td>Student</td>
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<tr>
<td>Unemployed</td>
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<td>SES Index</td>
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<td>47.35; 14.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men group (M; SD)</td>
<td>45.81; 12.70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Variance analysis also revealed that pregnant women had higher levels of depression \( F = 4.16; P = .04 \), higher RD scores \( F = 5.18; P = .03 \), and higher ST scores \( F = 4.21; P = .04 \) compared to their husbands (see Table 2).

In the women, a moderate positive correlation was found between scores for depression and HA \( r = .32; P = .01 \). In the men, in contrast, significant correlations were found between depression level and, respectively, age \( r = .38; P = .02 \) and SD score \( r = -.54; P = .00 \).

Hierarchical Multiple Regression Analysis in the pregnant women group showed that HA and SD were both significant predictors of the level of depression. Specifically, HA explained 12% of the variance and SD explained another 18%, while the inclusion of other variables did not increase the variance explained (see Table 3). Analysis in the husbands showed that only the SD score was a significant predictor of depression level, explaining 31% of variance (see Table 3).

4. Discussion

As expected from previous observations in the general population, we found that pregnant women report higher levels of depression prenatally than do their husbands. In fact, epidemiological data from around the world reveal that women are twice as likely as men to experience depression [23]. Due to the lack of a control group recruited from general population, we cannot attribute the level of depression to the clinical status of the women. However, extensive literature supports the hypothesis that women are particularly vulnerable to mood disorders during crucial periods of the reproductive life cycle, particularly pregnancy [24].

Likewise as expected from the influence of maternal-child bonding on personality, we found that women have higher levels of RD than men. On average, compared to men, women are more sensitive to cues of social approval and to formation of emotional attachments [25]. We also found that pregnant women had higher scores on ST than their husbands. Even though Pelissolo and Lepine [26] find this gender difference also in an adult general sample, it is possible that a woman who is carrying a new life inside may experience a state-specific outlook of unity and participation with all that exists and, consequently, she could be induced to feel more self-transcendent. We plan to evaluate changes in levels of personality traits longitudinally in these women so that we can evaluate changes in levels of personality scores with changes in pregnancy in the same woman. Finally, no differences are found between women and men on HA, even though previous data in the general population often find slightly higher scores in women than men.

Regarding Multiple Regression Analysis, two dimensions of the TCI predict the level of depression in women, even after adjusting for age. Specifically, we found that pregnant women were more depressed if they were high in HA and low in SD. In contrast, HA did not significantly influence the level of depression in the husbands of the pregnant women. However, low SD was a strong predictor of depression in the husbands, explaining 31% of the variance. This extends earlier observations that low SD is a significant predictor of depression level in both men and women in the general population [13].

The results of our study should be considered in light of several limitations. First, the size of the sample is small, and a larger number of men may be needed to evaluate
**Table 2**: ANOVA between women and men groups on Beck and TCI scores.

<table>
<thead>
<tr>
<th></th>
<th>Women group</th>
<th></th>
<th>Men group</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m</td>
<td>Sd</td>
<td>m</td>
<td>sd</td>
<td>F</td>
<td>P</td>
</tr>
<tr>
<td>Beck score</td>
<td>6.25</td>
<td>4.52</td>
<td>4.43</td>
<td>3.93</td>
<td>4.16</td>
<td>0.04</td>
</tr>
<tr>
<td>TCI-NS</td>
<td>100.92</td>
<td>17.76</td>
<td>100.35</td>
<td>17.63</td>
<td>0.03</td>
<td>0.88</td>
</tr>
<tr>
<td>TCI-HA</td>
<td>97.66</td>
<td>19.54</td>
<td>92.59</td>
<td>15.80</td>
<td>1.81</td>
<td>0.18</td>
</tr>
<tr>
<td>TCI-RD</td>
<td>104.62</td>
<td>16.87</td>
<td>96.86</td>
<td>15.94</td>
<td>5.17</td>
<td>0.02</td>
</tr>
<tr>
<td>TCI-P</td>
<td>115.83</td>
<td>24.87</td>
<td>111.57</td>
<td>26.35</td>
<td>0.66</td>
<td>0.42</td>
</tr>
<tr>
<td>TCI-SD</td>
<td>140.37</td>
<td>27.40</td>
<td>138.81</td>
<td>26.34</td>
<td>0.08</td>
<td>0.78</td>
</tr>
<tr>
<td>TCI-C</td>
<td>132.78</td>
<td>25.46</td>
<td>126.78</td>
<td>22.86</td>
<td>1.41</td>
<td>0.24</td>
</tr>
<tr>
<td>TCI-ST</td>
<td>75.38</td>
<td>19.25</td>
<td>67.89</td>
<td>14.69</td>
<td>4.21</td>
<td>0.04</td>
</tr>
</tbody>
</table>

**Table 3**: Percentage of variance, significance, B and β indexes, in Beck score explained by the different predictors (TCI temperament and character scales) in the Hierarchical Multiple Regression Equations (women and men samples).

<table>
<thead>
<tr>
<th></th>
<th>R² Change</th>
<th>B</th>
<th>β</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Age</td>
<td>.00</td>
<td>−.03</td>
<td>−.03</td>
<td>n.s.</td>
</tr>
<tr>
<td>(2) NS</td>
<td>.01</td>
<td>−.01</td>
<td>−.04</td>
<td>n.s.</td>
</tr>
<tr>
<td>(3) HA</td>
<td>.12</td>
<td>.07</td>
<td>.32</td>
<td>.02</td>
</tr>
<tr>
<td>(4) RD</td>
<td>.01</td>
<td>−.07</td>
<td>−.28</td>
<td>n.s.</td>
</tr>
<tr>
<td>(5) P</td>
<td>.01</td>
<td>.02</td>
<td>.10</td>
<td>n.s.</td>
</tr>
<tr>
<td>(6) SD</td>
<td>.18</td>
<td>−.11</td>
<td>−.68</td>
<td>.04</td>
</tr>
<tr>
<td>(7) C</td>
<td>.05</td>
<td>.13</td>
<td>.71</td>
<td>n.s.</td>
</tr>
<tr>
<td>(8) ST</td>
<td>.00</td>
<td>.00</td>
<td>−.02</td>
<td>n.s.</td>
</tr>
<tr>
<td><strong>Men group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Age</td>
<td>.15</td>
<td>.12</td>
<td>.15</td>
<td>n.s.</td>
</tr>
<tr>
<td>(2) NS</td>
<td>.00</td>
<td>.04</td>
<td>.16</td>
<td>n.s.</td>
</tr>
<tr>
<td>(3) HA</td>
<td>.09</td>
<td>.07</td>
<td>.29</td>
<td>n.s.</td>
</tr>
<tr>
<td>(4) RD</td>
<td>.03</td>
<td>.05</td>
<td>.19</td>
<td>n.s.</td>
</tr>
<tr>
<td>(5) P</td>
<td>.01</td>
<td>.04</td>
<td>.26</td>
<td>n.s.</td>
</tr>
<tr>
<td>(6) SD</td>
<td>.31</td>
<td>−.16</td>
<td>−1.10</td>
<td>.00</td>
</tr>
<tr>
<td>(7) C</td>
<td>.02</td>
<td>.04</td>
<td>.25</td>
<td>n.s.</td>
</tr>
<tr>
<td>(8) ST</td>
<td>.01</td>
<td>−.03</td>
<td>−.13</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

the weak effect of HA in men. Second, a control group made of notpregnant women would have allowed to attribute differences in personality, such as self-transcendence, to the state of pregnancy in the women. For example, our clinical experience suggests that the pregnant women are more exposed to social judgement and to strong external expectations to maintain a healthy state, such as a nonalcoholic and nutritious diet in order to promote healthy fetal and perinatal development. Consequently, pregnancy may be experienced as a stressful and demanding regime comparable to running an obstacle course or training for a marathon.

5. Conclusion

This study reports the first step of a longitudinal study designed to identify predictors (such as temperament, character, and mood) of family functioning and parenting style evaluated at 6 months, 1, and 3 years after a child’s birth.

At this preliminary stage in the project, we have evaluated for the first time in the literature, at least to our knowledge, the relationship of depression with the temperament and character of parents who are expecting a child. Several of our findings are consistent with observations about people in the general population, but we have been able to extend them to a specific life situation (pregnancy). The finding that self-directedness is related to depression in both parents is particularly interesting because of its implications for improving subsequent child care. Maternal depression, in fact, can reduce mother-child bonding, increase shyness and insecure attachments in the child, impair personality development, and reduce the health and happiness of children throughout their life [19, 27]. Moreover, self-directedness is a relatively stable character trait with broad impact on adapting to life challenges like pregnancy and child care. Accordingly, it is imperative that we deepen our understanding of these preliminary
findings with an increased sample size, a control group of nonpregnant women, and a long-term prospective followup with attention to the parenting roles of both the fathers and the mothers. Such observations will allow us to identify risk factors for the development of ill health and psychopathology in the children and to plan effective ways of intervening. Our data indicate that preventive interventions will require treatment of personality traits in the parents prior to or during prenatal psychoeducational courses.

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Research Article

Exposure to Community Violence, Psychopathology, and Personality Traits in Russian Youth

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Previous research with the US inner-city youth demonstrated the hazardous effects of community violence exposure. It remains unclear, however, whether these findings are generalizable to other cultures and populations. Furthermore, the role of factors influencing the processing of traumatic events such as personality has not been investigated. Two groups of Russian adolescents (community youth (N = 546) and male delinquents (N = 352)) completed questionnaires assessing their exposure to community violence, conduct problems, internalizing psychopathology and personality. The study demonstrates that the relationships between exposure to violence and psychopathology are similar across different populations within the same culture (community youth and juvenile delinquents), suggesting similar mechanisms behind this phenomenon. The patterns of these relationships were also similar for boys and girls, suggesting similarities in the mechanisms across gender. Hence, the effects of community violence exposure are generalizable to other cultures outside the US. The associations between personality traits and specific types of behaviors also tend to be similar across different populations. Higher levels of novelty seeking were related to more severe problem behaviors and to higher levels of witnessing and victimization, whereas higher levels of harm avoidance were related to higher levels of depression and posttraumatic stress.

1. Introduction

Research on exposure to community violence, which in early 1990s was called “a public health problem of epidemic proportions” [1], has consistently demonstrated its multiple effects on child and adolescent mental health. These effects include a wide range of internalizing psychopathology, such as posttraumatic stress [2–4], anxiety, and depression [5–8], and of externalizing problems, such as aggressive and delinquent behavior [7–12] and alcohol and drug use [7, 13]. Children who have been exposed to high levels of community violence often have a decreased self-esteem [5], pessimistic view of the future [7, 14], problems with social relationships [1], and poor academic performance [7, 15]. Although the levels of distress caused by traumatic events tend to decrease over time, there is some evidence that violence exposure may have a long-lasting impact on behavior and mental health of children [10, 11].

Although the above-mentioned effects have been reliably assessed and tend to be consistent in different studies, several important considerations should be kept in mind when assessing the relationships between violence exposure and psychopathology. First, there has been only one study outside the USA in Canada [16] and none outside North America that reports on the effects of community violence exposure. It remains unclear whether effects of violence exposure in other countries are similar to those reported in American inner city youth, who often experience higher levels of community violence than youths from other communities, and for whom exposure to violence has become an everyday reality and a source of chronic distress.
Second, it is unclear whether the relationships between violence exposure and psychopathology are different in different populations within the same culture. Recent research, for example, has documented that juvenile delinquents represent a highly traumatized group, with rates of posttraumatic stress approaching 30% [17, 18], related to various traumatic events, including domestic [18] and community violence [17]. Furthermore, the levels of psychopathology in antisocial youth tend to be higher than those in the general population as discussed by Ulzen and Hamilton [19]. Thus, it may be reasonable to suggest that the psychopathological outcomes in delinquent youth may not only be related to the magnitude of exposure, but also involve different mechanisms for its development than in the youth from general population.

Third, youth may report higher levels of exposure to violence, because of their own involvement in violence or in other severe problem behaviors [10]. It is unclear whether the effects of exposure to community violence on internalizing psychopathology are similar for a perpetrator and for an innocent bystander, and, thus, the levels of own involvement in severe problem behaviors should be controlled for when assessing these relationships. This is especially true in a cross-sectional study design when it is impossible to control for a baseline level of problem behaviors.

In addition, controlling for involvement in severe problem behaviors is important because, as mentioned previously, antisocial youth generally tend to have higher rates of psychopathology compared to their well-adjusted peers [20] and juvenile delinquency has been found associated with high levels of depression, hopelessness, anxiety, and posttraumatic stress [17, 18]. Thus, to demonstrate the relationships between violence exposure and internalizing psychopathology in a more clear-cut fashion, youth’s involvement in severe problem behaviors should be controlled for.

Fourth, the effects of violence exposure may, in certain respects, be gender specific. It has been found that although males typically are more likely to experience traumatic events [21, 22], females exposed to trauma are more likely to be diagnosed as having posttraumatic stress [21, 23, 24] or at least to report more posttraumatic stress symptoms [2, 12]. These findings raise a question about the necessity of separate analyses of the relationships for boys and girls, which rarely have been done in the past.

Finally, there is increasing evidence that certain cognitive strategies and related personality functions are involved in the processing of traumatic events [17, 25]. There are numerous studies demonstrating that specific personality traits are associated with certain types of psychopathology [26–28] and that temperament can affect the way in which the consequences of traumatic experiences unfold [29]. Previously, we suggested that increased exploratory activity may predispose an individual to greater violence exposure, whereas higher behavioral inhibition at the same time (and possibly, in the same subject) could lead to higher rates of psychopathology [17]. Clarifying the role of personality functions in the processing of traumatic events might help to develop effective prevention and intervention strategies and could increase an awareness of individual characteristics in the development of traumatic response.

Based on the above-mentioned considerations, we propose to assess the relationships between exposure to community violence and psychopathology, controlling for the levels of involvement in severe problem behavior in two samples of youth. First, we will check, whether the findings from the US inner city populations are applicable to the Russian youths from the general population, with results reported separately for boys and girls. The relationships between violence exposure and internalizing psychopathology will be assessed controlling for levels of severe problem behaviors. We will further assess whether the effects of community violence exposure would show a similar pattern in a group of incarcerated juvenile delinquents from the same geographic area. This group was selected as a population at risk that has been repeatedly exposed to high levels of violence in the past [17, 18]. Finally, we will assess the impact of the temperament traits of novelty seeking and harm avoidance that, after being added to the model, are expected to have moderating effects on the relationships between community violence exposure and psychopathology. These relationships will be assessed in both community and delinquent samples.

To achieve these goals, we will use structural equation modeling and will run several models: (a) a model of relationships between violence exposure and psychopathology, in which we control for levels of severe problem behaviors, first in the general population and second in the delinquent population; (b) a model of relationships between violence exposure and psychopathology with personality traits as moderators, controlling for the levels of severe problem behaviors.

We expected that, similar to the US samples, we would obtain significant relationships between the measures of violence exposure and psychopathology, which will remain significant even after controlling for the levels of severe problem behaviors. We also proposed that these relationships would be moderated by the temperament traits of novelty seeking and harm avoidance, with high novelty seeking related to more externalizing, and high harm avoidance to more internalizing problems. In spite of large potential differences in the levels of exposure to community violence and psychopathology, these relationships are expected to be similar across the three study groups (boys and girls from the community sample, and delinquents).

2. Materials and Methods
The study was approved by the appropriate Ethical Committees, including the Institutional Review Board of the Northern State Medical University (Arkhangelsk, Russia).

2.1. Community Sample. In this study, which represents a part of an ongoing cross-cultural project that assesses risk and protective factors for adolescent adjustment, surveys were administered to a community sample of 14–18-year-old adolescents (mean age = 15.5 ± 0.9) in a large region in the north of European Russia. The population of the region is very homogeneous, with approximately 98% being ethnic
2.2. Delinquent Sample. Delinquent subjects were recruited voluntarily from a group of male adolescent inmates ages 14–19 years (mean age = 16.4 ± 0.9), who had been court ordered after trial to the only correctional facility for juveniles in the region in the same part of Northern Russia, a catchment area with a population of 1.5 million. Most of the participants had multiple property crimes (theft, car theft, and so on—51%), violence-related crimes (e.g., assault, robbery—38%), and, in some cases, rape/sexual violence (6%) or murder (5%). Generally, those institutionalized for theft had shown a repetitive pattern of stealing, with multiple convictions, with sentencing to the correctional facility occurring only after repeated convictions during parole. At the time of the study, the mean length of sentence was 4.3 years and all participants had been incarcerated for at least 6 months. The data were collected in a sample of 352 delinquent youths.

Ethnic minorities in the study group represented less than 1%, with the majority of the sample represented by ethnic Russians. Of the delinquent sample, 120 youth (34.1%) came from a single-parent family, as compared to 80 girls (22.4%) and 36 boys (19.0%) from the general population (Chi-square = 19.23; P < .000).

2.3. Procedure. The translation of these scales into Russian followed established guidelines, including appropriate use of independent back translations [30]. The translations were made by a working group in Russia, followed by discussion of the translated questionnaires with colleagues. Finally, an independent interpreter made back translations, which were compared with the originals, and inconsistencies were analyzed and corrected. All questionnaires were also pretested in different samples of youths.

In the community sample, both students and their parents were provided with detailed descriptive information about the study and informed of the planned date of the survey administration and parents were informed of their option to decline participation of their child/children. Students also had the option to decline at the time the survey was administered (parents and student refusals <1%). All participants from the delinquent group were similarly informed about the voluntary and confidential nature of their participation in the study. They were further assured that the institutional staff would not obtain any individualized information about the subjects’ responses. Questions that arose were answered in detail. Eight delinquent subjects refused to participate because of unwillingness to provide any personal information.

In both study samples, the survey was completed in 45-minute sessions during a regular school day with the whole class present (generally 25–30 youths at a time). Those students who refused to complete the survey were given alternative tasks. Trained administrators read questions aloud while participants followed along with their copies of the survey, reading questions to themselves and marking responses in the booklets. The administrators also ensured the students privacy while responding.

2.4. Instruments

2.4.1. Social and Health Assessment. The Social and Health Assessment, developed by Weissberg et al. [33] and adapted by Schwab-Stone et al. [8], served as the basis for the survey. As described in more detail below, this survey includes several scales available from the literature that have been used with similar populations both in the USA and in other countries.

2.4.2. Violence Exposure. Items from this scale were derived from the Screening Survey of Exposure to Community Violence developed by Richters and Martinez [6]. Using yes/no response format, students were asked whether they had ever witnessed or been victimized by 6 types of violence (been beaten up or mugged, threatened with serious physical harm, shot or shot at with a gun, attacked or stabbed with a knife, chased by gangs or individuals, or seriously wounded in an incident of violence), providing separate scores for witnessing and victimization. The internal consistency coefficients (Cronbach’s α) for this scale were .67 for witnessing and .46 for victimization in the general population sample and .74 for witnessing and .61 for victimization in the delinquent sample. Low alphas obtained for the indexes of community violence exposure should not be discouraging, as it is inappropriate to expect that life-event lists should display high internal consistency [34]. Indeed, these measures represent coefficients, rather than scales, where witnessing of or victimization by one type of violence does not necessarily imply the presence of another type of exposure.

2.4.3. Severe Conduct Problems. Eight items describing different types of severe conduct problems (starting a fistfight; participating in gang fights; hurting someone badly in a fight; carrying a gun; having been arrested by police; carrying a blade, knife, or gun in school; suspension from school; being high at school from drinking alcohol or smoking marijuana) were adapted from Jessor et al. [31], NASHS survey [32], or developed specifically for the survey [33]. The respondents were asked to report on a 5-point scale how many times (if any) (ranging from 0 times to 5 or more times) they were involved in the above-mentioned behaviors during the past two-years (in delinquent population, during two year period prior to incarceration). The scale provides a total score that can range from 0 to 40. This scale had a Cronbach’s α value of .75 in a general population sample and .82 in the delinquent sample.
2.4.4. Psychopathology. To assess psychopathology, two measures were used in the present study. Child PTSD Reaction Index (CPTSD-RI) is a 20-item scale designed to assess posttraumatic stress reactions of school-aged children and adolescents after exposure to a broad range of traumatic events [4, 35]. The instrument has a Likert type five-point rating scale ranging from “none” (0) to “most of the time” (4) to rate the frequency of symptoms. Degree of reactions ranges from doubtful to very severe. The scale is highly correlated with the DSM-based diagnosis of posttraumatic stress syndrome [35]. In the present study, an adequate Cronbach’s α for the scale was obtained for both samples (.81 in the community sample and .84 in the delinquent sample). The Beck Depression Inventory [36] is a 21-item self-report measure that assesses current symptoms of depression. Each item includes four self-evaluative statements that are scored from 0 to 3. The BDI has been found to correlate with psychiatric ratings of depression [37, 38]. Cutoff scores have been established, ranging from minimal to severe depression [37]. In our sample, a good internal consistency for the scale was obtained for both samples (Cronbach’s α = .86 in the community sample and .87 in the delinquent sample).

2.4.5. TCI (Temperament and Character Inventory [26]). This inventory is based on Cloninger’s unified biosocial theory of personality [39] and measures four temperament and three character dimensions. According to Cloninger’s theory, temperament dimensions are independent and largely genetically determined [26]. Two scales for temperament related to the study hypothesis were used in the current study (harm avoidance and novelty seeking). Harm avoidance reflects a heritable bias in the inhibition or cessation of behaviors. Subjects scoring high on harm avoidance are pessimistic, chronically worried, shy with strangers, and tense in unfamiliar situations. Novelty seeking is viewed as a tendency toward behavior activation in response to novel stimuli or cues. Subjects high on novelty seeking show high levels of exploratory behavior, impulsive decision making, quick loss of temper, and active avoidance of frustration.

Cloninger’s theory of personality and the TCI have both been utilized and validated with adolescents, both in the USA [40] and other cultures [41, 42], including Russia [28]. In the present study, we used the short version of the TCI with 125 items to be answered as true or false. Cronbach’s α’s for novelty seeking were .63 in the community sample and .60 in delinquents, and for harm avoidance .78 in the community sample and .68 in delinquents.

2.5. Data Analysis. The data were analyzed using the Statistical Package for Social Sciences (SPSS-15.0), with the Analysis of Moment Structures [43] used to build a structural equation model. Missing data on the scales (less than 5%) were imputed using a series mean value.

3. Results

As presented in Table 1, both boys and girls from a Russian community sample reported relatively high levels of witnessing and victimization, with a general tendency for boys to have higher rates of violence exposure. Delinquent participants reported the highest rates of violence exposure, which were significantly higher than those in the community sample.

Although girls were less frequently exposed to community violence, they reported higher levels of psychopathology than boys (Table 2), including both depression and posttraumatic stress. The highest levels of psychopathology reported by delinquents were presumably related to their higher levels of traumatization. Predictably, delinquents reported the highest levels of severe problem behaviors, whereas girls in the community sample reported the lowest levels.

As predicted, the levels of severe problem behaviors in both community and delinquent samples were significantly related to witnessing and victimization (Table 3), implying that those involved in antisocial behavior generally would have had more chances to witness community violence or to be victimized by it [44]. In both samples, community violence exposure scores were also significantly related to the scores of psychopathology. Finally, the temperament trait of novelty seeking was significantly related to higher levels of community violence exposure and to higher levels of severe behavior problems, whereas higher levels of harm avoidance were significantly related to higher levels of internalizing psychopathology, and to lower levels of severe problem behaviors (Table 3).

To investigate links between the variables of interest within a model, structural equation modeling techniques were applied. As proposed, two models were tested: (1) the violence exposure-psychopathology model, controlling for the levels of severe problem behaviors and (2) the violence exposure-psychopathology model with novelty seeking and harm avoidance as moderators, controlling for the levels of severe problem behaviors.

To balance the models, for each scale, except for witnessing and victimization, three subscores were computed based on the item-total correlations within each scale. These subscores were used as manifest variables to produce the latent constructs of severe problem behaviors, depression, posttraumatic stress, and temperament traits of novelty seeking and harm avoidance (for a detailed theoretical explanation of the procedure, see Kishton and Widaman [45] and Little et al. [46]). This procedure was not applied to the scores for witnessing and victimization because they were considered to be coefficients rather than scales, where one type of violence exposure does not necessarily imply the presence of another type.

Model fit was assessed using two standard fit indexes, namely, the root mean squared error of approximation (RMSEA), for which values of .08 or less are deemed acceptable, and the comparative fit index (CFI), for which values greater than .90 are deemed acceptable [42, 47, 48]. Because the maximum likelihood Chi-squared value is highly sensitive to sample size, it was not employed to evaluate overall model fit. The models and model parameters are presented in Figures 1 and 2; the fit statistics for all models is presented in Table 4.
**Figure 1:** Relationships between violence exposure and psychopathology, with significant paths only (Model 1).

**Figure 2:** Relationships between violence exposure, personality, and psychopathology, with significant paths only (Model 2).

**Table 1:** Prevalence of different types of community violence exposure by sample and by gender N (%).

<table>
<thead>
<tr>
<th>In the past two years</th>
<th>General population</th>
<th>Delinquents</th>
<th>Chi-square</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have seen...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Someone else getting beaten up or mugged(^{a,b,c})</td>
<td>94 (26.3)</td>
<td>51 (27.1)</td>
<td>189 (54.0)</td>
<td>68.41;  P &lt; .000</td>
</tr>
<tr>
<td>Someone else get threatened with serious physical harm(^{a,b,c})</td>
<td>78 (21.8)</td>
<td>57 (30.2)</td>
<td>157 (45.0)</td>
<td>43.64;  P &lt; .000</td>
</tr>
<tr>
<td>Someone else get shot or shot at with a gun(^{b,c})</td>
<td>12 (3.4)</td>
<td>8 (4.2)</td>
<td>57 (16.3)</td>
<td>43.38;  P &lt; .000</td>
</tr>
<tr>
<td>Someone else being attacked or stabbed with a knife(^{a,b,c})</td>
<td>18 (5.0)</td>
<td>15 (7.9)</td>
<td>92 (26.4)</td>
<td>74.35;  P &lt; .000</td>
</tr>
<tr>
<td>Someone else being chased by gangs or individuals(^{a,b,c})</td>
<td>38 (10.6)</td>
<td>32 (16.9)</td>
<td>100 (28.6)</td>
<td>37.60;  P &lt; .000</td>
</tr>
<tr>
<td>A seriously wounded person after an incident of violence(^{a,b,c})</td>
<td>27 (7.6)</td>
<td>33 (17.5)</td>
<td>91 (26.1)</td>
<td>43.18;  P &lt; .000</td>
</tr>
<tr>
<td>I have been...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beaten up or mugged(^{a,b,c})</td>
<td>17 (4.8)</td>
<td>27 (14.3)</td>
<td>133 (37.9)</td>
<td>127.13;  P &lt; .000</td>
</tr>
<tr>
<td>Threatened with serious physical harm by someone(^{a,b,c})</td>
<td>37 (10.4)</td>
<td>31 (16.4)</td>
<td>147 (42.5)</td>
<td>106.88;  P &lt; .000</td>
</tr>
<tr>
<td>Shot or shot at with a gun(^{b,c})</td>
<td>3 (.8)</td>
<td>2 (1.1)</td>
<td>34 (9.7)</td>
<td>39.67;  P &lt; .000</td>
</tr>
<tr>
<td>Attacked or stabbed with a knife(^{b,c})</td>
<td>3 (.8)</td>
<td>4 (2.1)</td>
<td>74 (21.1)</td>
<td>102.35;  P &lt; .000</td>
</tr>
<tr>
<td>Chased by gangs or individuals(^{a,b,c})</td>
<td>51 (14.3)</td>
<td>22 (11.6)</td>
<td>82 (23.4)</td>
<td>15.23;  P &lt; .000</td>
</tr>
<tr>
<td>Seriously wounded in an incident of violence(^{b,c})</td>
<td>—</td>
<td>—</td>
<td>19 (5.4)</td>
<td>30.28;  P &lt; .000</td>
</tr>
</tbody>
</table>

\(^{a}\) Significant differences between girls and boys from the community sample; \(^{b}\) significant differences between girls from the community sample and delinquent boys; \(^{c}\) significant differences between boys from the community and delinquent boys.
First, the initial model of violence exposure-psychopathology relationships, controlling for the levels of severe problem behaviors, was assessed in a sample of Russian youths from the general population, separately for boys and girls. A good fit for the model was obtained (χ²(82) = 231.3; RMSEA = .058 (.049; .067); CFI = .92). Subsequently, all nonsignificant paths were excluded from the model and the fit of the reduced model (Figure 1) was assessed. The fit for the final (reduced) model is presented in Table 4. Subsequently, the same model was applied to the sample of juvenile delinquents and an even better fit was obtained (χ²(37) = 51.2; RMSEA = .033 (.000; .053); CFI = .99).

All significant relationships (beta weights and SE) and covariates for the Model 1 are presented in Table 4. The findings can be summarized in that, in all three groups, witnessing was related only to posttraumatic stress and victimization, was related to both posttraumatic stress and depression. Also, the scores for posttraumatic stress and depression in all groups were interrelated, suggesting a high degree of comorbidity between these two conditions, as were the scores of witnessing, victimization and severe problem behaviors. The only difference between the models was in the relationship between severe conduct problems and posttraumatic stress, which was positive in girls, nonsignificant in boys, and negative in delinquents. All models had good fit statistics (Table 4).

As a second step, we sought to assess the effects produced by the temperament traits of novelty seeking and harm avoidance, which were expected to have moderating effects on the relationships between community violence exposure and psychopathology. As in Model 1, these relationships were similarly assessed in the community and then in delinquent samples. A good fit for both models was obtained (χ²(216) = 274.0; RMSEA = .037 (.030; .043); CFI = .94—for the community sample and χ²(101) = 164.0; RMSEA = .042 (.030; .054); CFI = .97—for delinquents). After that, all nonsignificant paths were excluded from the model and the fit of the reduced model (Figure 2) was assessed. The fit for the final Model 2 and all significant relationships (beta weights and SE) and covariates are presented in Table 5. Adding temperament traits in the model did not impact on the relationships between violence exposure and severe problem behaviors or between posttraumatic stress and depression. The relationships between severe problem behaviors and posttraumatic stress, however, became significant and positive in all three groups.

The pattern of relationships between violence exposure scores and psychopathology after introducing temperament traits into the model remained generally the same as in the initial models, although the relationships became somewhat less pronounced. The relationships between novelty seeking, harm avoidance, and psychopathology were similar to those predicted. Higher levels of harm avoidance were related to higher levels of depression and posttraumatic stress, and in some cases were negatively related to the involvement in severe problem behaviors (delinquents) or to witnessing (control boys). Higher levels of novelty seeking in all three samples were related to greater involvement in severe problem behaviors and to higher levels of witnessing and victimization.

Table 2: Comparison of the variables used in the models across three groups.

<table>
<thead>
<tr>
<th></th>
<th>Controls</th>
<th>Boys</th>
<th>Delinquents</th>
<th>F (df), P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Girls (N = 357)</td>
<td>1.04 (1.39)</td>
<td>1.95 (1.77)</td>
<td>62.76 (2, 895) ; .000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.75 (1.14)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>.31 (.67)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Witnessing</td>
<td></td>
<td>.67 (2.00)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Victimization</td>
<td></td>
<td>.75 (1.14)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe problem behaviors</td>
<td>.31 (.67)</td>
<td>.46 (.80)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSD</td>
<td></td>
<td>23.63 (10.25)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td>9.29 (7.95)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Novelty seeking</td>
<td></td>
<td>11.31 (3.34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harm avoidance</td>
<td></td>
<td>9.59 (4.42)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Correlations between the variables used in the models in general/delinquent populations.

<table>
<thead>
<tr>
<th></th>
<th>Controls</th>
<th>Delinquents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Witnessing</td>
<td>—</td>
<td>.56**</td>
</tr>
<tr>
<td>Victimization</td>
<td>.44**</td>
<td>—</td>
</tr>
<tr>
<td>SPB</td>
<td>.36**</td>
<td>.37**</td>
</tr>
<tr>
<td>PTSD</td>
<td>.23**</td>
<td>.23**</td>
</tr>
<tr>
<td>BDI</td>
<td>.08</td>
<td>.13**</td>
</tr>
<tr>
<td>Novelty seeking</td>
<td>.17**</td>
<td>.17**</td>
</tr>
<tr>
<td>Harm avoidance</td>
<td>-.04</td>
<td>-.01</td>
</tr>
</tbody>
</table>

**Significant differences between girls and boys from the community sample.

*Significant differences between girls from the community sample and delinquent boys.

cSignificant differences between boys from the community and delinquent boys.
The purpose of the present study was to test the model of relationships between exposure to community violence and psychopathology in a community sample of Russian youths, controlling for the involvement in severe problem behaviors, and to further verify this model on a sample of incarcerated juvenile delinquents from the same area. We also sought to investigate whether personality traits would play a moderating role in the relationships between violence exposure and psychopathology and would help to clarify the dynamics of these interactions.

The novelty of this study is its cross-cultural application of findings that have been to date reported almost exclusively in the USA inner city populations. This study demonstrates that, even in the communities with less pronounced levels.
of community violence, the effects of violence exposure are still meaningful and related to increased levels of psychopathology. This study also addresses the issue of cross-cultural applicability of the findings reported in the USA, and calls for more attention to this problem from policy makers and mental health professionals in other countries.

This study demonstrates that the trends for the relationships between exposure to violence and psychopathology are also similar across different populations within the same culture, such as youth from a general population and incarcerated juvenile delinquents, suggesting at least some similarities in the mechanisms that underlie this phenomenon in different groups. Similar to the previous studies [21, 22, 24], boys reported more exposure to violence whereas girls reported higher levels of psychopathology. However, the patterns of the relationships between violence exposure and psychopathology for boys and girls were similar, suggesting possible similarities in the underlying mechanisms across gender. Juvenile delinquents reported the highest levels of psychopathology of all three groups. These findings support previous reports suggesting that juvenile delinquents as a population are frequently exposed to various types of violence with various psychopathological manifestations associated with such exposure [17, 18].

As previously suggested by Gorman-Smith and Tolan [10] when considering the relationships between violence exposure and psychopathology, it is important to discriminate between the rates of violence exposure reported by “innocent bystanders” and the rates of violence that might be reported due to own involvement in violence. Those who are involved in antisocial behaviors clearly have more chances to witness violence, or even to be victimized, and this association might distort the “real” relationships between violence exposure and psychopathology. In the present study even after controlling for the levels of severe problem behaviors, the relationships between violence exposure and psychopathology remained significant, suggesting that damaging effects of community violence on the mental health of youth can develop independently of involvement in problem behaviors.

The association between witnessing and psychopathology was generally less pronounced than that for victimization and psychopathology. In this study, victimization was related not only to posttraumatic stress, but also to depression. Such findings are supported by previous studies [8], which have demonstrated that direct victimization has more significant impact on psychopathology than witnessing does. These findings are also supported by the concept of proximity to trauma, with higher degree of physical proximity associated with greater distress [49]. Other studies similarly demonstrated that sometimes witnessing might be unrelated (or even negatively related) to depression, which can be explained by desensitization due to chronic exposure to community violence [50].

In studies of children’s reactions to violence exposure, several individual, family, and community factors have been identified as potential moderators, including age and gender of the child, family structure, school characteristics, and peer relationships [51]. There is also increasing evidence that certain cognitive strategies and related personality functions are involved in the processing of traumatic events [17, 25], that specific personality traits are associated with certain types of psychopathology [26–28], and that temperament can affect the way in which the consequences of traumatic experiences unfold [29]. In our previous work, we suggested that increased exploratory activity may predispose an individual to greater violence exposure whereas higher behavioral inhibition at the same time (and possibly, in the same subject) could lead to higher rates of psychopathology [17]. Thus, it is important to understand the impact of personality characteristics on the relationships between violence exposure and psychopathology, as clarifying the role of personality functions in the processing of traumatic events might help to develop effective prevention and intervention strategies and could increase an awareness of individual characteristics in the development of traumatic response.

5. Conclusions

Higher levels of novelty seeking in all three samples were related to greater involvement in severe problem behaviors and to higher levels of witnessing and victimization. Indeed, increased behavior activation (high novelty seeking) may potentially predispose youth to greater exposure to risky and violent situations. It has been found previously that youth who engage in antisocial behavior often have higher novelty seeking [27, 28], thus the current findings may reflect the pathways by which personality factors lead to increased violence exposure, both directly and indirectly through the involvement in severe problem behaviors.

These findings also indicate a relationship between the temperamental pattern of behavior inhibition and psychopathology, with higher levels of harm avoidance related to higher levels of depression and posttraumatic stress and, in some cases, negatively related to the involvement in severe problem behaviors (delinquents) or to witnessing (control boys). Generally, high harm avoidance reflects the tendency of the individual to be more fearful and cautious (and, thus, less involved in problem behaviors and potentially witnessing less traumatic events), as well as nervous, passive, and having low energy levels. These traits are often combined with poor coping skills, factors that make such youth especially sensitive to stressful life events, and potentially lead to various psychopathological manifestations [26] and internalizing problems in youth [28]. Finally, inhibited temperamental patterns have recently been associated with a physiological pattern of resting right frontal EEG activation in children [52, 53], which in adults appears to be associated with a tendency to respond to stressful events with negative affect or depressive symptomatology [54].

Contrary to expectation, higher novelty seeking does not necessarily imply low harm avoidance and, in the present study, harm avoidance and novelty seeking in the delinquent group were unrelated. These traits can be present in various combinations, as suggested by Cloninger [26, 39] in his typology of personality—high and low, high and high, and so forth. We thus suggest that increased exploratory activity
may predispose an individual to greater violence exposure, whereas higher behavioral inhibition at the same time could lead to higher rates of psychopathology. Environmental experiences, and particularly violence exposure, filtered through personality traits, may increase individual vulnerability to stress. Our findings also suggest that a wide range of psychopathology may be related to specific reactivity patterns to environmental stress and emphasize the importance of a focus on personality aspects in the treatment of traumatized delinquent youth.

This work has the usual limitations of cross-sectional studies that preclude the possibility of drawing causal relationships. The study relies on self-report measures and is limited by its retrospective assessment of psychopathology and violence exposure. Finally, although the findings expand the results obtained in the US inner city youth and demonstrate that the relationships between exposure to community violence and psychopathology are generalizable to other cultures, this study is nevertheless limited to youth from the Russian North and additional studies should address this issue in other samples and cultures.

References

a guide to its development and use, Washington University, Center for Psychobiology of Personality, St Louis, Mo, USA, 1994.


The Relationship between Individual Personality Traits (Internality-Externality) and Psychological Distress in Employees in Japan

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This study examines the relationship between the internality-externality (I-E) scale as an indicator of coping styles and the Kessler 6 (K6) scale as an indicator of psychological distress and analyzes the effects of sociodemographic and employment-related factors on this relationship. Employees from Akita prefecture in Japan were invited to complete self-administered questionnaires. A uniform pattern of findings emerged in the relationship between the two scales as follows: all the significant correlations were negative, that is, as the I-E score increased, the K6 score decreased. Furthermore, significant effects were observed for the I-E scale regarding sex, age, education, employee type, and employment status and the K6 scale with multiple regression analyses. Among these, the effect of the K6 scale was significant for the I-E scale in both males and females. The results of this study may help improve mental health clinicians’ understanding of psychological distress in employees.

1. Introduction

The majority of previous literature on stress has studied the relationship between stressors and psychological distress. In addition, several such studies adopted moderators or coping behaviors as factors [1–3]. Several factors serve as potential moderators of stressor-strain relationships; these include Type A behavior pattern, internality-externality (I-E), and hardiness. Type A refers to a behavioral style characterized by ambitousness, aggressiveness, competitiveness, impatience, potential for hostility, and a hard-driving nature; furthermore, it is characterized by motor responses such as muscle tenseness, a vigorous speech pattern, and rapidity of movement. I-E, which is also called locus of control (LOC), was also adopted as a moderator by several studies [3]. I-E is often described as a personality-like variable that might affect the long-term coping pattern of individuals. LOC refers to the differences in beliefs concerning personal control, represented by the continuum from internality to externality. “Internals” believe that “reinforcements are contingent upon their own behavior, capacities, or attributes.” In contrast, “externals” believe that “reinforcements are not under their personal control but rather are under the control of powerful others, luck, chance, fate, and so forth” [1].

In order to understand the processes related to occupational stress, it is necessary to explore how individuals behave in response to perceived stress (i.e., coping behavior) and to examine the relationship between potentially stressful incidents and psychological distress. Coping behavior is important; however, in analyzing coping with stress, just as they need to examine coping with each stressful incident, there is also a need to explore the “coping style” [2, 3]. Coping style refers to any long-term pattern of coping behavior exhibited by an individual, resulting either from how the individual tends to appraise events or from semihabitual behavior that s/he employs. Not all coping takes place only during stressful incidents or episodes. It is important to study long-term coping styles because psychological distress builds up over months or years, rather than as a mere response to a single stressful incident. Consequently, this study does not focus
on individual stressful incidents but rather on the coping style, which is assessed by I-E. In this study, the Kessler 6 (K6) scale was employed to assess the psychological distress of employees. Occupational safety and health (OSH) programs typically invite employees to complete a voluntary health assessment questionnaire consisting of brief self-report health scales (as opposed to a diagnosis). K6 is a brief, well-validated scale that assesses psychological distress and effectively predicts mental disorders [4, 5]. In 1998, the number of suicides in Japan increased sharply, particularly among middle-aged men (i.e., a productive age group). Consequently, Japan has one of the highest suicide rates among developed countries, presenting a significant problem for the country, and mental health problems are blamed for the majority of the reported suicides [5, 6].

The primary concern of this study is the possible effect of coping styles as assessed by the I-E on psychological distress in employees. The data presented in this paper identifies the sociodemographic and work-related factors that impact the relationship between coping styles and psychological distress. The results presented in this study can be easily incorporated by OSH professionals in future employee-health risk assessment surveys. Moreover, this information about the factors of psychological distress and coping styles may improve mental health clinicians’ understanding of employees.

2. Materials and Methods

2.1. Participants. The information presented in this paper was collected as part of the Akita Occupational Health Promotion Center’s Study for Mental Health [5]. This project involves conducting a study designed to investigate stressful situations and stress management skills and to assess psychological distress in employees. The participants in this study were recruited as follows. Randomly selected employers were recruited (random systematic sampling) and their employees were invited to complete the self-administered questionnaire. In all, fifteen employers from public and private sector firms in Akita prefecture, Japan, agreed to participate in the study. The questionnaires were distributed to the participants using paper-based methods. Employees in the present study were invited to answer the surveys for each company during a one-month survey period (September-October 2007). Participation in the survey was voluntary and confidential. In addition, this study obtained sociodemographic information from the participants. The demographic information collected during this study included the sex, age distribution (29 years or younger, 30 to 39 years, 40 to 49 years, and 50 years and older), and the highest level of education obtained. Across Japan, nine years of compulsory education, which includes elementary school and junior high school, is recognized as the minimum education level; the next highest level of education is typically considered the completion of three years of senior high school. Therefore, education was categorized into compulsory and senior high school, tertiary education, and graduate degree or higher. The questionnaire survey also elicited information on the employees’ occupational characteristics (i.e., full time, managerial class, and job category). They were asked to select their job category from the following possible choices: (1) clerical or administrative support (e.g., bookkeeper, administrative assistant, or office supervisor), (2) sales- or service-related occupation (e.g., sales representative, stockbroker, or retail sales staff), (3) professional or technical support (e.g., engineer, doctor, nurse, laboratory technician, or computer programmer), and (4) others (e.g., on-site worker, crafts worker, mechanic, or driver). The present study also posed a question on the employees’ average number of working hours per day. The Japan Labour Health and Welfare Organization, which has established occupational health promotion centers in each administrative division, approved the study protocol.

2.2. Instruments. In this study, the I-E scale was used to measure coping style factors. Certain major problems have been reported in the use of Rotter’s I-E scale. First, the scores on Rotter’s I-E scale have shown a consistent and significant relationship with social desirability [7, 8]. In addition, its face validity is low; as a number of authors have noted, Rotter’s scale confounds personal, social, political, and ideological causation [9–11]. In response to these problems, Kambara and his colleagues developed an alternative measure of I-E [12, 13]. They named their 18-item scale (9 items each for internality and externality) the “Japanese version of the locus of control scale.” Each item is evaluated using a 4-point rating scale ranging from “value = 1” to “value = 4.” The respondent is instructed to indicate a degree of agreement or disagreement with each item on the 4-point scale. Therefore, the sum of the response scores can range from 18 to 72—high scores indicate internality. Further analyses employing this scale can be found in Kambara et al. (2001) [12]. In the previous report, internal consistency reliability was estimated at 0.78, and the test-retest reliability was 0.76 [12, 13]. In the current study, this scale was used instead of the original I-E scale.

As mentioned above, the current study also administered the K6 scale (30-day prevalence) to assess psychological distress. Each of the six items on K6 is rated on a five-point scale ranging from “none of the time” (value = 0) to “all the time” (value = 4). Therefore, the sum of the response scores can range from 0 to 24. The psychological dimensions explored in K6 make it sensitive and specific to mental disorders like affective and anxiety disorders [4, 5].

2.3. Analytical Procedure. Statistical analyses on cross-tabulations of the I-E scores, K6 scores, and sociodemographic and employment-related variables were performed using SPSS version 11.0J for Windows (SPSS, Tokyo, Japan). Statistical differences for cross-tabulations in the sex and age distribution of each category were analyzed using Pearson’s χ² statistic. Furthermore, the Mann-Whitney U test was used to measure the statistical differences in sex and age distribution with regard to the values of the I-E and K6 scores. The correlations between the I-E and K6 scales in sex and age distribution were analyzed using Spearman’s rank correlation. Furthermore, stepwise multiple regression analyses were performed to assess the effects of related
### Table 1: Sociodemographics of the sample and the differences between the males and females.

<table>
<thead>
<tr>
<th></th>
<th>All participants</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
</tr>
<tr>
<td>Total</td>
<td>1533 (100)</td>
<td>632 (100)</td>
<td>901 (100)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤29</td>
<td>337 (22.0)</td>
<td>116 (18.4)</td>
<td>221 (24.5)</td>
</tr>
<tr>
<td>30–39</td>
<td>415 (27.1)</td>
<td>154 (24.4)</td>
<td>261 (29.0)</td>
</tr>
<tr>
<td>40–49</td>
<td>402 (26.2)</td>
<td>153 (24.2)</td>
<td>249 (27.6)</td>
</tr>
<tr>
<td>≥50</td>
<td>379 (24.7)</td>
<td>209 (33.1)</td>
<td>170 (18.9)</td>
</tr>
<tr>
<td>Education*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compulsory/senior high school</td>
<td>708 (46.2)</td>
<td>431 (68.2)</td>
<td>277 (30.7)</td>
</tr>
<tr>
<td>Some tertiary education</td>
<td>706 (46.1)</td>
<td>127 (20.1)</td>
<td>579 (64.3)</td>
</tr>
<tr>
<td>Graduate degree or higher</td>
<td>99 (6.5)</td>
<td>63 (10.0)</td>
<td>36 (4.0)</td>
</tr>
<tr>
<td>Unknown</td>
<td>20 (1.3)</td>
<td>11 (1.7)</td>
<td>9 (1.0)</td>
</tr>
<tr>
<td>Employment status†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-time work</td>
<td>1361 (88.8)</td>
<td>569 (90.0)</td>
<td>792 (87.9)</td>
</tr>
<tr>
<td>Part-time work</td>
<td>160 (10.4)</td>
<td>59 (9.3)</td>
<td>101 (11.2)</td>
</tr>
<tr>
<td>Unknown</td>
<td>12 (0.8)</td>
<td>4 (0.6)</td>
<td>8 (0.9)</td>
</tr>
<tr>
<td>Employee type*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managerial class</td>
<td>165 (10.8)</td>
<td>112 (17.7)</td>
<td>53 (5.9)</td>
</tr>
<tr>
<td>Nonmanagerial class</td>
<td>1346 (87.8)</td>
<td>517 (81.8)</td>
<td>829 (92.0)</td>
</tr>
<tr>
<td>Unknown</td>
<td>22 (1.4)</td>
<td>3 (0.5)</td>
<td>19 (2.1)</td>
</tr>
<tr>
<td>Job category*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clerical/administrative</td>
<td>209 (13.6)</td>
<td>111 (17.6)</td>
<td>98 (10.9)</td>
</tr>
<tr>
<td>Sales/service</td>
<td>172 (11.2)</td>
<td>101 (16.0)</td>
<td>71 (7.9)</td>
</tr>
<tr>
<td>Professional/technical</td>
<td>784 (51.1)</td>
<td>216 (34.2)</td>
<td>568 (63.0)</td>
</tr>
<tr>
<td>Others (on-site workers, etc.)</td>
<td>318 (20.7)</td>
<td>179 (28.3)</td>
<td>139 (15.4)</td>
</tr>
<tr>
<td>Unknown</td>
<td>50 (3.3)</td>
<td>25 (4.0)</td>
<td>25 (2.8)</td>
</tr>
<tr>
<td>Working hours per day*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 hours or less</td>
<td>829 (54.1)</td>
<td>260 (41.1)</td>
<td>569 (63.2)</td>
</tr>
<tr>
<td>More than 8 hours</td>
<td>693 (45.2)</td>
<td>369 (58.4)</td>
<td>324 (36.0)</td>
</tr>
<tr>
<td>Unknown</td>
<td>11 (0.7)</td>
<td>3 (0.5)</td>
<td>8 (0.9)</td>
</tr>
</tbody>
</table>

Significances representing the differences between males and females (Pearson's χ² statistic).

*P < 0.001, †not significant.

Factors, and three regression analyses—with the dependent variable as the I-E score—were performed. In one regression, sex was included as an independent variable. The remaining two regressions were conducted on separate data sets for males and females.

### 3. Results

Of the 2,145 employees, 1,873 responded to the questionnaire (response rate: 87.3%); however, the number of questionnaires with satisfactory responses, excluding those with insufficient data, was 1,533 (71.5%), which included 632 males and 901 females. The respective Cronbach's alphas for “internality” and “externality” in the I-E scale were 0.77 and 0.72; Cronbach's alpha for the K6 scale was 0.88. Table 1 divides the participants according to their sex and summarizes the information pertaining to sociodemographic status and employment-related variables. With regard to the differences between males and females, Pearson's χ² test revealed significant differences (P < 0.001) in age, education, employee type (managerial or nonmanagerial class), job category, and number of working hours per day. However, there was no significant difference in employment status (full-time or part-time work).

Table 2 presents the mean and standard deviations of the scores of the I-E scale on the basis of sex and age distribution. With regard to the sex-based differences, significant differences were observed solely in the 40–49 years age group (P < 0.05; Mann-Whitney U test). Other age groups showed no significant sex-based differences. Table 3 presents the mean and standard deviations of the scores of the K6 scale on the basis of sex and age distribution. For all age groups except the 30–39 years group, the mean K6 scores of females were higher than those of males. Furthermore, the older age groups tended to have lower K6 scores with the exception of the males in this age group. Significant sex-based differences were observed in the 29 years or younger age group (P < 0.05), 50 years and older (P < 0.01), and all.
The response rate of 87.3% obtained by this survey was much higher than the typical response rate obtained in the case of employee-administered health questionnaires in many large organizations [5, 14]. The I-E was hypothesized to moderate stressor-strain relations because it appears as the factor most likely to affect the coping styles of individuals. Comparatively little research has been conducted on how coping styles interact with job-related psychological distress assessed by a psychological distress scale in an applied setting, although factors related to coping styles such as I-E have a lengthy tradition of research. Therefore, the discussion first addresses the principal concern of the study, which is the relationship between the effects of coping styles (I-E) and psychological distress (K6). Following this, some consideration is given to the effects that related sociodemographic and occupational factors have on these variables. On observing the direct correlations between I-E and K6 (Spearman's rank correlation), a uniform pattern of findings emerged—all the significant correlations were negative, indicating that, as the I-E score increased (greater internality), the K6 score decreased (less psychological distress). These results are in accordance with those observed in earlier research on psychological distress from job-related stressors, such as job demands [15, 16]. For instance, externals are likely to undergo greater psychological distress than others. In contrast, internals are likely to undergo less psychological distress, even if they have relatively many stressors. The simplest explanation for the observation that externals report both greater job-related stressors and psychological distress is that they perceive themselves as being more environment dependent, with their life rewards more likely to be viewed as a matter of fate, chance, or luck [1, 17]. However, the moderator results suggest that the picture is more complicated than this since I-E interacts with specific job-related stressors in its relationship with psychological distress (i.e., the effects of I-E on the stressor-strain relationship differ according to the subtype of job-related stressors such as role conflict, role ambiguity, qualitative role low-load, quantitative role high-load, and environmental frustration [3]). Some previous studies report the relationships between I-E and psychological distress from these subtypes of stressors [3, 18–21]. Moreover, some reports add the factor of Type A to the relationship between I-E and psychological distress. It has been generally reported that persons with Type A personalities have increased psychological distress, as do persons with high external LOC. Furthermore, persons with Type A personalities and external LOC undergo greater psychological distress than those with

Table 2: Scores of internality-externality (locus of control) scale by sex and age distribution.

<table>
<thead>
<tr>
<th>Age</th>
<th>All participants</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>≤29‡</td>
<td>47.37 ± 6.80</td>
<td>47.62 ± 7.42</td>
<td>47.24 ± 6.46</td>
</tr>
<tr>
<td>30–39</td>
<td>47.43 ± 6.62</td>
<td>47.31 ± 7.57</td>
<td>47.50 ± 6.00</td>
</tr>
<tr>
<td>40–49</td>
<td>46.87 ± 6.99</td>
<td>47.87 ± 7.90</td>
<td>46.26 ± 6.30</td>
</tr>
<tr>
<td>≥50‡</td>
<td>47.25 ± 7.10</td>
<td>47.81 ± 6.72</td>
<td>46.55 ± 7.51</td>
</tr>
<tr>
<td>Total</td>
<td>47.22 ± 6.87</td>
<td>47.67 ± 7.34</td>
<td>46.91 ± 6.51</td>
</tr>
</tbody>
</table>

Significance scores representing the differences between males and females (Mann-Whitney U test).

*P < 0.05, ‡not significant.

4. Discussion

The response rate of 87.3% obtained by this survey was much higher than the typical response rate obtained in the case of employee-administered health questionnaires in many large organizations [5, 14]. The I-E was hypothesized to moderate stressor-strain relations because it appears as the factor most likely to affect the coping styles of individuals. Comparatively little research has been conducted on how coping styles interact with job-related psychological distress assessed by a psychological distress scale in an applied setting, although factors related to coping styles such as I-E have a lengthy tradition of research. Therefore, the discussion first addresses the principal concern of the study, which is the relationship between the effects of coping styles (I-E) and psychological distress (K6). Following this, some consideration is given to the effects that related sociodemographic and occupational factors have on these variables. On observing the direct correlations between I-E and K6 (Spearman's rank correlation), a uniform pattern of findings emerged—all the significant correlations were negative, indicating that, as the I-E score increased (greater internality), the K6 score decreased (less psychological distress). These results are in accordance with those observed in earlier research on psychological distress from job-related stressors, such as job demands [15, 16]. For instance, externals are likely to undergo greater psychological distress than others. In contrast, internals are likely to undergo less psychological distress, even if they have relatively many stressors. The simplest explanation for the observation that externals report both greater job-related stressors and psychological distress is that they perceive themselves as being more environment dependent, with their life rewards more likely to be viewed as a matter of fate, chance, or luck [1, 17]. However, the moderator results suggest that the picture is more complicated than this since I-E interacts with specific job-related stressors in its relationship with psychological distress (i.e., the effects of I-E on the stressor-strain relationship differ according to the subtype of job-related stressors such as role conflict, role ambiguity, qualitative role low-load, quantitative role high-load, and environmental frustration [3]). Some previous studies report the relationships between I-E and psychological distress from these subtypes of stressors [3, 18–21]. Moreover, some reports add the factor of Type A to the relationship between I-E and psychological distress. It has been generally reported that persons with Type A personalities have increased psychological distress, as do persons with high external LOC. Furthermore, persons with Type A personalities and external LOC undergo greater psychological distress than those with

Table 4: Correlation between the internality-externality (locus of control) scale and Kessler 6 (K6) scale by sex and age distribution (Spearman's rank correlation).

<table>
<thead>
<tr>
<th>Age</th>
<th>All participants</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rₚ</td>
<td>rᵢ</td>
<td>rᵢ</td>
</tr>
<tr>
<td>≤29</td>
<td>−0.379*</td>
<td>−0.273*</td>
<td>−0.443*</td>
</tr>
<tr>
<td>30–39</td>
<td>−0.331*</td>
<td>−0.407*</td>
<td>−0.284*</td>
</tr>
<tr>
<td>40–49</td>
<td>−0.315*</td>
<td>−0.348*</td>
<td>−0.287*</td>
</tr>
<tr>
<td>≥50</td>
<td>−0.310*</td>
<td>−0.348*</td>
<td>−0.253*</td>
</tr>
<tr>
<td>Total</td>
<td>−0.328*</td>
<td>−0.344*</td>
<td>−0.311*</td>
</tr>
</tbody>
</table>

rᵢ: Spearman's rank correlation coefficient, *P < 0.01.
Type A personalities and internal LOC, that is, Type A persons are generally likely to have greater psychological distress, which is exacerbated if they are externals [22]. In addition, low levels of hardness, self-respect, tendency of avoidance-oriented coping behavior, and external LOC are related to burnout [23]. Consequently, externals are more likely to experience burnout. Furthermore, persons with low levels of self-confidence and self-esteem and persons with a lack of self-efficacy (i.e., externals) are likely to adopt non-adaptive coping behaviors such as avoidance-oriented coping behaviors. Such persons are more likely to have increased burnout.

Other variables that moderate the stressor-strain relationship are sex and age. For example, male teachers reported greater burnout and lower job satisfaction than that among female teachers. In addition, although male department heads scored significantly higher on psychological burnout, there were no sex differences in the measures of satisfaction and emotional well-being [24]. Another report shows that age is related to personal accomplishment and professional commitment but inversely related to emotional exhaustion, that is, younger subjects are likely to have a higher level of burnout [25]. Varieties of studies and results demonstrate the effect of behavioral control, such as I-E, on psychological distress. In sum, they remain possible conjectures from the present findings and provide interesting possibilities for future research.

In this study, the K6 scale was used to evaluate the degree of psychological distress. The psychological dimensions explored in K6 make it sensitive and specific to mental disorders such as affective and anxiety disorders [4]. It is reasonable to assume that the severity of mental health symptoms (degree of psychological distress) is primarily responsible for reduced performance at work [5, 26, 27]. K6 is one of the most widely used psychological distress scales across the globe. Therefore, it is ideal for inclusion in health risk assessment for OSH. However, there is a dearth of published large-scale, normative values that specifically pertain to the workforce. This study is one of the few reports where employees’ psychological distress is assessed using K6 by varying the demographic, employment-related, and individual personality variables.

A limitation of this study was cross-sectional sampling, which made it difficult to infer causality. The data sample was selected at random, but companies (employers) decided to participate in the project, and the employees from these companies decided to respond to the survey. However, self-selection biases in the current data are representative of those inherent in typical employee health assessment surveys. Moreover, the structured interview method is not feasible in large sample studies (as in this case), so some alternative method must be employed. The assessment of factor-related coping with stressors is another limitation of this study because it was based on a single questionnaire measurement (I-E). As previously noted, one reason for studying long-term coping styles is that not all coping is synchronous with stressful incidents or episodes; psychological distress builds up over months or years rather than being the response to a single stressful incident. One approach to investigating the long-term patterns of coping styles is to measure the coping behavior repeatedly. However, in this type of research design, the response obtained may in part be an artifact of the method utilized by repeatedly focusing their attention on how they cope in the long term [3]. An alternative to this approach, which reduces the occurrence of such problems, is to examine the extent to which job stressor-strain relations are accentuated by certain coping styles. Since long-term patterns of coping styles are being examined, the necessity of performing frequent repeated measures is reduced.

### 5. Conclusions

This study reveals the relationship between the I-E scale as an indicator of coping styles and the K6 scale as an indicator of psychological distress and the effects of sociodemographic and employment-related factors on this relationship.
The effect of the K6 scale was significant for the I-E scale for all three sets (all participants, males, and females). Further research should be conducted on the relationship between the factors related to coping style and the psychological distress scale since there are only a few studies directly examining this relationship. The information obtained by this study related to the factors of psychological distress and its coping style will hopefully improve mental health clinicians’ understanding of employees.

Acknowledgments

The author would like to thank Tetsuo Shimizu, Katsuyuki Murata, Yasutsugu Kudo, Masayuki Seki, and Seiji Saito for their valuable comments and suggestions.

References

Research Article
Bipolar Disorder and the TCI: Higher Self-Transcendence in Bipolar Disorder Compared to Major Depression

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Personality traits are potential endophenotypes for genetic studies of psychiatric disorders. One personality theory which demonstrates strong heritability is Cloninger’s psychobiological model measured using the temperament and character inventory (TCI). 277 individuals who completed the TCI questionnaire as part of the South Island Bipolar Study were also interviewed to assess for lifetime psychiatric diagnoses. Four groups were compared, bipolar disorder (BP), type 1 and 2, MDD (major depressive disorder), and unaffected relatives of a proband with BP. With correction for mood state, total harm avoidance (HA) was higher than unaffected in both MDD and BP groups, but the mood disorder groups did not differ from each other. However, BP1 individuals had higher self-transcendence (ST) than those with MDD and unaffected relatives. HA may reflect a trait marker of mood disorders whereas high ST may be specific to BP. As ST is heritable, genes that affect ST may be of relevance for vulnerability to BP.

1. Introduction
An individual’s personality develops early, is stable, and has a strong heritable component. Personality traits have been implicated as factors which influence the predisposition to bipolar disorder and may help to distinguish between major depressive disorder (MDD), bipolar disorder (BP1) and bipolar disorder with hypomania, bipolar type 2 (BP2). Personality traits are also being considered as potential useful endophenotypes for the investigation of the genetic basis of complex mental disorders [1]. The adequate description of personality in bipolar disorder is required to identify profiles and traits that may be useful to enhance the understanding of bipolar disorder.

The Temperament and character inventory revised (TCI-R) is a 240-item 5-point Likert scale self-administered questionnaire which assesses personality following Cloninger’s psychobiological model [2]. This model assesses personality in seven dimensions, four temperament scales: novelty seeking (NS), harm avoidance (HA), reward dependence (RD) and persistence (PS), and three character scales: self-directedness (SD), cooperativeness (CO), and self-transcendence (ST). All of the scales reflect total scores of either four or five subscales (Table 1).

In this study, we applied the TCI-R to a sample of bipolar disorder patients and their relatives with the objective of highlighting differences between diagnostic groups for future investigation. As self-reported personality traits may be affected by current mood state, we were also interested in personality differences between diagnostic groups when the effect of current self-reported mood was taken into consideration.

2. Methods
Bipolar probands and their family members were recruited in Christchurch, New Zealand as part of the South Island Bipolar Study [3–5] and interviewed using the Diagnostic
Table 1: TCI scales by compared diagnostic group.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Bipolar I (N = 60)</th>
<th>Bipolar II (N = 33)</th>
<th>Major depressive disorder (N = 97)</th>
<th>Unaffected relatives (N = 87)</th>
<th>F-statistic</th>
<th>P value</th>
<th>Post hoc analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novelty-seeking</td>
<td>18.78 ± 6.66</td>
<td>20.30 ± 6.09</td>
<td>17.98 ± 8.47</td>
<td>17.37 ± 5.73</td>
<td>2.28</td>
<td>.085</td>
<td>BP 1, BP 2, MDD &gt; unaffected</td>
</tr>
<tr>
<td>Harm-avoidance</td>
<td>18.78 ± 8.57</td>
<td>17.12 ± 8.52</td>
<td>15.98 ± 6.84</td>
<td>11.91 ± 6.38</td>
<td>11.79</td>
<td>&lt;.001</td>
<td>MDD, unaffected &gt; BP 1, BP 2</td>
</tr>
<tr>
<td>Reward-dependence</td>
<td>23.37 ± 6.40</td>
<td>22.61 ± 5.49</td>
<td>23.30 ± 7.13</td>
<td>22.43 ± 5.74</td>
<td>0.42</td>
<td>.742</td>
<td></td>
</tr>
<tr>
<td>Persistence</td>
<td>22.75 ± 10.50</td>
<td>26.58 ± 11.04</td>
<td>24.37 ± 13.34</td>
<td>26.06 ± 8.65</td>
<td>1.84</td>
<td>.146</td>
<td></td>
</tr>
<tr>
<td>Self-directedness</td>
<td>31.13 ± 8.51</td>
<td>30.52 ± 10.91</td>
<td>35.08 ± 10.82</td>
<td>37.34 ± 6.11</td>
<td>10.26</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Cooperativeness</td>
<td>33.88 ± 6.89</td>
<td>34.33 ± 6.36</td>
<td>35.87 ± 4.22</td>
<td>35.57 ± 5.92</td>
<td>1.94</td>
<td>.131</td>
<td></td>
</tr>
<tr>
<td>Self-transcendence</td>
<td>22.43 ± 12.30</td>
<td>18.79 ± 9.45</td>
<td>17.54 ± 11.15</td>
<td>15.39 ± 10.99</td>
<td>4.04</td>
<td>.01</td>
<td>BP 1 &gt; MDD, unaffected</td>
</tr>
</tbody>
</table>

Subscales

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Bipolar I (N = 60)</th>
<th>Bipolar II (N = 33)</th>
<th>Major depressive disorder (N = 97)</th>
<th>Unaffected relatives (N = 87)</th>
<th>F-statistic</th>
<th>P value</th>
<th>Post hoc analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>HA1 (anticipatory worry versus uninhibited optimism)</td>
<td>5.00 ± 2.90</td>
<td>5.18 ± 3.08</td>
<td>4.23 ± 2.38</td>
<td>3.03 ± 2.30</td>
<td>8.87</td>
<td>&lt;.001</td>
<td>BP 1, BP 2, MDD &gt; unaffected</td>
</tr>
<tr>
<td>HA1 (fear of uncertainty versus confidence)</td>
<td>4.73 ± 1.64</td>
<td>3.82 ± 1.98</td>
<td>4.26 ± 1.82</td>
<td>3.55 ± 1.79</td>
<td>6.25</td>
<td>.01</td>
<td>BP 1, MDD &gt; unaffected</td>
</tr>
<tr>
<td>HA3 (shyness with strangers versus gregariousness)</td>
<td>4.13 ± 2.75</td>
<td>3.97 ± 2.86</td>
<td>3.97 ± 2.61</td>
<td>3.14 ± 2.25</td>
<td>2.43</td>
<td>.071</td>
<td></td>
</tr>
<tr>
<td>HA4 (fatigability and asthenia versus vigour)</td>
<td>4.92 ± 3.02</td>
<td>4.15 ± 2.94</td>
<td>3.53 ± 2.32</td>
<td>2.18 ± 1.94</td>
<td>17.94</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>SD1 (responsibility versus blaming)</td>
<td>5.92 ± 2.16</td>
<td>5.55 ± 2.66</td>
<td>6.65 ± 1.66</td>
<td>6.93 ± 1.54</td>
<td>4.99</td>
<td>.03</td>
<td></td>
</tr>
<tr>
<td>SD2 (purposefulness versus lack-of-goal direction)</td>
<td>5.25 ± 2.11</td>
<td>5.15 ± 2.09</td>
<td>6.05 ± 1.81</td>
<td>6.30 ± 1.59</td>
<td>5.45</td>
<td>.002</td>
<td></td>
</tr>
<tr>
<td>SD3 (resourcefulness)</td>
<td>3.10 ± 1.70</td>
<td>3.45 ± 1.54</td>
<td>3.86 ± 1.22</td>
<td>4.43 ± 0.94</td>
<td>14.05</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>SD4 (self-acceptance versus self-striving)</td>
<td>7.97 ± 2.65</td>
<td>7.48 ± 3.28</td>
<td>8.62 ± 2.47</td>
<td>9.06 ± 2.13</td>
<td>3.78</td>
<td>.014</td>
<td>Unaffected &gt; BP 1, BP 2</td>
</tr>
<tr>
<td>SD5 (congruent second nature)</td>
<td>8.90 ± 2.92</td>
<td>8.88 ± 3.30</td>
<td>9.91 ± 1.93</td>
<td>10.63 ± 1.76</td>
<td>7.59</td>
<td>&lt;.001</td>
<td>Unaffected &gt; BP 1, BP 2</td>
</tr>
<tr>
<td>ST1 (self-forgetfulness versus self-conscious experience)</td>
<td>4.05 ± 2.46</td>
<td>3.88 ± 2.62</td>
<td>2.96 ± 2.38</td>
<td>2.11 ± 1.72</td>
<td>10.63</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>ST2 (transpersonal identification versus self-isolation)</td>
<td>2.38 ± 2.11</td>
<td>1.79 ± 2.09</td>
<td>1.73 ± 1.81</td>
<td>1.54 ± 1.59</td>
<td>1.82</td>
<td>.15</td>
<td></td>
</tr>
<tr>
<td>ST3 (spiritual acceptance versus rational materialism)</td>
<td>5.87 ± 3.57</td>
<td>5.06 ± 2.83</td>
<td>4.49 ± 3.30</td>
<td>4.28 ± 2.82</td>
<td>3.31</td>
<td>.024</td>
<td>BP 1 &gt; MDD, unaffected</td>
</tr>
<tr>
<td>ST4 (enlightened versus Objective)</td>
<td>4.95 ± 4.07</td>
<td>4.06 ± 3.47</td>
<td>4.23 ± 4.37</td>
<td>3.56 ± 4.15</td>
<td>1.29</td>
<td>.285</td>
<td></td>
</tr>
<tr>
<td>ST5 (idealistic versus practical)</td>
<td>5.18 ± 2.45</td>
<td>4.00 ± 2.44</td>
<td>4.12 ± 2.62</td>
<td>3.90 ± 2.81</td>
<td>2.84</td>
<td>.043</td>
<td>BP 1 &gt; MDD, unaffected</td>
</tr>
<tr>
<td>Beck depression inventory</td>
<td>10.90 ± 9.83</td>
<td>9.79 ± 9.48</td>
<td>6.91 ± 8.64</td>
<td>2.99 ± 3.68</td>
<td>13.82</td>
<td>&lt;.001</td>
<td>BP 1 &gt; MDD, unaffected; BP 2, MDD &gt; unaffected</td>
</tr>
</tbody>
</table>
Interview for Genetic Studies (DIGS) [6, 7]. All participants also completed the revised 240-item temperament and character inventory (TCI-R) self-report questionnaire [8]. Probands and relatives were not required to be euthymic when completing the TCI, and the Beck depression inventory (BDI) [9] was used to assess mood state at the time of questionnaire completion.

Two hundred and seventy-seven individuals comprising 65 bipolar probands (50 BP1 and 15 BP2), 134 first-degree relatives, 70 other blood relatives and 8 spouses were assessed using the DIGS, which resulted in four diagnostic categories, BP1 (n = 60, 55% female), BP2 (n = 33, 52% female), MDD (n = 97, 69% female) and unaffected relatives (n = 87, 49% female). Individuals with diagnoses of bipolar disorder and depression not otherwise specified were excluded from analyses. Groups were compared using one-way analysis of variance (ANOVA) with Tukey post hoc analysis. TCI scales significantly different in the ANOVA analyses were corrected for current mood state by including BDI score as a covariate in a univariate analysis of covariance (ANCOVA). As the participants of this study are related, the influence of family clustering was corrected for by including family identification number during sample preparation as a cluster using complex sample preparation with replacement sampling. As this study was explorative, no correction for multiple testing was applied. All statistical analysis was conducted using SPSS version 13 (SPSS Inc., Chicago, Ill, USA). With a = 0.05 and power of 80% and ignoring the possible design effect from clustering, the detectable alternative for comparison of the two smallest groups (33 and 65) was 0.6 sd between the means whereas for comparison of the two largest groups (87 and 95) it was 0.4 sd [10].

3. Results

The mean values and standard deviations of the TCI scales of the four diagnostic groups are presented in Table 1. Of the seven scales, harm avoidance, self-directedness and self-transcendence were significantly different between diagnostic groups. Post hoc analyses revealed that BP1, BP2 and MDD had higher harm avoidance. Both bipolar groups had lower self-directedness than the unaffected relatives and BP1 had higher self-transcendence than MDD or unaffected relatives.

When the subscales were dissected, significant differences were observed for: HA1 (anticipatory worry versus uninhibited optimism), HA2 (fear of uncertainty), HA4 (fatigability and asthenia versus vigour), SD1 (responsibility versus blaming), SD2 (purposefulness versus lack-of-goal directedness), SD3 (resourcefulness), SD4 (self-acceptance versus self-striving), SD5 (enlightened second nature), ST1 (self-forgetfulness versus self-conscious experience), ST3 (spiritual acceptance versus rational materialism), and ST5 (idealistic versus practical). The Tukey post hoc analyses of these subscales are presented in Table 1.

In addition to differing in personality, the four groups demonstrated significant differences in depressive mood state at the time of assessment. The total BDI scores for the three mood disorder groups were all higher than the unaffected relatives, and the BP1 group scored higher than MDD group. As differences in personality could potentially be due to current mood-state [11, 12], an ANCOVA was conducted for each of the TCI items which displayed a significant difference between the groups. The TCI scale was the dependent variable and mood diagnosis was the fixed variable. Total BDI score was included in the model as a covariate. Results of these analyses are presented in Table 2.

After correction for self-reported depression, all the mood disorder groups had higher HA than the unaffected relatives. In contrast, only BP1 subjects had higher ST than MDD and controls. Among the subscales, three HA subscales, two ST subscales, and SD3 remained different between diagnostic groups.

4. Discussion

In this investigation of personality in a sample of individuals with bipolar disorder and their relatives we have shown differences in personality profiles between diagnostic groups. All groups with mood disorder had higher HA than unaffected relatives. ST was higher only in those with bipolar disorder. Initially SD appeared to be different between bipolar disorder and other groups, but correction for current mood state rendered the difference insignificant.

High HA has often been reported in bipolar disorder [13–20]. Our analysis shows both BP and MDD to be more harm avoidant than nonaffected relatives, further establishing high HA as a characteristic of susceptibility to mood disorder, and not unique to either MDD or BP. High HA or high neuroticism has consistently been linked to depression; however, this vulnerability likely includes bipolar as well as unipolar depression.

Differences on other scales found by other authors have not been replicated. Janowsky et al. reported greater NS in bipolar patients compared with patients with unipolar depression [15]. In our investigation, a trend to higher novelty seeking in the BP2 group was observed, but no significant difference was found. Using an earlier version of the TCI with nonexpanded persistence dimension, Osher et al. reported lower persistence in bipolar disorder [14, 21]. In our study three persistence subscales were lower in bipolar, however correction for BDI eliminated all but PS4 (perfectionist versus pragmatist), where the BP2 group was greater than the MDD group but no different from BP1 or the nonaffected relatives. Our results do not support the suggestion that low persistence is a temperamental marker of bipolarity.

The ST dimension of personality is associated with spirituality and a high score is considered to be an adaptive personality trait, when combined with high SD and CO. When high ST is not found with high SD and CO, Cloninger suggests that a schizotypal personality type emerges [8]. Our findings of higher ST in the BP1 group compared with unaffected relatives or those with a lifetime diagnosis of MDD suggests that BP1 patients experience more otherworldly experience. Higher ST scores in bipolar patients have been reported elsewhere compared with unaffected controls [18, 20].
### Table 2: Adjusted means of TCI scales and subscales found to be significant in original ANOVA corrected for mood at time of completing TCI questionnaire using total BDI score as a covariate.

<table>
<thead>
<tr>
<th>Scales and Subscales</th>
<th>Bipolar I (N = 60)</th>
<th>Bipolar II (N = 33)</th>
<th>Major depressive disorder (N = 97)</th>
<th>Unaffected relatives (N = 87)</th>
<th>F-statistic</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Harm Avoidance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HA1 (anticipatory worry versus uninhibited optimism)</td>
<td>4.44 0.31</td>
<td>4.77 0.41</td>
<td>4.22 0.24</td>
<td>3.58 0.23</td>
<td>2.76</td>
<td>.047</td>
</tr>
<tr>
<td>HA2 (fear of uncertainty versus confidence)</td>
<td>4.49 0.20</td>
<td>3.64 0.33</td>
<td>4.26 0.18</td>
<td>3.79 0.19</td>
<td>3.05</td>
<td>.033</td>
</tr>
<tr>
<td>HA4 (fatigability and asthenia versus vigour)</td>
<td>4.33 0.34</td>
<td>3.73 0.46</td>
<td>3.52 0.20</td>
<td>2.75 0.2</td>
<td>5.89</td>
<td>.001</td>
</tr>
<tr>
<td><strong>Self Directedness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD1 (responsibility versus blaming)</td>
<td>6.47 0.21</td>
<td>5.95 0.33</td>
<td>6.65 0.13</td>
<td>6.39 0.18</td>
<td>1.89</td>
<td>.14</td>
</tr>
<tr>
<td>SD2 (purposefulness versus lack-of-goal direction)</td>
<td>5.74 0.24</td>
<td>5.50 0.28</td>
<td>6.05 0.17</td>
<td>5.83 0.17</td>
<td>0.97</td>
<td>.41</td>
</tr>
<tr>
<td>SD4 (self-acceptance versus self-striving)</td>
<td>8.33 0.34</td>
<td>7.75 0.53</td>
<td>8.62 0.25</td>
<td>8.70 0.25</td>
<td>0.9</td>
<td>.44</td>
</tr>
<tr>
<td>SD5 (congruent second nature)</td>
<td>9.50 0.33</td>
<td>9.31 0.42</td>
<td>9.91 0.16</td>
<td>10.05 0.21</td>
<td>1.05</td>
<td>.37</td>
</tr>
<tr>
<td><strong>Self Transcendence</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST1 (self-forgetfulness versus self-conscious experience)</td>
<td>3.82 0.30</td>
<td>3.72 0.45</td>
<td>2.96 0.23</td>
<td>2.33 0.2</td>
<td>5.77</td>
<td>.001</td>
</tr>
<tr>
<td>ST3 (spiritual acceptance versus rational materialism)</td>
<td>5.84 0.45</td>
<td>5.04 0.51</td>
<td>4.49 0.34</td>
<td>4.30 0.32</td>
<td>2.93</td>
<td>.038</td>
</tr>
<tr>
<td>ST5 (idealistic versus practical)</td>
<td>5.08 0.32</td>
<td>3.92 0.43</td>
<td>4.12 0.26</td>
<td>4.00 0.3</td>
<td>2.26</td>
<td>.088</td>
</tr>
</tbody>
</table>
and MDD [17]. It appears that the high HA predisposes towards mood disorder and high ST, which is associated with schizotypy [22], contributes a second hit towards the expression of a bipolar phenotype. The ST scores of the BP2 group were not statistically different from the other diagnostic groups but were intermediate. Given the small numbers of BP2 subjects, further research on ST in BP2 is indicated.

High ST has been associated with polymorphisms in three genes, vesicular monoamine transporter 2 (VMAT2), [23], the serotonin receptor 1A (HTR1A) [24], and glycogen synthase kinase 3beta (GSK3B). Recently, two risk haplotypes within the VMAT2 gene have been identified for bipolar disorder and schizophrenia in a Spanish cohort [25]. Possession of the T-A-G haplotype at markers rs363420-rs363343-rs363272 conferred a relative risk of 4.4, and the C-C-A conferred a relative risk of 1.8 for bipolar disorder versus controls. A polymorphism (-50T/C) in the promoter of glycogen synthase kinase 3β (GSK3B), associated with age of onset and lithium response in an Italian bipolar cohort, is associated with the ST subscale ST2 (transpersonal identification). Participants homozygous for the rare C allele were significantly higher than those with the TT and CT genotypes [26].

Differences in serotonin receptor 1A density measured by positron emission tomography (PET) have also been associated with ST, especially the subscale spiritual acceptance [27]. Another PET study using the VMAT2 specific ligand (+)- [11C] dihydrotetrabenzine found brain stem binding to be higher in bipolar disorder and schizophrenic patients compared to controls. Greater VMAT2 binding was observed in the thalamus of the bipolar patients compared with both schizophrenic and control groups [28]. Future investigation into the mechanisms of these two genes and their associations with bipolar disorder and self-transcendence is warranted.

High harm avoidance and neuroticism personality traits have been well established in unipolar depression. This analysis suggests that high harm avoidance increases disposition to mood disorder, with other modifying factors, genetic and otherwise, may allow the bipolar phenotype to be expressed. This data could be seen as consistent with the findings of McGuffin et al. who demonstrated the independent inheritance of depression and mania in a twin study [28]. The independence may arise from risk genes for high harm avoidance predisposing to mood disorders in general interacting with risk genes for high self-transcendence to increasing vulnerability to a bipolar mood disorder phenotype.

This is one of the larger studies to have used the TCI to compare the personality traits of individuals with bipolar disorder, with major depression, and with no mood disorder. Larger sample size increases the power of detecting true differences. Furthermore the inclusion of a comparison between BP and MDD allows the dissection of the relevance of personality to bipolarity and to mood disorders in general.

The correction of our data for current mood state is important [12]. The inclusion of BDI in the analysis enables us to infer with more certainty that the differences of personality are important in the context of the diagnostic grouping rather than how differences in current level of depression influence personality. The TCI-R is the most current and complete version available, including persistence subscales and two additional ST subscales.

In this investigation of the personality of bipolar disorder probands and their relatives, we have identified differences in the personality dimensions of HA and ST. High HA reflecting tendency to mood disorder and high self-transcendence appears to be specific to bipolar disorder. For future studies of the genetics of bipolar disorder, high ST may be of interest as an endophenotype, and equally genes that influence ST could be considered candidate genes for bipolarity.

Acknowledgments

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References


Temperament and Character Domains of Personality and Depression
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Editorial

Temperament and Character Domains of Personality and Depression

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The link between personality and depression has long intrigued researchers and clinicians alike. Personality has been viewed as contributing to the onset and course of depression as well as influencing therapeutic choices for depression. Two major current personality theories are the “Big Five,” in which the NEO-PI is used as a measuring instrument, and the Psychobiology Theory of Personality, which uses the Temperament and Character Inventory (TCI) as a measuring instrument. This special issue deals with the latter theory in terms of its interrelations with depression and related conditions.

The last couple of decades have witnessed a great number of research reports on this topic. The association of TCI dimension with diverse types of health problems, and depression in particular, has been reported in the literature. The TCI has also been studied in terms of predicting treatment responses of depressed patients. Genetic and environmental correlates of TCI dimensions are a hot topic among researchers. Hence we believe that the present special issue is very timely.

This issue consists of six reports. K. Josefsson and colleagues, in Finland, present results from a longitudinal study of young Finns. Based on TCI scores at Time 1, the group tried to predict levels of depression 10 years later. They found that both high harm avoidance (HA) and low self-directedness (SD) independently predicted later depression severity. Thus, a prospective population-based design yielded findings that echoed the results of past cross-sectional and clinical treatment studies.

In a two-year follow-up study of a clinical population of depression, J. G. Goekoop and colleagues in the Netherland reported that only the increase in SD (in this two-year period) was related to the decrease in emotional dysregulation symptoms, while the increase in SD was associated with the decrease in HA. This suggests that symptomatic recovery follows reversibility of lowered SD.

People with current depression may be diagnosed with bipolar disorder if they have a lifelong history of manic or hypomanic episodes. Hence the association of TCI profiles with depression should be examined in terms of previous diagnoses of mood disorders. J. A. Harley and colleagues, in New Zealand, relate the results of their South Island Bipolar Study, namely, that high HA scores differentiated people with major depressive disorder (MDD) and those with bipolar disorder (BD) from unaffected relatives of bipolar probands after controlling for the current severity of depression. HA, however, failed to differentiate those with MDD from those with BD. On the other hand, high self-transcendence (ST) differentiated people with bipolar I (major depression with manic episodes) from those with MDD and unaffected relatives, confirming other reports of the importance of self-transcendence in the creativity of people with bipolar disorders.

People with depression are diagnosed with psychotic depression if they show positive symptoms simultaneously. J. G. Goekoop and colleagues in the Netherland in a followup study of clinical samples of depression reported that whereas patients with depression as a whole were characterized by higher HA and lower SD than healthy controls during the acute episode and higher HA after full remission, patients with psychotic depression were characterized by lower cooperativeness and lower reward dependence (RD) in the acute
episode and lower RD after full remission. Hence it may be that people with psychotic depression share the same personality traits of low RD with people with schizophrenia although the latter may be differentiated by high self-transcendence.

Z. Chen and colleagues in China, in their cross-sectional nonclinical population study, conducted a unique examination of TCI subscale score associations not with the total score of Zung’s Self-rating Depression Scale but with the scores of its subscales. Unexpectedly, it was not the negative subscale score but the positive subscale score (consisting of items such as “enjoy things” (reverse) and “feel useful and needed” (reverse)) that was predicted by low SD, cooperativeness, RD, and persistence. This observation shows the importance of the absence of positive emotions in addition to the presence of negative emotions in mood disorders.

Depression is often observed among pregnant women. E. Andriola and colleagues, in Italy, present unique preliminary findings on TCI patterns among expectant mothers and their partners. Both groups were characterized by low SD, whereas only expectant mothers were demonstrated to have high HA.

Eating disorders (ED) are often comorbid with depression, and individuals with both conditions are known to be resistant to treatment. A. D. Giovanni and colleagues, in Italy, report a high prevalence of major depression (MD) in outpatients with ED. Compared to patients with ED only, those with ED and MD demonstrated higher anger and eating disorder pathology scores. They were also characterized by high HA and low SD.

C. R. Cloninger hypothesized dopamine, serotonin, and noradrenaline to be biological substrates of novelty seeking (NS), HA, and RD, respectively. Hence it may be of research interest to investigate the temperaments of patients suffering from conditions characterized primarily by deficiencies of these neurotransmitters. Parkinson’s disease (PD) is such an example. PD is known to be caused by dopamine deficiency in cells of the substantia nigra. Pluck and Brown, in the UK, studied PD patients and controls. They found that NS scores correlated with a reaction time measure of attentional orientation to visual novelty, whereas HA scores correlated with anxiety scores. These observations confirm Cloninger’s original hypotheses about attention and learning in NS and HA.

Now that we have identified links between temperament and character domain patterns and depression, we must further investigate what mediates these effects. One possible mediator is coping style. M. Fushimi, in Japan, provides a hint that external locus of control is linked to psychological maladaptive patterns. Such coping styles may be based on personality traits. Other promising candidate mediators include self-esteem and self-efficacy, depressogenic dysfunctional attitudes and thinking errors, lack of social supports and social networks, poor coping reaction (rather than perceived coping styles), and stressful life events induced by specific personal traits.

Deeper insight into the association between personality and depression may contribute to the more efficacious treatment of depression.

Toshinori Kitamura
C. Robert Cloninger
An Increase of the Character Function of Self-Directedness Is Centrally Involved in Symptom Reduction during Remission from Major Depression

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Background. Studies with the Temperament and Character Inventory (TCI) in depressive disorders have shown changes \( (\Delta) \) of the character of Self-Directedness (SD) and the temperament of Harm Avoidance (HA). The central question of this study is which of these two changes is most proximally related to the production of depressive symptoms. Methods. The start and endpoint data from a two-year followup of 58 depressed patients were reanalyzed. We used the \( \Delta HA \) and \( \Delta SD \) scores as well as the \( \Delta \) scores on three dimensions of psychopathology, called Emotional Dysregulation (ED), Retardation (RET), and Anxiety (ANX). The presence of the main relation between personality and psychopathology was tested in all patients and in four subcategories. The data were analyzed by MANCOVA and Structural Equation Modelling (SEM). Results. \( \Delta HA \) and \( \Delta SD \) correlated negatively, and only \( \Delta SD \) was related (negatively) to \( \Delta ED \). This pattern was found in all subcategories. SEM showed \( \Delta HA \) and \( \Delta SD \) had an ambiguous causal interrelationship, while \( \Delta SD \), \( \Delta RET \), and \( \Delta ANX \) had unidirectional effects on \( \Delta ED \). Conclusion. The results correspond with a central pathogenetic role for a state-related deficit at the character level in depression. This may have important consequences for investigations of endophenotypes and clinical treatment.

1. Introduction

A change of personality has been found consistently in major depressive episodes [1]. A central question is whether this should be seen as an epiphenomenon or an essential step in the pathogenetic process. The current study focuses on changes of personality and relations with changes in the production of depressive symptoms in the course of remission. In order to allow for a fine-grained analysis of the personality changes involved, and for an optimal detection of relations with dimension(s) of psychopathology, we used multidimensional rating scales. The choice of dimensions for personality and psychopathology to be considered is important in such analyses. This will be discussed here below.

Previous studies of personality in patients with a major depressive disorder have shown that the premorbid personality traits of Neuroticism [2], Harm Avoidance (HA) [1, 3], and Self-Directedness (SD) [3] are related to the life-time risk of a depressive episode. Since Neuroticism is positively correlated with HA and negatively with SD [4], whereas HA and SD are themselves negatively correlated [5–17], these findings suggest that HA and SD represent different aspects of the more global vulnerability or resilience trait, that is nonspecifically covered by the Neuroticism dimensions of several other personality models [18–20]. Since Neuroticism does not predict the time of onset of the depressive episode [21], this global dimension may not be sufficiently differentiated to allow for the detection of the most proximal personality dimension that, in interaction with stress, would be involved in the eventual pathogenesis of the depressive disorder. For this reason, we used the Temperament and Character Inventory (TCI) [5] with its differentiation between SD and HA in this global domain of personality. In order to enhance the chance of finding the dimension that
is most proximally related to the transition from normal to pathological functioning and therefore to the production of depressive symptoms, we used state-related changes.

Changes of personality have been found before to be related to changes of depression in varying degrees of severity, and the findings may vary depending on the use of the measures of personality change. The first to mention are relations between subsyndromal symptom production and changes of Neuroticism immediately above the basal level [22]. In the higher severity range of symptom production changes of Neuroticism have been found to be present [23] but small [24], while highly reproducible changes have been found for the HA and SD dimensions of the TCI [1, 25–28]. The varying frequency of "comorbid" Axis-II diagnoses in patients with major depression [29] could be a third way in which personality changes may be assessed. From the perspective of the TCI, low basic levels of SD are the defining hallmark of personality disorders [30]. As improvement of the level of depressive symptoms has been found to correlate with the change in Axis-II prediction based on this SD score [25], the state-related-reduced SD in depression may be involved in this Axis-II "comorbidity". These findings support the necessity to differentiate between the dimensions of SD and HA in the studies of the primary and most proximally related factor in the onset and remission of depressive disorders. In the present study we therefore used the change of both dimensions, hypothesizing that either ΔHA or ΔSD would be most directly involved in the production of symptoms in depressive disorders. The analyses were carried out in all depressed patients as well as in four subcategories to test if the relation between the change of personality and change of psychopathology found is a general characteristic of all depressive disorders or just pertains to one or more subcategories.

The phenotypical significance of ΔHA or ΔSD can be derived from the personality model of the TCI and the subscales that are comprised by these dimensions. According to the TCI [5], personality can be conceived as a multidimensional construct comprising higher and lower levels of personal functioning and coping called character and temperament respectively. Whereas character is thought to involve conscious-adaptive information processing, temperament involves automatic adaptation via conditioned response patterns. The model includes three character dimensions called Self-Directedness (SD), Cooperativeness (CO), and Self-Transcendence (ST) and four temperament dimensions called Harm Avoidance (HA), Reward Dependence (RD), Novelty Seeking (NS), and Persistence (PER). HA comprises the subscales or facets of worrying/pessimism, fear of uncertainty, shyness, and fatigability, while low SD results in apathy, a loss of goals or direction, loss of self-striving behaviour, externalizing, and an incongruent second nature. This suggests that either or both changes could be directly involved in the pathogenesis of depression or one or more subcategories in particular.

To optimize the chances of finding relations with specific aspects of major depression, we also used a multidimensional approach to assess psychopathology. This involved the administration of the Comprehensive Psychopathological Rating Scale (CPRS) [31], which enables the assessment of six global dimensions of psychopathology [32] called Emotional Dysregulation (ED), Motivational Inhibition (or retardation (RET), Autonomous Dysregulation (or anxiety (ANX), Motivational Disinhibition (or Mania), Perceptual Disintegration, and Behavioural Disintegration. For the present study we used the three nonpsychotic and nonmanic global dimensions of ED, RET, and ANX. Emotional Dysregulation (ED) is a 20-item scale that comprises 9 of the 10 items of the Montgomery Asberg Depression Rating Scale (MADRS) [33]. Other items of the dimension of ED concern specific neurotic symptoms like compulsive thoughts, phobias, indecision, fatigability, failing memory, reduced sexual interest, reported muscular tension, loss of sensation or movements, derealisation, and depersonalisation [32]. The dimension of RET comprises items of inability to feel, apparent sadness, observed lack of appropriate emotion, reduced speech, and slowness of movement. The dimension of ANX comprises items of inner tension, reduced sleep, reported autonomic disturbances, aches and pains, observed autonomic disturbances signs, and observed muscular tension [32]. We used these global dimensions of psychopathology in the present study as we previously have found combinations of ANX and RET to be specifically involved in the phenotypes of subcategories of depression derived from the melancholic subtype [34]. This method has also enabled the detection of a phenotypic homology between one of these subcategories called depression with above-normal vasopressin concentration [35] and the stress-induced behavioural pattern of the animal model for depression called high anxiety-like behaviour rat [36]. Moreover, the combination of ED and RET appeared to be involved in psychotic depression [37].

As has already been reported previously [1], we investigated the changes of personality and psychopathology in the context of a two-year follow-up study of patients treated for an acute episode of major depression. We used the change scores between the start and the end of this two-year follow-up period. We first analyzed the correlations between the changes of the dimensions of personality and the dimensions of psychopathology by using Pearson's correlations and MANCOVA. Thereafter, we used Structural Equation Modelling (SEM) to analyze the pathway between personality change and change of psychopathology and at the same time the pathways between the changes of the dimensions of psychopathology. Since the personality dimensions of character and temperament and the dimensions of psychopathology represent different levels of functioning from the conscious conceptual level of character via the temperamental level of automatic conditioned behaviour to instinctual response patterns, the results of the present study are discussed from the perspective of the hierarchic organization of brain regions involved in depression. The support for either of two pathogenetic models will be evaluated. These models are based on the hypothesis of a continuity between premorbid temperament, increased temperament score, subsyndromal symptom level, major depressive disorder [38, 39], and the hypothesis of the development of a high-level functional deficit as precondition for the production of depressive
2.2. Personality. As in our previous studies on depression [1], we consider the continuity model to be supported if AHA relates most directly with the change of psychopathology, and the high-level functional deficit model to apply if ΔSD is most directly related to the change of psychopathology.

2. Methods

2.1. Subjects. We used the data set from 58 depressed patients who completed a two-year followup [1]. Mean age was 39.1 (sd = 11.8) years, 40 (69.0%) were female, 35 (60.3%) were outpatients, and 49 (84.5%) were at least partially remitted. Forty-one patients (70.7%) had depression in full remission, 8 patients (13.8%) had depression in partial remission, and 9 (15.5%) still fulfilled criteria for major depressive episode. The level of education was assessed from low education to university or postgraduate. The mean level of education was 3.3 (sd = 1.6).

The group of 58 patients was divided into four subcategories. These subcategories were based on our previous studies of vasopressinergic and noradrenergic mechanisms in depression and subcategories in the field of melancholic or endogenous depression [34] and psychotic depression [37]. These studies have resulted in two subcategories, called Highly Anxious-Retarded (HAR) depression, depression with above-normal plasma AVP concentration (ANA), as well as in support for psychotic depression as a distinct subcategory. In the present study, we eliminated all overlap between these three subcategories. This resulted in the following four subcategories: (1) psychotic depression (according to the DSM-IV-TR) (n = 7), (2) nonpsychotic depression with above-normal plasma AVP concentration (ANA-R) (n = 12), (3) nonpsychotic normal AVP highly anxious-retarded depression (HAR-R) (n = 12), and (4) all other depressed patients (n = 27).

2.2. Assessments

2.2.1. Personality. As in our previous studies on depression [1, 43], we used the Dutch translation [6] of the Temperament and Character Inventory (TCI) [5]. The lists were filled in within 2 weeks after recruitment and every 6 months until 2 years after recruitment. Patients were asked to respond to the items “as if they were in their premorbid state”, to maximally reduce state-dependent changes of response tendency.

2.2.2. Psychopathology. We used three of the six global dimensions of psychopathology assessed by the Comprehensive Psychopathological Rating Scale (CPRS) [31, 32]. These were the basic nonpsychotic and nonmanic dimensions of Emotional Dysregulation (ED), Motivational Inhibition (or psychomotor retardation (RET)), and Autonomic Dysregulation (or somatic anxiety (ANX)). We excluded the manic and two psychotic dimensions because these symptoms dimensions were not supposed to contribute to a large degree to the differentiation between the clinical pictures.

2.3. Statistical Analyses. Pearson’s correlations were used to test the correlation between ΔSD or, ΔHA and, ΔED, ΔRET, or ΔANX. Bonferroni correction was used, and alpha was set at P < 0.0083 to correct for 6 assessments. Two MANCOVAs were used to analyse the dependence of ΔED, ΔRET, and ΔANX on ΔSD and ΔHA. In these analyses, we changed the positions of the two sets of variables as dependent and independent variables. Sex was used as independent factor, and age and levels of education as covariables in an additional analysis. These analyses were carried out with the SPSS version 18.0.

A combined method was used with partial correlations (PC) and Structural Equation Modelling (SEM) to construct a graph and to analyze the correlation coefficients between the nodes and the weights of the edges, to explore the causal direction of the dependencies found between the changes of all dimensions of personality and psychopathology. This analysis was carried out using TETRAD, a software package for causal analyses provided by Carnegie Mellon University [44].

3. Results

3.1. Means and Δ Scores of HA, SD, ED, RET, and ANX. Table 1 shows means and standard deviations of the scores at start and after 2 years of followup on the personality dimensions of SD and HA and the basic symptom dimensions of ED RET, and ANX. The two personality dimensions and the three dimensions of psychopathology changed significantly over the two years. SD increased while all other dimensions decreased.

3.2. Correlations between ΔSD, ΔHA, ΔED, ΔRET, and ΔANX. Table 2 shows the correlations between the changes of all dimensions of personality and psychopathology used in this study. In all 58 patients, there was a moderately high negative correlation between ΔSD and ΔHA, a moderate negative correlation between ΔSD and ΔED, and a low positive correlation between ΔHA and ΔANX (just lacking statistical significance after Bonferroni correction), while there were moderately high positive correlations between ΔED, ΔRET, and ΔANX. The difference in the strength of the correlations of the latter three scores of the change of psychopathology suggests that the ED functions as the central or common dimension of psychopathological change.

3.3. Dependence of ΔED, ΔRET, and ΔANX on ΔSD and ΔHA, and Vice Versa. MANCOVA (Table 3) with ΔED, ΔRET, and ΔANX as dependent variables and ΔSD and ΔHA as independent variables showed that the relation between change of character (ΔSD) or temperament (ΔHA) and change of psychopathology was restricted to the relation between ΔSD and ΔED. The addition of sex, age, and level of education did not result in a significant relation with any of the two dimensions of personality change. MANCOVA with ΔSD and ΔHA as dependent variables and ΔED, ΔRET, and ΔANX as independent variables (Table 4) shows that the strength of the relation between ΔSD and ΔED increased if
Table 1: Mean scores (standard deviation between brackets) of SD, HA, ED, RET, and ANX at the start and after two years, and their differences, in 58 patients with depression.

<table>
<thead>
<tr>
<th></th>
<th>Mean score at start</th>
<th>Mean score at end of 2-year followup</th>
<th>Difference between start and end of followup</th>
<th>P-value of the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>23.7 (7.0)</td>
<td>28.4 (7.9)</td>
<td>4.74 (7.70)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HA</td>
<td>25.4 (5.8)</td>
<td>23.2 (7.4)</td>
<td>-2.16 (6.44)</td>
<td>0.014</td>
</tr>
<tr>
<td>ED</td>
<td>52.8 (11.6)</td>
<td>26.6 (16.4)</td>
<td>-26.21 (16.74)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>RET</td>
<td>8.5 (3.4)</td>
<td>3.8 (3.8)</td>
<td>-4.74 (3.64)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>ANX</td>
<td>11.3 (4.0)</td>
<td>7.4 (4.5)</td>
<td>-3.90 (4.80)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 2: Correlations between the changes of (Δ) the dimensions of personality (Self-Directedness and Harm Avoidance) and the dimensions of psychopathology (Emotional Dysregulation, Retardation, and Anxiety) in all 58 patients (lower left part of the table).

<table>
<thead>
<tr>
<th>Δ Self-Directedness</th>
<th>Δ Harm Avoidance</th>
<th>Δ Emotional Dysregulation</th>
<th>Δ Retardation</th>
<th>Δ Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ Self-Directedness</td>
<td>-.641</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δ Harm-Avoidance</td>
<td>&lt;.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δ Emotional Dysregulation</td>
<td>-.463</td>
<td>330</td>
<td>&lt;.001</td>
<td>.677</td>
</tr>
<tr>
<td>Δ Retardation</td>
<td>-.211</td>
<td>173</td>
<td>.111</td>
<td>.594</td>
</tr>
<tr>
<td>Δ Anxiety</td>
<td>-3.13</td>
<td>339</td>
<td>.017</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.009</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: The dependence of the change of (Δ) Emotional Dysregulation, Δ Retardation and Δ Anxiety on Δ Self-Directedness, and Δ Harm Avoidance in 58 patients assessed over 2 years (F and P values of a MANCOVA).

<table>
<thead>
<tr>
<th>Δ Emotional Dysregulation</th>
<th>Δ Retardation</th>
<th>Δ Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ Self-Directedness</td>
<td>7.54 (0.008)</td>
<td>0.994 (0.323)</td>
</tr>
<tr>
<td>Δ Harm Avoidance</td>
<td>1.35 (0.715)</td>
<td>0.135 (0.714)</td>
</tr>
</tbody>
</table>

Table 4: The dependence of the change of (Δ) Self-Directedness and Δ Harm Avoidance on Δ Emotional Dysregulation, Δ Retardation, and Δ Anxiety in 58 patients assessed over 2 years (F and P values of a MANCOVA).

<table>
<thead>
<tr>
<th>Δ Emotional Dysregulation</th>
<th>Δ Retardation</th>
<th>Δ Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ Self-Directedness</td>
<td>9.58 (0.003)</td>
<td>1.43 (0.237)</td>
</tr>
<tr>
<td>Δ Harm Avoidance</td>
<td>1.88 (0.176)</td>
<td>0.783 (0.380)</td>
</tr>
</tbody>
</table>

This relation was controlled for the effect of ΔRET and ΔANX on ΔED.

If the differentiation into 4 subcategories was added as fixed factor to this MANCOVA model, then it appeared that the strongest correlation was found in the largest subcategory of all other depressed patients (F = 9.303; P = 0.004) and that not any of the three other subcategories had a significantly deviant correlation. The subcategory of HAR-R depression, which has the lowest SD score after full remission had a nearly significantly higher range for ΔSD (t = 1.877; P = 0.066) than the group of All Other Depressed patients with one patient having a high decrease of SD after 2 years (see Figure 1).

3.4. Pathways Involved in Symptom Production. Structural Equation Modelling (Figure 2) showed that ΔHA and ΔSD were bidirectionally related, suggesting the possibility of a positive feedback loop within the change of personality associated with the production of depressive symptoms. As far as the relation between the two domains of personality change and depressive symptoms is concerned, ΔSD was related uniquely and negatively with ΔED (P = 0.024), and this involved a causal effect of ΔSD on ΔED, but not vice versa. ΔRET and ΔANX were uninfluenced by ΔHA and ΔSD, and each had a unique positive contribution to ΔED (P = 0.001 and 0.010 resp.). Figure 2 shows the correlations. The Edge Coefficients of the weights of the effects were as follows: ΔHA on ΔSD −0.32 (SE = 0.13), ΔSD on ΔHA −0.38 (SE = 0.09), ΔSD on ΔED −0.58 (SE = 0.18), and ΔRET and ΔANX on ΔED 1.89 (SE = 0.45) and 1.23 (SE = 0.35), respectively.

4. Discussion

4.1. Correlations. As previously reported on data from the same patient sample [1] the present study showed that the mean of the score of the character dimension of SD increased during the two-year followup, while the mean of the score of the temperament dimension of HA showed a decrease. The
present study now in addition showed that the state-related changes of SD and HA were negatively correlated, and that only ASD correlated with the change of psychopathology. This ASD appeared to correlate uniquely with the change of the psychopathology dimension of ED. Within the domain of psychopathology the changes of all three dimensions (ED, RET, and ANX) appeared to be strongly intercorrelated, with ΔED having the strongest correlations. This suggests that this dimension of ED represents the core of the depressive disorder and that ANX and RET are variably associated dimensions, as has been found in our previous studies on the clinical phenotype of subcategories of depression [35, 37, 45].

4.2. SEM Findings and Support for the High-Level Functional Deficit Model. The bidirectional pathway between ASD and ΔHA, combined with the absence of a correlation between ΔHA and any dimension of psychopathology, corresponds with a relatively independent dynamic interaction within the field of personality. As the dimension of HA is thought to represent a conditioned sensitivity for stressful events and SD a learned way to cope with stress conditions [5], this bidirectional relation could reflect a stress-induced vicious circle of the experience of stress, a loss of learned coping, and an increase of the sensitivity for stress conditions. The unidirectional causal pathway between ASD and ΔED suggests that the stress-induced loss of SD may function as a central pathogenetic factor for the production and maintenance of depressive symptoms. Since the state relatedness of reduced SD has been found in all of the 4 subcategories in which we divided the whole group of depressive disorders, and ASD and ΔED now appeared to be correlated in all these subcategories, this factor appears to be a general characteristic of major depression. The hierarchic structure found by SEM of the relations within the psychopathological domain between ΔED, ΔRET, and ΔANX may correspond with a recent model of activated regions within the hierarchic organization of brain structures involved in the “default resting state” of depression [39].

The results of the present study do not support the model of a continuity between premorbid temperament, increased temperament, subsyndromal symptom level, and major depressive disorder. In contrast, the relation of ASD to ΔED corresponds with the classic high-level functional deficit model of mental disorders [41], derived from neurology [40]. While this high level deficit has more recently been claimed to apply specifically to neuropsychological functional deficits of depressive disorders [42], we now found evidence that it may be conceptualized in terms of psychological functioning. According to the classic model, a high-level functional deficit (described as “negative” symptoms) should be the actual pathogenetic factor that functions as the precondition for relatively lower level functions to become disinhibited and to produce the most manifest or “positive” symptoms of the disorder. ASD can be conceived as such a high-level functional deficit, and ΔED, ΔRET, and ΔANX as dimensions of psychopathology that result from the disinhibition of lower levels of cerebral organization.

This ASD may be a useful target for the translational search for endophenotypes of depressive disorders. This means that the accidentally discovered inability of the HAB rat—an animal model with increased vasopressinergic
activation and increased vulnerability for depression—to activate the Dorso-Medial Prefrontal region that is normally involved in the inhibition of conditioned avoidance behaviour, may be seen as such an endophenotype [46]. In contrast, the hypotheses that the depressive disorder can be conceived as a severe form of the premorbid trait or temperament [38, 47], or as being due to an abnormally increased activation of a network that is also activated by a normal affective response to stress in healthy brains [39], would direct the search for endophenotypes towards regions of the brain that could not be most centrally involved in the pathogenetic mechanism of depression.

Since the diagnosis of an Axis-II disorder depends on low SD [30], and the change of SD during the change of depression has been found to reduce the prediction of an Axis-II diagnosis in a substantial way [25] around the mean of the frequency of the Axis-II diagnosis in depression [27], the present support for a central role of ΔSD in the pathogenesis may result in a revision of the interpretation of this Axis-II diagnosis from a secondary complication or “comorbidity” [29] to a change of personality that is inherently related to the general and central pathogenetic mechanism. This reinterpretation of the clinically obvious and disturbing deficit of Axis-II “comorbidity” will also probably enhance the interest in related neurobiological changes and targets for treatment.

The unidirectional effects from ΔRET and ΔANX on ΔED may be due to several factors. These effects could be inherently related to a sequential pattern of remission in clinical pictures of subcategories of depression with high ANX and/or RET, like HAR depression and psychotic depression [37, 45]. On the other hand, dimensions of RET and ANX could be influenced independently by specific treatments.

4.3. Implications for the Neurobiological Research of SD. The central role for ΔSD in the relation between change of personality and psychopathology, and the negative interaction between ΔSD and HA suggest that the hypofunctional and hyperactive cerebral regions involved in this relation should be investigated in detail. Up to now only evidence has been reported of a relation between the character dimension of SD and “prefrontal function” [48, 49], while HA has been found to be related with more specifically defined regions, like the right Anterior Cingulum [50] and the Subgenual Anterior Cingulate Cortex (SUACC) [51]. Three regions, the Perigenual Anterior Cingulate Cortex (PACC), the (SUACC), and the Ventro-Medial Prefrontal Cortex (VMPFC), have consistently been found to be abnormally activated during a depressive state [39]. This suggests that one should search for neurobiological correlates of ΔSD in a network that complementarily mediates at the highest prefrontal level both the balance between activation and inhibition of conditioned emotional responses and the top-down regulation of the lower-level neurobiological correlates of emotional, instinctual and neuroendocrine states. This network could comprise the already-mentioned Dorso-Medial Prefrontal Cortex (DMPFC), which inhibits emotional and conditioned responses and has been found to be hypofunctional in depressed patients [52]. The same network could also comprise the medial prefrontal/cingulate region that is involved in the inhibition of the glucocorticoid response to stress [53], and the ventromedial prefrontal region [54] that is involved in the extinction memory of conditioned freezing behaviour. A problem with the supposedly reduced function of the DMPFC in depression is that a stress-induced increased activation of this region has been found in depression and that this was found to be associated with HA [55]. This suggests that future studies should carefully delineate in what extent the responses and state-related activities of the DMPFC are related to both SD and HA.

A limitation of the present study is that it only supports the central role of reduced SD in the pathogenesis of depression in the second part of the acute episode during the transition from full pathology to remission. The findings therefore warrant investigations of the first part of the acute episode of depression. Nonetheless the support for a central role of reduced SD in the pathogenesis of depression warrants further research-related prefrontal hypofunction and treatment effects both in man and translational studies of animal models of depression.

References


Research Article

Temperament and Character in Psychotic Depression Compared with Other Subcategories of Depression and Normal Controls

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Background. Support has been found for high harm avoidance as general vulnerability trait for depression and decreased self-directedness (SD) as central state-related personality change. Additional personality characteristics could be present in psychotic depression (PD). Increased noradrenergic activation in PD predicts the involvement of reward dependence (RD).

Methods. The data during the acute episode and after full remission from the same subjects, that we used before, were reanalyzed. The dependence of the 7 dimensions of the Temperament and Character Inventory version 9 on PD, three other subcategories of depression, and a group of normal controls was tested by MANCOVA.

Results. Low RD at both time points, and low Cooperativeness during the acute episode, were found as additional characteristics of PD.

Conclusion. The combination of two premorbid temperaments, high HA and low RD, and the development of a state-related reduction of two character functions, SD and CO, may be the precondition for the development of combined depressive and psychotic psychopathology.

1. Introduction

The relation between personality and depression is complex, because of the many different types of relationships that have been found. Personality characteristics may be operative as premorbid vulnerability traits, pathoplastic traits, reversible state-dependent changes of personality that may have a pathoplastic or pathogenetic function, and even irreversible scars. Moreover, each subcategory of depression could have specific characteristics in one or more of these areas. The present study focuses on trait and state-related characteristics of personality in major depression with psychotic features, hereafter called psychotic depression (PD). As far as we know, this type of investigation has not been carried out before. This is a shortcoming not only from the theoretical perspective, but also from the practical point of view, since particularly vulnerability traits and pathogenetic personality changes could have important therapeutic consequences.

The present study is part of a series of investigations in the same patient sample that aimed at the stepwise development of knowledge of subcategories of depression and of depressive disorders in general, by using (a) multidimensional description of the complex clinical pictures of subcategories of depression based on global dimensions of psychopathology [1] assessed by the comprehensive psychopathological rating scale (CPRS) [2], (b) multidimensional description of personality characteristics assessed by the Temperament and Character Inventory (TCI version 9) [3], (c) neurobiological characterization by means of plasma concentrations of arginine-vasopressin (AVP), cortisol and norepinephrine (NE), as well as their correlations, (c) family history of depression [4], and (d) a two-year followup.

According to the TCI, personality can be conceived as a multidimensional construct comprising lower and higher levels of personal functioning and coping called temperament and character, respectively [3]. Whereas temperament involves automatic adaptation via conditioned response patterns, character is thought to involve conscious-adaptive information processing. The model comprises four temperament dimensions, called harm avoidance (HA), reward dependence (RD), novelty seeking (NS) and persistence (PER), and three character dimensions, called...
self-directedness (SD), cooperativeness (CO), and self-transcendence (ST). In the TCI version 9, HA consists of anticipatory worry versus optimism (HA1), fear of uncertainty versus confidence (HA2), shyness versus gregariousness (HA3), and fatigability and asthenia versus rigor (HA4). RD consists of sentimentiality versus insensitivity (RD1), attachment versus detachment (RD3), and dependence versus independence (RD4). NS consists of exploratory excitability versus rigidity (NS1), impulsiveness versus reflection (NS2), extravagance versus reserve (NS3), and disorderliness versus regimentation (NS4), and PER of one facet called persistence versus irresoluteness. SD consists of acceptance of responsibility for one's own choices instead of blaming other people and circumstances (SD1), identification of individually valued goals and purposes versus lack of goal direction (SD2), development of skills and confidence in solving problems (resourcefulness) versus apathy (SD3), self-acceptance versus self-striving (SD4), and congruent second nature versus personal distrust (SD5). CO consists of social acceptance versus intolerance (CO1), empathy versus social disinterest (CO2), helpfulness versus unhelpfulness (CO3), compassion versus revengefulness (CO4), and pure-hearted principles versus self-advantage (CO5). ST comprises self-forgetful versus self-conscious experience (ST1), transpersonal identification (i.e., identification with nature) versus self-differentiation (ST2), and spiritual acceptance versus rational materialism (ST3).

Our investigations started by the development of two new subcategories of depression in the field of melancholic or endogenous depression [5]. We first found support for a highly anxious-retarded (HAR) subcategory that was derived from the melancholic subtype according to the DSM-IV. Thereafter, we found support for a subcategory of depression with above-normal plasma arginine-vasopressin (ANA) concentration. At the level of personality characteristics, all patients with depression had increased harm avoidance (HA) after full remission compared with control subjects [6]. Fully remitted patients with HAR and ANA depression appeared to have in addition low self-directedness (SD) and low cooperativeness (CO), respectively, [6, 7]. Depression at large further appeared to be characterized by a state-related reduction of SD and increase of HA [6], while ANA depression in addition had a state-related reduction of reward dependence (RD) [7]. At the neurobiological level we found support for the HAR and ANA subcategories to have a genetic increase of the pituitary vasopressin receptor function and of the vasopressin synthesis, respectively, [5], while untreated depression at large eventually appeared also to have evidence of increased vasopressinergic function [8]. Recently we found the change of the character dimension of SD to be most directly related to the change of depressive symptoms [9]. This implies that rather than high HA, which we assume to be the most general vulnerability trait for depression, the state-related decrease of SD may represent the most general and central pathogenetic step for the actual development of depressive psychopathology.

In the present study we searched for the additional personality characteristics of PD. Most recently we detected an increased concentration of plasma norepinephrine and evidence of increased noradrenergic-vasopressinergic activation in this subcategory [10]. Since measures of noradrenergic function have been associated with RD [11–16], we hypothesized PD to be specifically related with this dimension of temperament.

In this study of PD we used three other subcategories of depression and a group of normative subjects as control groups. As a consequence of the stepwise procedure of our previous investigations, several subcategories that had been developed first appeared to have a small percentage of patients with features that eventually came out to be the defining characteristics of one or more other distinct subcategories. The increased AVP concentration initially found in HAR depression [17] appeared to belong to the defining characteristic of the ANA subcategory [18], and the psychotic features found in HAR as well as in ANA depression appeared to be better conceived to define a distinct subcategory of psychotic depression (PD) than as the phenotype of the severest form of HAR or ANA depression [10]. These results suggest that better delimitations between the subcategories of HAR and ANA depression as well as PD should be made by elimination of the initially accepted overlap. In this study we therefore used these better delimited subcategories, and we tested whether the previously found relations with the HAR and ANA subcategories do still hold after the elimination of overlap.

The data set of the same patient sample that we used before [6] was reanalyzed. We defined 4 subcategories of depression: PD, ANA depression without psychotic features (ANA-R), HAR depression without psychotic features and with normal vasopressin concentration (HAR-R), and the remaining group of all other depressed patients as the fourth subcategory. As before, we used the data of the personality characteristics at time of entrance in the study and after 2 years during full remission. The four depressive subgroups together with a control group of normative subjects were used as fixed factors in a MANCOVA, in which the 7 TCI version 9 dimensions served as the dependent variables, and age and gender as covariates. During the acute episode we hypothesized that HAR-R is not specifically related with any personality dimension [6], and that ANA-R is related with both reduced CO and RD [7]. After full remission, HAR-R was hypothesized to depend specifically on low SD [6], and ANA-R on low CO [7]. We hypothesized that PD is related to RD at least during the acute episode, in which we found the increased plasma NE concentration. The state-relatedness of RD and other dimensions of personality in PD was explored. Eventually, we explored the role of the subscales of the TCI version 9 dimensions that were found to be related to PD, by comparing all four subcategories of depression.

2. Methods

2.1. Patients and Control Subjects. We used the same sample of acutely depressed patients referred to our institute, that we used before in our investigation of the relation between TCI version 9 data and the ANA and HAR subcategories of depression [6, 7]. For the present study we selected the data from the start of the study (t1; n = 78) and after
2 years \( (t = 7; n = 58) \). The inclusion criteria were major depression (DSM-IV (APA, 2000)) and a score >20 on the Montgomery-Asberg rating scale (MADRS) [19]. All patients were recently referred to the psychiatric institute and referred to the study by the psychiatrist who made the initial diagnosis. After confirmation of the diagnosis by RFPdeW, using a semistandardized interview, the patient was asked to participate in the study. Exclusion criteria were bipolar disorder; treatment with lithium, carbamazepine, or valproate; first episode of major depression at age 60 years or older; alcohol or drug abuse or dependence; pregnancy; clinical evidence of a condition associated with abnormal plasma AVP release, such as the syndrome of inappropriate Secretion of antidiuretic hormone. The noncompleters of the study were just lost in the followup. Those lost and those remaining in the followup did not differ on clinical or demographic parameters (neuroticism, number of previous episodes, duration of current episode, family history of depression, psychotic depression, atypical depression, melancholia and anxious-retarded subtype, severity, and age, gender, and education) [20].

The MADRS was used as this scale has been developed from the CPRS and has maximal sensitivity to change in depressed patients. The use of the score >20 was derived from the general rule of thumb at the time of the study to take 1/3 of the maximal scale score for the delimitation of sufficient severity. The MADRS was preferred above the Hamilton rating scale for depression (HAMD) since the MADRS has high unidimensionality [21], and the (HAMD) an insufficiently reproducible factor-structure [22]. The MADRS was preferred above the Beck depression inventory, since the MADRS is less influenced by maladaptive personality traits [23].

Psychotic depression (PD; \( n = 10 \)) was diagnosed according to the DSM-IV-criteria [24]; ANA-R (\( n = 13 \)) was defined by a concentration of plasma AVP > 5.6 pg/mL and [18] and the absence of PD; HAR-R (\( n = 14 \)) was defined by the combination of anxiety and retardation scores \( \leq \) the median [25] and the absence of ANA and PD. The remaining group of all other depressed patients was the fourth depressive subcategory (all other depressed; \( n = 41 \)). After two years of followup \( (t = 7) \), 41 of the 58 completers of the followup were in full remission (71\%) defined as no more than 2 items of the DSM-IV criteria for major depressive episode during two weeks corresponding with the criteria proposed by Frank et al. [26]. In a previous study using somewhat more rigid criteria, we found 65\% to have full remission [27]. In the present study, the DSM-IV criteria for major depression were assessed by using the corresponding CPRS items. The CPRS items were rated from 0 to 6, covering the two weeks preceding the assessment. A score \( >2 \) was taken to represent the DSM-IV severity criterion of a symptom being more present than absent. Increased appetite and weight were rated separately. The number of patients in each subcategory at \( t \) was PD: \( n = 6 \); ANA-R: \( n = 9 \); HAR-R: \( n = 8 \); all other depressed patients: \( n = 18 \).

Normal control subjects (\( n = 86 \)) were selected from a normative sample [28] that was recruited at random from the national telephone book, as described in the study of the relation between the HAR subcategory and personality [6]. For reason of comparability with our previous studies, the number of control subjects was kept the same. The differences between the scores of these 86 normal controls and the scores of the normative sample by Cloninger et al., [3] (higher HA, lower PER, and lower ST scores compared to Cloninger’s normative sample (HA: 15.4 (7.1) versus 12.6 (6.8), PER: 4.4 (1.9) versus 5.6 (1.9), ST: 11.2 (6.1) versus (19.2 (6.3))), correspond with the data of the full sample of the Dutch validation study [28] and seem to be due to cultural differences. The controls were not investigated for anxiety or depression.

2.2. Personality. In patients and controls we used the scores of the three character dimensions of self-directedness (SD), cooperativeness (CO) and self-transcendence (ST), and the four temperament dimensions of harm avoidance (HA), reward dependence (RD), novelty seeking (NS), and persistence (PER) of the TCI version 9 [3, 28]. Scores of the subscales of these main dimensions were only available in the patient sample.

2.3. Statistical Analysis. The four depressive subgroups (PD, ANA-R, HAR-R, and all other depressed patients) were used together with a control group of normative subjects, as fixed factors in a MANCOVA, in which the seven TCI version 9 scores served as the dependent variables, and age and gender as covariates. For the test of the dependence of PD on RD, we used a \( P \) value of 0.05. To correct for chance effects in case of additional relations between PD and any of the 7 TCI measures we used a \( P \) value of 0.007 in the exploratory analyses. The relations between HAR-R and SD and between ANA-R and CO, that we previously found in the same sample for the HAR and ANA subcategories, were tested by using a \( P \) value of 0.05. The one sample binomial test and one-sample Kolmogorov-Smirnov tests were used to test the homogeneity of the distribution of gender and age, and RD and CO at start and at the end of the followup. The analyses were carried out with the SPSS version 18.0.

3. Results

3.1. Personality Characteristics during the Acute Depressive Episode. Table 1 shows the scores on the 7 TCI version 9 scales at the start of the study, when all patients fulfilled the criteria for major depressive episode. Corresponding with our previous analysis in the same patients sample [6], a MANCOVA with the whole depressed group and the control group as fixed factors, showed that depression \( (n = 78) \) had significantly increased HA \( (F = 76.625; P < 0.001) \) and decreased SD \( (F = 92.755; P < 0.001) \), while CO and RD were nonsignificantly reduced \( (F = 5.118; P = 0.025, \text{ and } F = 5.885; P = 0.016, \text{ resp.}) \). A MANCOVA that used the 4 subcategories of depression and the control group as 5 fixed factors, showed that PD was characterized by low CO \( (t = -2.949; P = 0.004) \) and low RD \( (t = -2.717; P = 0.007) \), and ANA-R similarly still also had low RD \( (t = -2.718; P = 0.007) \) with low CO \( (t = -2.237; P = 0.027) \). All
Table 1: Temperament and character (standard deviation between brackets) during the acute depressive episode of psychotic depression (PD), ANA-R depression, HAR-R depression, and all other depressed patients, as well as in healthy controls (**P < 0.001; *P < 0.0071; +P < 0.05; P values compared with controls).

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>HA</th>
<th>RD</th>
<th>NS</th>
<th>PER</th>
<th>SD</th>
<th>CO</th>
<th>ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depressive episode</td>
<td>78</td>
<td>25.4*** (6.1)</td>
<td>14.7 (3.9)</td>
<td>17.7 (6.6)</td>
<td>4.7 (1.9)</td>
<td>23.1*** (7.1)</td>
<td>31.4 (6.1)</td>
<td>10.6</td>
</tr>
<tr>
<td>PD</td>
<td>10</td>
<td>24.7*** (7.8)</td>
<td>12.7** (3.1)</td>
<td>18.9 (7.1)</td>
<td>4.2 (1.2)</td>
<td>23.4*** (6.9)</td>
<td>28.1*** (6.7)</td>
<td>13.8</td>
</tr>
<tr>
<td>ANA-R</td>
<td>13</td>
<td>24.1*** (6.8)</td>
<td>12.8* (4.8)</td>
<td>16.3 (6.4)</td>
<td>5.5 (1.8)</td>
<td>24.1*** (8.4)</td>
<td>29.4* (6.0)</td>
<td>10.1</td>
</tr>
<tr>
<td>HAR-R</td>
<td>14</td>
<td>26.4*** (5.9)</td>
<td>16.1 (3.2)</td>
<td>16.4 (4.1)</td>
<td>4.9 (2.4)</td>
<td>21.7*** (7.0)</td>
<td>32.6 (6.0)</td>
<td>12.3</td>
</tr>
<tr>
<td>All other depressed</td>
<td>41</td>
<td>25.7*** (5.7)</td>
<td>15.2 (3.8)</td>
<td>18.3 (7.2)</td>
<td>4.6 (1.9)</td>
<td>23.3*** (6.9)</td>
<td>32.5 (5.7)</td>
<td>9.4</td>
</tr>
<tr>
<td>Healthy controls</td>
<td>86</td>
<td>15.4 (7.1)</td>
<td>16.1 (4.1)</td>
<td>19.5 (5.5)</td>
<td>4.4 (1.9)</td>
<td>32.3 (6.4)</td>
<td>33.3 (5.2)</td>
<td>11.2</td>
</tr>
</tbody>
</table>

4 subcategories had high HA (t = 4.131, 4.504, 5.804, and 7.945; P < 0.001) and low SD (t = −4.020, −4.136, −5.493, and −6.976; P < 0.001). The high HA and low SD were most strongly present in the group of all other depressed patients.

A similar analysis within the sample of depressed patients showed that PD was characterized by a statistically non-significant low score on the dependence subscale of the RD dimension in comparison with the subcategory of all other depressed patients (t = −1.857; P = 0.067), and low scores on the compassion versus revengefulness (t = −2.004; P = 0.049) and (nonsignificantly) pure-hearted versus Selfserving subscales (t = −1.282; P = 0.072) of the CO dimension, while the ANA-R subcategory was characterized only by low compassion versus revengefulness (t = −2.018; P < 0.047) from the CO dimension. Given the fact that 3 subscales could be involved in low RD and 5 subscales in low CO, these relations were not statistically significant after correction for multiple assessment.

3.2 Personality Characteristics after Full Remission of the Depressive Episode. In the whole group of fully remitted patients (see Table 2) MANCOVA showed that HA was high (t = 4.645; P < 0.001) and ST low (t = −2.008; P = 0.047) compared with the control subjects. A MANCOVA that used the 4 subcategories of depression and the control group as 5 fixed factors, showed that PD (n = 6) was only characterized by low RD (t = −2.236; P = 0.027), while the ANA-R subcategory (n = 9) had only low CO (t = −2.761; P = 0.007). The HAR-R subcategory (n = 8) had low SD (t = −2.001; P = 0.048). The ANA-R and HAR-R subcategories and the group of all other depressed patients (n = 18) had significantly high HA (t = 1.981; P = 0.050, t = 2.770; P = 0.007, and t = 3.186; P = 0.002, resp.), while the PD subcategory had a similarly increased HA combined with a low standard deviation, that nonetheless just lacked statistical significance (P = 0.053). A comparison of the data from Tables 1 and 2 shows that CO in PD and RD in the ANA-R subcategory showed some state-related increase resulting in the absence of a difference compared with the normal control subjects, while RD in PD and CO in ANA-R had not changed very much. These data suggest state-dependent reductions of CO in PD and of RD in ANA-R.

A similar analysis, within the sample of fully remitted patients, showed that PD was characterized by a low score on the attachment subscale of the RD dimension in comparison with the subcategory of all other depressed patients (t = −2.433; P = 0.020), and a low score on the Compassion versus revengefulness subscale of the CO dimension (t = −2.309; P = 0.027), while the ANA-R subcategory was characterized by low compassion versus revengefulness (t = −4.538; P < 0.001) and a low score on the pure-hearted versus selfserving subscale (t = −3.631; P = 0.001) of the CO dimension, combined with a low Dependence (t = −2.153; P = 0.038) within the RD dimension. After correction for multiple assessment only the relations between the two subscales of CO and ANA-R remained statistically significant.

Finally, the one-sample binomial test and one-sample Kolmogorow-Smirnov tests showed that in the subcategory with PD the null hypothesis of the distribution of gender and age, and RD and CO at start and at the end of the followup should be retained (P = 0.508; P = 0.666; P = 0.982; P = 0.993; P = 0.982; P = 0.998, resp.). This supports the relative stability of the PD sample.

4. Discussion

4.1 Personality Characteristics of PD and the General Characteristics of Depressive Disorders. This study confirmed the hypothesis that PD is related to RD. We found that RD was low compared with normal control subjects both during the acute episode and after full remission. This supports that low RD is an additional vulnerability trait for PD. The present study unexpectedly also showed that PD is related with a probably state-dependent reduction of CO. As far as the most general characteristics of depression are concerned, we found that the high HA and state-related reduction of SD found in the whole group of depressed patients [6] were present.
in all four subcategories (PD, ANA-R, HAR-R and all other depressed patients). The high HA in PD after full remission just lacked statistical significance. This is probably due to the low number of fully remitted PD patients, as the HA score had the same high level combined with even a relatively low standard deviation compared with the other subcategories of depression. Despite this low number of PD patients, the combined data strongly suggest that PD is characterized by two premorbid temperamental traits, namely, high HA and low RD, and two state-related changes of character function, involving SD and CO. The nonpsychotic subcategories on the other hand appeared to be characterized only by high HA and SD, low RD, and two state-related changes of character function, involving SD and CO. The nonpsychotic subcategories on the other hand appeared to be characterized only by high HA and SD, low RD, and two state-related changes of character function, involving SD and CO.

4.2. The Effect of Elimination of Overlap between PD, HAR, and ANA Depression. The present study further showed that the elimination of overlap between the PD, ANA, and HAR subcategories did not substantially affect our previous findings of specific low character scores of SD and CO after full remission in HAR and ANA depression, and the state-related change of RD in ANA depression. In our previous study ANA-depression had reduced RD \( F = 8.466; P = 0.004 \) and reduced CO \( F = 8.052; P = 0.006 \) during the acute episode compared with the control subjects [7]. The fact that in the present study the same relations with ANA-R were less strong than in the nonrevised ANA subcategory is presumably due to the lower number of subjects, as the mean values during the acute episode did not differ much (RD = 12.8; sd = 4.3 versus 12.8; sd = 4.8, and CO = 29.2; sd = 5.6 versus CO = 29.4; sd = 6.1, resp.). The mean of the CO score in the ANA-R subcategory after full remission (CO = 28.4; sd = 3.3) was nearly identical to that of ANA depression (CO = 28.5; sd = 3.4), and the strength of the relation was only weakly reduced \( P = 0.007 \) compared to before the elimination of overlap \( P = 0.003 \) [7]. This may be due to the fact that only two psychotic patients were eliminated from the group of fully remitted patients with ANA depression. In the group of HAR-R patients in full remission we found a mean SD score of 27.3 (sd = 7.6) and a \( P \) value of this relation of 0.048. This mean SD value was somewhat lower than that found in unrevised HAR depression (SD = 28.4; sd = 7.9) [6], which suggests that the elimination of overlap has resulted in a subcategory with increased validity.

4.3. Noradrenergic Mechanism Involved in the Low RD and Decreased CO in PD. As far as we know this is the first report on temperament and character in PD. The finding of the low score on the temperament dimension of RD confirmed the hypothesis that a noradrenergic mechanism is involved in PD. This hypothesis was derived from earlier findings of correlations between RD and noradrenergic function [11–16].
The fact that RD was decreased in this psychotically depressed subcategory, while the plasma NE concentration was increased \((F = 4.993; \ P = 0.023)\) [10], could be seen as contrasting with the findings of a positive correlation between RD and concentrations of the main metabolite of NE in urine [15, 16]. However, as the NE concentrations in PD are for a large part above the normal reference value [10], a concentration-dependent inverted U-curve relationship between NE release and the function of the central target regions involved in the affiliative behavior of RD could be involved. As the personality characteristics of PD and ANA-R seem to form mirror images, as far as the RD and CO traits and state-related changes of CO and RD are concerned, the opposite neurobiological mechanisms that we found in PD and ANA-R, namely, a positive NE-AVP correlation in PD [10] and a negative AVP-NE correlation in ANA-R [40], could be involved.

These data further support the usefulness of the original concept of the TCI as a scale that corresponds with the sociobiological origins of personal differences. Next to the above mentioned findings in the field of the noradrenergic system, the model is supported by relations between the serotonergic system and both HA and SD [27], as well as the dopaminergic system and NS [20].

4.4. Comparison between PD and Schizophrenic Disorders. The personality characteristics of high HA and low RD after full remission in PD and state-dependent reductions of the character dimensions of SD and CO, that we found to differentiate PD from other depressive disorders, appear to have some correspondence with the personality characteristics found in schizophrenic patients [41]. The patients in the latter study also had the combination of high HA and low RD, as well as the combination of low SD and low CO. The main differences compared with the PD patients of the present study was an additional high ST in the schizophrenic patients and the probable reversibility of the decreases of SD and CO. The comparison with the results of the present study suggest that the combination of high HA and low RD may constitute a general vulnerability configuration for psychotic disorders, and that the reduced character dimensions of SD and CO may function as the chronic or reversible character deficits that are involved in the actual development of the psychotic dysregulation.

Limitations of the study are the lack of subscale scores of the TCI version 9 in the normal control subjects, as well as the small number of patients with PD. The support for a specific vulnerability trait for the psychotic component of PD may imply that drugs that enhance affiliative behavior could be useful, and that specific psychotherapeutic attention could be directed towards the improvement of this type of behavior.

References


Research Article

Early Life Stress and Child Temperament Style as Predictors of Childhood Anxiety and Depressive Symptoms: Findings from the Longitudinal Study of Australian Children

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Objective. The purpose of this study was to determine whether the relationship between stressful infant environments and later childhood anxiety and depressive symptoms varies as a function of individual differences in temperament style.

Methods. Data was drawn from the Longitudinal Study of Australian Children (LSAC). This study examined 3425 infants assessed at three time points, at 1-year, at 2/3 years and at 4/5 years. Temperament was measured using a 12-item version of Toddler Temperament Scale (TTS) and was scored for reactive, avoidant, and impulsive dimensions. Logistic regression was used to model direct relationships and additive interactions between early life stresss, temperament, and emotional symptoms at 4 years of age. Analyses were adjusted for socioeconomic status, parental education, and marital status.

Results. Stressful family environments experienced in the infant's first year of life (high versus low) and high reactive, avoidant, and impulsive temperament styles directly and independently predicted anxiety and depressive problems in children at 4 years of age. There was no evidence of interaction between temperament and family stress exposure.

Conclusions. Both infant temperament and stress exposures are independent and notable predictors of later anxiety and depressive problems in childhood. The risk relationship between stress exposure in infancy and childhood emotion problems did not vary as a function of infant temperament. Implications for preventive intervention and future research directions are discussed.

1. Introduction

Children as young as three years of age have been shown to meet DSM IV criteria for major depressive disorder [1]. Childhood onset of depressive symptoms has been associated with a distinct pattern of risk factors while childhood depression is itself a major risk factor for the recurrence of depression in adulthood [2, 3]. Among the most well-characterized risk factors are stress exposure (antenatal and perinatal) and patterns of emotion dysregulation in infancy indicated by temperamental dispositions towards avoidance, impulsivity and stress reactivity [4–6]. The determinants of early childhood depressive symptoms are of interest for clinical and preventative interventions. In this study, we will focus on early temperament and stressful life events, separately and in interaction, as predictors of anxiety and depressive problems in early childhood and draw on life course data to examine developmental pathways toward depressive symptoms.

1.1. Childhood Temperament as a Factor in Emotional Regulation. One of the most influential theories of temperament is Cloninger’s model grounded in genetic, psychobiologic, and evolutionary theory which informs a broad theory of personal and moral development as well as vulnerability to psychological disorder [7–9]. The role of temperament in Cloninger’s model is not dissimilar to that of other theories of temperament insofar as temperament is considered to
reflect individual differences in the regulation of experience which emerges early in life and remain moderately stable across development. Temperament is distinct from character which develops in a stepwise manner over the life course, progressively assimilating higher-order cognitive capacities, and experience-dependent social and cultural learning, leading to increasingly sophisticated representations of the self over time. Temperament is a highly heritable platform for such development but remains open to interaction with the environment across development.

Cloninger's model of temperament is measured using four dimensions: novelty seeking (NS), harm avoidance (HA), reward dependence (RD), and persistence (P) [9]. Novelty seeking refers to a tendency to respond strongly to novel stimuli and to avoid monotony or potential punishment (and has been linked to dopaminergic activity). Harm avoidance is conceptualized as a tendency to show high react-ivity to aversive stimuli leading to the inhibition of behavior (and has been associated with serotonergic activity). Reward dependence indicates a tendency to maintain behavior which has previously been associated with reward (and been related to noradrenergic activity). Persistence indicates a tendency towards perseverance of effort despite frustration but has not been linked to a specific monoamine neurochemistry. More recent animal studies have suggested considerable overlap in the monoamine neurochemistries underlying temperament [10, 11] while considerable research is currently emerging with respect to genetic variants mediating neurotransmitter function in circuitry involved in mood disorder and temper-ament [12].

Much of the research on Cloninger's biopsychological model of temperament and personality has been undertaken with respect to adult psychopathology. The measurement of temperamental dimensions prospectively in early childhood as a predictor of subsequent emotional symptoms within a longitudinal cohort design has been recommended in several papers [13, 14]. The development of the preschool temperament and character inventory (psTCI) enabled Cloninger’s dimensions to be examined in children and the results compared to other measures of temperament in childhood [14]. The current study used a shortened version of a related measure, the Toddler Temperament Scale (TTS) which measures approach, reactivity, and persistence dimensions of temperament. Examination of items from the psTCI and the TTS shows very similar wording for items measuring HA, NS, and P, respectively.

There is substantial evidence of a role for childhood temperament in the etiology of emotional symptoms in early childhood. In a sample of 30-month-old children using the psTCI, Constantino et al. [14] reported an association between internalizing and both HA ($r = .49$) and NS ($r = .66$) but a negligible association with persistence. Using other measures of temperament, highly reactive infants were found to be more likely to display anxious symptoms in mid childhood (7 years) [5]. Avoidance at 2.5 years has been found to predict anxiety in early adolescence (12-13 years) and emotionality at both 18 months, and 2.5 years of age are associated with anxiety and depression in early adolescence [6]. Using the Dunedin Multidisciplinary Health and Development Study, a particularly long running study, avoidance in childhood was used to predict risk for a diagnosis of depression at age 21 years [15]. The consistency of findings on both HA and NS temperament as predictive of anxiety and depressive symptoms across differing research methodologies (i.e., measurement tools, time spans, and ages) illustrates the significance of early temperament in psychological development.

1.2. Stress in Early Childhood as a Factor in Emotional Regulation. Environmental stresses have been widely investigated as a source of anxiety and depressive problems in children and can be divided into stresses occurring as a result of (1) parental relationship dysfunction, (2) parent-child interaction, (3) socioeconomic disadvantage, or (4) negative life events [16]. Here we focus on negative life events occurring in early life as one of the most consistent predictors of anxiety and depressive problems across the life course. Increasingly, the application of ideas derived from the developmental origin of health and disease (DOHaD) hypothesis is suggesting a higher degree of vulnerability to stressors which occur within the antenatal and early postnatal environment [17]. Van den Bergh’s review of 14 prospective studies suggested that antenatal maternal stress creates risk for behavioural and emotional regulation problems in children [18]. Theories derived from this body of literature focus on the early development of the HPA axis and the links between HPA dysregulation and vulnerability to anxiety and depressive disorders [19–21].

1.3. Interaction between Infant Temperament and Stress Exposure. Since temperament regulates a child’s personal experience of the external world, response to stressful life events might be expected to vary as a function of temperament style. In principle, temperament should interact with an individual’s appraisal of a given stressor, the degree of stress experienced, efforts to cope with stress, and psychobiological correlations of the response to stress [22]. However, little is known about interaction between infant temperament and stress exposure in creating risk for anxiety and depressive problems in early childhood. Yet temperament can be regarded as a behavioral proxy for inheritable differences in stress regulation and is a potentially important driver of sensitivity to social challenges such as family life stressors and maternal depression. Greater knowledge of person-by-environment interactions therefore holds considerable promise for identifying at-risk populations and aligning psychosocial resources for effective and targeted prevention.

1.4. Aims and Hypotheses. The purpose of the study was to examine interaction between infant temperament and stress exposure in the development of anxiety and depressive symptoms in childhood (4- to 5-years) using data from 3425 children participating in the Longitudinal Study of Australian Children (LSAC). Specifically, the aims were to examine prediction of anxious-depressive symptoms in childhood as a function of (1) infant stress exposure, (2) infant temperament (avoidant, impulsive, reactive), and (3)
interaction between infant temperament and stress exposure. We sought to test the hypothesis that both stressful life events experienced in the first year of life and high reactive, avoidant, and impulsive children (high temperament risk) would directly and independently predict anxious-depressive symptoms in children at 4 years of age. We further hypothesized that high reactive, avoidant, and impulsive temperament styles would interact with early life stressors to augment risk anxious-depressive symptoms.

2. Methods

2.1. Study Design and Sample. Data was drawn from the first three waves of the Longitudinal Study of Australian Children (LSAC), a nationally representative study of the growth and development of children in Australia. LSAC was initiated by the Australian Government Department of Families, Housing, Community Services, and Indigenous Affairs. The sampling design and method have been described in Soloff et al. [23]. LSAC used a two-stage cluster sampling design with Australian postcodes (stratified by state of residence and urban versus rural status) as the primary sampling units. Secondary sampling units were infants born between March 2003 and February 2004 selected from the Australian Medicare database. Random selection of infants within each postcode produced a cohort aged between 3 and 19 months, with all birth months represented. Of those selected infants who were contacted, 5107 parents elected to take part in the first wave of LSAC in 2004 (64.2% response rate). Wave two data was collected in 2006, and wave three commenced in 2008. The sample for this current analysis was limited to the 3425 children who had complete data for the Strengths and Difficulties Questionnaire delivered in Wave 3 of the study at the 4-5-year time point.

2.2. Procedures. Data was collected from the child’s primary caregiver via face-to-face interview with a trained researcher. 98.6% of primary caregivers were the child’s mother [23]. After each interview, both primary and secondary caregivers completed a self-report questionnaire. The study was approved by the Australian Institute of Family Studies Ethics Committee, and a parent provided written informed consent for every participant.

2.3. Measures

2.3.1. Demographic Data. Mothers were asked to report on their child’s gender and age in months as well as their own age in years, country of birth (Australia/New Zealand versus other), marital status (married versus other), main language spoken at home (English versus other), and employment status (part time/variable work hours versus full time). Social and economic disadvantage was measured using Socioeconomic Indexes for Areas (SEIFA) which is based on Australian census data (Australian Bureau of Statistics, 2001). The index of relative socioeconomic disadvantage uses postcode of residence to determine neighborhood economic status and has been standardized to a mean of 1000 (SD 100), with higher values indicating a greater advantage.

2.3.2. Temperament. This study makes use of a shortened version of the Australian revision of the Toddler Temperament Scale (TTS). This is a highly regarded and frequently used questionnaire which is a psychometrically sound measure of early childhood behaviour [4]. The TTS is a 97-item measure which was first implemented in the Australian Temperament Project in 1983. Items in the TTS are typically grouped into six temperament styles which have moderate-to-high internal consistency (alphas = 0.53–0.76) and good test-retest reliability [24]. The shortened TTS used in LSAC includes 4 items each for approach, persistence, and reactivity rated on a six-point scale (alphas = 0.98–0.99). For the current analysis, each temperament style was dichotomized into high/low. These were calculated by dividing the distribution into three equal groups with high scores taken as the top third of the distribution for reactive, and the bottom third of the distribution for persistence (to form “impulsive”) and approach (to form “avoidant”). Risk temperament styles were compared to the remaining two thirds of the distribution. For comparison to Cloninger’s terminology, the TTS dimension of reactive is analogous to novelty seeking, persistence refers to the same dimension and avoidant is analogous to Cloninger’s harm avoidance.

2.3.3. Early Life Stress. At the first wave of the study, when children were between 0-1 years of age, parents indicated exposure to adverse life events over the past year. As such this period of time covers the late antenatal period and post-partum period of the child’s life. Participants indicated the exposure to such life events (yes or no) from a list of 13 items which included marital breakdown, serious illness or death of friend or relative, employment or workplace stressors, relationship conflict, and substance use. These were summed and dichotomised. Following Rutter’s observations regarding the deleterious impact of cumulative stressful life events, for the current analysis, high-stress environments were considered to be those in which parents indicated that they had experienced two or more of these stressful life events [25].

2.3.4. Anxiety and Depressive Symptoms. Anxiety and depressive symptoms were measured from the emotional symptoms subscale of the Strengths and Difficulties Questionnaire (SDQ) [26]. The SDQ is a 25-item measure of behavioral and emotional problems for children aged 4 to 16 years which is widely used and has sound psychometric properties. The anxiety and depressive symptoms scale has five items which are rated 1 = not true; 2 = somewhat true; 3 = certainly true. The mean of the 5 items is used as a summary score. Items assess anxiety and depressive symptoms of somatic complaints, worried, unhappy or fearful, nervous or lacking confidence, and fearful. In the current study, a dichotomised score (high/low) was created by taking high scores to be those at the top decile (10%).

2.3.5. Covariates. Information was collected about several factors which may potentially confound the relationship between early life stress and anxiety and depressive symptoms. For this study, we examined differences between
children with and without anxiety and depressive symptoms at 4-5 years of age in terms of gender, family structure (married versus other), and indicators of socioeconomic status (SEIFA score as a continuous measure as described above). We also examined ethnicity as a potential covariate codes in terms of Australian/New Zealand origin versus other.

2.4. Statistical Analysis. All analyses were performed using the SPSS version 18 (SPSS Inc, Chicago, Ill, USA). Those with missing data on all of the key variables were excluded listwise from the analyses. Population weights were used in all adjusted analyses.

We examined the joint effect of temperament (reactive, persistent, and approach) and early life stress on risk for anxiety and depressive problems in childhood based on the additive scale and using a $2 \times 4$ table format with a single common reference group [27, 28]. This approach differs from conventional models of interaction based on the multiplicative scale and using at least two reference groups (one for each level of the moderating variable). The $2 \times 4$ approach provides easily accessible information on the independent and joint effects of each risk factor with respect to a reference group defined by exposure to neither risk factor. We defined four composite exposures: (level 1) high temperamental risk and high social stress (joint effects), (level 2) high temperamental risk and low social stress (temperamental risk only), (level 3) low temperamental risk and high social stress (social risk only), and (level 4) low temperamental risk and low social stress (reference group).

Joint effects were examined by comparing risk associated with the joint exposure to both temperament and social stress factors (level 1) and risk associated exposure to neither factor (level 4, references group). However, joint exposure does not necessarily mean that both temperament and life stress processes are acting together within one causal mechanism. To estimate the percentage of risk due to the combined actions of both exposures, we first summed risks at level 2 (temperamental risk only) and level 3 (early life stress risks only) and then subtracted the background risk (level 4) to obtain the expected risk for no interaction. The difference between the expected risk for no interaction and the observed risk for joint exposure was then divided by the observed risk for joint exposure to represent the % risk attributable to the joint action of both exposures. Interaction is notable when the % risk attributable to joint interaction exceeds 30% [29].

Within each exposure level, we estimated the positive predictive value (PV+) and the attributable risk percent (AR%, also referred to as the attributable fraction in the exposed). PV+ is the probability of reporting problematic anxiety and depressive symptoms given exposure status and provides information of value for prediction of individual level risk. AR% is the proportion of individuals showing anxiety and depressive symptoms within a particular exposure level that is attributable to having that exposure (cf. reference group).

### 3. Results

3.1. Sample Characteristics. Baseline characteristics were examined from the first wave of the study for those children and parents who reported on anxiety and depressive symptoms at the third wave of the study. Sample characteristics were examined including gender, age of parent and child, parental education, ethnicity, and socioeconomic status. Differences between categorical and continuous data for these variables for the groups with and without anxiety and depressive symptoms were examined. Significant differences were discerned using a Chi square or independent samples $t$-test as appropriate and results are shown in Table 1. Significant differences were found for mothers of children in the anxiety and depressive symptoms group being slightly younger and less likely to be married.

3.2. Infant Temperament, Infant Stress Exposure and Childhood Anxiety and Depressive Maladjustment. Association between early life stress in the first year of life, child temperament at 2 years of age, and anxiety and depressive symptoms at 4 years of age were tested using logistic regression. In the direct model, each variable was entered simultaneously into the regression model, and results are therefore controlled for

### Table 1: Demographic characteristics of participants ($N = 3824$).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total $N$ (%)</th>
<th>No anxiety and depressive symptoms $N$ (%)</th>
<th>Anxiety and depressive symptoms $N$ (%)</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>3824</td>
<td>3444</td>
<td>380</td>
<td></td>
</tr>
<tr>
<td>Child at time 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (months), M (SD)</td>
<td>8.77 (2.5)</td>
<td>8.75 (2.5)</td>
<td>8.91 (2.6)</td>
<td>0.29</td>
</tr>
<tr>
<td>Male</td>
<td>1972 (51.6)</td>
<td>1798 (51.9)</td>
<td>183 (48.2)</td>
<td>0.16</td>
</tr>
<tr>
<td>Maternal at time 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years), M (SD)</td>
<td>31.5 (5.2)</td>
<td>31.6 (5.2)</td>
<td>30.6 (5.1)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Born in Australia/New Zealand</td>
<td>3200 (83.7)</td>
<td>2889 (83.9)</td>
<td>311 (81.8)</td>
<td>0.31</td>
</tr>
<tr>
<td>Married</td>
<td>2962 (77.5)</td>
<td>2687 (78.0)</td>
<td>275 (72.4)</td>
<td>0.01</td>
</tr>
<tr>
<td>Did not complete yr 12 high school</td>
<td>507 (13.3)</td>
<td>449 (13.0)</td>
<td>58 (15.3)</td>
<td>0.39</td>
</tr>
<tr>
<td>Disadvantage index (SEIFA), M (SD)</td>
<td>1011 (39.9)</td>
<td>1011 (39.4)</td>
<td>1007 (64.1)</td>
<td>0.19</td>
</tr>
</tbody>
</table>
The purpose of the study was to examine independent and interactive effects of early stressful life events and temperament style in the development of anxiety and depressive symptoms in early childhood. Results support the notion that stressful family environments experienced in the infant’s first year of life and high reactive, avoidant, and impulsive temperament styles directly and independently contribute to anxiety and depressive symptoms in children at 4 years of age. However, contrary to expectations, we observed no notable interaction between temperamental and social risks. This study does not support the hypothesis that temperament style creates underlying patterns of individual susceptibility to social risks for later emotional disorders.

The central question in the current paper concerns the possible interaction between environmental factors inducing stress and heritable individual differences in temperament. While a number of studies have found associations between Cloninger’s temperament dimension of harm avoidance and depression, these studies have largely been conducted with clinical adult populations. The current finding suggests an extension within a child sample with degrees of early life stress exposure which are relatively common in Western populations.

Temperament is generally understood to refer to emotional or affective aspects of the developing personality. This relationship between emotional regulation and the development of anxiety and depressive symptoms emerged strongly as our two-year-old temperament measures uniquely and independently predicted later mood-related symptoms 4-5-year children. This result confirms the predictive validity and clinical significance of temperament as an early risk factor indicating vulnerability for childhood onset depressive symptoms.

While a number of studies have found associations between Cloninger’s temperament dimension of harm avoidance and depression, these studies have largely been conducted with clinical adult populations. The current finding suggests an extension within a child sample of Cloninger’s finding in an adult population sample that HA is predictive of depression. Findings with respect to Cloninger’s novelty seeking (NS), considered here to be analogous to reactivity, have been mixed. While Celikel et al. did report an association between NS and depression, there have been several studies which have not found such an association.

### 4. Discussion

The purpose of the study was to examine independent and interactive effects of early stressful life events and temperament style in the development of anxiety and depressive symptoms in early childhood. Results support the notion that stressful family environments experienced in the infant’s first year of life and high reactive, avoidant, and impulsive temperament styles directly and independently contribute to anxiety and depressive symptoms in children at 4 years of age. However, contrary to expectations, we observed no notable interaction between temperamental and social risks. This study does not support the hypothesis that temperament style creates underlying patterns of individual susceptibility to social risks for later emotional disorders.

The central question in the current paper concerns the possible interaction between environmental factors inducing stress and heritable individual differences in temperament. Both experimental studies in animals and naturalistic studies of children raised in adversity have shown that severe perturbations in the family environment such as maternal deprivation and significant maltreatment can produce derangement of the normal relationships between monoamine neurotransmitters and the nervous system. The current study examines more modest perturbations of the family environment consistent with degrees of early life stress exposure which are relatively common in Western populations.

Temperament is generally understood to refer to emotional or affective aspects of the developing personality. This relationship between emotional regulation and the development of anxiety and depressive symptoms emerged strongly as our two-year-old temperament measures uniquely and independently predicted later mood-related symptoms 4-5-year children. This result confirms the predictive validity and clinical significance of temperament as an early risk factor indicating vulnerability for childhood onset depressive symptoms.

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Table 3: Odds ratios for anxiety and depressive symptoms at age 4 years attributable to person-environment interaction between early life stress and reactive temperament style.

<table>
<thead>
<tr>
<th>Infant reactivity</th>
<th>Stress exposure</th>
<th>Noncase</th>
<th>Case</th>
<th>OR†</th>
<th>95% CI†</th>
<th>PPV</th>
<th>AR%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
<td>1405</td>
<td>113</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>620</td>
<td>64</td>
<td>1.3</td>
<td>(0.96-1.5)</td>
<td>9%</td>
<td>22%</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
<td>360</td>
<td>54</td>
<td>1.9</td>
<td>(1.3-2.6)</td>
<td>13%</td>
<td>47%</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
<td>200</td>
<td>48</td>
<td>3.0</td>
<td>(2.1-4.3)</td>
<td>19%</td>
<td>66%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2585</td>
<td>279</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additive model of interaction:

<table>
<thead>
<tr>
<th></th>
<th>ORe+ORp-1</th>
<th>ORpe-E</th>
<th>DE/ORpe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected ORpe</td>
<td>2.2</td>
<td>0.8</td>
<td>28%</td>
</tr>
<tr>
<td>Departure from expected (DE) % of ORpe attributable to the joint action of person and environment</td>
<td>14%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

†OR: odds ratio, 95% CI: 95% confidence interval, ORe: Infant stress exposure, ORp: infant temperament, ORpe: infant temperament and stress exposure, Reference: neither exposure; AR%: attributable risk percent, PPV: positive predictive value.

Table 4: Odds ratios for anxiety and depressive symptoms at age 4 years attributable to person-environment interaction between early life stress and avoidant temperament style.

<table>
<thead>
<tr>
<th>Infant avoidance</th>
<th>Stress exposure</th>
<th>Noncase</th>
<th>Case</th>
<th>OR†</th>
<th>95% CI†</th>
<th>PPV</th>
<th>AR%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
<td>1182</td>
<td>86</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>531</td>
<td>55</td>
<td>1.4</td>
<td>(1.00-2.0)</td>
<td>9%</td>
<td>30%</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
<td>584</td>
<td>81</td>
<td>1.9</td>
<td>(1.4-2.6)</td>
<td>12%</td>
<td>48%</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
<td>290</td>
<td>57</td>
<td>2.7</td>
<td>(1.9-3.9)</td>
<td>16%</td>
<td>63%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2587</td>
<td>279</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additive model of interaction:

<table>
<thead>
<tr>
<th></th>
<th>ORe+ORp-1</th>
<th>ORpe-E</th>
<th>DE/ORpe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected ORpe</td>
<td>2.3</td>
<td>0.4</td>
<td>14%</td>
</tr>
<tr>
<td>Departure from expected (DE) % of ORpe attributable to the joint action of person and environment</td>
<td>14%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

†OR: odds ratio, 95% CI: 95% confidence interval, ORe: Infant stress exposure, ORp: infant temperament, ORpe: infant temperament and stress exposure, Reference: neither exposure; AR%: attributable risk percent, PPV: positive predictive value.

Table 5: Odds ratios for anxiety and depressive symptoms at age 4 years attributable to person-environment interaction between early life stress and impulsive temperament style.

<table>
<thead>
<tr>
<th>Group</th>
<th>Infant impulsivity</th>
<th>Stress exposure</th>
<th>Noncase</th>
<th>Case</th>
<th>OR†</th>
<th>95% CI†</th>
<th>PPV</th>
<th>AR%</th>
</tr>
</thead>
<tbody>
<tr>
<td>low/low</td>
<td>low</td>
<td>Low</td>
<td>1079</td>
<td>94</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>low/high</td>
<td>low</td>
<td>High</td>
<td>515</td>
<td>62</td>
<td>1.4</td>
<td>(1.00-2.0)</td>
<td>11%</td>
<td>29%</td>
</tr>
<tr>
<td>high/low</td>
<td>high</td>
<td>Low</td>
<td>687</td>
<td>73</td>
<td>1.2</td>
<td>(0.90-1.7)</td>
<td>10%</td>
<td>19%</td>
</tr>
<tr>
<td>high/high</td>
<td>high</td>
<td>High</td>
<td>305</td>
<td>50</td>
<td>1.9</td>
<td>(1.30-20.8)</td>
<td>14%</td>
<td>48%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>2586</td>
<td>279</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additive model of interaction:

<table>
<thead>
<tr>
<th></th>
<th>ORe+ORp-1</th>
<th>ORpe-E</th>
<th>DE/ORpe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected ORpe</td>
<td>1.7</td>
<td>0.2</td>
<td>11%</td>
</tr>
<tr>
<td>Departure from expected (DE) % of ORpe attributable to the joint action of person and environment</td>
<td>11%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

†OR: odds ratio, 95% CI: 95% confidence interval, ORe: Infant stress exposure, ORp: infant temperament, ORpe: infant temperament and stress exposure, Reference: neither exposure; AR%: attributable risk percent, PPV: positive predictive value.
The current findings are interesting to consider in the light of the idea that temperament is one of the relatively stable characteristics to emerge early in the development of personality across the life course [39]. It is also widely acknowledged that temperament interacts with life course factors to moderate continuity and change in personality across development [9, 40]. However, the current study suggests that the very early experience of a moderate level of life stress within the family environment does not substantially interact with the temperament styles measured in the current study. This is consistent with Cloninger's assertion that temperament is relatively immune from the influence of culture or social experience [41].

It is also to be noted that our results point to an interaction between gender and temperament in prediction of anxiety and depressive symptoms, showing that boys with avoidant temperament are particularly susceptible. In a recent meta-analysis, negative affectivity did not show significant gender differences with the small gender difference in fear (d = 0.12) not being sufficient to conclude that boys and girls differ markedly in fearfulness [42]. Our finding that boys with avoidant temperament are more vulnerable than girls suggests that there may be a subset of boys whose avoidant temperament predisposes them to negative social experiences and negative self-appraisal.

Our interest in interaction is based on a desire to understand modifiable factors in early development which could be a target for preventive intervention. Despite marked improvements in knowledge of individual risk factors for childhood anxiety and depressive problems, the efficacy of most universal (school-based) preventive interventions designed to minimize risk exposure remains unremarkable [43]. Targeted approaches to preventive intervention appear to hold greater promise [43]; however, they remain fundamentally limited by a general lack of knowledge about individual differences in sensitivity to stressful life events (person-by-environment interaction). From this applied perspective, the current results suggest that intervention should be targeted at developing independent and tailored preventive intervention aimed at minimising risk associated with both temperamental and social risk factors for anxious-depressive symptoms in early childhood. However, further research is needed to identify social exposures that are capable of buffering constitutional factors. Such exposures may well be factors which have a more direct impact on the child such as parental mental health, family conflict, and hostile parenting styles.

This study presented a unique opportunity to test such models in several respects. Very few large population studies in children have the scope to examine the interactions of both life stressors and temperament across early childhood using several different modeling techniques. Sample size also permits robust testing of differences between male and female children in the cohort in a nationally representative sample with relatively low attrition across three waves of data collection. As a population-based study, this also includes inevitable limitations in terms of the use of brief measures of anxiety and depressive symptoms and parental report versions of temperament and life stress variables. The life stress measure can only act as an indicator of environmental events which are assumed to lead to infant stress exposure but without a physiological indicator of stress reactivity; this remains only an assumption. Our study was also based on an assumption that what we regarded as a moderate degree of stress exposure would be sufficient to find both direct and interactive effects. In addition, the study design asked parents to rate stress over the last year while their infants were within their first year, thereby, not enabling a clear demarcation between antenatal and postnatal stressors nor precision in the time of stress exposure. Studies vary widely in terms of the level, timing, and type of infant stress exposure so this suggests that future studies and reviews can examine different timing, levels, and types of infant stress exposure. Finally, it should be noted that we examined anxious and depressive symptoms only at one-time point which does not rule out the possibility that the interaction between early life stress and child temperament may be discerned at a later point in development.

Our emphasis in this study has been to investigate infant stress exposure and temperament as predictors of early childhood indicators of anxiety and depressive symptoms. Major environmental adversity such as maternal deprivation has been repeatedly shown to be capable of overriding temperament. Our findings indicate that temperament styles are considerably stronger predictors of such anxiety and depressive symptoms than exposure to a moderate level of early life stress. We have found that moderate environmental stressors in the family environment as a whole seem to have little or no interaction with temperament and allow for the persistence of temperament influence in early child adjustment. Such findings suggest that temperament requires a "species typical" family social environment in order to influence the direction of child development, but it is also reasonably robust to moderate environmental perturbation. Our findings also suggest a differential susceptible to avoidant temperament as a risk factor for anxiety and depressive symptoms specifically in boys supporting previous findings suggestive of sex-specific gene × environment interactions with temperament operating across the developmental life course [44].

Conflict of Interests

All authors declare that they have no conflict of interests.

Acknowledgments

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Research Article

The Effects of Temperament and Character on Symptoms of Depression in a Chinese Nonclinical Population

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Objective. To examine the relations between personality traits and syndromes of depression in a nonclinical Chinese population.

Method. We recruited 469 nonclinical participants in China. They completed the Chinese version temperament and character inventory (TCI) and self-rating depression scale (SDS). A structural equation model was used to rate the relation between seven TCI scales and the three SDS subscale scores (based on Shafer’s meta-analysis of the SDS items factor analyses). This was based on the assumption that the three depression subscales would be predicted by the temperament and character subscales, whereas the character subscales would be predicted by the temperament subscales.

Results. The positive symptoms scores were predicted by low self-directedness (SD), cooperativeness (C), reward dependence (RD), and persistence (P) as well as older age. The negative symptoms scores were predicted only by an older age. The somatic symptoms scores were predicted by high SD.

Conclusion. Syndromes of depression are differentially associated with temperament and character patterns. It was mainly the positive symptoms scores that were predicted by the TCI scores. The effects of harm avoidance (HA) on the positive symptoms scores could be mediated by low SD and C.

1. Introduction

Depression is the most prevalent mental disorder in many countries. Personality has been extensively studied as a risky factor of depression. One of the most promising theories to understand depression from the personality perspective is Cloninger’s biosocial personality model. This has come from behavioral genetics, neuropsychology, and psychology, and it gives insight into the aetiology of depression [1–3]. This model posits seven personality traits: four temperament dimensions (novelty seeking (NS), harm avoidance (HA), reward dependence (RD), and persistence (P)) and three character dimensions (self-directedness (SD), cooperativeness (C), and self-transcendence (ST)). Temperament is determined by genetic structure and manifests itself as a heritable component of one’s behaviour. It refers to reflective emotional reactions. Character refers to self-identity, which is acquired primarily through a socialisation process, although recent study also identified a hereditary contribution to the development of character. Character is considered to be evoked by temperament. Such interaction of the two dimensions enhances cognitive learning of an individual’s self-concept throughout the lifespan [4].

There are many reports suggesting that high HA and low SD predict depression [5–12], although other subscales of temperament and character were found to be related to depression in a few studies.

Almost all the studies on the association between personality traits and depression have been performed as if depression is a homogenous condition. However, factor analyses of depressive symptoms generally noted that depressive symptoms consisted of a few syndromes. Thus, a new paradigm may be required from whether personality trait predicts depression to which personality traits predict...
which depressive syndrome. It should also be noted here that 
research has shown that the constructs of depressive symp- 
toms in clinical and nonclinical populations are qualitatively 
identical [13]. Difference between clinical and nonclinical 
populations in depression is symptom severity [14, 15].

Another issue about the studies on the association be- 
tween depression and personality—particularly tempera- 
tment and character—is previous investigations treating tem- 
perament and character domains simultaneously predicting 
depression. However, Cloninger has posited that tempera-
tment is a set of reflect emotions on which character develops. 
Thus, it is feasible to speculate that the effects of tem-
perament, if any, on depression may not be direct but be 
mediated via character. Hence, 0-order correlations between 
temperament subscale scores and depression scores may be 
spurious. This point has rarely been studied empirically.

The objective of this paper is to examine the relations 
between personality traits and syndromes of depression in 
a nonclinical Chinese population. We paid attention to the 
mediation of the effects of temperament on depression via 
character as well as differential association with depressive 
syndromes.

2. Methods

2.1. Participants and Procedure. The data of the present 
study came from a population of 486 inhabitants in Beijing 
City, Shenyang city, and Dalian city (all cities are located 
in the north eastern area of China). We distributed 500 set 
of questionnaires and stamped envelopes to office workers 
of three companies separately in above three cities. Usable 
questionnaires were returned by 469 participants. They were 
235 men and 234 women. Their ages ranged between 18 and 
81 years. Men were slightly but significantly ($t = 1.98, P < 
0.05$) older ($M = 42.8; SD = 11.7$) than women ($M = 40.6; 
SD = 11.9$).

2.2. Measures

2.2.1. Temperament and Character. The temperament and 
character inventory (TCI) [2] was used to assess two aspects 
of personality—temperament and character. Temperament, 
which is moderately heritable and stable throughout life, 
refers to automatic emotional responses to experiences. This 
includes four dimensions, NS, HA, RD, and P. Character 
refers to self-perception and individual differences in goals 
and values that influence voluntary choices, intentions, and 
the meaning of experiences throughout life. Character, which 
is also moderately heritable [16] but influenced by socio-
cultural learning, matures in progressive steps throughout 
life. This factor includes SD, C, and ST. We used the 144-item 
Chinese version of the TCI [17]. Each scale of the TCI (NS, 
HA, RD, P, SD, C, and ST) consists of 20 items. Each item 
in the original version is rated with a 2-point scale (“yes” or 
“no”). In this study, items were rated using a 5-point scale (1 
= “very unlikely” to 5 = “very likely”). This was because 5-
point scales were more suitable for factor analysis compared 
with two-point scales.

2.2.2. Depression. The self-rating depression scale (SDS) [18] 
was used to rate depressive mood. It consisted of 20 items 
selected by the factor analysis. It has been translated into a 
wide range of languages and its validity and reliability across 
cultures have been thoroughly assessed. From the time of the 
original report of the SDS, there have been efforts to evaluate 
factor structure of the SDS [19–21] and a number of factors 
structure models have been found.

2.3. Statistical Analysis. We followed the results of Shafer’s 
[20] meta-analyses of SDS that confirmed three subscales— 
positive, negative, and somatic symptoms. The positive 
symptoms subscale includes “enjoy things” (item 20), “feel 
useful and needed” (item 17), “my life is pretty ful” (item 
18), “mind is clear as ever” (item 11), “easy to make deci-
sions” (item 16), “hopeful about future” (item 14), “easy to 
do things” (item 12), “I enjoy attractive men/women” (item 
6), and “feel best in morning” (item 2). Negative symptoms 
subscale includes “have crying spells” (item 3), “feel down-
hearted, sad, blue” (item 1), “more irritable than usual” (item 
15), “restless and cannot keep still” (item 13), “tired for no 
reason” (item 10), “have trouble sleeping” (item 4), “heart 
beats faster than usual” (item 9), and “others better off if I 
were dead” (item 19). Somatic symptoms subscale includes 
“I am losing weight” (item 7), “eat as much as usual” (item 
5), and “trouble with constipation” (item 8).

We tried to create three subscales of the SDS by adding 
scores of the items belonging to each subscale. However, item 
6 of the positive symptoms, items 4, 9, 15, and 19 of the 
negative symptoms, and item 7 of the somatic symptoms 
were reversely correlated with other item scores of each total 
score; thus, they were excluded from the summation to create 
the subscale scores.

In order to analyse the relationship of depression syn-
drome and temperament and character scales, we examined 
means, SDs, and internal consistency (measured as Cron-
bach’s alpha coefficient) of all the variables used in this study. 
We then correlated all of them. We set alpha level at 0.001 
rather than 0.05 because of multiple comparisons.

The associations between the depressive and personality 
scales were studied with the following hypotheses. Be-
cause Cloninger hypothesized that character domains would 
develop based on the temperament domain profiles, we 
posited that all the temperament scales would predict both 
the character domain scales and the depressive symptomat-
ology scales. We also posited that the character domain 
scales would predict the depressive symptomatology scales. 
Both gender and age of the participant were expected to 
predict all the personality and depressive symptomatology 
scales. According to these hypotheses, we created a structural 
equation model (SEM) (Figure 1).

Statistical analyses were performed using SPSS 18.0 and 
AMOS 18.0 [22]. The fit of the CFA model was examined 
in terms of chi-squared (CMIN), goodness-of-fit index 
(GFI), adjusted goodness-of-fit index (AGFI), comparative 
fit index (CFI), and root mean square error of approximation 
(RMSEA). According to conventional criteria, a good fit 
would be indicated by CMIN/df < 2, GFI > 0.95, AGFI > 0.90,
3. Results

3.1. Characteristics of the TCI and SDS Subscales. Table 1 shows the means, SDs, and internal consistency of all the SDS and TCI scale scores. The Cronbach’s alpha coefficients of the three SDS scales ranged between 0.44 and 0.80. Those of the seven TCI scales ranged from 0.41 to 0.81 for the temperament scales and from 0.65 to 0.82 for the character scales.

The correlations between the scales of TCI and SDS are also shown in Table 1. High HA and low SD were significantly correlated only with the positive symptom scores but, unexpectedly reversed with the negative as well as somatic symptoms scores. Among the SDS subscale scores, the positive symptoms scores were inversely correlated with the negative and somatic symptom scores whereas the latter two scores were positively correlated. Among the temperament subscales, NS and HA were inversely correlated with P whereas among the character subscales, SD was correlated positively with C and inversely with ST. Between temperament and character subscales, NS and HA were inversely correlated with SD and C; RD was correlated with C; P was correlated with SD, C, and ST.

3.2. The Relations between Personality and Depression in a SEM Path Analysis. We posited the original model with covariances between error variables of NS and HA with that of P as well as between error variables of C and ST with that of SD because of significant correlations observed in bivariate correlations. This model yielded CMIN/df = 1.8, GFI = 0.996, AGFI = 0.950, CFI = 0.996, and RMSEA = 0.042 (90% CI = 0.000–0.081). These indices suggested a good fit of the model with the data.

In this model (Figure 2), the positive symptoms scores were predicted by low C, SD, RD, and P as well as older age; the negative symptoms scores were predicted only by older age, and; the somatic symptoms scores were predicted by high SD. SD and C were predicted by low NS and low HA; C was predicted by RS as well as female gender; ST was predicted by high NS, HA, and P as well as older age.

4. Discussion

To the best of our knowledge, this study is the first to examine the differential associations of the TCI scales and different syndromes of depression. We also studied this issue taking the proposal of Cloninger into account that character develops based on temperament.

Depression has been thought of as compilation of different symptoms. There were many studies demonstrating several factors of depressive symptoms using a variety of rating instruments. And yet it has been not very common to examine the links of risky factors such as personality traits as in this study after dividing depressive symptoms into discrete syndromes. Our study showed the three depressive syndrome scores—the positive, negative, and somatic symptom scores—had unique links with the TCI subscale scores.
| (1) Positive symptoms | — | — | — | — | — | — | — | — | — | — | — |
| (2) Negative symptoms | −0.48*** | — | — | — | — | — | — | — | — | — | — |
| (3) Somatic symptoms | −0.43*** | 0.63*** | — | — | — | — | — | — | — | — | — |
| (4) HA | 0.19*** | −0.39*** | −0.35*** | 0.08 | — | — | — | — | — | — | — |
| (5) RD | 0.09 | −0.13** | −0.06 | — | — | — | — | — | — | — | — |
| (6) HA | 0.19*** | 0.04 | 0.00 | 0.07 | −0.00 | — | — | — | — | — | — |
| (7) P | 0.19*** | 0.12 | 0.12 | −0.23*** | −0.43*** | 0.03 | — | — | — | — | — |
| (8) SD | −0.30*** | 0.41*** | 0.36*** | −0.32*** | −0.51*** | −0.02 | 0.20*** | — | — | — | — |
| (9) C | −0.24*** | 0.26*** | 0.14** | −0.42*** | −0.26*** | 0.23*** | 0.24*** | 0.42*** | — | — | — |
| (10) ST | 0.08 | −0.07 | −0.12* | 0.11* | −0.02 | 0.08 | 0.30*** | −0.23*** | −0.03 | — | — |
| (11) Age | 0.20*** | 0.12** | −0.04 | −0.25*** | −0.08 | −0.05 | 0.19*** | 0.16*** | 0.16** | 0.16*** | — |
| (12) Gender (men, 1; women, 2) | −0.06 | 0.05 | −0.09* | −0.02 | 0.15** | 0.15** | −0.11* | −0.01 | 0.10* | −0.01 | −0.09* | — |
| Number of items | 7 | 4 | 2 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 1 | 1 |
| M | 13.0 | 12.5 | 6.0 | 54.2 | 55.4 | 60.7 | 69.4 | 63.9 | 65.3 | 56.9 | 41.7 | 1.5 |
| SD | 3.9 | 2.4 | 1.2 | 8.0 | 9.4 | 6.8 | 10.4 | 9.1 | 8.3 | 11.4 | 11.9 | 0.5 |
| Alpha | 0.80 | 0.65 | 0.44 | 0.58 | 0.74 | 0.41 | 0.81 | 0.71 | 0.65 | 0.82 | — | — |

Note: NA: negative affectivity; NS: novelty seeking; HA: harm avoidance; RD: reward dependence; P: persistence; SD: self-directedness; C: cooperativeness; ST: self-transcendence.

*P < 0.05; **P < 0.01.
High HA and low SD have usually been reported as associated with depression. However, our study showed that high HA and low SD were linked only with the positive symptoms scores in a bivariate analysis. This suggests that lack of positive mood (such as “enjoy things,” “feel best in morning”) and cognition (“feel useful and needed,” “my life is pretty full,” “mind is clear as ever,” “easy to make decisions,” “hopeful about future,” and “easy to do things”) were associated with this personality trait pattern.

HA is the temperament trait that many studies demonstrated connecting to depression [7, 9, 11, 12, 24–37]. Only a few studies showed contradictory results [38, 39]. However, high HA is not specific to depression. It was reported to be associated with panic disorder [40], social phobia [41], specific phobia [42], obsessional compulsive disorder [43–45], posttraumatic stress disorder [46], anorexia nervosa [47], bulimia nervosa [46, 48], somatization disorder [49], body dysmorphic disorder [50], schizophrenia [51], primary insomnia [52], pain [53], attention deficit/hyperactivity disorder [54, 55], autism spectrum disorders [54], and anxiety in general [12]. Hence, high HA may be a nonspecific trait for anxiety rather than depression per se. In this study, high HA was linked not to affective syndrome but to cognitive syndrome. Thus, high HA may be a risk factor of cognitive dysfunctioning that in turn makes individual vulnerable to anxiety (such as worrying, pessimism, shyness, and being fearful and doubtful [56]) of different types of psychopathology.

Another unique finding of this study is the lack of a direct link from high HA towards any of the depressive syndromal scores. HA predicted low SD and C that in turn predicted the positive symptoms scores. Thus, low SD and C mediated the effects of HA on the positive symptoms scores.

As in high HA, low SD was also known as a risk factor of depression [7, 9, 11, 12, 24–36]. Yet again, low SD is not a risky factor specific to depression. Low SD was reported to be associated with many other axis I and axis II disorders. In the present study, low SD was linked to lack of positive mood and cognition. Hence, low SD may be a nonspecific risky factor of psychological maladjustment.

Low RD and P were also reported in some studies as a risky factor of depression [12, 24, 27, 29, 34]. In this study, low RD and P were associated only with positive symptoms scores.

The positive symptoms scores were also linked to low C in this study. This was echoed in some previous studies [7, 9, 12, 26–29, 32, 34]. People low in affectionate ties with others may be more likely to feel depressed. Cooperativeness trait insists on coordination, harmony, solidarity, and so on. Low C may mean unsophisticatedness, being consonant, or even unsociable, and then can induce poor interpersonal relationship or low social support. Under these conditions, when an individual is hit by a crisis or suffers from a blow, without sufficient or effective social support or emotional platform, he or she may be in the lack of positive mood or cognition.

The uniqueness of the study is the examination of differential links of the TCI subscale scores with the three depressive syndromal scores. Most of the previous studies examined the association of the TCI subscale scores with
the severity of depression as a whole. They rarely studied such association in different syndromes of depression. Our study suggested that while low SD, C, RD, and P predicted lack of positive mood and cognition, none of the TCI subscale scores except SD predicted the negative symptoms scores. Unexpectedly, high SD predicted the severity of the somatic symptoms scores after controlling the effects of all other variables. This was what we did not expect and could not explain without difficulty. The negative symptoms scores (i.e., “have crying spells,” “feel downhearted, sad, blue,” “restless and cannot keep still,” “tired for no reason”) are thought of as core symptoms of depression and yet were predicted by none of the TCI subscales but by older age. Our study suggested different personality dimensions would predict different syndromes of depression.

Limitations of this study should be considered. This study was cross-sectional. Hence the results may not indicate causality. Links posited in the path model were hypothetical and thus may be interpreted in reverse directions. Longitudinal studies following individuals with a set of measurements (e.g., [57]) may clarify the causality issue. Another drawback of this study was heavy reliance on self-report questionnaire. Depression may be better assessed by structured interviews. A third drawback is the fact that we used only nonclinical population. Studies on clinical populations may reveal different findings.

Although we relied on the meta-analysis of Shafer [20] of the SDS factor structure in order to make it easy to make international comparison, it remains to be further studied whether the factor structure of depression symptoms such as those measured by the SDS among a Chinese population would be the same as that reported in the Western countries. For example, the internal consistency was good for the positive symptoms score but fair or even worse for the other two SDS subscale scores. The factor structure of the SDS was reported using a Japanese population [19, 21], out of which Kitamura and colleagues’ [58] reported the factor structure of the SDS in a fairly large (more than 20,000) population in Japan. An exploratory factor analysis yielded three factors—affective, cognitive, and somatic. Their affective factor included items such as “feel downhearted, sad, blue” (item 1), “have crying spells” (item 3), “heart beats faster than usual” (item 9), “tired for no reason” (item 10), “restless and cannot keep still” (item 13), “more irritable than usual” (item 15), and “others better off if I were dead” (item 19). Thus, this factor corresponds to Shafer’s [20] negative symptoms. Kitamura et al.’s [58] cognitive factor included items such as “hopeful about future” (item 14), “easy to make decisions” (item 16), “feel useful and needed” (item 17), and “my life is pretty full” (item 18). Hence, this factor corresponded to Shafer’s [20] positive symptoms. Kitamura et al.’s [58] Somatic factor included items such as “eat as much as usual” (item 5), “I enjoy attractive men/women” (item 6), and “easy to do things” (item 12). This factor differed from Shafer’s [20] somatic symptoms. Therefore, the factor structures of the SDS in East Asian countries may not be very different from each other as well as from those in Western countries.

Another methodological concern of this study is relatively poor internal consistency of the TCI subscale scores. Cronbach’s alpha was over 0.70 in HA, P, SD, and ST. Use of personality measures developed in the Western countries such as the TCI should be considered with caution when applying in a non-Western country like China. We used the Chinese version of the TCI which was one of the early versions of the measure. We should use the revised TCI (TCI-R) in a future study.

Finally, we should be very cautious about the robustness of the results. Ideally, we should solicit a larger and representative population in China. A resampling method such as bootstrapping may have to be considered. However, bootstrapping may potentially magnify the effects of unusual features in a data set and is not a magical means to compensate unrepresentativeness of the data [59, page 43].

Taking these methodological shortcomings into consideration, this study suggests that syndromes of depression are differentially associated with temperament and character patterns and that the effects of temperament on depression are mediated through character.

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References


Research Article

Eating Disorders and Major Depression: Role of Anger and Personality

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This study aimed to evaluate comorbidity for MD in a large ED sample and both personality and anger as clinical characteristics of patients with ED and MD. We assessed 838 ED patients with psychiatric evaluations and psychometric questionnaires: Temperament and Character Inventory, Eating Disorder Inventory-2, Beck Depression Inventory, and State-Trait Anger Expression Inventory. 19.5% of ED patients were found to suffer from comorbid MD and 48.7% reported clinically significant depressive symptomatology: patients with Anorexia Binge-Purging and Bulimia Nervosa were more likely to be diagnosed with MD. Irritable mood was found in the 73% of patients with MD. High Harm Avoidance (HA) and low Self-Directedness (SD) predicted MD independently of severity of the ED symptomatology, several clinical variables, and ED diagnosis. Assessing both personality and depressive symptoms could be useful to provide effective treatments. Longitudinal studies are needed to investigate the pathogenetic role of HA and SD for ED and MD.

1. Introduction

Lifetime comorbidity between Eating Disorders (EDs) and Mood Disorders has been confirmed by several retrospective studies reporting that in Anorexia Nervosa (AN) the prevalence of mood disorders varies between 64.1% and 96% whereas in Bulimia Nervosa (BN) between 50% and 90%. In addition, a substantial part of individuals affected by an ED is likely to be affected also by a mood disorder, and the current comorbidity varies from 12.7 to 68% in AN and is about 40% in BN [1]. Major Depression (MD) is the most prevalent comorbid mood disorder in ED patients, and the severity of depressive symptomatology seems to be related to the ED one [2–5].

In spite of the importance of this topic, most of previous studies on mood in ED were conducted on small samples (e.g., fewer than 30 cases), and the role of age, duration of illness, and weight were not considered. Moreover, ED subtypes and their differences were not carefully classified, particularly Eating Disorder Not Otherwise Specified (EDNOS) [6], and the dimensional assessment of depressive symptomatology was not evaluated in detail. Furthermore, the experience and expression of anger in patients with comorbid depression and ED have been relatively neglected, even though hostility and aggressiveness are commonly reported in ED populations [7, 8].

Indeed anxious/preoccupied behaviors, mood intolerance, and dysthymic traits have been reported in ED patients [5, 9, 10]. Studies conducted with the Temperament and Character Inventory (TCI) [11] have found that ED individuals both in the acute phase [9, 12, 13] and after remission [14–16] performed higher scores of Harm Avoidance (HA) and low scores of Self-Directedness (SD) than healthy controls. Individuals with these personality features are thought to have poorer abilities to cope with stressful events [9, 13] and, although future studies are needed high HA and low SD have been proposed as potential risk factors for ED and not only consequences of the illness [13]. Various authors have found such alterations of personality dimensions—high HA and low SD—in patients with MD.
[17–19] also after remission [20–22]; hence, it should be noted that the alterations of these traits are not only state dependent, as suggested by some studies [23]. Despite these findings, few studies have examined the personality traits of patients with comorbid ED and MD, after controlling for eating psychopathology and other clinical variables.

With this study we aimed to (a) evaluate the prevalence of a current MD in a large sample of ED patients; (b) assess the prevalence of MD with irritable mood in ED patients; (c) provide data supporting the correlation between MD and ED severity; (d) show possible differences between ED patients with and without MD, independently from the severity of eating symptomatology.

2. Materials and Methods

The sample consisted of 838 patients admitted to the outpatient service of the ED Program of the University of Turin between the 1st of January 2003 and the 31st of December 2010. All subjects were diagnosed with an ED, and the sample was represented by the following subjects:

- AN, restricting type (AN-R), n = 214;
- AN, binge-purging type (AN-BP), n = 103;
- BN, purging type (BN-E), n = 223;
- Eating Disorder Not Otherwise Specified (EDNOS), n = 298.

Patients with BN, nonpurging type, were excluded because their number (n = 13) was not statistically relevant. Diagnoses of ED and MD were based on the structured clinical interview for DSM-IV (SCID-I) [24]. Exclusion criteria were medical comorbidity (e.g., epilepsy or diabetes), drug abuse, and male gender.

The first two assessment interviews were conducted by psychiatrists experienced in the diagnosis and treatment of ED. Irritable mood and angry outbursts were assessed according to the criteria proposed by Fava and Kellner [25] and evaluated with clinical interviews derived by authors’ questionnaires. Patients completed the self-report questionnaires described below between the first and the second interview. After complete description of the study to the subjects, written informed consent was obtained. The Italian version of self-ratings instruments was used.

2.1. Temperament and Character Inventory (TCI). The TCI [11] is divided into seven dimensions. Four of these assess temperament (Novelty Seeking [NS], Harm Avoidance [HA], Reward Dependence [RD], and Persistence [P]), defined as partly heritable emotional responses, stable throughout life, mediated by neurotransmitters in the central nervous system. The other three dimensions assess character (Self-Directedness [SD], Cooperativeness [C], and Self-Transcendence [ST]), defined as the overall personality traits acquired through experience.

2.2. State-Trait Anger Expression Inventory (STAXI). The 44-item STAXI [26] measures the intensity of anger as an emotional state (State-anger) and the disposition toward anger as a personality trait (Trait-anger). Anger Expression-In (AX-In) measures the suppression of angry feelings. Anger Expression-Out (AX-Out) measures the frequency of the expression of anger toward other people or objects in the environment. Anger Expression Control (AX-Con) measures the control of anger. AX/Ex provides a general index of the expression of anger.

2.3. Beck Depression Inventory (BDI). The BDI [27] is a self-report questionnaire used to assess the severity of symptoms of depression. Clinical euthymia is defined by scores lower than 10. The BDI has been found to be a reliable instrument for assessing depressive symptoms in ED patients.

2.4. Eating Disorder Inventory-2 (EDI-2). The EDI-2 [28] is a self-report measure of disordered eating attitudes and behaviors, as well as of personality traits common to individuals with ED. Eleven subscales evaluate symptoms and psychological correlates of ED.

2.5. Statistical Analysis. Statistical analyses were carried out using Statistical Package for Social Sciences (SPSS) software version 13.0 for Windows (SPSS 13.0 Application Guide. Chicago, SPSS, Inc., 2004). Categorical data were compared using the chi-squared test, and continuous data were analysed using a two-tailed independent t-test. Age, age of onset of the disorder, duration of illness, and Body Mass Index (BMI) were analysed in terms of confounding variables using a Univariate General Linear Model.

A logistic regression analysis was performed to detect personality variables that independently correlate with MD. The presence/absence of MD was regarded as a dependent variable. ED diagnosis, duration of illness expressed in months, BMI, age, age of onset of the disorder, presence/absence of irritable mood, and scores on the TCI, EDI-2, and STAXI scales were included as independent variables.

To assess the possible correlation with the depressive state of personality traits we found as significant at the linear regression has been checked the linear correlation (Pearson bivariate) between BDI and personality score and we performed also a MANOVA with personality scores as dependent variables, depressive versus nondepressive group as fixed factor, the BDI score as covariate, an the BDI group interaction.

3. Results

3.1. Sociodemographic and Clinical Features of the Sample. Sociodemographic and clinical features are reported in Tables 1 and 2.

3.2. MD Diagnosis and Depressive Symptomatology. Subjects with MD represent the 19.5% (n = 161) of the sample: 15.3% of AN-R (n = 33), 25.5% of AN-BP (n = 25), 25.3% of BN (n = 56), and 16% of EDNOS (n = 47). Significant differences were found among AN and EDNOS individuals and the other ED subtypes ($\chi^2 = 11.752; P = 0.008$).

Patients with MD did not show any significant difference when compared to those without MD in regard to age, age of onset of the disorder, duration of illness, and BMI.
The logistic regression model was significant ($\chi^2 = 212.7; df = 36; P < 0.001; R$-square $= 0.454$). The state anger STAXI subscale ($B = 0.086; Wald = 13.315$; $P < 0.001$), the HA subscale of the TCI ($B = 0.05; Wald = 5.85; P < 0.016$), the SD subscale of the TCI ($B = 0.074; Wald = 8.015; P < 0.005$), and Ineffectiveness as measured by the EDI-2 ($B = 0.064; Wald = 5.466; P = 0.019$).
independently correlated with MD. Age, age of onset, ED diagnosis, BMI, episodes of binge-eating and vomiting per week, irritable mood, and other variables measured by the STAXI, TCI, and EDI-2 were not significant.

3.6. Correlations and MANOVA. BDI scores correlate significantly directly with HA ($r = 0.379; P < 0.001$) and inversely with ($r = -0.589 P < 0.001$). Using the MANOVA, HA, and SD differences remain significant even when controlled for BDI scores and for the interaction BDI group (HA: $F = 75.031; P < 0.001$; SD: $F = 227.362; P < 0.001$). Also the BDI score effect was found significant for both variables (both variables: $P < 0.001$).

4. Discussion

4.1. Characteristics of Depressive Symptomatology. Data from the present study reported lower MD rates than other studies; such a difference could be due to participants’ different stages of illness and it should be also noted that we considered only outpatients while other studies included inpatients.

Significant differences were demonstrated among diagnostic subtypes; patients with purging behaviours (AN-BP and BN) were more likely to be diagnosed with MD when compared to AN and EDNOS. This association is supported by previous research showing that individuals with purging symptomatology are more likely to show comorbid disorders and greater clinical severity [30, 31]. Also our group in previous studies found a correlation—although not related to diagnosis—with purging symptomatology [5].

Moreover, in our sample MD in ED patients seem typically characterized by irritable mood as measured according to Fava and Kellner criteria [25]. To our knowledge, these results have not been described yet in the literature. We found that depressed ED patients were not inhibited or melancholic, but tended to show angry depression, hostility, aggressiveness, anger attacks, and angry outbursts. In fact, irritability and angry outbursts are approximately twice as prevalent among patients with MD and ED (73%) than among depressed patients without ED, as reported in literature [2, 32]. Results of the STAXI revealed that patients with MD and ED experienced greater difficulty in recognizing, managing, and expressing anger than patients without MD. Also logistic regression considered State Anger as one of the four independent variables correlated to MD diagnosis. Anger problems among those with ED have been well documented in the literature [8, 33, 34], but the role of depressive symptomatology in such difficulties in coping with anger has been rarely considered. Past findings of mood instability deriving from fasting [33], the notorious treatment resistance of ED patients [35], and the presence of self-injurious behaviours [36] highlight other possible sources for angry outbursts and irritability. However, it should be considered the possibility that anger and oppositionalism can originate from depressive symptoms. The importance of evaluating patients with AN and BN for irritable mood is reinforced by the observation that depression and aggressive-ness totally mediate the connection between ED and suicidal behavior [37]. Given the correlations between depression and anger, the construct of an anxiety/aggression-driven depression has been proposed to correlate depressive and angry aspects, both related to low serotonergic function [38, 39]. It is noteworthy that MD in ED shows some peculiarities since the course is often protracted, the MD recovery may depend on ED type, and antidepressants are not likely to be as effective as in patients with MD without the ED [40]. Dysphoric traits could underlie such differences in features and course of illness [41].

Considering the BDI, the 48.7% of the sample obtained scores indicating a clinically significant depressive symptomatology (BDI > 10); this datum should be added to the 19.5% of individuals affected by full MD and therefore the total percentage of individuals with relevant depressive symptoms was 68.2%. Moreover, patients with ED were reported to suffer from a wide spectrum of depressive symptoms [42]. Specific characteristics of MD and such a common depressive symptomatology even not meeting MD full criteria highlight the importance of considering also these psychopathological aspects in assessment, monitoring, and treatment of these disorders.

Moreover, also this larger group of depressed patients reported at the STAXI higher scores than ED patients without depressive symptoms. Therefore, previous considerations regarding the group with both ED and DM about high percentage of irritable mood can be extended to depressed patients without an ED.

4.2. Depressive Symptomatology and Eating Psychopathology. We found that eating psychopathology, as measured by the EDI-2 scales included in this study, was significantly more severe in patients with comorbid ED and MD than in patients with ED without MD. This correlation between a severe depressive symptomatology and ED severity validated the results of previous studies and confirmed expected hypothesis [2, 3, 30]. Moreover it is well known in literature that eating symptomatology is also associated with depression in women, even among those with no history of threshold-level eating disorder symptomatology [43].

The presence of MD represented an index of clinical severity and/or an indication of the acuity of the ED. Therefore, diagnostic evaluation for MD in patients suffering from AN or BN should be considered, and psychotherapeutic involvement in treatment planning should be included as appropriate, also because these patients are often hopeless about the possibility of change and this should be carefully considered in treatments [37]. Indeed, Ametller et al. [44] have demonstrated that high BDI scores at the first psychiatric assessment represent one of the independent predictors of hospitalization.

The logistic regression analysis showed that the Ineffectiveness subscale of EDI-2 independently predicted MD in the sample. Low self-esteem represents the common core symptom of ED and depression. Thus it could be hypothesized that ED treatments based on cognitive-behavioral therapies focused on low self-esteem [45] can be effective for ED depressed subjects.
Antidepressants might be effective for treating comorbid ED and depression [46]. However, research suggests that psychopharmacological treatment is effective for BN [47], but is of debatable value for AN [40, 48] even to prevent relapse after weight restoration [49].

4.3. Depressive Symptomatology and Personality. Patients with both ED and MD were characterized by higher HA and lower scores on the RD, SD, and C scales of the TCI.

Logistic regression showed that Harm Avoidance and Self-Directedness remained significant after controlling for personal and several clinical variables. These data are consistent with the results of previous studies that have identified these traits as characterizing ED samples when compared to healthy controls [12]. Other studies have shown that these traits persist after recovery from the ED [50] and that they are altered in adolescents at high risk for developing a clinically significant ED [30]. Both in the acute phase and after remission, also patients with MD but without ED obtained high HA and low SD scores on the TCI [17–23]. In fact, such HA and SD alterations are likely to be both state and trait dependent [51]. Also bipolar euthymic patients showed the same pattern [52]. A recent comprehensive review and meta-analysis of the literature investigated the effects of temperament on vulnerability to depression providing evidence that high HA can be associated both with current depressive symptoms and depressive traits [53]. Interestingly, a significant negative change in HA scores has been reported during treatment, and it can be also related to treatment response and recovery. A minority of studies reported also how low Reward Dependence—another temperamental dimension—was associated with depressive symptomatology [53].

This study showed that higher HA and low SD scores were correlated with comorbid MD in ED patients; this correlation was found to be independent of the severity of the ED (as measured by BMI, binge-purging behaviours, and EDI-2 scales), age, age of onset, and duration of illness. Other studies have shown that low SD can predict suicide attempts among ED subjects [35, 54].

ED patients with a personality profile characterized by high HA and low RD, SD, and C represent a subgroup of patients likely to experience feelings of inferiority, inadequacy, unhappiness, anxiety, and dependence [5, 31, 55–57]. It is well known that ED patients with MD represent a substantial group of patients with specific and semi-independent clinical features and that these features require aimed treatments [46, 58].

The cross-sectional design of this study makes it difficult to rule out the possibility that high HA scores represented a risk factor or a "scarring effect" for ED and depression on personality [18, 59]. Otherwise it is well known the issue of state dependency of HA and SD from depressive disorder [51]. However, there is growing evidence that high Harm Avoidance levels could represent a trait aspect contributing to vulnerability both to ED [41] and mood disorders [53], and in the present study with the MANOVA analysis we found that the BDI score does not completely explain the difference in HA and SD scores between depressed and nondepressed groups. Nevertheless, future research is warranted to perform a longitudinal assessment of the general population to compare premorbid personality traits with those associated with both the ED and depression development during adolescence.

This study is limited by the lack of a control group of healthy subjects or of another clinical population, including patients with other comorbid disorders, and by not considering lifetime comorbidity. On the other hand, one strength of this study is the large sample of patients with MD and ED.

5. Conclusions

This study aimed to evaluate comorbidity between ED and MD and the role of personality as predictor of MD in ED. Our data are in line with previous literature since we found a current prevalence of MD of 19.5% with significant differences among diagnostic subtypes since patients with purging behaviours were more likely to be affected by MD. Irritability was found to be a feature of MD in ED with rates of irritability and angry outbursts twice as prevalent among patients with MD and ED (73%) than among depressed patients without ED as reported in the literature. Considering the BDI, the 48.7% of the sample obtained scores indicating a clinically significant depressive symptomatic load (BDI > 10). The eating psychopathology, as measured by the EDI-2 scales, was significantly more severe in patients with MD comorbidity. With regard to personality dimensions, patients with ED and MD showed higher Harm Avoidance and lower scores on the Reward Dependence, Self-Directedness, and Cooperativeness scales of the TCI. The personality dimensions of high HA and low SD could be risk factors in the development of Major Depression in ED individuals because the differences between depressed and non-depressed groups remain significant even after controlling for the BDI score and BDI group interaction.

Clinicians should carefully evaluate in patients with Eating Disorders their depressive symptomatic load and the role of anger and personality to provide effective treatments tailored to person and not based only on symptomatology [60].

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References


Personality Profiles Identify Depressive Symptoms over Ten Years? A Population-Based Study

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1. Introduction

The biosocial model of personality developed by Cloninger conceptualizes personality as the combination of two interrelated domains: temperament traits reflecting heritable and neurobiologically based differences in behavioral conditioning and character traits reflecting both neurobiological and sociocultural mechanisms of semantic and self-aware learning. Those domains are hypothesized to interact as a nonlinear dynamic system regulating the development of human psychological functions [1, 2].

According to Cloninger et al. [1, 3], temperament is related to heritable variation in automatic responses to environmental stimuli, especially to emotional ones, and is suggested to be involved in a specific neurotransmitter system of the brain. Temperament is characterized by novelty seeking (NS; a tendency toward exploratory activity and intense excitement in response to novel stimuli) that was originally hypothesized to be linked with low basal dopaminergic activity, harm avoidance (HA; a tendency to respond intensely to aversive stimuli and to avoid punishment and novelty) that was originally hypothesized to be linked with high serotonergic activity, reward dependence (RD; a tendency to respond intensely to reward and to learn to maintain rewarded behavior) that was originally hypothesized to be linked with low basal noradrenergic activity, and persistence (P) that has no special neural correlates [3]. However, Cloninger [1] has later acknowledged that the relationship between neurotransmitters and temperament is more complex than the originally postulated.

The three character dimensions include self-directedness (SD), cooperativeness (CO) and self-transcendence (ST), and they reflect differences in higher cognitive functions underlying a person’s self-concept, goals, and values [3]. SD describes the extent to which a person identifies the self as an autonomous individual. Typical people scoring high on SD are responsible, resourceful, and self-accepting. People scoring low on SD are blaming, aimless, and self-defeating. Cooperativeness expresses empathy and identification with other people and reflects the ability to cooperate with other people. Highly cooperative persons are tolerant, empathic, and helpful [4], while those scoring...
low on CO are prejudiced, insensitive, and hostile. Self-transcendence involves self-awareness of being an integral part of the unity of all things and is related to ones spirituality and universal values [3]. People having high level of ST are characterized as creative, intuitive, and spiritual [4], whereas a person scoring low on ST is typically conventional, analytical, and empirical. While temperament traits reflect stimulus-response characteristics underlying basic emotions, character depicts the maturity and coherent integration of the multiple facets of a person’s personality in pursuit of particular goals and values in life. Together, they constitute personality as a dynamic and adaptive system with which individuals interpret and respond to their environment [3].

The extreme variants of the temperament traits of this dynamic system closely correspond to the traditional descriptions of different personality disorders, while immature character profile is used as a general marker of possible psychopathology [5]. This implies that the underlying structure of the normal adaptive personality traits is basically the same as that of the maladaptive personality traits [3, 6] and that the combinations and levels of traits make the difference between healthy and pathological personality. A combination of high HA and low SD has been convincingly associated with major depression in clinical populations [7–16]. HA has also been shown to modify the treatment effect of antidepressants on major depression [17]. Further, an association between high HA—low SD and depressive mood has been demonstrated in nonclinical samples, too [18–27]. Many of these studies have been based on general population samples [20, 23–27].

In general, it is important to know whether the findings derived from clinical samples can be generalized across healthy population. From the point of understanding the aspects of personality that predispose a person to depression, this is of high importance. TCI character profiles have been used in previous studies to explore the relationship between personality and well-being [28, 29]. However, to our knowledge, there is only one previous study that has used personality profiles to study the association between TCI and depression [30]. This study was cross-sectional, and there were 498 nonclinical participants who were all teachers. Personality profile in this study and in our study is defined as a combination of different personality traits within an individual. It is possible that, for example, the effect of high novelty seeking on an outcome measure is different in people who are low on harm avoidance than in people who are high on harm avoidance. Within individual personality profile is the only way to study this possibility. Gurpegui et al. [30] found that profiles with high harm avoidance or low self-directedness had higher frequency of depressive symptoms than other profiles. Similar results were observed with anxiety, social dysfunction, and somatic symptoms.

Most of the before-mentioned studies are cross-sectional. There is no prospective, longitudinal population-based study to examine whether TCI personality profiles are associated with later depression. One challenge of cross-sectional studies is that temporary depressive mood might temporarily change personality and especially HA scores [27]. However, this is not necessarily true. For example, Cloninger et al. [23] found that all seven TCI-traits are more stable over one year interval than depressive mood. The greater stability of TCI compared to depression has also been reported by Richter et al. [31].

In this study we use temperament and character profiles, that is, a person-centered approach, in explaining the variation of depression. Examining personality profiles instead of single separate trait dimensions makes it possible to understand those processes within an individual that are associated with depression. This gives us more information than just examining differences between individuals using single traits. The present study was taken with a purpose to meet those challenges. We examine how temperament profiles as well as character profiles predict depressive symptoms cross-sectionally and prospectively four and ten years later in a population based cohort-study.

2. Methods

2.1. Participants. The Cardiovascular Risk in Young Finns Study started in 1980. The subjects for the original sample in 1980 (N = 3596) were selected randomly from six different age cohorts in the population register of the Social Insurance Institution, a database covering the whole population of Finland. The design of the study and the selection of the sample have been described in detail by Raitakari et al. [32]. The TCI-measurements for the present study were carried out in 1997. In 1997, the cohorts were 20, 23, 26, 29, 32 and 35 years old. Participants with missing information on any of the temperament and character traits were excluded. Some participants lacked these measures, because they did not fulfill the criteria of having answered a minimum of 50% of the items. Only 2% of the included participants had more than two missing items per one temperament or character trait. Depressive symptoms were measured in 1997, 2001, and 2007. Participants were excluded if they had not answered at least 50% of the depression items. At most, 0.3% of the included participants had more than two missing depression items. Statistical analyses on the relationship between temperament and character traits and depressive symptoms in different years were conducted independently of each other so the participants in each year formed highly overlapping but nonidentical groups. Table 1 shows the frequency distribution of participants each year.

2.2. Measures

2.2.1. Temperament and Character Inventory. We used version 9 of the TCI which has 240 items [33]. Instead of the original true/false response format, we used a 5 point Likert scale with response categories ranging from 1) absolutely false to 5) absolutely true. Temperament dimensions include harm avoidance (HA; 35 items, Cronbach’s α = 0.92), novelty Seeking (NS; 40 items, α = 0.85), reward dependence (RD; 24 items, α = 0.80), and persistence (PS; 8 items, α = 0.64). Character dimensions include self-directedness (SD; 44 items, α = 0.89), cooperativeness (CO; 42 items, α = 0.91), and self-transcendence (ST; 33 items, α = 0.91).
2.2.2. Tridimensional Temperament and Character Profiles. We followed the example of previous studies in forming the tridimensional personality profiles [2, 4, 30]. Temperament profiles consist of the eight possible combinations of high and low scores of novelty seeking, harm avoidance, and reward dependence. Character profiles consist of the eight possible combinations of high and low scores of self-directedness, cooperativeness, and self-transcendence. High and low scores were defined for all dimensions by median split.

As our aim was to capture the effects of extreme personality traits (high versus low), we decided to exclude participants with average temperament or character profile as was done in two previous studies [28, 29]. Average people form their own group, are usually flexible, and they do not demonstrate extreme characteristics [5]. Removing average people can be useful, because it reduces noise when studying the effects of extreme personality traits. A participant was labeled as average if he or she was in the middle third of the distribution for all three temperament traits or all three character traits. The final distribution of the profiles is shown in Table 1.

2.2.3. Persistence. Originally, persistence was not included in the tridimensional temperament profiles [2, 4]. However, persistence has been found in previous studies to be associated with depressive symptoms [23, 25]. This is why we decided to analyze Persistence as an independent dimension.

2.2.4. Mild Depressive Symptoms and Depressive Symptoms. Mild depressive symptoms were assessed using a modified version of Beck’s depression inventory [34] in 1997, 2001, and 2007. In the original version of the BDI, subjects were asked to choose between one of four alternative descriptions of 21 items, with the descriptions of each item ranging from minimal to severe symptoms of depression. In the present study, the participants were asked to rate the second mildest descriptions of the original 21 items (e.g., “I often feel sad”) on a five-point scale ranging from totally disagree (1) to totally agree (5). For instance, an original BDI item could have the following four response options: (0) I do not feel sad, (1) I feel sad, (2) I am sad all the time and I cannot stand it. In our modified version we would select response option (1) and ask the participants to rate their agreement with it on a five-point Likert scale. Originally, these second mildest descriptions of the original 21 items (e.g., “I often feel sad”) on a five-point scale ranging from totally disagree (1) to totally agree (5).

In addition to mild depressive symptoms, in 2007 depressive symptoms were assessed using Beck’s depression inventory-II (BDI-II). It measures self-reported depressive symptoms in adolescents and adults according to DSM-IV criteria for diagnosing depressive disorders [35]. Scale reliability in our data was $\alpha = 0.91$. Each of the 21 items is rated on a four-point scale ranging from 0 to 3 and the total sum-score can range from 0 to 63. Scores from

<table>
<thead>
<tr>
<th>Table 1: Frequency distribution of TCI profiles.</th>
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<tbody>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Temperament</td>
</tr>
<tr>
<td>---</td>
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<tr>
<td>NHR—sensitive</td>
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<tr>
<td>NHR—explosive</td>
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<tr>
<td>NhR—passionate</td>
</tr>
<tr>
<td>NhR—adventurous</td>
</tr>
<tr>
<td>NhR—cautious</td>
</tr>
<tr>
<td>NhR—methodical</td>
</tr>
<tr>
<td>NhR—reliable</td>
</tr>
<tr>
<td>nhr—independent</td>
</tr>
<tr>
<td>SCT—creative</td>
</tr>
<tr>
<td>SCT—organized</td>
</tr>
<tr>
<td>ScT—fanatical</td>
</tr>
<tr>
<td>ScT—autocratic</td>
</tr>
<tr>
<td>sCT—moody</td>
</tr>
<tr>
<td>sCT—dependent</td>
</tr>
<tr>
<td>sCT—disorganized</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

In 1997 and 2001, depressive symptoms were assessed by the modified version of the BDI only (see methods for details). In 2007 depressive symptoms were assessed by both the original BDI-II and modified BDI NHR = sensitive; NhR = explosive; NhR = adventurous; nHR = cautious; nHR = methodical; nhR = reliable; nhr = independent. SCT = creative; ScT = organized; ScT = fanatical; ScT = autocratic; sCT = moody; sCT = dependent; sCT = disorganized; sct = depressive.
was in line with the criteria used with modified depressive symptoms scale assessing milder depressive symptoms.

2.3. Statistical Analyses. Analysis of variance (ANOVA) was used to examine differences between personality profiles. Sex and birth year were controlled when analyzing the profile differences. Possible profile × sex and profile × birth year interactions with depression scores were examined each year, but they were all nonsignificant in all the measurements. Profile comparisons were based on estimated marginal means, which were adjusted for sex and birth year. These adjustments were made because the original profiles were based on median scores unadjusted for sex and birth year. Bonferroni correction was used to correct for the multiple comparisons. We also used LSD-correction (equal to individual t-tests) when comparing different profiles. Persistence was studied using linear regression analysis and correlation coefficients. All analyses were conducted using SPPS for Windows version 18.

3. Results

3.1. Mild Depressive Symptoms (Modified BDI). Figure 1 shows the standardized mild depressive symptoms scores in 1997, 2001, and 2007 in the eight character profiles measured in 1997. Analysis of variance revealed highly significant differences between the profile groups in 1997 (F = 164.69, P < .001), 2001 (F = 51.85, P < .001), and 2007 (F = 40.03, P < .001). Bonferroni corrected comparison between groups showed that in all three measurement years the four profiles low on self-directedness (sct, scT, sCt, and sCT) had more frequently mild depressive symptoms than three profiles high in self-directedness (SCT, SCt, and ScT). The fanatical profile (ScT) was an exception; in all three measurement years fanatical people had more frequently mild depressive symptoms than organized (SCt) people.

Figure 2 shows the standardized mild depressive symptoms scores in 1997, 2001, and 2007 in the eight temperament profiles measured in 1997. Analysis of variance revealed highly significant differences between the profile groups in 1997 (F = 97.53, P < .001), 2001 (F = 35.39, P < .001), and 2007 (F = 29.41, P < .001). Bonferroni corrected comparison between groups showed that in all three measurement years the four profiles high on harm avoidance (nHR, nHr, NHR, and NhR) had more often mild depressive symptoms than the four profiles low on harm avoidance (nhR, nhR, NHR, and NhR). Also, the adventurous profile (Nhr) exhibited more mild depressive symptoms in all three measurement years than reliable (nHR) profile.

3.2. Depressive Symptoms (BDI-II). Figure 3 shows the depressive symptoms sum scores in year 2007 in the eight character profiles measured in 1997. Analysis of variance revealed highly significant differences between the profile groups (F = 15.41, P < .001). Bonferroni corrected comparison between groups showed that three profiles high on self-directedness (SCT, SCt, and ScT) had less frequently
Depression symptoms than the three profiles low on Self-directedness (sct, scT, and sCT). Fanatical people (ScT) were again an exception; the fanatical profile did not differ significantly from any other character profile.

Figure 4 shows the depressive symptoms sum-scores in 2007 in the eight temperament profiles measured in 1997. Analysis of variance revealed highly significant differences between the profile groups \((F = 15.16, P < .001)\). Bonferroni corrected comparison between groups showed that the four profiles high on harm avoidance (nHR, nHr, NHR, and NHr) had more frequently depressive symptoms than the three profiles low on harm avoidance (nrh, nHR, and NhR). In addition, the sensitive profile (NHR) had more frequently depressive symptoms than the methodical (nHR) profile.

3.3. Pairwise Comparison of Depressive Symptoms Scores in Different TCI-Profiles. Table 2 shows the pairwise profile comparisons for each TCI profile configuration for depressive symptoms. The comparisons show the effect of being high or low on a given trait when the other traits are held constant. The comparisons revealed the strong effect of harm avoidance and self-directedness on depressive symptoms. In all the comparisons people high on harm avoidance reported more frequently depressive symptoms than people low on harm avoidance. Also, in all the comparisons people high on self-directedness reported less frequently depressive symptoms than people low on Self-directedness.

Other TCI-traits showed more mixed results. In most comparisons, people high on cooperativeness reported less frequently mild depressive symptoms (BDI_M) than people low on cooperativeness. However, cooperativeness did not have a significant effect on depressive symptoms (BDI-II) in 2007. Also, novelty seeking seemed to increase self-reported depressive symptoms. In all the comparisons people high on novelty seeking reported more frequently depressive symptoms than people low on novelty seeking. Not all the comparisons were significant but the trend was clear and consistent. Those having high novelty seeking reported more frequently high levels of depressive symptoms (BDI-II) especially when harm avoidance was high compared to those with low novelty seeking. Results were less clear for reward dependence. Those having high reward dependence reported less frequently higher levels of mild depressive symptoms (BDI_M) especially in 1997 and 2001 but in 2007 it did not have much significant effect. Also, Reward Dependence did not affect reported depressive symptoms (BDI-II). High self-transcendence consistently increased the probability of high reported depressive symptoms when both self-directedness and cooperativeness were high (SCT versus SCt). Mean difference in depressive symptoms between high and low self-transcendence was also consistently rather large when only self-directedness was high (ScT versus Sc) but due to the small N in the profile groups, the mean difference was not significant in three of the four measurements.

3.4. TCI-Profiles in 1997 Predicting BDI-II Depression in 2007. Table 3 shows the frequency of depression (BDI-II) in personality profiles in 2007. “No depression” means that a person’s depressive symptoms score is at most 13. “Depressed” means that a person’s depressive symptoms score is at least 14. The percentage of depressed people is higher (All %) in all those profiles where harm avoidance is high than in those where harm avoidance is low. Interestingly, in addition to harm avoidance, reward dependence, and novelty seeking seem to contribute to the frequency of depression; sensitive people (NHR) are more frequently depressed (All %) than methodical (nHR), explosive (NHR), or cautious (NhR) people. According to the odds ratios, methodical people (nHR) are not significantly more frequently depressed than reliable (nHR) people. Sensitive people (NHR) have over 5-times higher odds of being depressed and also explosive (NHR) and cautious (NhR) people have over 3 times greater odds to be depressed than reliable (nHR) people. The number...
Table 2: Pairwise comparison of depressive symptom scores between groups of various temperament and character profiles.

<table>
<thead>
<tr>
<th></th>
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<tr>
<td>NHR versus nHR</td>
<td>.283</td>
<td>.000</td>
<td>.140</td>
<td>.152</td>
<td>.159</td>
<td>.110</td>
<td>2.074</td>
<td>.002</td>
</tr>
<tr>
<td>NHR versus nHr</td>
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<td>.207</td>
<td>.146</td>
<td>.163</td>
<td>.211</td>
<td>.053</td>
<td>1.728</td>
<td>.021</td>
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<td>.149</td>
<td>.129</td>
<td>.196</td>
<td>.048</td>
<td>.424</td>
<td>.534</td>
</tr>
<tr>
<td>Nhr versus nhr</td>
<td>.247</td>
<td>.002</td>
<td>.209</td>
<td>.040</td>
<td>.136</td>
<td>.000</td>
<td>.549</td>
<td>.444</td>
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<td></td>
</tr>
<tr>
<td>NHR versus NhR</td>
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<td>.000</td>
<td>.719</td>
<td>.000</td>
<td>.786</td>
<td>.000</td>
<td>4.912</td>
<td>.000</td>
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<tr>
<td>NhR versus nHr</td>
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<td>.000</td>
<td>.737</td>
<td>.000</td>
<td>.667</td>
<td>.000</td>
<td>3.420</td>
<td>.000</td>
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<td>nhR versus nhR</td>
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<td>.000</td>
<td>.728</td>
<td>.000</td>
<td>.823</td>
<td>.000</td>
<td>3.262</td>
<td>.000</td>
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<tr>
<td>NhR versus nhr</td>
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<td>.000</td>
<td>.800</td>
<td>.000</td>
<td>.593</td>
<td>.000</td>
<td>2.241</td>
<td>.000</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NHR versus Nhr</td>
<td>−.152</td>
<td>.084</td>
<td>−.225</td>
<td>.048</td>
<td>−.050</td>
<td>.672</td>
<td>.831</td>
<td>.307</td>
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<tr>
<td>NhR versus nHr</td>
<td>−.319</td>
<td>.000</td>
<td>−.207</td>
<td>.028</td>
<td>−.169</td>
<td>.088</td>
<td>−.660</td>
<td>.331</td>
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<td>nhR versus nhR</td>
<td>−.334</td>
<td>.000</td>
<td>−.219</td>
<td>.014</td>
<td>.001</td>
<td>.993</td>
<td>.485</td>
<td>.441</td>
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<td>NhR versus nhr</td>
<td>−.210</td>
<td>.015</td>
<td>−.147</td>
<td>.172</td>
<td>−.229</td>
<td>.032</td>
<td>−.536</td>
<td>.465</td>
</tr>
<tr>
<td><strong>Self-directedness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCT versus sCT</td>
<td>−.968</td>
<td>.000</td>
<td>−.766</td>
<td>.000</td>
<td>−.456</td>
<td>.000</td>
<td>−2.480</td>
<td>.000</td>
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<td>SCt versus sCt</td>
<td>−1.146</td>
<td>.000</td>
<td>−.798</td>
<td>.000</td>
<td>−.725</td>
<td>.000</td>
<td>−3.515</td>
<td>.000</td>
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<td>ScT versus sCT</td>
<td>−.944</td>
<td>.000</td>
<td>−.684</td>
<td>.000</td>
<td>−.608</td>
<td>.000</td>
<td>−2.487</td>
<td>.007</td>
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<tr>
<td>Sct versus sct</td>
<td>−1.076</td>
<td>.000</td>
<td>−.837</td>
<td>.000</td>
<td>−.744</td>
<td>.000</td>
<td>−3.537</td>
<td>.000</td>
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<tr>
<td><strong>Cooperativeness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCT versus ScT</td>
<td>−.328</td>
<td>.001</td>
<td>−.239</td>
<td>.040</td>
<td>−.215</td>
<td>.100</td>
<td>−.967</td>
<td>.290</td>
</tr>
<tr>
<td>SCt versus Sct</td>
<td>−.355</td>
<td>.000</td>
<td>−.203</td>
<td>.033</td>
<td>−.245</td>
<td>.012</td>
<td>−.535</td>
<td>.433</td>
</tr>
<tr>
<td>sCT versus sCT</td>
<td>−.305</td>
<td>.000</td>
<td>−.157</td>
<td>.096</td>
<td>−.367</td>
<td>.000</td>
<td>−.975</td>
<td>.150</td>
</tr>
<tr>
<td>sCt versus sct</td>
<td>−.286</td>
<td>.002</td>
<td>−.242</td>
<td>.040</td>
<td>−.264</td>
<td>.031</td>
<td>−.558</td>
<td>.515</td>
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<tr>
<td><strong>Self-transcendence</strong></td>
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<td></td>
</tr>
<tr>
<td>SCT versus ScT</td>
<td>.244</td>
<td>.000</td>
<td>.162</td>
<td>.040</td>
<td>.289</td>
<td>.000</td>
<td>1.133</td>
<td>.046</td>
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<tr>
<td>ScT versus Sct</td>
<td>.217</td>
<td>.033</td>
<td>.197</td>
<td>.125</td>
<td>.259</td>
<td>.068</td>
<td>1.564</td>
<td>.116</td>
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<tr>
<td>sCT versus sCT</td>
<td>.066</td>
<td>.010</td>
<td>.129</td>
<td>.311</td>
<td>.020</td>
<td>.875</td>
<td>.098</td>
<td>.915</td>
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<td>sCt versus sct</td>
<td>.085</td>
<td>.162</td>
<td>.044</td>
<td>.588</td>
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<td>.149</td>
<td>.514</td>
<td>.388</td>
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</table>

BDI_M = modified Beck’s depression index; BDI = original Beck’s depression index Comparisons based on LSD-adjusted marginal means in ANOVA. Results are adjusted for sex and cohort.

NHR = sensitive; NHr = explosive; NhR = passionate; Nhr = adventurous; nHR = cautious; nHr = methodical; nhR = reliable; nhr = independent.

SCT = creative; SCt = organized; ScT = fanatical; Sct = autocratic; sCT = moody; sCt = dependent; scT = disorganized; sc = depressive.

of men in certain profiles is not large but still the difference between the most frequently depressed profile (NHR, 45.5%) and least frequently depressed profile (nHR, 3.9%) in men is very large in terms of depression frequency. Both in men and women sensitive (NHR) people have the highest frequency of depression. Cautious women (nHR) are rather often depressed (19.8%) but this is not true for cautious men (7.1%).

Also the character profiles show differences in depression frequency. Except for the fanatical (ScT) profile, people high on self-directedness (SCT, SCt, and Sct) belonged less frequently in depressed group than people low on self-directedness (sCT, sCt, sct, and SCT). If self-directedness and Cooperativeness are held constant (e.g., SCT versus SCt in Table 3) in all the contrasts the profile higher on self-transcendence is more frequently depressed (All %). Fanatical men and women (SCT) were more frequently depressed than other profiles high on Self-directedness, and, in men, fanatical profile was most often depressed (19.0%). According to percentages, disorganized (sCT) or depressive (sct) women were more frequently depressed than disorganized or depressive men, respectively. According to the odds ratios, fanatical people (SCT) and those low on self-directedness (sCT, ScT, sCt, and SCT) were more often depressed than organized (SCt) people. Disorganized people (sCT) were the most frequently depressed group according to the odds ratios.

3.5. The Relationship between Depressive Symptoms and Persistence. The linear relationship between Persistence and
Table 3: Results of logistic regression where temperament or character profile was the independent variable and binary BDI-II depression score (not depressed = 0 and >13 = 1) the dependent variable.

<table>
<thead>
<tr>
<th>Character</th>
<th>All %</th>
<th>Women %</th>
<th>Men %</th>
<th>Odds ratio (All)</th>
<th>CI (All)</th>
<th>P (All)</th>
<th>Odds ratio (women)</th>
<th>CI (women)</th>
<th>P (women)</th>
<th>Odds ratio (men)</th>
<th>CI (men)</th>
<th>P (men)</th>
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<td>Temperament</td>
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<tr>
<td>NHR—sensitive</td>
<td>25.9</td>
<td>24.5</td>
<td>45.5</td>
<td>5.78</td>
<td>2.58–12.95</td>
<td>.000</td>
<td>4.74</td>
<td>1.90–11.78</td>
<td>.001</td>
<td>20.01</td>
<td>3.06–130.92</td>
<td>.002</td>
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<td>NHR—explosive</td>
<td>17.8</td>
<td>16.9</td>
<td>18.8</td>
<td>3.89</td>
<td>1.63–9.31</td>
<td>.002</td>
<td>3.09</td>
<td>1.06–9.04</td>
<td>.040</td>
<td>6.71</td>
<td>1.33–33.75</td>
<td>.021</td>
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<td>NHR—passionate</td>
<td>6.1</td>
<td>5.8</td>
<td>6.8</td>
<td>1.06</td>
<td>0.43–2.59</td>
<td>.907</td>
<td>.89</td>
<td>0.31–2.53</td>
<td>.822</td>
<td>1.60</td>
<td>0.27–9.28</td>
<td>.603</td>
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<td>NHR—adventurous</td>
<td>6.7</td>
<td>8.1</td>
<td>5.3</td>
<td>1.24</td>
<td>0.47–3.26</td>
<td>.658</td>
<td>1.31</td>
<td>0.40–4.24</td>
<td>.657</td>
<td>1.36</td>
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<td>nHr—cautious</td>
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<td>19.8</td>
<td>7.1</td>
<td>3.65</td>
<td>1.63–8.17</td>
<td>.002</td>
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<td>1.46–9.01</td>
<td>.006</td>
<td>1.98</td>
<td>0.26–15.22</td>
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<td>nHr—methodical</td>
<td>11.3</td>
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<td>10.2</td>
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<td>0.98–5.07</td>
<td>.057</td>
<td>2.11</td>
<td>0.78–5.69</td>
<td>.139</td>
<td>2.54</td>
<td>0.54–12.04</td>
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<td>reference</td>
<td>reference</td>
<td>.694</td>
<td>1.29</td>
<td>0.37–4.43</td>
<td>.691</td>
<td>1.32</td>
<td>0.25–6.91</td>
<td>.743</td>
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<td>nhr—independent</td>
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<td>8.1</td>
<td>5.4</td>
<td>1.21</td>
<td>0.47–3.12</td>
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<td>0.25–6.91</td>
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<td>SCT—creative</td>
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<td>reference</td>
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<td>0.37–4.43</td>
<td>.691</td>
<td>1.32</td>
<td>0.25–6.91</td>
<td>.743</td>
</tr>
<tr>
<td>ScT—fanatical</td>
<td>14.8</td>
<td>12.5</td>
<td>19.0</td>
<td>3.59</td>
<td>1.43–8.99</td>
<td>.006</td>
<td>2.72</td>
<td>0.84–8.86</td>
<td>.096</td>
<td>6.48</td>
<td>1.44–29.16</td>
<td>.015</td>
</tr>
<tr>
<td>ScT—autocratic</td>
<td>4.5</td>
<td>5.5</td>
<td>3.8</td>
<td>1.06</td>
<td>0.39–2.90</td>
<td>.914</td>
<td>1.08</td>
<td>0.28–4.26</td>
<td>.908</td>
<td>0.93</td>
<td>0.20–4.31</td>
<td>.924</td>
</tr>
<tr>
<td>sCT—moody</td>
<td>18.4</td>
<td>18.9</td>
<td>16.0</td>
<td>4.43</td>
<td>2.15–9.11</td>
<td>.000</td>
<td>4.44</td>
<td>1.90–10.38</td>
<td>.001</td>
<td>4.65</td>
<td>1.06–20.44</td>
<td>.042</td>
</tr>
<tr>
<td>sCT—depressed</td>
<td>14.7</td>
<td>16.4</td>
<td>10.0</td>
<td>3.46</td>
<td>1.45–8.25</td>
<td>.005</td>
<td>3.65</td>
<td>1.33–10.05</td>
<td>.012</td>
<td>2.78</td>
<td>0.47–16.56</td>
<td>.263</td>
</tr>
<tr>
<td>scT—disorganized</td>
<td>20.7</td>
<td>23.9</td>
<td>14.3</td>
<td>5.56</td>
<td>2.86–10.81</td>
<td>.000</td>
<td>6.16</td>
<td>2.75–13.80</td>
<td>.000</td>
<td>4.72</td>
<td>1.43–15.56</td>
<td>.011</td>
</tr>
<tr>
<td>scT—depressive</td>
<td>14.5</td>
<td>17.5</td>
<td>11.6</td>
<td>3.83</td>
<td>1.92–7.62</td>
<td>.000</td>
<td>4.01</td>
<td>1.69–9.50</td>
<td>.002</td>
<td>3.56</td>
<td>1.12–11.31</td>
<td>.031</td>
</tr>
</tbody>
</table>

Depression measured by Beck’s original depression index (BDI-II).
Odds ratio and P value based on binary logistic regression where depression (0 or 1) was the outcome and personality profile the predictor. Odds ratios based on combined sample of men and women cohort and sex were controlled in the regression analysis.
Birth year was not controlled when calculating the percentages.
depressive symptoms was explored using correlation coefficients and linear regression. Correlations between Persistence and mild depressive symptoms in 1997, 2001, and 2007 were −.07, −.01, and .00, respectively. Correlation between persistence and depressive symptoms (BDI-II) in 2007 was .02. Only the correlation with mild depressive symptoms in 1997 was significant at .05 level.

Table 4 shows the results of linear regression analysis for persistence predicting depressive symptoms. The association between persistence and depressive symptoms was negative in 1997 and positive in 2001 and 2007. Three of the seven regression coefficients for persistence were statistically significant. Persistence explained, at best, 0.4% of the variation in depressive symptoms.

4. Discussion

The most important findings of this study were the effect of novelty seeking and reward dependence temperament traits on depressive symptoms in addition to harm avoidance, and the increased probability for BDI-II depression (Table 3) of the fanatical character profile (ScT) despite having high self-directedness. Sensitive people (NHR) had more frequently depressive symptoms (BDI-II) than methodical people (nHr) although both had high harm avoidance. In addition, the current results confirmed the findings of previous studies about the strong impact of high harm avoidance and low self-directedness on the frequency of depressive symptoms (e.g., [7–10, 23]). High level of depressive symptoms could be predicted with high harm avoidance and low self-directedness strongly and consistently both cross-sectionally and over time. Our results also confirmed the findings of previous studies according to which persistence was positively associated with depressive symptoms when baseline depressive symptoms are controlled [23, 25].

The use of personality profiles led to an important finding: the effect of harm avoidance and self-directedness on depressive symptoms depends on the configuration of the other temperament and character traits. It is interesting to contrast our results with those of Gurpegui et al. [30] who also used TCI personality profiles in their nonclinical psychopathology study although they used the short version of TCI (TCI-125) and a true/false response format which reduces variance compared to a five-point Likert-scale. The differences found by them in depressive symptoms scores between personality profiles were mostly due to harm avoidance and self-directedness. People with sensitive (NHR), explosive (Nhr), or methodical (nHr) temperament profile had more frequently depressive symptoms than others. Also, people with moody (sCT), dependent (sCt), disorganized (scT), or depressive (sct) character profiles had more frequently depressive symptoms than others. Other TCI-traits besides HA and SD did not have a consistent significant effect on depressive symptoms. Our results are different in this aspect, because we found that all seven TCI-traits had at least some effect on the frequency of depressive symptoms between different profiles.

From the temperament profiles sensitive (NHR) temperament was the best predictor of BDI-II depression 10-years later, increasing the risk to almost 6-fold. Also having explosive (Nhr) or cautious (nHR) temperament profile increased the risk of BDI-II depression to over 3-fold. Regarding the character traits, disorganized (scT) individuals had over 5-times greater risk to become depressed compared to organized (ScT) persons. Also, moody (sCT), depressive (sct), fanatical (ScT) or dependent (sCt) character profiles predicted over threefold risk of later BDI-II depression. Thus those having disorganized (scT) character and sensitive (NHR) temperament profile might be most vulnerable for future depression. Also, fanatical people (ScT) had an increased risk for BDI-II depression even though they were high on self-directedness. Fanatical people can be characterized as independent and paranoid, and being projective of blame [36].

Novelty seeking and reward dependence, in turn, did not have a consistent effect on BDI-II depression in 2007 when harm avoidance was low. However, when harm avoidance was high, both high novelty seeking and high reward dependence increased the probability for having BDI-II depression. Sensitive people (NHR) were most likely to be depressed according to BDI-II. Sensitive people respond intensely to aversive (HA) and novel (NS) stimuli, and to social reward and punishment (RD). This combination seems to make them especially vulnerable to depression.

Temperament traits, especially harm avoidance, might be related to emotional vulnerability to depression, whereas character traits, especially self-directedness, might be associated with executive cognitive functions that protect a person from depression [23]. However, high harm avoidance is associated with a wide range of psychopathology and it is not typical only of depression [30]. All in all, it seems that individuals with depression are likely to be both anxiety-prone (i.e., high in harm avoidance) and immature (i.e., low in self-directedness). Maturity refers to the character configuration typical of healthy middle-aged individuals, which is characterized by high Self-directedness and high Cooperativeness [2, 3, 28, 29]. It is consistent with what is described as healthy or health-promoting personality traits, as proposed for DSM-V [37].

Cooperativeness, self-transcendence, reward dependence, and novelty seeking also had an impact on depressive symptoms in addition to harm avoidance and self-directedness. Cooperativeness was negatively associated with mild depressive symptoms cross-sectionally and over four and ten years. However, cooperativeness was not significantly associated with BDI-II depressive symptoms over ten years. This is in line with previous research which has found that cooperativeness is cross-sectionally associated with depression but does not predict later depression [23]. However, our results show that cooperativeness is negatively associated with mild depressive symptoms over time but not with more severe self-reported depressive symptoms.

Using personality profiles proved to be useful in examining the effect of Self-transcendence on depressive symptoms. When self-directedness was low, self-transcendence, by itself, did not have a significant effect on depressive symptoms. However, when self-directedness was high, Self-transcendence was positively associated with the mean levels of depressive symptoms. This might explain why some
earlier studies have found a positive association between Self-transcendence and depression [7, 10, 14] and some have not found an association [11, 27].

The previous studies regarding the role of novelty seeking or reward dependence as a predictor of depression are contradictory. Some studies have found that novelty seeking is negatively associated with depression [7, 15, 26, 31] while some studies have reported a positive association [14, 19]. Similarly, in some studies reward dependence has been found to be negatively associated with depression [14, 21] but not in all [11]. Our results suggest that the association between novelty seeking and depressive symptoms is positive but the magnitude depends on the personality profile. High novelty seeking was a significant predictor of high levels of BDI-depressive symptoms (Table 2) only when harm avoidance was high. As regards to reward dependence, our results suggest that it is negatively associated with mild depressive symptoms but not significantly with BDI-II depressive symptoms, thus giving support to the previous findings.

Another key finding of our study was that the association between temperament and character traits and depressive symptoms might depend on the definition of depressive symptoms themselves. For example, when mild depressive symptoms were used as a depressive symptoms measure, the effect of novelty seeking was quite similar in all personality profiles. However, when BDI-II depressive symptoms were used as a depressive symptoms measure, novelty seeking was significantly associated with depressive symptoms only in the profiles with high harm avoidance. Furthermore, reward dependence was negatively associated with mild depressive symptoms but positively associated with BDI-II depressive symptoms when harm avoidance was high. In addition, cooperativeness was consistently positively associated with mild depressive symptoms but not with BDI-II depressive symptoms.

The temperaments and character profiles were associated with depressive symptoms cross-sectionally and also four or ten years later. This is an important finding since it implies that cross-sectional analyses focusing on the association between personality and depressive symptoms give valuable information and predictions can be made using them. TCI profiles identified depressive symptoms both cross-sectionally and prospectively. However, it is not clear what the clinical significance of this finding is. A replication of this study is needed using clinically verified depression as an outcome instead of depressive symptoms.

Our results are in agreement with neurobiological findings according to which a personality trait might not be related to a single neurotransmitter system [38]. Modulation and interaction are very common in brain functions and the effects of neurotransmitters on behavior are not linear [38]. This is exactly what our results suggest; the effects of different temperament and character traits are not strictly linear or independent of each other but depend on the combination and levels of other traits. Our results suggest that the strong effects of harm avoidance and self-directedness on depressive symptoms are very dominating and can mask the effects of other temperament and character traits if the interactions between the traits are not taken into account. When these interactions are taken into account, the complex relationship between personality and depressive symptoms is better understood, as we have shown. In future studies and with a sufficiently large number of participants, it would be useful to study the combination of harm avoidance and the maturity of personality because mature personality forms a preventive shield protecting oneself of developing mental disorders [3, 37].

Our study was not without limitations. Cloninger’s theory sees personality as an adaptive system where the temperament traits interact, and where the outcomes of temperament are modified by the maturity levels of character traits. Temperament and character are not independent of each other, implying that when we assess temperament we also assess character to some extent. Therefore, our temperament and character profiles do not represent pure temperament or character but a combination of both. It would be extremely interesting in future studies to explore the combined temperament × character profiles. This, however, leads to $8 \times 8 = 64$ different profiles which means that a large number of participants is needed to avoid profiles with zero or only a few participants. The associations between temperament traits and depression risk may also depend on social and environmental circumstances [39], and the association between character and well-being might be influenced by culture [29]. This context-specificity implies that the associations between personality and depression

### Table 4: Regression coefficients of persistence predicting depressive symptoms.

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B$ (SE)</td>
<td>$P$</td>
<td>$\Delta R^2$</td>
<td>$B$ (SE)</td>
<td>$P$</td>
<td>$\Delta R^2$</td>
<td>$B$ (SE)</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persistence</td>
<td>$-.11$</td>
<td>$.010$</td>
<td>$.004$</td>
<td>$-.01$</td>
<td>$.881$</td>
<td>$.000$</td>
<td>$.01$</td>
</tr>
<tr>
<td>Step 2</td>
<td>Persistence</td>
<td>$.07$</td>
<td>$.042$</td>
<td>$.001$</td>
<td>$.07$</td>
<td>$.042$</td>
<td>$.065$</td>
</tr>
</tbody>
</table>

$\Delta R^2 = $ change in $R^2$ compared to the model with only control variables.

Step 1 = effect of persistence when sex and birth year were controlled. Step 2 = effect of persistence when sex, birth year, and mild depressive symptoms in 1997 were controlled.

BDI-M = mild depressive symptoms (see Section 2).
BDI-II = depressive symptoms measured by BDI-II.
might be, at least partly, culture specific and not fully generalizable from one country to another.

Given the longitudinal design, some associations might have been affected by selective study attrition. We tried to lower the probability for this possibility by not requiring all the participants to have full data in all the measurement years which makes the study sample less selective. In addition, both personality and depressive symptoms were self-rated. It is possible that personality affects a person’s depressive symptoms rating or vice versa. The clinical significance of our results is questionable, since it cannot be said how many of the participants would fill the criteria for a clinical depression diagnosis. It is also questionable if causal attributions can be inferred from our study, since we did not control for baseline depressive symptoms. Nevertheless, our study gives a rather comprehensive picture of the association between personality profiles and depressive symptoms. Our aim was not to predict depressive symptoms per se but to identify the differences between TCI profiles in the frequency of depressive symptoms.

5. Conclusions

In summary, we have shown the importance of personality profiles in studying the vulnerability to depressive symptoms cross-sectionally and over time. We showed that in addition to disorganized (sCT) character profile carriers, also those having moody (sCT), depressive (sct), fanatical (ScT), or dependent (sCT) character profiles are vulnerable to developing BDI-II depression. Especially the fanatical profile is interesting since high self-directedness usually protects a person from depression. From temperament traits it seems that it is not high harm avoidance alone, rather it is high harm avoidance combined with other high temperament traits that increases frequency of depressive symptoms. The reason for this is not clear but it might refer to inner conflicts in the person’s motivational systems, that is, a combination of anxiousness and a preference for novelty and social rewards. Those having sensitive (NHR), explosive (NHr) or cautious (nHR) temperament profiles are in increased danger to have BDI-II depression. Interestingly, the methodical (nHR) profile has only slightly increased risk for BDI-II depression although their harm avoidance is high. Our results highlight the importance of the interaction of harm avoidance and self-directedness with the other TCI traits when assessing the risk for depressive symptoms.

References


Research Article

Cognitive and Affective Correlates of Temperament in Parkinson’s Disease

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Parkinson’s disease (PD) patients display low novelty seeking scores on the Tridimensional Personality Questionnaire (TPQ), which may reflect the low dopamine function that characterises the disease. People with PD also display raised harm avoidance scores. Due to these and other observations, a “parkinsonian personality” has been suggested. However, little is known about how these features relate to cognitive and affective features of the disorder. We examined links between TPQ scores and performance on an attentional orienting task in a sample of 20 people with PD. In addition, associations between TPQ and depression and anxiety scores were explored. It was found that novelty seeking scores were significantly correlated with a reaction time measure of attentional orienting to visual novelty. Harm avoidance scores were significantly correlated with anxiety, but not depression scores. These findings extend our understanding of how temperament interacts with cognitive and affective features of the disorder.

1. Introduction

Parkinson’s disease (PD) patients display low novelty seeking scores on the Tridimensional Personality Questionnaire (TPQ), which may reflect the low dopamine function that characterises the disease. People with PD also display raised harm avoidance scores. Due to these and other observations, a “parkinsonian personality” has often been described, which appears to be premorbid to neurological symptoms [1, 2] and may therefore be a temperament feature of the disease. At present, the extent to which such personality features contribute to the cognitive and affective components of the disease is poorly understood.

The primary pathology in the brains of PD patients is the loss of dopamine-producing cells in the substantia nigra [3]. Physiologically, the importance of the substantia nigra is in its dopaminergic projections to the striatum, which is one of the three main dopamine systems in the brain [4]. In PD patients, dopamine levels in this area have been observed to be only 10% of the normal level [5]. Therefore, PD is often considered as a disease that provides a model of low dopamine function in the human brain. Consequently, PD is of particular interest when considering theories that include the functional significance of dopamine.

One such theory, Cloninger et al.’s psychobiological approach to personality [6–9], posits that dopamine systems in the brain are the biological substrate of the temperament trait of novelty seeking. This “tridimensional” approach to personality measurement also proposes two further traits; harm avoidance (linked to serotonin) and reward dependence (linked to noradrenaline) [6]. However, later factor analytic studies revealed a fourth minor factor called persistence, which had formally been part of reward dependence [8]. Following the confirmation of the genetic structure of these four temperament dimensions, additional personality features were identified by Cloninger and colleagues which mature in adulthood. In fact, three additional character dimensions have been proposed which are influenced by insight learning, these are self-directedness, cooperativeness, and self-transcendence [9]. This psychobiological model of temperament and character has continued to evolve and is supported from a range of clinical and neuroscientific studies [7]. In particular, physiology-based research has
focused on the temperament dimensions of novelty seeking, harm avoidance, and reward dependence, due to their supposed genetic basis and neurochemical substrates. It is of course reductionist and an over simplification to equate a personality trait directly with a single neurotransmitter substance. There is a large degree of cross-over between the different circuits and systems in the brain, and highly complex neurotransmitter interactions at the cellular level [10]. Nevertheless, it is accepted that PD is primarily a dopamine deficiency disorder [11] and that novelty seeking is more closely linked to dopamine function than any of the other neurochemical systems [12]. Therefore, in regard to PD, it is the temperament trait of novelty seeking which has received particular research attention. Indeed, patients with PD have been shown to display significantly lower novelty seeking scores in PD patients [13]. In a follow-up study, the role of dopamine was confirmed by the finding that 18 F Dopa striatal uptake in PET scans correlated with novelty seeking scores in PD patients [14]. Further research has confirmed this link between low novelty seeking and PD [15, 16].

The distinctive personality of PD patients has been recognized for many years. As early as 1880, Charcot had described low motivation in patients with PD [17]. In addition, patients with PD have been described as displaying “premature social ageing.” This was based on the observation that many PD patients have few friends, reduced social involvement, few hobbies, and often prefer to spend time on solitary tasks [18, 19]. Furthermore, it has long been noted that PD patients are more likely to be nonsmokers than the general population. From this, it has been suggested that premorbidly, PD patients are less hedonistic or more self-controlled than the average person [2].

Cognitive impairments, particularly involving frontal lobe function are also widely described in PD [20, 21]. However, it is possible that the cognitive impairments are in part manifestations of the parkinsonian personality profile. Recently it has been noted that frontal lobe-associated cognitive task performance correlates with personality variables in patients with PD, and it has been suggested that both may reflect a common mechanism [22]. In this respect, novelty seeking may be of particular interest, as it is partly defined as “a heritable bias in the activation or initiation of behaviours such as frequent exploratory activity in response to novelty” [9]. It could therefore be suggested that novelty seeking would be associated with orientation and attention in cognitive tasks. Indeed, it has been shown that there are significant correlations between novelty seeking scores and performance of visual attention tasks in healthy individuals [23]. In particular, orientation to novelty has traditionally been considered as crucial to adaptation and action within a changing environment [24]. We may therefore hypothesise that impaired performance of cognitive tasks involving attention to novelty, will be linked to personality factors in patients with PD, in particular, novelty seeking.

Affective disorders are also common in patients with PD. Anxiety has been shown to be more prominent in PD than in healthy samples [25]. However, it is unclear whether this is a response to, or a symptom of, the disease itself. While anxiety varies with motor fluctuations and correlates with disease progression [26], this could be viewed as either indicating a neurobiological or a reactive mechanism. In support of a neurobiological cause is the observation that high levels of anxiety are linked to a serotonin transporter gene polymorphism in patients with PD [27]. Higher levels of depression were also found to be linked to the gene polymorphism, highlighting the fact that anxiety in PD tends to be comorbid with depressive symptoms, and that both may have a serotonergic basis.

Considering depression in PD, different studies have produced different estimates of its prevalence and a variety of theories are available to explain its occurrence. Prevalence estimates have varied between 4% and 70% [28]. It is known that serotonergic function is impaired in PD [29], and this is a likely neurochemical substrate of affective aspects of the disease [30]. For example, it has been shown using transcranial sonography that there are morphological changes to the serotonergic dorsal raphe in depressed but not nondepressed PD patients [31].

Serotonergic function is also thought to underlie Cloninger’s temperament feature of harm avoidance. In addition to the previously described association between PD and low novelty seeking, it is perhaps not surprising then that a relationship between PD and high harm avoidance scores has also been described, an observation that the authors attribute to the presence of depression [32]. Indeed, harm avoidance scores have been found to positively correlate with depression severity in patients with PD [33]. Nevertheless, the relationship between harm avoidance and depression in PD is not well understood.

In this investigation we sought to examine the relationship between the personality dimension of harm avoidance and affective symptoms in patients with PD. We hypothesised that within a sample of PD patients, harm avoidance scores would be correlated with depression and anxiety scores. Furthermore, to examine the relationship between visual attention and the trait of novelty seeking in the same sample, we developed a method to measure how novel visual events influence attention. This was an adaptation of the attentional cueing paradigm [34], a reaction time task often used in experimental psychology. In the standard version, arrowheads presented at the centre of a display facilitate response times to stimuli that later appear at the cued location. Although such tests are widely used, they do not involve orientation to visual novelty. We used a version that we adapted ourselves in which visual novelty was manipulated so that its influence on attention could be measured with reaction times. We hypothesised that within our sample of PD patients, the trait of novelty seeking would be correlated with task performance.

2. Method

2.1. Participants. A total of 20 PD patients participated in this study, 11 of these were female. All were patients of the National Hospital for Neurology and Neurosurgery in London, and the diagnoses of idiopathic PD were made by a consultant neurologist specialising in movement disorders.
The mean age of the patients was 68.5 years (SD = 9.4). The sample had a mean Hoehn and Yahr [35] stage of 1.9 (range 1–4), indicating a wide range of disease progression. Thirteen healthy control subjects also participated; all were volunteers who responded to advertisements. Ten of the control subjects were female. The mean age of the control sample was 69.7 years (SD = 9.1). There was no significant difference between the patients and controls for age ($t(31) = .38, P = .710$).

2.2. Materials and Apparatus. For the assessment of personality, the Tridimensional Personality Questionnaire was employed [6]. This measures three personality dimensions, novelty seeking, harm avoidance, and reward dependence. The hospital anxiety and depression scale was employed to measure severity of affective symptoms [36]. Although this is a brief measure, it is well suited to the current study as it was originally developed for use with medical outpatient samples [37] and has been validated for use with PD patients [38]. To administer the experimental task, a laptop computer with a colour 12.1” LCD monitor was used. The experimental task was implemented with the Visual Basic programming language. Details of the task are given below.

2.3. The Experimental Task. To measure attention to novelty, participants were required to make a simple button press response to a white dot appearing on the laptop screen. This white dot appeared either to the left or right of a central cross. A pair of coloured shapes always appeared 200 msecs before the white dot, one on either side of the central cross (see Figure 1). These two coloured shapes appeared simultaneously and always in the same two locations. One of the shapes was always a light brown square. The other shape was varied such that a totally novel, different coloured shape, would often be substituted for the previous shape. The substitutions occurred randomly every four to seven trials. The coloured shapes always appeared as background to the target white dot. Therefore a typical trial involved the simultaneous display of two coloured shapes, one to the left and one to the right, followed one fifth of a second later by the target white dot, in front of one of the coloured shapes. The participants’ task was to press the button as soon as they saw the white dot.

The location of the shape stimuli alternated randomly left to right, independently of the side that the target white dot would appear on. The shapes were therefore irrelevant to task performance, as shifting attention to either would confer no advantage in predicting the location of the white dot. However, if orientation of attention is influenced spontaneously then participants may orient their attention to the novel stimuli that is being displayed. If they did, and the white dot appeared there (200 msecs later), this might produce faster response times as their attention is already at the correct location. Conversely, if they spontaneously orient their attention to the novel stimuli (the coloured shape) and the white dot target appears on the other side (it is a 50:50 chance) then response times would likely be slowed as their attention has been diverted to the wrong location.

On 14% of the trials the target stimulus was not shown and a three-second delay was inserted before the next trial began. This was done to stop participants getting into the habit of just pressing the button each trial, as some were “blanks” they had to wait until the white dot appeared before pressing the button. If the response button was pressed on those “blank” trials where no target white dot was present, the computer emitted a tone and the word “error” was displayed on the screen.

After each trial the shape stimuli and white dot target disappeared and there was a one-second delay before the start of the next trial. Reaction times and number of errors were automatically recorded to a computer file. A visual representation of the temporal sequence of events in a typical trial is shown in Figure 1.

2.4. Procedure. All participants were contacted by telephone and an appointment made for their research participation. The assessment was conducted in the participant’s own home. All participants contributed data on the novelty attention task performance; however, clinical data on affective symptoms and personality data was only collected on the PD patients. All participants provided informed and written consent, and the project was approved by the local research ethics committee.

PD patients were interviewed after an overnight withdrawal (approximately 11 hours) of their antiparkinsonian medication to ensure that they were in a hypodopaminergic state. During the interview, basic demographic and clinical information was collected. Next, the experimental task was administered. Participants sat approximately 70 cm from the laptop screen. In each location, dim lighting was employed to enhance the visibility of the display. One finger of the dominant hand was held over a microswitch and the participant was told to press the button as quickly as possible whenever they saw a white dot appear either to the left or right of the central cross. They were told to try and keep their
fixation on this cross but that coloured shapes would appear in the background and that these would change occasionally. Responses were made via a button pad linked to a digital timing card in the computer. Input from the key was sampled at the rate of 1000 Hz. Two blocks of trials were performed. Each block involved 40 novel stimuli. There were 200 trials in each block. Each block took approximately 8 minutes to complete. Other cognitive assessments were performed which are not reported here.

2.5. Statistical Analyses. For all continuous data, the normality of distribution assumptions was verified with Kolmogorov-Smirnov one sample tests. Parametric tests were used with normally distributed variables and nonparametric equivalents when data was nonnormally distributed. To compare RTs on the novelty attention task, a mixed model ANOVA was used. For all statistically significant effects in the ANOVA calculations, estimates of effect size are provided as partial Eta^2 statistics. Where t-tests were employed, effect sizes are reported as Cohen’s d. To assess associations between variables and test our main hypotheses, Pearson bivariate correlation statistics were employed. For all inferential statistics, a value of P < .05 (two-tailed) was taken to indicate significance. All calculations were performed with PASW Statistics 18 [39].

3. Results

The novelty attention task is analysed first, followed by tridimensional personality questionnaire scores and hospital anxiety and depression scale scores. Finally, associations between the various measures are considered, as well as associations with disease progression.

For the novelty attention task, data from the first seven trials in each block were excluded, as they did not involve a novel change of stimulus. In addition, trials that occurred immediately after a withheld response were excluded. To control for anticipatory responding or lapses of attention, RTs of less than 100 msecs or more than 1000 msecs were excluded. From the remaining datasets, averages were calculated for the location of the target (either in conjunction with the repetitive or novel stimuli) and for the level of novelty. Level of novelty was defined as the number of times that the participant had seen the shape, including the current trial. Therefore, level of novelty ranged from 1–7, with 1 being a shape that was displayed for the first time. For each participant there were more data points for level of novelty 1–4 than for 5, 6, or 7. For this reason, mean rather than median averages were used to summarise the raw data as these are considered more appropriate for unequal datasets [40].

Response times in all conditions for all participants are shown in Table 1. To analyse the effect of novelty on response times, data was entered into a mixed model ANOVA, with group as a between subjects factor, within subject factors were location (novel or repetitive) and level of novelty (how often the novel shape had been presented). In order to compare the effect of novelty, the data points were averaged to provide three main groups of novelty level, when the novel shape first appeared, the mean of the responses for the 2nd and 3rd presentation, and the mean of the 4th to 7th presentations. The response times using these groupings are shown in Figure 2 and were analysed as described above. There was no main effect of group (F(1,31) = 2.14, P = .154) and the interactions involving group membership were all non-significant. There was a main effect of location (F(1, 33) = 9.40, P = .004, partial Eta^2 = .223) and of novelty (F(2,62) = 4.31, P = .018, partial Eta^2 = .122). The first presentation resulted in response times approximately 9 msecs slower than either the second set (novelty level 2 and 3) or the third set (novelty level 4, 5, 6, and 7). The exact mean RT values in msecs were 408, 399, and 399, respectively. A planned contrast was performed to compare RTs when the novel stimulus was first presented with the combined 2nd and 3rd presentation RTs, the difference was statistically significant, F(1,31) = 9.26, P = .005, partial Eta^2 = .230). However, the difference in RTs from the 1st presentation to the combined 4th, 5th, 6th, and 7th presentations was not statistically significant.

Absolute levels of errors (responding in the absence of a stimulus) were low with several participants making no errors at all, and so error distributions were nonnormal. For this reason, medians, rather than means, are reported. The PD sample made a median of 3 errors (range = 0–23) and the control group made a median of 4 errors (range = 0–9), this difference was not significant (Mann-Whitney U test, P = .896).

Table 1: Response times (and SDs) in milliseconds for the PD and control participants in the novelty attention task.

<table>
<thead>
<tr>
<th>Level of novelty</th>
<th>Parkinson’s</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Novel</td>
<td>Repetitive</td>
</tr>
<tr>
<td>1</td>
<td>417 (85)</td>
<td>425 (85)</td>
</tr>
<tr>
<td>2</td>
<td>409 (90)</td>
<td>416 (83)</td>
</tr>
<tr>
<td>3</td>
<td>411 (95)</td>
<td>415 (89)</td>
</tr>
<tr>
<td>4</td>
<td>420 (92)</td>
<td>416 (88)</td>
</tr>
<tr>
<td>5</td>
<td>409 (94)</td>
<td>416 (96)</td>
</tr>
<tr>
<td>6</td>
<td>398 (96)</td>
<td>418 (89)</td>
</tr>
<tr>
<td>7</td>
<td>406 (99)</td>
<td>418 (92)</td>
</tr>
</tbody>
</table>

"Novel" indicates when the target appeared in conjunction with the novel stimuli and "Repetitive" indicates when it appeared in conjunction with the repetitive stimuli. The level of novelty ranges from when a novel shape was shown for the very first time (1) to when it had been shown 7 times.
Table 2: Correlation coefficients and P values for the associations between temperament dimensions in the PD sample with cognitive and affective measures.

<table>
<thead>
<tr>
<th>Temperament Dimension</th>
<th>RT difference</th>
<th>Depression</th>
<th>Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novelty seeking</td>
<td>-.505, P = .023</td>
<td>.004, P = .987</td>
<td>-.116, P = .625</td>
</tr>
<tr>
<td>Harm avoidance</td>
<td>-.238, P = .313</td>
<td>.309, P = .186</td>
<td>.508, P = .022</td>
</tr>
<tr>
<td>Reward dependence</td>
<td>.001, P = .996</td>
<td>-.378, P = .100</td>
<td>-.436, P = .055</td>
</tr>
</tbody>
</table>

3.1. Anxiety-Depression Scores and Temperament. The PD sample had a mean novelty seeking score of 13.9 (SD = 4.8), the mean harm avoidance score was 18.7 (SD = 7.3), and the mean reward dependence score was 16.8 (SD = 4.0). On examination of the HADS scale scores, it was found that the mean score for depression was 4.8 (SD = 3.5, range = 1–15) and the mean score for anxiety was 7.3 (SD = 4.4, range = 2–19). Using the standard cut score of 8 [36], 3/20 (15%) of the PD patients would be considered as probable cases of depressive disorder. Similarly with the same cut score for anxiety, 8/20 (40%) of the PD patients would be considered as probable cases of anxiety disorder. Independent group t-tests revealed that there were no significant differences for anxiety or depression scores when male PD participants were compared with the female participants. Although there were no statistically significant sex differences for novelty seeking or reward dependence, it was found that the female PD patients had significantly higher levels of harm avoidance (female mean = 22.1, SD = 7.0, male mean = 14.4, SD = 5.5; t(18) = −.266, P = .016, d = 1.23).

To test our hypotheses that harm avoidance scores would be associated with depression and anxiety scores in the PD patients, correlation coefficients were calculated. These are shown in Table 2. It can be seen that there was a significant positive association between harm avoidance and anxiety severity scores; however, no significant association was detected with depression severity scores. There were no significant correlations between novelty seeking scores and depression or anxiety scores. The association between reward dependence and anxiety was approaching, but did not reach statistical significance. To further examine the relationship, those cases scoring above the cut scores for depression and anxiety were identified. Their TPQ scores are compared with those scoring below the cut scores in Figure 3. It can be seen that those PD participants scoring positive for probable anxiety disorder scored higher than the other patients for harm avoidance, and that this difference was statistically significant, t(18) = 3.53, P = .002, and d = .70. Furthermore, the same participants scored lower on reward dependence, a difference that was also statistically significant, t(18) = −2.37, P = .029, and d = 1.06. There was no significant difference for novelty seeking scores. A similar pattern of differences is seen when comparing those with and without depression. The three patients with probable depression appeared on visual inspection to score higher on harm avoidance and lower on reward dependence. However, no inferential statistical analysis was attempted due to the small sample size (3 verses 17).

Returning to the novelty attention task, Figure 2 shows that there is a tendency for RTs to be larger for the 1st presentation of the novel stimuli than the combined 2nd and 3rd presentation RTs. This is true for the conditions in...
which the target stimuli appeared in either the repetitive or novel location, but particularly in the latter. Indeed, for the full sample, mean response times when the novel stimuli was first presented (in conjunction with the target) were approximately 9 msecs longer than for when it was presented the 2nd/3rd time (401.7 msecs (SD = 77) compared to 392.6 msecs (SD = 80)). As described above, this difference is statistically significant, and implies that the presence of a novel stimulus produces a measurable effect on responding. The difference between these two RTs could therefore indicate an overall effect of novel stimuli on responses. To test our hypothesis that attention to novelty would be correlated with novelty seeking, the difference between 1st presentation and the combined 2nd and 3rd presentation response times when the target appeared in conjunction with the novel stimuli were calculated for each patient. The correlations between this difference statistic and temperament dimensions on the TPQ are also shown in Table 2. It can be seen that there was a significant negative correlation between novelty seeking and the RT difference statistic, indicating that patients with high novelty seeking scores had smaller difference statistics. There were no significant correlations with the other temperament dimensions of harm avoidance and reward dependence.

Finally, the effect of disease severity on temperament, affective and cognitive performance scores was investigated. The median Hoehn and Yahr disease severity score [35] was 2 (range 1–4), this was used to divide the PD sample into those with relatively early progression (stages 1 and 1.5, unilateral symptoms only, n = 8) and those with more advanced disease (stages 2–4, bilateral symptoms, n = 12). It was found that there were no significant differences between the groups for any of the temperament dimensions, anxiety, depression, or the difference statistic used to measure the impact of novelty on attention. This was true even if a higher disease progression cutoff was selected which compared the six most advanced cases with the 14 less advanced cases.

4. Discussion

We found a relationship between the underlying concept embodied in the definition of novelty seeking and an experimentally derived measure of responses to visual novelty. We have previously shown that novelty seeking scores are associated with efficiency of parallel visual processing in a healthy control sample [23]. However, in the current study a cognitive association has been demonstrated which directly links to novelty, and in a sample of PD patients, individuals considered to be low on the trait of novelty seeking. Although in our own PD sample we found no specific evidence for low novelty seeking scores. Nevertheless, the finding of low novelty seeking among patients with PD has been demonstrated previously [13–16].

Using the custom-designed attentional task, it was found that both the PD and control participants displayed a significant novelty-related location effect. That is, responses were generally faster when the target appeared in conjunction with the novel stimulus. The procedure is therefore capable of measuring the influence of novel visual events on response times. It was also found that there was a significant level of novelty effect. That is, responses tended to be relatively faster on 2nd and 3rd (combined) and 4th to 7th (combined) presentations of the novel stimulus relative to the 1st presentation. This effect occurred whether the target appeared in conjunction with the novel or repetitive stimulus. It is not possible to definitely say whether this effect occurred because the novel stimuli slowed or enhanced responses. However, we can assume that the novel stimulus was able to attract attention, which consequently influenced RTs. Similar effects have been observed in other cognitive experimental procedures when novel elements “pop-out” and familiar items “sink-in” to the display [41]. There was also a main effect of target location. Response times in general were significantly faster when the target appeared in conjunction with the novel, relative to the repetitive, stimuli. In the paradigm of attentional cueing developed by Posner [34], faster response times at a cued location are taken to indicate that attention is orientated to the location prior to the presentation of the target, hence faster response times. The current findings show that novelty can act to unconsciously cue attention to a spatial location. This supports the theory of novel “pop-out” which argues that novel visual elements attract rapid covert shifts in attention [41, 42].

In order to obtain a single measure of the effect of the novel stimulus on responding, the difference between response times from the 1st presentation and combined 2nd–3rd presentations for targets appearing in conjunction with the novel event were calculated. This gives a simple measure of the impact of novelty on the performance of individual participants. When this statistic was compared to personality dimensions with the Tridimensional Personality Questionnaire, it was found that there was a significant negative correlation with novelty seeking. Those patients with low novelty seeking scores showed the highest impact of novelty on the responses. Novelty seeking is considered to be a trait dependent on dopaminergic tone [6] and has been found to be lower in PD patients compared to controls [13]. The negative correlation therefore seems to be paradoxical in that it may have been hypothesised that high novelty
seeking individuals would show the highest impact of the novel stimuli. However, it may be that as low novelty seeking predisposes to lower behavioural responses to novelty, the initial presentation of the novel stimulus produced inhibited responding. When the level of novelty was reduced (2nd-3rd presentation) responding was returning to normal therefore giving a larger difference on the impact of novelty.

The current study found that harm avoidance scores were significantly higher in female patients with PD than male patients. We also found that harm avoidance was positively and significantly correlated with anxiety scores in our PD sample. This contributes to findings that there is a link between the temperament trait of harm avoidance and anxiety [43]. More surprising was our failure to find a link between depression and harm avoidance scores, as this link is commonly reported in nonneurological samples. One explanation maybe that depression in PD is somewhat different in its manifestation than general depression. For example it has been argued that depression in PD is indicative of a more advanced and widespread neurodegenerative illness [44, 45]. Furthermore, it has been observed that symptom profiles and responses to antidepressant medication are different in depressed patients with PD compared to general depressed patients, suggesting a different underlying pathological mechanism [30]. However, levels of depression were generally low in our PD sample, with only 15% scoring in the range of probable clinical depression, and this is an alternative explanation for our lack of association with harm avoidance scores.

5. Conclusions
Temperament traits in people with PD may be associated with aspects of cognitive performance and with affective disorder. In particular, we provide evidence that harm avoidance may be more linked to the presence of anxiety than to depression in people with PD. The trait of novelty seeking, which is thought to have low expression in PD, was found to be associated with performance of a cognitive task involving orientation to visual novelty. These findings extend our understanding of how temperament interacts with other manifestations of PD.

References


Research Article

The Relationship between Personality and Depression in Expectant Parents

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Several studies assessed the relationship between depression and dimensions of temperament/character using the Cloninger’s model of personality and the TCI-R. The aim of this study is clarify the relation between depression and personality in men and women who are expecting a baby. The Temperament and Character Inventory—Revised Form and the Beck Depression Inventory were administered to 65 pregnant women and 37 husbands during the last quarter of pregnancy. ANOVAs showed that pregnant women had higher levels of depression, reward dependence, and self-transcendence than the expectant fathers. Hierarchical Multiple Regression Analysis in the pregnant women group showed that harm avoidance and self-directedness were significant predictors of the level of depression. In the expectant fathers, only self-directedness was a significant predictor of depression. Low TCI-R self-directedness is a strong predictor of depression in expectant parents during pregnancy regardless of gender, and high TCI-R harm avoidance is an additional predictor of depression in expectant mothers.

1. Introduction

The relationship between personality and mood disorders must be considered from multiple points of view because of the complexity of the development of both depression and personality. On one hand, personality features may be an antecedent influence on depression. There is evidence that personality influences the risk of depression as a predisposition or as an early attenuated expression of later disorder [1, 2]. On the other hand, current mood state can influence how people describe their personality [3].

Cloninger et al. [4, 5] developed a psychobiological model in which personality is comprised of both temperament and character traits. There are four dimensions of temperament in Cloninger’s model: Harm Avoidance (HA) involves the inhibition of behavior by anxiety-provoking stimuli; Novelty Seeking (NS) involves the activation of behavior by desire to explore novelty or complexity, as well as excitability by frustration and boredom; Reward Dependence (RD) involves need for social approval and attachment; Persistence (P) is related to perseverance in behavior despite frustration and fatigue. Hence temperament involves individual differences in basic emotional impulses, such as fear (related to high HA), anger (related to high NS), disgust (related to high RD), and ambition (related to high P). There are advantages and disadvantages to both high and low extremes of temperament, and conflicts in motivation may arise when the same situation, such as expecting a baby, presents both potential difficulties and potential rewards. Consequently, the basic emotional drives of temperament are regulated by three character traits in Cloninger’s model of personality development. Self-directedness (SD) is a per-sons’ ability to self-regulate their behavior in accordance with chosen goal and values, so that they are responsible, purposeful, and resourceful. Cooperativeness (C) is the ability to get along with other people by being tolerant, empathic, helpful, and forgiving. Self-Transcendence (ST) is a person ability to identify with nature and the world as a whole, so that a person seeks to understand what is beyond their individual human existence and is able to sublimate and
act altruistically. Strong development of each of the three character dimensions has been shown to promote health and happiness generally [6]. Cloninger’s Temperament and Character Inventory—Revised Form (TCI-R) is one widely used self-report measure of personality and it assessed the temperament and the character according to the Cloninger’s model [7].

Several studies have assessed the relationship between dimensions of temperament/character and depression using the TCI in clinical samples [3, 8–11] and among students [12, 13].

A number of studies have shown that HA is positively correlated with depressive mood [2, 3, 10, 11, 14]. In particular, the HA subscales, HA1 (Anticipatory Worry) and HA4 (Fatigability), are more strongly correlated with mood than the other subscales [13, 15]. The relationship between depression and NS overall is inconsistent [8, 16], but there is clear evidence of a negative correlation between the subscale NS1 (Exploratory Excitability) and depressive symptoms [8, 11, 17]. Regarding RD, high levels of RD have been found to protect against the development of depression [11]. For SD, Peirson and Heuchert [13] found a significant negative correlation between SD subscales and mood, whereas Hansenne et al. [8] found no difference on SD scores between subjects with and without depression. Recently, one study found a negative correlation between SD and depression in a clinical sample after different treatments [3]. Most research has shown that low SD is associated with depression [2, 11, 18]. The C subscale Social Acceptance may be influenced by mood [8, 17].

It is also important to highlight that no studies valuate the relationship between temperament and depression in the general population during specific life situations, such as pregnancy. Although the presence of depression during and after pregnancy is currently considered a risk factor for the development of pathology in the child [19], few studies are available in the literature about the influence of temperamental characteristics of pregnant women on depression. Some data is available about the postpartum period, however. For example, Josefsson et al. [20] investigated whether women with postpartum depression differ in personality traits from healthy postpartum women. Results showed that HA and ST scales were higher, while SD and C were lower, in women with postpartum depression than the control group.

This study is the first step of a longitudinal research aimed to identify predictors (temperament and mood) of family functioning/parenting style evaluated at 6 months, 1 year, and 3 years from child’s birth. The aim of this first phase of our longitudinal study is to evaluate the relationship between depression and personality in men and women who are expecting a baby. In particular, we are interested in understanding how the pregnancy condition influences the mood of both the pregnant woman and her husband.

2. Method

2.1. Participants. 102 expectant parents participated to the study: 65 pregnant women and 37 husbands. Eighteen husbands of pregnant women did not participate at the prenatal courses from which the sample was recruited and ten husbands did not agree to participate to the study.

The mean age is 34.11 years for the women group (sd = 4.55) and 36.70 for the men group (sd = 4.99). Women were all primiparas and Caucasian; pregnant adolescents and single mothers were excluded from the sample.

All socioeconomic classes were represented in the sample: all subjects reported their socioeconomic status according to seven categories from 1 to 7 to determine the educational level and the profession of subjects (SES) [21]. The characteristics of participants are summarized in Table 1.

2.2. Materials. The Temperament and Character Inventory—Revised Form (TCI-R) [7] is a self-report 5-point Likert scale, with 240 items. The questionnaire is used for the evaluation of personality according to the psychobiological model of Cloninger et al. [4, 5].

The Beck Depression Inventory (BDI) [22] is a 21-question multiple-choice self-report inventory for measuring the severity of depression in terms of its affective, physiological, and cognitive features.

2.3. Procedure. The sample recruited volunteers during prenatal courses in the Obstetrical Unit of an Italian Clinical Hospital. Subjects completed the TCI-R and BDI in the last quarter of pregnancy.

The questionnaires were administrated during one session of the prenatal course that was conducted by a psychologist. Subjects gave their written informed consent, although the questionnaires were anonymous.

2.4. Statistical Analysis. The two groups, pregnant women and their husbands, were compared on socio-demographic characteristics (age, education, occupation, and socioeconomic status).

In order to evaluate differences on depression level and temperament characteristics between women and men, Analysis of Variance (one way ANOVA) was performed between the two groups on Beck and TCI scores.

Moreover, correlations (Pearson r) were calculated between age, Beck score, and all TCI scales, respectively on women and men samples. Subsequently, Hierarchical Multiple Regression Equations were computed, separately for pregnant women and their husbands, to reveal predictive relationships between temperament/character characteristics and depression level according to gender. Specifically, the Beck score was considered as the dependent variable, while age, TCI temperament scales (HA, RD, NS, and PS), and TCI character scales (SD, C, and ST) were included as predictors.

3. Results

ANOVA revealed significant differences between women and men on age (F = 7.15, P = .01), but there were no differences in SES (F = .29; P = .59). There were significant differences between men and women on education (Chi² = 6.86; P = .03) but not on occupation (Chi² = 7.43; P = .11).
Table 1: Characteristics of participants.

<table>
<thead>
<tr>
<th>Demographic data</th>
<th>Gender (F; M)</th>
<th>Age in years: Men group (M; SD)</th>
<th>Age in years: Women group (M; SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>65; 37</td>
<td>36.70; 4.99</td>
<td>34.11; 4.55</td>
</tr>
<tr>
<td>Education women group</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Primary school</td>
<td>1</td>
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<td></td>
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<tr>
<td>Secondary school</td>
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<td></td>
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<tr>
<td>University</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Education men group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>5</td>
<td></td>
<td></td>
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<tr>
<td>Secondary school</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>17</td>
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<td></td>
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<tr>
<td>Occupation: women group</td>
<td></td>
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<tr>
<td>Employee</td>
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<td>Self-employed worker</td>
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<tr>
<td>Housewife</td>
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<td>Student</td>
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<td>Unemployed</td>
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<tr>
<td>Occupation: men group</td>
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<td>Employee</td>
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<tr>
<td>Self-employed worker</td>
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<tr>
<td>Student</td>
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<td></td>
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<tr>
<td>Unemployed</td>
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<td></td>
<td></td>
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<td>SES Index</td>
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<tr>
<td>Women group (M; SD)</td>
<td>47.35; 14.58</td>
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<td></td>
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<tr>
<td>Men group (M; SD)</td>
<td>45.81; 12.70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Variance analysis also revealed that pregnant women had higher levels of depression ($F = 4.16; P = .04$), higher RD scores ($F = 5.18; P = .03$), and higher ST scores ($F = 4.21; P = .04$) compared to their husbands (see Table 2).

In the women, a moderate positive correlation was found between scores for depression and HA ($r = .32; P = .01$). In the men, in contrast, significant correlations were found between depression level and, respectively, age ($r = .38; P = .02$) and SD score ($r = -.54; P = .00$).

Hierarchical Multiple Regression Analysis in the pregnant women group showed that HA and SD were both significant predictors of the level of depression. Specifically, HA explained 12% of the variance and SD explained another 18%, while the inclusion of other variables did not increase the variance explained (see Table 3). Analysis in the husbands showed that only the SD score was a significant predictor of depression level, explaining 31% of variance (see Table 3).

4. Discussion

As expected from previous observations in the general population, we found that pregnant women report higher levels of depression prenatally than do their husbands. In fact, epidemiological data from around the world reveal that women are twice as likely as men to experience depression [23]. Due to the lack of a control group recruited from general population, we cannot attribute the level of depression to the clinical status of the women. However, extensive literature supports the hypothesis that women are particularly vulnerable to mood disorders during crucial periods of the reproductive life cycle, particularly pregnancy [24].

Likewise as expected from the influence of maternal-child bonding on personality, we found that women have higher levels of RD than men. On average, compared to men, women are more sensitive to cues of social approval and to formation of emotional attachments [25]. We also found that pregnant women had higher scores on ST than their husbands. Even though Pelissolo and Lepine [26] find this gender difference also in a general sample, it is possible that a woman who is carrying a new life inside may experience a state-specific outlook of unity and participation with all that exists and, consequently, she could be induced to feel more self-transcendent. We plan to evaluate changes in levels of personality traits longitudinally in these women so that we can evaluate changes in levels of personality scores with changes in pregnancy in the same woman. Finally, no differences are found between women and men on HA, even though previous data in the general population often find slightly higher scores in women than men.

Regarding Multiple Regression Analysis, two dimensions of the TCI predict the level of depression in women, even after adjusting for age. Specifically, we found that pregnant women were more depressed if they were high in HA and low in SD. In contrast, HA did not significantly influence the level of depression in the husbands of the pregnant women. However, low SD was a strong predictor of depression in the husbands, explaining 31% of the variance. This extends earlier observations that low SD is a significant predictor of depression level in both men and women in the general population [13].

The results of our study should be considered in light of several limitations. First, the size of the sample is small, and a larger number of men may be needed to evaluate
Table 2: ANOVA between women and men groups on Beck and TCI scores.

<table>
<thead>
<tr>
<th></th>
<th>Women group</th>
<th></th>
<th>Men group</th>
<th></th>
<th>F</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>m</td>
<td>Sd</td>
<td>m</td>
<td>sd</td>
<td></td>
<td></td>
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<tr>
<td>Beck score</td>
<td>6.25</td>
<td>4.52</td>
<td>4.43</td>
<td>3.93</td>
<td>4.16</td>
<td>0.04</td>
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<tr>
<td>TCI-NS</td>
<td>100.92</td>
<td>17.76</td>
<td>100.35</td>
<td>17.63</td>
<td>0.03</td>
<td>0.88</td>
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<tr>
<td>TCI-HA</td>
<td>97.66</td>
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<td>92.59</td>
<td>15.80</td>
<td>1.81</td>
<td>0.18</td>
</tr>
<tr>
<td>TCI-RD</td>
<td>104.62</td>
<td>16.87</td>
<td>96.86</td>
<td>15.94</td>
<td>5.17</td>
<td>0.02</td>
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<tr>
<td>TCI-P</td>
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<td>24.87</td>
<td>111.57</td>
<td>26.35</td>
<td>0.66</td>
<td>0.42</td>
</tr>
<tr>
<td>TCI-SD</td>
<td>140.37</td>
<td>27.40</td>
<td>138.81</td>
<td>26.34</td>
<td>0.08</td>
<td>0.78</td>
</tr>
<tr>
<td>TCI-C</td>
<td>132.78</td>
<td>25.46</td>
<td>126.78</td>
<td>22.86</td>
<td>1.41</td>
<td>0.24</td>
</tr>
<tr>
<td>TCI-ST</td>
<td>75.38</td>
<td>19.25</td>
<td>67.89</td>
<td>14.69</td>
<td>4.21</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Table 3: Percentage of variance, significance, B and β indexes, in Beck score explained by the different predictors (TCI temperament and character scales) in the Hierarchical Multiple Regression Equations (women and men samples).

<table>
<thead>
<tr>
<th></th>
<th>Women group</th>
<th></th>
<th>B</th>
<th>β</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R² Change</td>
<td></td>
<td>B</td>
<td>β</td>
<td></td>
</tr>
<tr>
<td>(1) Age</td>
<td>.00</td>
<td></td>
<td>-.03</td>
<td>-.03</td>
<td>n.s.</td>
</tr>
<tr>
<td>(2) NS</td>
<td>.01</td>
<td></td>
<td>-.04</td>
<td>n.s.</td>
<td></td>
</tr>
<tr>
<td>(3) HA</td>
<td>.12</td>
<td></td>
<td>.32</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td>(4) RD</td>
<td>.01</td>
<td></td>
<td>-.28</td>
<td>n.s.</td>
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</tr>
<tr>
<td>(5) P</td>
<td>.01</td>
<td></td>
<td>.10</td>
<td>n.s.</td>
<td></td>
</tr>
<tr>
<td>(6) SD</td>
<td>.18</td>
<td></td>
<td>-.68</td>
<td>.04</td>
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</tr>
<tr>
<td>(7) C</td>
<td>.05</td>
<td></td>
<td>.71</td>
<td>n.s.</td>
<td></td>
</tr>
<tr>
<td>(8) ST</td>
<td>.00</td>
<td></td>
<td>-.02</td>
<td>n.s.</td>
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</table>

<table>
<thead>
<tr>
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<th>Men group</th>
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<td>R² Change</td>
<td></td>
<td>B</td>
<td>β</td>
<td></td>
</tr>
<tr>
<td>(1) Age</td>
<td>.15</td>
<td></td>
<td>.12</td>
<td>.15</td>
<td>n.s.</td>
</tr>
<tr>
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<td>.16</td>
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<tr>
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<tr>
<td>(4) RD</td>
<td>.03</td>
<td></td>
<td>.19</td>
<td>n.s.</td>
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<tr>
<td>(5) P</td>
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<td>n.s.</td>
<td></td>
</tr>
<tr>
<td>(6) SD</td>
<td>.31</td>
<td></td>
<td>-.10</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td>(7) C</td>
<td>.02</td>
<td></td>
<td>.25</td>
<td>n.s.</td>
<td></td>
</tr>
<tr>
<td>(8) ST</td>
<td>.01</td>
<td></td>
<td>-.13</td>
<td>n.s.</td>
<td></td>
</tr>
</tbody>
</table>

5. Conclusion

This study reports the first step of a longitudinal study designed to identify predictors (such as temperament, character, and mood) of family functioning and parenting style evaluated at 6 months, 1, and 3 years after a child’s birth. At this preliminary stage in the project, we have evaluated for the first time in the literature, at least to our knowledge, the relationship of depression with the temperament and character of parents who are expecting a child.

Several of our findings are consistent with observations about people in the general population, but we have been able to extend them to a specific life situation (pregnancy). The finding that self-directedness is related to depression in both parents is particularly interesting because of its implications for improving subsequent child care. Maternal depression, in fact, can reduce mother-child bonding, increase shyness and insecure attachments in the child, impair personality development, and reduce the health and happiness of children throughout their life [19, 27]. Moreover, self-directedness is a relatively stable character trait with broad impact on adapting to life challenges like pregnancy and child care. Accordingly, it is imperative that we deepen our understanding of these preliminary...
findings with an increased sample size, a control group of nonpregnant women, and a long-term prospective followup with attention to the parenting roles of both the fathers and the mothers. Such observations will allow us to identify risk factors for the development of ill health and psychopathology in the children and to plan effective ways of intervening. Our data indicate that preventive interventions will require treatment of personality traits in the parents prior to or during prenatal psychoeducational courses.

References


Research Article

Exposure to Community Violence, Psychopathology, and Personality Traits in Russian Youth

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Previous research with the US inner-city youth demonstrated the hazardous effects of community violence exposure. It remains unclear, however, whether these findings are generalizable to other cultures and populations. Furthermore, the role of factors influencing the processing of traumatic events such as personality has not been investigated. Two groups of Russian adolescents (community youth (N = 546) and male delinquents (N = 352)) completed questionnaires assessing their exposure to community violence, conduct problems, internalizing psychopathology and personality. The study demonstrates that the relationships between exposure to violence and psychopathology are similar across different populations within the same culture (community youth and juvenile delinquents), suggesting similar mechanisms behind this phenomenon. The patterns of these relationships were also similar for boys and girls, suggesting similarities in the mechanisms across gender. Hence, the effects of community violence exposure are generalizable to other cultures outside the US. The associations between personality traits and specific types of behaviors also tend to be similar across different populations. Higher levels of novelty seeking were related to more severe problem behaviors and to higher levels of witnessing and victimization, whereas higher levels of harm avoidance were related to higher levels of depression and posttraumatic stress.

1. Introduction

Research on exposure to community violence, which in early 1990s was called “a public health problem of epidemic proportions” [1], has consistently demonstrated its multiple effects on child and adolescent mental health. These effects include a wide range of internalizing psychopathology, such as posttraumatic stress [2–4], anxiety, and depression [5–8], and of externalizing problems, such as aggressive and delinquent behavior [7–12] and alcohol and drug use [7, 13]. Children who have been exposed to high levels of community violence often have a decreased self-esteem [5], pessimistic view of the future [7, 14], problems with social relationships [1], and poor academic performance [7, 15]. Although the levels of distress caused by traumatic events tend to decrease over time, there is some evidence that violence exposure may have a long-lasting impact on behavior and mental health of children [10, 11].

Although the above-mentioned effects have been reliably assessed and tend to be consistent in different studies, several important considerations should be kept in mind when assessing the relationships between violence exposure and psychopathology. First, there has been only one study outside the USA in Canada [16] and none outside North America that reports on the effects of community violence exposure. It remains unclear whether effects of violence exposure in other countries are similar to those reported in American inner city youth, who often experience higher levels of community violence than youths from other communities, and for whom exposure to violence has become an everyday reality and a source of chronic distress.
Second, it is unclear whether the relationships between violence exposure and psychopathology are different in different populations within the same culture. Recent research, for example, has documented that juvenile delinquents represent a highly traumatized group, with rates of posttraumatic stress approaching 30% [17, 18], related to various traumatic events, including domestic [18] and community violence [17]. Furthermore, the levels of psychopathology in antisocial youth tend to be higher than those in the general population as discussed by Ulzen and Hamilton [19]. Thus, it may be reasonable to suggest that the psychopathological outcomes in delinquent youth may not only be related to the magnitude of exposure, but also involve different mechanisms for its development than in the youth from general population.

Third, youth may report higher levels of exposure to violence, because of their own involvement in violence or in other severe problem behaviors [10]. It is unclear whether the effects of exposure to community violence on internalizing psychopathology are similar for a perpetrator and for an innocent bystander, and, thus, the levels of own involvement in severe problem behaviors should be controlled for when assessing these relationships. This is especially true in a cross-sectional study design when it is impossible to control for a baseline level of problem behaviors.

In addition, controlling for involvement in severe problem behaviors is important because, as mentioned previously, antisocial youth generally tend to have higher rates of psychopathology compared to their well-adjusted peers [20] and juvenile delinquency has been found associated with high levels of depression, hopelessness, anxiety, and posttraumatic stress [17, 18]. Thus, to demonstrate the relationships between violence exposure and internalizing psychopathology in a more clear-cut fashion, youth’s involvement in severe problem behaviors should be controlled for.

Fourth, the effects of violence exposure may, in certain respects, be gender specific. It has been found that although males typically are more likely to experience traumatic events [21, 22], females exposed to trauma are more likely to be diagnosed as having posttraumatic stress [21, 23, 24] or at least to report more posttraumatic stress symptoms [2, 12]. These findings raise a question about the necessity of separate analyses of the relationships for boys and girls, which rarely have been done in the past.

Finally, there is increasing evidence that certain cognitive strategies and related personality functions are involved in the processing of traumatic events [17, 25]. There are numerous studies demonstrating that specific personality traits are associated with certain types of psychopathology [26–28] and that temperament can affect the way in which the consequences of traumatic experiences unfold [29]. Previously, we suggested that increased exploratory activity may predispose an individual to greater violence exposure, whereas higher behavioral inhibition at the same time (and possibly, in the same subject) could lead to higher rates of psychopathology [17]. Clarifying the role of personality functions in the processing of traumatic events might help to develop effective prevention and intervention strategies and could increase an awareness of individual characteristics in the development of traumatic response.

Based on the above-mentioned considerations, we propose to assess the relationships between exposure to community violence and psychopathology, controlling for the levels of involvement in severe problem behavior in two samples of youth. First, we will check, whether the findings from the US inner city populations are applicable to the Russian youths from the general population, with results reported separately for boys and girls. The relationships between violence exposure and internalizing psychopathology will be assessed controlling for levels of severe problem behaviors. We will further assess whether the effects of community violence exposure would show a similar pattern in a group of incarcerated juvenile delinquents from the same geographic area. This group was selected as a population at risk that has been repeatedly exposed to high levels of violence in the past [17, 18]. Finally, we will assess the impact of the temperament traits of novelty seeking and harm avoidance that, after being added to the model, are expected to have moderating effects on the relationships between community violence exposure and psychopathology. These relationships will be assessed in both community and delinquent samples.

To achieve these goals, we will use structural equation modeling and will run several models: (a) a model of relationships between violence exposure and psychopathology, in which we control for levels of severe problem behaviors, first in the general population and second in the delinquent population; (b) a model of relationships between violence exposure and psychopathology with personality traits as moderators, controlling for the levels of severe problem behaviors.

We expected that, similar to the US samples, we would obtain significant relationships between the measures of violence exposure and psychopathology, which will remain significant even after controlling for the levels of severe problem behaviors. We also proposed that these relationships would be moderated by the temperament traits of novelty seeking and harm avoidance, with high novelty seeking related to more externalizing, and high harm avoidance to more internalizing problems. In spite of large potential differences in the levels of exposure to community violence and psychopathology, these relationships are expected to be similar across the three study groups (boys and girls from the community sample, and delinquents).

2. Materials and Methods

The study was approved by the appropriate Ethical Committees, including the Institutional Review Board of the Northern State Medical University (Arkhangelsk, Russia).

2.1. Community Sample. In this study, which represents a part of an ongoing cross-cultural project that assesses risk and protective factors for adolescent adjustment, surveys were administered to a community sample of 14–18-year-old adolescents (mean age = 15.5 ± 0.9) in a large region in the north of European Russia. The population of the region is very homogeneous, with approximately 98% being ethnic
Russian. The socioeconomic status of the majority of the population is estimated to be similar to the (low) Russian average, and interindividual differences in socioeconomic status are minimal. The schools for the assessment were randomly selected from the list of schools in four districts of the city. The assessment was conducted in classes, which were also randomly selected from the list of the classes within each school. A total of 546 subjects were eligible for analyses (189 (34.6%) boys).

2.2. Delinquent Sample. Delinquent subjects were recruited voluntarily from a group of male adolescent inmates ages 14–19 years (mean age = 16.4 ± 0.9), who had been court ordered after trial to the only correctional facility for juveniles in the region in the same part of Northern Russia, a catchment area with a population of 1.5 million. Most of the participants had multiple convictions that included property crimes (theft, car theft, and so on—51%), violence-related crimes (e.g., assault, robbery—38%), and, in some cases, rape/sexual violence (6%) or murder (5%). Generally, those institutionalized for theft had shown a repetitive pattern of stealing, with multiple convictions, with sentencing to the correctional facility occurring only after repeated convictions during parole. At the time of the study, the mean length of sentence was 4.3 years and all participants had been incarcerated for at least 6 months. The data were collected in a sample of 352 delinquent youths.

Ethnic minorities in the study group represented less than 1%, with the majority of the sample represented by ethnic Russians. Of the delinquent sample, 120 youth (34.1%) came from a single-parent family, as compared to 80 girls (22.4%) and 36 boys (19.0%) from the general population (Chi-square = 19.23; P < .000).

2.3. Procedure. The translation of these scales into Russian followed established guidelines, including appropriate use of independent back translations [30]. The translations were made by a working group in Russia, followed by discussion of the translated questionnaires with colleagues. Finally, an independent interpreter made back translations, which were compared with the originals, and inconsistencies were analyzed and corrected. All questionnaires were also pretested in different samples of youths.

In the community sample, both students and their parents were provided with detailed descriptive information about the study and informed of the planned date of the survey administration and parents were informed of their option to decline participation of their child/children. Students also had the option to decline at the time the survey was administered (parents and student refusals <1%). All participants from the delinquent group were similarly informed about the voluntary and confidential nature of their participation in the study. They were further assured that the institutional staff would not obtain any individualized information about the subjects’ responses. Questions that arose were answered in detail. Eight delinquent subjects refused to participate because of unwillingness to provide any personal information.

In both study samples, the survey was completed in 45-minute sessions during a regular school day with the whole class present (generally 25–30 youths at a time). Those students who refused to complete the survey were given alternative tasks. Trained administrators read questions aloud while participants followed along with their copies of the survey, reading questions to themselves and marking responses in the booklets. The administrators also ensured the students privacy while responding.

2.4. Instruments

2.4.1. Social and Health Assessment. The Social and Health Assessment, developed by Weissberg et al. [33] and adapted by Schwab-Stone et al. [8], served as the basis for the survey. As described in more detail below, this survey includes several scales available from the literature that have been used with similar populations both in the USA and in other countries.

2.4.2. Violence Exposure. Items from this scale were derived from the Screening Survey of Exposure to Community Violence developed by Richters and Martinez [6]. Using yes/no response format, students were asked whether they had ever witnessed or been victimized by 6 types of violence (been beaten up or mugged, threatened with serious physical harm, shot or shot at with a gun, attacked or stabbed with a knife, chased by gangs or individuals, or seriously wounded in an incident of violence), providing separate scores for witnessing and victimization. The internal consistency coefficients (Cronbach’s α) for this scale were .67 for witnessing and .46 for victimization in the general population sample and .74 for witnessing and .61 for victimization in the delinquent sample. Low alphas obtained for the indexes of community violence exposure should not be discouraging, as it is inappropriate to expect that life-event lists should display high internal consistency [34]. Indeed, these measures represent coefficients, rather than scales, where witnessing or victimization by one type of violence does not necessarily imply the presence of another type of exposure.

2.4.3. Severe Conduct Problems. Eight items describing different types of severe conduct problems (starting a fistfight; participating in gang fights; hurting someone badly in a fight; carrying a gun; having been arrested by police; carrying a blade, knife, or gun in school; suspension from school; being high at school from drinking alcohol or smoking marijuana) were adapted from Jesser et al. [31], NASHS survey [32], or developed specifically for the survey [33]. The respondents were asked to report on a 5-point scale how many times (if any) (ranging from 0 times to 5 or more times) they were involved in the above-mentioned behaviors during the past two years (in delinquent population, during two year period prior to incarceration). The scale provides a total score that can range from 0 to 40. This scale had a Cronbach’s α value of .75 in a general population sample and .82 in the delinquent sample.
2.4.4. Psychopathology. To assess psychopathology, two measures were used in the present study. *Child PTSD Reaction Index (CPTSD-RI)* is a 20-item scale designed to assess posttraumatic stress reactions of school-aged children and adolescents after exposure to a broad range of traumatic events [4, 35]. The instrument has a Likert type five-point rating scale ranging from “none” (0) to “most of the time” (4) to rate the frequency of symptoms. Degree of reactions ranges from doubtful to very severe. The scale is highly correlated with the DSM-based diagnosis of posttraumatic stress syndrome [35]. In the present study, an adequate Cronbach’α for the scale was obtained for both samples (.81 in the community sample and .84 in the delinquent sample). The *Beck Depression Inventory* [36] is a 21-item self-report measure that assesses current symptoms of depression. Each item includes four self-evaluative statements that are scored from 0 to 3. The BDI has been found to correlate with psychiatric ratings of depression [37, 38]. Cutoff scores have been established, ranging from minimal to severe depression [37]. In our sample, a good internal consistency for the scale was obtained for both samples (Cronbach’α = .86 in the community sample and .87 in the delinquent sample).

2.4.5. TCI (Temperament and Character Inventory [26]). This inventory is based on Cloninger’s unified biosocial theory of personality [39] and measures four temperament and three character dimensions. According to Cloninger’s theory, temperament dimensions are independent and largely genetically determined [26]. Two scales for temperament related to the study hypothesis were used in the current study (harm avoidance and novelty seeking). Harm avoidance reflects a heritable bias in the inhibition or cessation of behaviors. Subjects scoring high on harm avoidance are pessimistic, chronically worried, shy with strangers, and tense in unfamiliar situations. Novelty seeking is viewed as a tendency toward behavior activation in response to novel stimuli or cues. Subjects high on novelty seeking show high levels of exploratory behavior, impulsive decision making, quick loss of temper, and active avoidance of frustration.

Cloninger’s theory of personality and the TCI have been utilized and validated with adolescents, both in the USA [40] and other cultures [41, 42], including Russia [28]. In the present study, we used the short version of the TCI with 125 items to be answered as true or false. Cronbach’α’s for novelty seeking were .63 in the community sample and .60 in delinquents, and for harm avoidance .78 in the community sample and .68 in delinquents.

2.5. Data Analysis. The data were analyzed using the Statistical Package for Social Sciences (SPSS-15.0), with the Analysis of Moment Structures [43] used to build a structural equation model. Missing data on the scales (less than 5%) were imputed using a series mean value.

3. Results

As presented in Table 1, both boys and girls from a Russian community sample reported relatively high levels of witnessing and victimization, with a general tendency for boys to have higher rates of violence exposure. Delinquent participants reported the highest rates of community violence exposure, which were significantly higher than those in the community sample.

Although girls were less frequently exposed to community violence, they reported higher levels of psychopathology than boys (Table 2), including both depression and posttraumatic stress. The highest levels of psychopathology reported by delinquents were presumably related to their higher levels of traumatization. Predictably, delinquents reported the highest levels of severe problem behaviors, whereas girls in the community sample reported the lowest levels.

As predicted, the levels of severe problem behaviors in both community and delinquent samples were significantly related to witnessing and victimization (Table 3), implying that those involved in antisocial behavior generally would have had more chances to witness community violence or to be victimized by it [44]. In both samples, community violence exposure scores were also significantly related to the scores of psychopathology. Finally, the temperament trait of novelty seeking was significantly related to higher levels of community violence exposure and to higher levels of severe behavior problems, whereas higher levels of harm avoidance were significantly related to higher levels of internalizing psychopathology, and to lower levels of severe problem behaviors (Table 3).

To investigate links between the variables of interest within a model, structural equation modeling techniques were applied. As proposed, two models were tested: (1) the violence exposure-psychopathology model, controlling for the levels of severe problem behaviors and (2) the violence exposure-psychopathology model with novelty seeking and harm avoidance as moderators, controlling for the levels of severe problem behaviors.

To balance the models, for each scale, except for witnessing and victimization, three subscores were computed based on the item-total correlations within each scale. These subscores were used as manifest variables to produce the latent constructs of severe problem behaviors, depression, posttraumatic stress, and temperament traits of novelty seeking and harm avoidance (for a detailed theoretical explanation of the procedure, see Kishton and Widaman [45] and Little et al. [46]). This procedure was not applied to the scores for witnessing and victimization because they were considered to be coefficients rather than scales, where one type of violence exposure does not necessarily imply the presence of another type.

Model fit was assessed using two standard fit indexes, namely, the root mean squared error of approximation (RMSEA), for which values of .08 or less are deemed acceptable, and the comparative fit index (CFI), for which values greater than .90 are deemed acceptable [42, 47, 48]. Because the maximum likelihood Chi-squared value is highly sensitive to sample size, it was not employed to evaluate overall model fit. The models and model parameters are presented in Figures 1 and 2; the fit statistics for all models is presented in Table 4.
Figure 1: Relationships between violence exposure and psychopathology, with significant paths only (Model 1).

Figure 2: Relationships between violence exposure, personality, and psychopathology, with significant paths only (Model 2).

Table 1: Prevalence of different types of community violence exposure by sample and by gender N (%).

<table>
<thead>
<tr>
<th>In the past two years</th>
<th>General population</th>
<th>Delinquents</th>
<th>Chi-square</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have seen...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Someone else getting beaten up or mugged</td>
<td>94 (26.3)</td>
<td>51 (27.1)</td>
<td>189 (54.0)</td>
</tr>
<tr>
<td>Someone else get threatened with serious physical harm</td>
<td>78 (21.8)</td>
<td>57 (30.2)</td>
<td>157 (45.0)</td>
</tr>
<tr>
<td>Someone else get shot or shot at with a gun</td>
<td>12 (3.4)</td>
<td>8 (4.2)</td>
<td>57 (16.3)</td>
</tr>
<tr>
<td>Someone else being attacked or stabbed with a knife</td>
<td>18 (5.0)</td>
<td>15 (7.9)</td>
<td>92 (26.4)</td>
</tr>
<tr>
<td>Someone else being chased by gangs or individuals</td>
<td>38 (10.6)</td>
<td>32 (16.9)</td>
<td>100 (28.6)</td>
</tr>
<tr>
<td>A seriously wounded person after an incident of violence</td>
<td>27 (7.6)</td>
<td>33 (17.5)</td>
<td>91 (26.1)</td>
</tr>
<tr>
<td>I have been...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beaten up or mugged</td>
<td>17 (4.8)</td>
<td>27 (14.3)</td>
<td>133 (37.9)</td>
</tr>
<tr>
<td>Threatened with serious physical harm by someone</td>
<td>37 (10.4)</td>
<td>31 (16.4)</td>
<td>147 (42.5)</td>
</tr>
<tr>
<td>Shot or shot at with a gun</td>
<td>3 (.8)</td>
<td>2 (1.1)</td>
<td>34 (9.7)</td>
</tr>
<tr>
<td>Attacked or stabbed with a knife</td>
<td>3 (.8)</td>
<td>4 (2.1)</td>
<td>74 (21.1)</td>
</tr>
<tr>
<td>Chased by gangs or individuals</td>
<td>51 (14.3)</td>
<td>22 (11.6)</td>
<td>82 (23.4)</td>
</tr>
<tr>
<td>Seriously wounded in an incident of violence</td>
<td>—</td>
<td>—</td>
<td>19 (5.4)</td>
</tr>
</tbody>
</table>

\*Significant differences between girls and boys from the community sample; \*significant differences between girls from the community sample and delinquent boys; \*significant differences between boys from the community and delinquent boys.
First, the initial model of violence exposure-psychopathology relationships, controlling for the levels of severe problem behaviors, was assessed in a sample of Russian youths from the general population, separately for boys and girls. A good fit for the model was obtained (χ²(82) = 231.3; RMSEA = .058 (.049; .067); CFI = .92). Subsequently, all nonsignificant paths were excluded from the model and the fit of the reduced model (Figure 1) was assessed. The fit for the final (reduced) model is presented in Table 4. Subsequently, the same model was applied to the sample of juvenile delinquents and an even better fit was obtained (χ²(37) = 51.2; RMSEA = .033 (.000; .053); CFI = .99).

All significant relationships (beta weights and SE) and covariates for the Model 1 are presented in Table 4. The findings can be summarized in that, in all three groups, witnessing was related only to posttraumatic stress and victimization, was related to both posttraumatic stress and depression. Also, the scores for posttraumatic stress and depression in all groups were interrelated, suggesting a high degree of comorbidity between these two conditions, as were the scores of witnessing, victimization and severe problem behaviors. The only difference between the models was in the relationship between severe conduct problems and posttraumatic stress, which was positive in girls, nonsignificant in boys, and negative in delinquents. All models had good fit statistics (Table 4).

As a second step, we sought to assess the effects produced by the temperament traits of novelty seeking and harm avoidance, which were expected to have moderating effects on the relationships between community violence exposure and psychopathology. As in Model 1, these relationships were similarly assessed in the community and then in delinquent samples. A good fit for both models was obtained (χ²(216) = 274.0; RMSEA = .037 (.030; .043); CFI = .94—for the community sample and χ²(101) = 164.0; RMSEA = .042 (.030; .054); CFI = .97—for delinquents). After that, all nonsignificant paths were excluded from the model and the fit of the reduced model (Figure 2) was assessed. The fit for the final Model 2 and all significant relationships (beta weights and SE) and covariates are presented in Table 5. Adding temperament traits in the model did not impact on the relationships between violence exposure and severe problem behaviors or between posttraumatic stress and depression. The relationships between severe problem behaviors and posttraumatic stress, however, became significant and positive in all three groups.

The pattern of relationships between violence exposure scores and psychopathology after introducing temperament traits into the model remained generally the same as in the initial models, although the relationships became somewhat less pronounced. The relationships between novelty seeking, harm avoidance, and psychopathology were similar to those predicted. Higher levels of harm avoidance were related to higher levels of depression and posttraumatic stress, and in some cases were negatively related to the involvement in severe problem behaviors (delinquents) or to witnessing (control boys). Higher levels of novelty seeking in all three samples were related to greater involvement in severe problem behaviors and to higher levels of witnessing and victimization.

| Table 2: Comparison of the variables used in the models across three groups. |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
|                                | Controls        | Boys (N = 189)  | Delinquents (N = 352) | F (df), P       |
| Witnessing^c                   | .75 (1.14)      | 1.04 (1.39)     | 1.95 (1.77)        | 62.76 (2, 895); .000 |
| Victimization^c                | .31 (.67)       | .46 (.80)       | 1.39 (1.39)        | 106.82 (2, 895); .000 |
| Severe problem behaviors^b,c   | .67 (2.00)      | 2.62 (4.21)     | 10.21 (7.74)       | 298.93 (2, 891); .000 |
| PTSD^b,c                       | 23.63 (10.25)   | 18.40 (7.91)    | 26.48 (12.74)      | 33.77 (2, 892); .000 |
| Depression^b,c                 | 9.29 (7.95)     | 5.84 (7.12)     | 17.59 (11.40)      | 119.05 (11.40); .000 |
| Novelty seeking^b              | 11.31 (3.34)    | 10.85 (3.23)    | 11.61 (2.94)       | 3.52 (2, 895); .030 |
| Harm avoidance^b               | 9.59 (4.42)     | 7.88 (3.59)     | 9.12 (3.69)        | 11.41 (2, 895); .000 |

^aSignificant differences between girls and boys from the community sample.
^bSignificant differences between girls from the community sample and delinquent boys.
^cSignificant differences between boys from the community and delinquent boys.

| Table 3: Correlations between the variables used in the models in general/delinquent populations. |
|---------------------------------|-----------------|-----------------|
|                                | Controls        | Delinquents     |
| Witnessing                      | —               | .56**           |
| Victimization                   | .44**           | .42**           |
| Severe problem behaviors        | .36**           | .20**           |
| PTSD                            | .23**           | .10*            |
| BDI                             | .08             | .02             |
| Novelty seeking                 | .17**           | .17**           |
| Harm avoidance                  | -.04            | -.15**          |

**P < .01; *P < .05.
The purpose of the present study was to test the model of relationships between exposure to community violence and psychopathology in a community sample of Russian youths, controlling for the involvement in severe problem behaviors, and to further verify this model on a sample of incarcerated juvenile delinquents from the same area. We also sought to investigate whether personality traits would play a moderating role in the relationships between violence exposure and psychopathology and would help to clarify the dynamics of these interactions.

The novelty of this study is its cross-cultural application of findings that have been to date reported almost exclusively in the USA inner city populations. This study demonstrates that, even in the communities with less pronounced levels
of community violence, the effects of violence exposure are still meaningful and related to increased levels of psychopathology. This study also addresses the issue of cross-cultural applicability of the findings reported in the USA, and calls for more attention to this problem from policy makers and mental health professionals in other countries.

This study demonstrates that the trends for the relationships between exposure to violence and psychopathology are also similar across different populations within the same culture, such as youth from a general population and incarcerated juvenile delinquents, suggesting at least some similarities in the mechanisms that underlie this phenomenon in different groups. Similar to the previous studies [21, 22, 24], boys reported more exposure to violence whereas girls reported higher levels of psychopathology. However, the patterns of the relationships between violence exposure and psychopathology for boys and girls were similar, suggesting possible similarities in the underlying mechanisms across gender. Juvenile delinquents reported the highest levels of psychopathology of all three groups. These findings support previous reports suggesting that juvenile delinquents as a population are frequently exposed to various types of violence with various psychopathological manifestations associated with such exposure [17, 18].

As previously suggested by Gorman-Smith and Tolan [10] when considering the relationships between violence exposure and psychopathology, it is important to discriminate between the rates of violence exposure reported by “innocent bystanders” and the rates of violence that might be reported due to own involvement in violence. Those who are involved in antisocial behaviors clearly have more chances to witness violence, or even to be victimized, and this association might distort the “real” relationships between violence exposure and psychopathology. In the present study even after controlling for the levels of severe problem behaviors, the relationships between violence exposure and psychopathology remained significant, suggesting that damaging effects of community violence on the mental health of youth can develop independently of involvement in problem behaviors.

The association between witnessing and psychopathology was generally less pronounced than that for victimization and psychopathology. In this study, victimization was related not only to posttraumatic stress, but also to depression. Such findings are supported by previous studies [8], which have demonstrated that direct victimization has more significant impact on psychopathology than witnessing does. These findings are also supported by the concept of proximity to trauma, with higher degree of physical proximity associated with greater distress [49]. Other studies similarly demonstrated that sometimes witnessing might be unrelated (or even negatively related) to depression, which can be explained by desensitization due to chronic exposure to community violence [50].

In studies of children’s reactions to violence exposure, several individual, family, and community factors have been identified as potential moderators, including age and gender of the child, family structure, school characteristics, and peer relationships [51]. There is also increasing evidence that certain cognitive strategies and related personality functions are involved in the processing of traumatic events [17, 25], that specific personality traits are associated with certain types of psychopathology [26–28], and that temperament can affect the way in which the consequences of traumatic experiences unfold [29]. In our previous work, we suggested that increased exploratory activity may predispose an individual to greater violence exposure whereas higher behavioral inhibition at the same time (and possibly, in the same subject) could lead to higher rates of psychopathology [17]. Thus, it is important to understand the impact of personality characteristics on the relationships between violence exposure and psychopathology, as clarifying the role of personality functions in the processing of traumatic events might help to develop effective prevention and intervention strategies and could increase an awareness of individual characteristics in the development of traumatic response.

5. Conclusions

Higher levels of novelty seeking in all three samples were related to greater involvement in severe problem behaviors and to higher levels of witnessing and victimization. Indeed, increased behavior activation (high novelty seeking) may potentially predispose youth to greater exposure to risky and violent situations. It has been found previously that youth who engage in antisocial behavior often have higher novelty seeking [27, 28], thus the current findings may reflect the pathways by which personality factors lead to increased violence exposure, both directly and indirectly through the involvement in severe problem behaviors.

These findings also indicate a relationship between the temperamental pattern of behavior inhibition and psychopathology, with higher levels of harm avoidance related to higher levels of depression and posttraumatic stress and, in some cases, negatively related to the involvement in severe problem behaviors (delinquents) or to witnessing (control boys). Generally, high harm avoidance reflects the tendency of the individual to be more fearful and cautious (and, thus, less involved in problem behaviors and potentially witnessing less traumatic events), as well as nervous, passive, and having low energy levels. These traits are often combined with poor coping skills, factors that make such youth especially sensitive to stressful life events, and potentially lead to various psychopathological manifestations [26] and internalizing problems in youth [28]. Finally, inhibited temperamental patterns have recently been associated with a physiological pattern of resting right frontal EEG activation in children [52, 53], which in adults appears to be associated with a tendency to respond to stressful events with negative affect or depressive symptomatology [54].

Contrary to expectation, higher novelty seeking does not necessarily imply low harm avoidance and, in the present study, harm avoidance and novelty seeking in the delinquent group were unrelated. These traits can be present in various combinations, as suggested by Cloninger [26, 39] in his typology of personality—high and low, high and high, and so forth. We thus suggest that increased exploratory activity...
may predispose an individual to greater violence exposure, whereas higher behavioral inhibition at the same time could lead to higher rates of psychopathology. Environmental experiences, and particularly violence exposure, filtered through personality traits, may increase individual vulnerability to stress. Our findings also suggest that a wide range of psychopathology may be related to specific reactivity patterns to environmental stress and emphasize the importance of a focus on personality aspects in the treatment of traumatized delinquent youth.

This work has the usual limitations of cross-sectional studies that preclude the possibility of drawing causal relationships. The study relies on self-report measures and is limited by its retrospective assessment of psychopathology and violence exposure. Finally, although the findings expand the results obtained in the US inner city youth and demonstrate that the relationships between exposure to community violence and psychopathology are generalizable to other cultures, this study is nevertheless limited to youth from the Russian North and additional studies should address this issue in other samples and cultures.

References

a guide to its development and use, Washington University, Center for Psychobiology of Personality, St. Louis, Mo, USA, 1994.


The Relationship between Individual Personality Traits (Internality-Externality) and Psychological Distress in Employees in Japan

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This study examines the relationship between the internality-externality (I-E) scale as an indicator of coping styles and the Kessler 6 (K6) scale as an indicator of psychological distress and analyzes the effects of sociodemographic and employment-related factors on this relationship. Employees from Akita prefecture in Japan were invited to complete self-administered questionnaires. A uniform pattern of findings emerged in the relationship between the two scales as follows: all the significant correlations were negative, that is, as the I-E score increased, the K6 score decreased. Furthermore, significant effects were observed for the I-E scale regarding sex, age, education, employee type, and employment status and the K6 scale with multiple regression analyses. Among these, the effect of the K6 scale was significant for the I-E scale in both males and females. The results of this study may help improve mental health clinicians’ understanding of psychological distress in employees.

1. Introduction

The majority of previous literature on stress has studied the relationship between stressors and psychological distress. In addition, several such studies adopted moderators or coping behaviors as factors [1–3]. Several factors serve as potential moderators of stressor-strain relationships; these include Type A behavior pattern, internality-externality (I-E), and hardiness. Type A refers to a behavioral style characterized by ambitiousness, aggressiveness, competitiveness, impatience, potential for hostility, and a hard-driving nature; furthermore, it is characterized by motor responses such as muscle tenseness, a vigorous speech pattern, and rapidity of movement. I-E, which is also called locus of control (LOC), was also adopted as a moderator by several studies [3]. I-E is often described as a personality-like variable that might affect the long-term coping pattern of individuals. LOC refers to the differences in beliefs concerning personal control, represented by the continuum from internality to externality. “Internals” believe that “reinforcements are contingent upon their own behavior, capacities, or attributes.” In contrast, “externals” believe that “reinforcements are not under their personal control but rather are under the control of powerful others, luck, chance, fate, and so forth” [1].

In order to understand the processes related to occupational stress, it is necessary to explore how individuals behave in response to perceived stress (i.e., coping behavior) and to examine the relationship between potentially stressful incidents and psychological distress. Coping behavior is important; however, in analyzing coping with stress, just as they need to examine coping with each stressful incident, there is also a need to explore the “coping style” [2, 3]. Coping style refers to any long-term pattern of coping behavior exhibited by an individual, resulting either from how the individual tends to appraise events or from semihabitual behavior that s/he employs. Not all coping takes place only during stressful incidents or episodes. It is important to study long-term coping styles because psychological distress builds up over months or years, rather than as a mere response to a single stressful incident. Consequently, this study does not focus...
on individual stressful incidents but rather on the coping style, which is assessed by I-E. In this study, the Kessler 6 (K6) scale was employed to assess the psychological distress of employees. Occupational safety and health (OSH) programs typically invite employees to complete a voluntary health assessment questionnaire consisting of brief self-report health scales (as opposed to a diagnosis). K6 is a brief, well-validated scale that assesses psychological distress and effectively predicts mental disorders [4, 5]. In 1998, the number of suicides in Japan increased sharply, particularly among middle-aged men (i.e., a productive age group). Consequently, Japan has one of the highest suicide rates among developed countries, presenting a significant problem for the country, and mental health problems are blamed for the majority of the reported suicides [5, 6].

The primary concern of this study is the possible effect of coping styles as assessed by the I-E on psychological distress in employees. The data presented in this paper identifies the sociodemographic and work-related factors that impact the relationship between coping styles and psychological distress. The results presented in this study can be easily incorporated by OSH professionals in future employee-health risk assessment surveys. Moreover, this information about the factors of psychological distress and coping styles may improve mental health clinicians’ understanding of employees.

2. Materials and Methods

2.1. Participants. The information presented in this paper was collected as part of the Akita Occupational Health Promotion Center’s Study for Mental Health [5]. This project involves conducting a study designed to investigate stressful situations and stress management skills and to assess psychological distress in employees. The participants in this study were recruited as follows. Randomly selected employers were recruited (random systematic sampling) and their employees were invited to complete the self-administered questionnaire. In all, fifteen employers from public and private sector firms in Akita prefecture, Japan, agreed to participate in the study. The questionnaires were distributed to the participants using paper-based methods. Employees in the present study were invited to answer the surveys for each company during a one-month survey period (September-October 2007). Participation in the survey was voluntary and confidential. In addition, this study obtained sociodemographic information from the participants. The demographic information collected during this study included the sex, age distribution (29 years or younger, 30 to 39 years, 40 to 49 years, and 50 years and older), and the highest level of education obtained. Across Japan, nine years of compulsory education, which includes elementary school and junior high school, is recognized as the minimum education level; the next highest level of education is typically considered the completion of three years of senior high school. Therefore, education was categorized into compulsory and senior high school, tertiary education, and graduate degree or higher. The questionnaire survey also elicited information on the employees’ occupational characteristics (i.e., full time, managerial class, and job category). They were asked to select their job category from the following possible choices: (1) clerical or administrative support (e.g., bookkeeper, administrative assistant, or office supervisor), (2) sales- or service-related occupation (e.g., sales representative, stockbroker, or retail sales staff), (3) professional or technical support (e.g., engineer, doctor, nurse, laboratory technician, or computer programmer), and (4) others (e.g., on-site worker, crafts worker, mechanic, or driver). The present study also posed a question on the employees’ average number of working hours per day. The Japan Labour Health and Welfare Organization, which has established occupational health promotion centers in each administrative division, approved the study protocol.

2.2. Instruments. In this study, the I-E scale was used to measure coping style factors. Certain major problems have been reported in the use of Rotter’s I-E scale. First, the scores on Rotter’s I-E scale have shown a consistent and significant relationship with social desirability [7, 8]. In addition, its face validity is low; as a number of authors have noted, Rotter’s scale confounds personal, social, political, and ideological causation [9–11]. In response to these problems, Kambara and his colleagues developed an alternative measure of I-E [12, 13]. They named their 18-item scale (9 items each for internality and externality) the “Japanese version of the locus of control scale.” Each item is evaluated using a 4-point rating scale ranging from “value = 1” to “value = 4.” The respondent is instructed to indicate a degree of agreement or disagreement with each item on the 4-point scale. Therefore, the sum of the response scores can range from 18 to 72—high scores indicate internality. Further analyses employing this scale can be found in Kambara et al. (2001) [12]. In the previous report, internal consistency reliability was estimated at 0.78, and the test-retest reliability was 0.76 [12, 13]. In the current study, this scale was used instead of the original I-E scale.

As mentioned above, the current study also administered the K6 scale (30-day prevalence) to assess psychological distress. Each of the six items on K6 is rated on a five-point scale ranging from “none of the time” (value = 0) to “all the time” (value = 4). Therefore, the sum of the response scores can range from 0 to 24. The psychological dimensions explored in K6 make it sensitive and specific to mental disorders like affective and anxiety disorders [4, 5].

2.3. Analytical Procedure. Statistical analyses on cross-tabulations of the I-E scores, K6 scores, and sociodemographic and employment-related variables were performed using SPSS version 11.0J for Windows (SPSS, Tokyo, Japan). Statistical differences for cross-tabulations in the sex and age distribution of each category were analyzed using Pearson's χ² statistic. Furthermore, the Mann-Whitney U test was used to measure the statistical differences in sex and age distribution with regard to the values of the I-E and K6 scores. The correlations between the I-E and K6 scales in sex and age distribution were analyzed using Spearman’s rank correlation. Furthermore, stepwise multiple regression analyses were performed to assess the effects of related...
Table 1: Sociodemographics of the sample and the differences between the males and females.

<table>
<thead>
<tr>
<th></th>
<th>All participants</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1533 (100)</td>
<td>632 (100)</td>
<td>901 (100)</td>
</tr>
<tr>
<td>Age*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤29</td>
<td>337 (22.0)</td>
<td>116 (18.4)</td>
<td>221 (24.5)</td>
</tr>
<tr>
<td>30–39</td>
<td>415 (27.1)</td>
<td>154 (24.4)</td>
<td>261 (29.0)</td>
</tr>
<tr>
<td>40–49</td>
<td>402 (26.2)</td>
<td>153 (24.2)</td>
<td>249 (27.6)</td>
</tr>
<tr>
<td>≥50</td>
<td>379 (24.7)</td>
<td>209 (33.1)</td>
<td>170 (18.9)</td>
</tr>
<tr>
<td>Education*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compulsory/senior high school</td>
<td>708 (46.2)</td>
<td>431 (68.2)</td>
<td>277 (30.7)</td>
</tr>
<tr>
<td>Some tertiary education</td>
<td>706 (46.1)</td>
<td>127 (20.1)</td>
<td>579 (64.3)</td>
</tr>
<tr>
<td>Graduate degree or higher</td>
<td>99 (6.5)</td>
<td>63 (10.0)</td>
<td>36 (4.0)</td>
</tr>
<tr>
<td>Unknown</td>
<td>20 (1.3)</td>
<td>11 (1.7)</td>
<td>9 (1.0)</td>
</tr>
<tr>
<td>Employment status†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-time work</td>
<td>1361 (88.8)</td>
<td>569 (90.0)</td>
<td>792 (87.9)</td>
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<tr>
<td>Part-time work</td>
<td>160 (10.4)</td>
<td>59 (9.3)</td>
<td>101 (11.2)</td>
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<td>4 (0.6)</td>
<td>8 (0.9)</td>
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<td>Employee type*</td>
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<td></td>
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<tr>
<td>Managerial class</td>
<td>165 (10.8)</td>
<td>112 (17.7)</td>
<td>53 (5.9)</td>
</tr>
<tr>
<td>Nonmanagerial class</td>
<td>1346 (87.8)</td>
<td>517 (81.8)</td>
<td>829 (92.0)</td>
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<td>Unknown</td>
<td>22 (1.4)</td>
<td>3 (0.5)</td>
<td>19 (2.1)</td>
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<tr>
<td>Job category*</td>
<td></td>
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<tr>
<td>Clerical/administrative</td>
<td>209 (13.6)</td>
<td>111 (17.6)</td>
<td>98 (10.9)</td>
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<td>Sales/service</td>
<td>172 (11.2)</td>
<td>101 (16.0)</td>
<td>71 (7.9)</td>
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<tr>
<td>Professional/technical</td>
<td>784 (51.1)</td>
<td>216 (34.2)</td>
<td>568 (63.0)</td>
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<tr>
<td>Others (on-site workers, etc.)</td>
<td>318 (20.7)</td>
<td>179 (28.3)</td>
<td>139 (15.4)</td>
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<tr>
<td>Unknown</td>
<td>50 (3.3)</td>
<td>25 (4.0)</td>
<td>25 (2.8)</td>
</tr>
<tr>
<td>Working hours per day*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 hours or less</td>
<td>829 (54.1)</td>
<td>260 (41.1)</td>
<td>569 (63.2)</td>
</tr>
<tr>
<td>More than 8 hours</td>
<td>693 (45.2)</td>
<td>369 (58.4)</td>
<td>324 (36.0)</td>
</tr>
<tr>
<td>Unknown</td>
<td>11 (0.7)</td>
<td>3 (0.5)</td>
<td>8 (0.9)</td>
</tr>
</tbody>
</table>

Significances representing the differences between males and females (Pearson’s \(\chi^2\) statistic).

*\(P < 0.001\), †not significant.

Factors, and three regression analyses—with the dependent variable as the I-E score—were performed. In one regression, sex was included as an independent variable. The remaining two regressions were conducted on separate data sets for males and females.

3. Results

Of the 2,145 employees, 1,873 responded to the questionnaire (response rate: 87.3%); however, the number of questionnaires with satisfactory responses, excluding those with insufficient data, was 1,533 (71.5%), which included 632 males and 901 females. The respective Cronbach’s alphas for “internality” and “externality” in the I-E scale were 0.77 and 0.72; Cronbach’s alpha for the K6 scale was 0.88. Table 1 divides the participants according to their sex and summarizes the information pertaining to sociodemographic status and employment-related variables. With regard to the differences between males and females, Pearson’s \(\chi^2\) test revealed significant differences \((P < 0.001)\) in age, education, employee type (managerial or nonmanagerial class), job category, and number of working hours per day. However, there was no significant difference in employment status (full-time or part-time work).

Table 2 presents the mean and standard deviations of the scores of the I-E scale on the basis of sex and age distribution. With regard to the sex-based differences, significant differences were observed solely in the 40–49 years age group \((P < 0.05; \text{Mann-Whitney } U \text{ test})\). Other age groups showed no significant sex-based differences. Table 3 presents the mean and standard deviations of the scores of the K6 scale on the basis of sex and age distribution. For all age groups except the 30–39 years group, the mean K6 scores of females were higher than those of males. Furthermore, the older age groups tended to have lower K6 scores with the exception of the males in this age group. Significant sex-based differences were observed in the 29 years or younger age group \((P < 0.05)\), 50 years and older \((P < 0.01)\), and all
the K6 score was significant for males (P < 0.01) on the I-E scale using multiple regression analyses; unstandardized (β) and standardized (β*) regression coefficients are provided. The analysis of the effects of K6 scores, sociodemographic status, and employment-related variables on the I-E scores indicates that the independent effects of sex (P < 0.05), compulsory/senior high school education (P < 0.01), managerial employee type (P < 0.05), and K6 score (P < 0.01) on the I-E score were significant for all participants. Furthermore, only the K6 score was significant for males (P < 0.01). Conversely, for females, the 40–49 years age group (P < 0.01), 50 years and older age group (P < 0.05), compulsory/senior high school education (P < 0.01), full-time employment status (P < 0.01), managerial employee type (P < 0.05), and K6 score (P < 0.01) were significant. The effects of the variable of number of working hours per day were insignificant in all three sets. Therefore, the K6 score was the only score that was significant for all three sets.

4. Discussion

The response rate of 87.3% obtained by this survey was much higher than the typical response rate obtained in the case of employee-administered health questionnaires in many large organizations [5, 14]. The I-E was hypothesized to moderate stressor-strain relations because it appears as the factor most likely to affect the coping styles of individuals. Comprehensively little research has been conducted on how coping styles interact with job-related psychological distress assessed by a psychological distress scale in an applied setting, although factors related to coping styles such as I-E have a lengthy tradition of research. Therefore, the discussion first addresses the principal concern of the study, which is the relationship between the effects of coping styles (I-E) and psychological distress (K6). Following this, some consideration is given to the effects that related sociodemographic and occupational factors have on these variables. On observing the direct correlations between I-E and K6 (Spearman’s rank correlation), a uniform pattern of findings emerged—all the significant correlations were negative, indicating that, as the I-E score increased (greater internalization), the K6 score decreased (less psychological distress). These results are in accordance with those observed in earlier research on psychological distress from job-related stressors, such as job demands [15, 16]. For instance, externals are likely to undergo greater psychological distress than others. In contrast, internals are likely to undergo less psychological distress, even if they have relatively many stressors. The simplest explanation for the observation that externals report both greater job-related stressors and psychological distress is that they perceive themselves as being more environment dependent, with their life rewards more likely to be viewed as a matter of fate, chance, or luck [1, 17]. However, the moderator results suggest that the picture is more complicated than this since I-E interacts with specific job-related stressors in its relationship with psychological distress (i.e., the effects of I-E on the stressor-strain relationship differ according to the subtype of job-related stressors such as role conflict, role ambiguity, qualitative role low-load, quantitative role high-load, and environmental frustration [3]). Some previous studies report the relationships between I-E and psychological distress from these subtypes of stressors [3, 18–21]. Moreover, some reports add the factor of Type A to the relationship between I-E and psychological distress. It has been generally reported that persons with Type A personalities have increased psychological distress, as do persons with high external LOC. Furthermore, persons with Type A personalities and external LOC undergo greater psychological distress than those with

<table>
<thead>
<tr>
<th>Age</th>
<th>All participants Mean ± SD</th>
<th>Males Mean ± SD</th>
<th>Females Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r₁</td>
<td>r₂</td>
<td>r₃</td>
</tr>
<tr>
<td>≤29</td>
<td>-0.379*</td>
<td>-0.273*</td>
<td>-0.443*</td>
</tr>
<tr>
<td>30–39</td>
<td>-0.331*</td>
<td>-0.407*</td>
<td>-0.284*</td>
</tr>
<tr>
<td>40–49</td>
<td>-0.315*</td>
<td>-0.348*</td>
<td>-0.287*</td>
</tr>
<tr>
<td>≥50</td>
<td>-0.310*</td>
<td>-0.348*</td>
<td>-0.253*</td>
</tr>
<tr>
<td>Total</td>
<td>-0.328*</td>
<td>-0.344*</td>
<td>-0.311*</td>
</tr>
</tbody>
</table>

r₁: Spearman’s rank correlation coefficient, *P < 0.01.
Type A personalities and internal LOC, that is, Type A persons are generally likely to have greater psychological distress, which is exacerbated if they are externals [22]. In addition, low levels of hardness, self-respect, tendency of avoidance-oriented coping behavior, and external LOC are related to burnout [23]. Consequently, externals are more likely to experience burnout. Furthermore, persons with low levels of self-confidence and self-esteem and persons with a lack of self-efficacy (i.e., externals) are likely to adopt non-adoptive coping behaviors such as avoidance-oriented coping behaviors. Such persons are more likely to have increased burnout.

Other variables that moderate the stressor-strain relationship are sex and age. For example, male teachers reported greater burnout and lower job satisfaction than that among female teachers. In addition, although male department heads scored significantly higher on psychological burnout, there were no sex differences in the measures of satisfaction and emotional well-being [24]. Another report shows that age is related to personal accomplishment and professional commitment but inversely related to emotional exhaustion, that is, younger subjects are likely to have a higher level of burnout [25]. Varieties of studies and results demonstrate the effect of behavioral control, such as I-E, on psychological distress. In sum, they remain possible conjectures from the present findings and provide interesting possibilities for future research.

In this study, the K6 scale was used to evaluate the degree of psychological distress. The psychological dimensions explored in K6 make it sensitive and specific to mental disorders such as affective and anxiety disorders [4]. It is reasonable to assume that the severity of mental health symptoms (degree of psychological distress) is primarily responsible for reduced performance at work [5, 26, 27]. K6 is one of the most widely used psychological distress scales across the globe. Therefore, it is ideal for inclusion in health risk assessment for OSH. However, there is a dearth of published large-scale, normative values that specifically pertain to the workforce. This study is one of the few reports where employees’ psychological distress is assessed using K6 by varying the demographic, employment-related, and individual personality variables.

A limitation of this study was cross-sectional sampling, which made it difficult to infer causality. The data sample was selected at random, but companies (employers) decided to participate in the project, and the employees from these companies decided to respond to the survey. However, self-selection biases in the current data are representative of those inherent in typical employee health assessment surveys. Moreover, the structured interview method is not feasible in large sample studies (as in this case), so some alternative method must be employed. The assessment of factor-related coping with stressors is another limitation of this study because it was based on a single questionnaire measurement (I-E). As previously noted, one reason for studying long-term coping styles is that not all coping is synchronous with stressful incidents or episodes; psychological distress builds up over months or years rather than being the response to a single stressful incident. One approach to investigating the long-term patterns of coping styles is to measure the coping behavior repeatedly. However, in this type of research design, the response obtained may in part be an artifact of the method utilized by repeatedly focusing their attention on how they cope in the long term [3]. An alternative to this approach, which reduces the occurrence of such problems, is to examine the extent to which job stressor-strain relations are accentuated by certain coping styles. Since long-term patterns of coping styles are being examined, the necessity of performing frequent repeated measures is reduced.

5. Conclusions

This study reveals the relationship between the I-E scale as an indicator of coping styles and the K6 scale as an indicator of psychological distress and the effects of sociodemographic and employment-related factors on this relationship.
The effect of the K6 scale was significant for the I-E scale for all three sets (all participants, males, and females). Further research should be conducted on the relationship between the factors related to coping style and the psychological distress scale since there are only a few studies directly examining this relationship. The information obtained by this study related to the factors of psychological distress and its coping style will hopefully improve mental health clinicians' understanding of employees.

Acknowledgments

The author would like to thank Tetsuo Shimizu, Katsuyuki Murata, Yasutsgu Kudo, Masayuki Seki, and Seiji Saito for their valuable comments and suggestions.

References

Bipolar Disorder and the TCI: Higher Self-Transcendence in Bipolar Disorder Compared to Major Depression

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Personality traits are potential endophenotypes for genetic studies of psychiatric disorders. One personality theory which demonstrates strong heritability is Cloninger’s psychobiological model measured using the temperament and character inventory (TCI). 277 individuals who completed the TCI questionnaire as part of the South Island Bipolar Study were also interviewed to assess for lifetime psychiatric diagnoses. Four groups were compared, bipolar disorder (BP), type 1 and 2, MDD (major depressive disorder), and unaffected relatives of a proband with BP. With correction for mood state, total harm avoidance (HA) was higher than unaffected in both MDD and BP groups, but the mood disorder groups did not differ from each other. However, BP1 individuals had higher self-transcendence (ST) than those with MDD and unaffected relatives. HA may reflect a trait marker of mood disorders whereas high ST may be specific to BP. As ST is heritable, genes that affect ST may be of relevance for vulnerability to BP.

1. Introduction

An individual’s personality develops early, is stable, and has a strong heritable component. Personality traits have been implicated as factors which influence the predisposition to bipolar disorder and may help to distinguish between major depressive disorder (MDD), bipolar disorder (BP), and bipolar disorder with hypomania, bipolar type 2 (BP2). Personality traits are also being considered as potential useful endophenotypes for the investigation of the genetic basis of complex mental disorders [1]. The adequate description of personality in bipolar disorder is required to identify profiles and traits that may be useful to enhance the understanding of bipolar disorder.

The Temperament and character inventory revised (TCI-R) is a 240-item 5-point Likert scale self-administered questionnaire which assesses personality following Cloninger’s psychobiological model [2]. This model assesses personality in seven dimensions, four temperament scales: novelty seeking (NS), harm avoidance (HA), reward dependence (RD) and persistence (PS), and three character scales: self-directedness (SD), cooperativeness (CO), and self-transcendence (ST). All of the scales reflect total scores of either four or five subscales (Table 1).

In this study, we applied the TCI-R to a sample of bipolar disorder patients and their relatives with the objective of highlighting differences between diagnostic groups for future investigation. As self-reported personality traits may be affected by current mood state, we were also interested in personality differences between diagnostic groups when the effect of current self-reported mood was taken into consideration.

2. Methods

Bipolar probands and their family members were recruited in Christchurch, New Zealand as part of the South Island Bipolar Study [3–5] and interviewed using the Diagnostic
<table>
<thead>
<tr>
<th></th>
<th>Bipolar I</th>
<th>Bipolar II</th>
<th>Major depressive disorder</th>
<th>Unaffected relatives</th>
<th>F-statistic</th>
<th>P value</th>
<th>Post hoc analysis</th>
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<td></td>
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<td>15.98</td>
<td>6.84</td>
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<tr>
<td>Reward-dependence</td>
<td>23.37</td>
<td>6.40</td>
<td>22.61</td>
<td>5.49</td>
<td>23.30</td>
<td>7.13</td>
<td>22.43</td>
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<td>Persistence</td>
<td>22.75</td>
<td>10.50</td>
<td>26.58</td>
<td>11.04</td>
<td>24.37</td>
<td>13.34</td>
<td>26.06</td>
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<tr>
<td>Self-directedness</td>
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<td>8.51</td>
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<td>10.91</td>
<td>35.08</td>
<td>10.82</td>
<td>37.34</td>
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<td>6.89</td>
<td>34.33</td>
<td>6.36</td>
<td>35.87</td>
<td>4.22</td>
<td>35.57</td>
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<tr>
<td>Self-transcendence</td>
<td>22.43</td>
<td>12.30</td>
<td>18.79</td>
<td>9.45</td>
<td>17.54</td>
<td>11.15</td>
<td>15.39</td>
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**Subscales**

<table>
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<th>Unaffected relatives</th>
<th>F-statistic</th>
<th>P value</th>
<th>Post hoc analysis</th>
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<td>SD</td>
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<td>SD</td>
<td>Mean</td>
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<td>Mean</td>
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<tr>
<td>HA1 (anticipatory worry versus uninhibited optimism)</td>
<td>5.00</td>
<td>2.90</td>
<td>5.18</td>
<td>3.08</td>
<td>4.23</td>
<td>2.38</td>
<td>3.03</td>
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<td>HA1 (fear of uncertainty versus confidence)</td>
<td>4.73</td>
<td>1.64</td>
<td>3.82</td>
<td>1.98</td>
<td>4.26</td>
<td>1.82</td>
<td>3.55</td>
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<tr>
<td>HA3 (shyness with strangers versus gregariousness)</td>
<td>4.13</td>
<td>2.75</td>
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<td>2.86</td>
<td>3.97</td>
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<td>HA4 (fatigability and asthenia versus vigour)</td>
<td>4.92</td>
<td>3.02</td>
<td>4.15</td>
<td>2.94</td>
<td>3.53</td>
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<td>1.54</td>
<td>3.86</td>
<td>1.22</td>
<td>4.43</td>
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<td>7.48</td>
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<td>8.62</td>
<td>2.47</td>
<td>9.06</td>
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<tr>
<td>SD5 (congruent second nature)</td>
<td>8.90</td>
<td>2.92</td>
<td>8.88</td>
<td>3.30</td>
<td>9.91</td>
<td>1.93</td>
<td>10.63</td>
</tr>
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<td>2.46</td>
<td>3.88</td>
<td>2.62</td>
<td>2.96</td>
<td>2.38</td>
<td>2.11</td>
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<tr>
<td>ST2 (transpersonal identification versus self-isolation)</td>
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<td>2.11</td>
<td>1.79</td>
<td>2.09</td>
<td>1.73</td>
<td>1.81</td>
<td>1.54</td>
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<tr>
<td>ST3 (spiritual acceptance versus rational materialism)</td>
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<td>3.57</td>
<td>5.06</td>
<td>2.83</td>
<td>4.49</td>
<td>3.30</td>
<td>4.28</td>
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<td>ST4 (enlightened versus Objective)</td>
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<td>4.07</td>
<td>4.06</td>
<td>3.47</td>
<td>4.23</td>
<td>4.37</td>
<td>3.56</td>
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<td>ST5 (idealistic versus practical)</td>
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<td>2.45</td>
<td>4.00</td>
<td>2.44</td>
<td>4.12</td>
<td>2.62</td>
<td>3.90</td>
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<td>Beck depression inventory</td>
<td>10.90</td>
<td>9.83</td>
<td>9.79</td>
<td>9.48</td>
<td>6.91</td>
<td>8.64</td>
<td>2.99</td>
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</table>
Interview for Genetic Studies (DIGS) [6, 7]. All participants also completed the revised 240-item temperament and character inventory (TCI-R) self-report questionnaire [8]. Proband and relatives were not required to be euthymic when completing the TCI, and the beck depression inventory (BDI) [9] was used to assess mood state at the time of questionnaire completion.

Two hundred and seventy-seven individuals comprising 65 bipolar probands (50 BP1 and 15 BP2), 134 first-degree relatives, 70 other blood relatives and 8 spouses were assessed using the DIGS, which resulted in four diagnostic categories, BP1 (n = 60, 55% female), BP2 (n = 33, 52% female), MDD (n = 97, 69% female) and unaffected relatives (n = 87, 49% female). Individuals with diagnoses of bipolar disorder and depression not otherwise specified were excluded from analyses. Groups were compared using one-way analysis of variance (ANOVA) with Tukey post hoc analysis. TCI scales significantly different in the ANOVA analyses were corrected for current mood state by including BDI score as a covariate in a univariate analysis of covariance (ANCOVA). As the participants of this study are related, the influence of family clustering was corrected for by including family identification number during sample preparation as a cluster using complex sample preparation with replacement sampling. As this study was explorative, no correction for multiple testing was applied. All statistical analysis was conducted using SPSS version 13 (SPSS Inc., Chicago, Ill, USA). With α = 0.05 and power of 80% and ignoring the possible design effect from clustering, the detectable alternative for comparison of the two smallest groups (33 and 65) was 0.6 sd between the means whereas for comparison of the two largest groups (87 and 95) it was 0.4 sd [10].

3. Results

The mean values and standard deviations of the TCI scales of the four diagnostic groups are presented in Table 1. Of the seven scales, harm avoidance, self-directedness and self-transcendence were significantly different between diagnostic groups. Post hoc analyses revealed that BP1, BP2 and MDD had higher harm avoidance. Both bipolar groups had lower self-directedness than the unaffected relatives and BP1 had higher self-transcendence than MDD or unaffected relatives.

When the subscales were dissected, significant differences were observed for: HA1 (anticipatory worry versus uninhibited optimism), HA2 (fear of uncertainty), HA4 (fatigability and asthenia versus vigour), SD1 (responsibility versus blaming), SD2 (persistence versus lack-of-goal directedness), SD3 (resourcefulness), SD4 (self-acceptance versus self-striving), SD5 (enlightened second nature), ST1 (self-forgetfulness versus self-conscious experience), ST3 (spiritual acceptance versus rational materialism), and ST5 (idealistic versus practical). The Tukey post hoc analyses of these subscales are presented in Table 1.

In addition to differing in personality, the four groups demonstrated significant differences in depressive mood state at the time of assessment. The total BDI scores for the three mood disorder groups were all higher than the unaffected relatives, and the BP1 group scored higher than MDD group. As differences in personality could potentially be due to current mood-state [11, 12], an ANCOVA was conducted for each of the TCI items which displayed a significant difference between the groups. The TCI scale was the dependent variable and mood diagnosis was the fixed variable. Total BDI score was included in the model as a covariate. Results of these analyses are presented in Table 2.

After correction for self-reported depression, all the mood disorder groups had higher HA than the unaffected relatives. In contrast, only BP1 subjects had higher ST than MDD and controls. Among the subscales, three HA subscales, two ST subscales, and SD3 remained different between diagnostic groups.

4. Discussion

In this investigation of personality in a sample of individuals with bipolar disorder and their relatives we have shown differences in personality profiles between diagnostic groups. All groups with mood disorder had higher HA than unaffected relatives. ST was higher only in those with bipolar disorder. Initially SD appeared to be different between bipolar disorder and other groups, but correction for current mood state rendered the difference insignificant.

High HA has often been reported in bipolar disorder [13–20]. Our analysis shows both BP and MDD to be more harm avoidant than nonaffected relatives, further establishing high HA as a characteristic of susceptibility to mood disorder, and not unique to either MDD or BP. High HA or high neuroticism has consistently been linked to depression; however, this vulnerability likely includes bipolar as well as unipolar depression.

Differences on other scales found by other authors have not been replicated. Janovsky et al. reported greater NS in bipolar patients compared with patients with unipolar depression [15]. In our investigation, a trend to higher novelty seeking in the BP2 group was observed, but no significant difference was found. Using an earlier version of the TCI with nonexpanded persistence dimension, Osher et al. reported lower persistence in bipolar disorder [14, 21]. In our study three persistence subscales were lower in bipolar, however correction for BDI eliminated all but PS4 (perfectionist versus pragmatist), where the BP2 group was greater than the MDD group but no different from BP1 or the nonaffected relatives. Our results do not support the suggestion that low persistence is a temperamental marker of bipolarity.

The ST dimension of personality is associated with spirituality and a high score is considered to be an adaptive personality trait, when combined with high SD and CO. When high ST is not found with high SD and CO, Cloninger suggests that a schizotypal personality type emerges [8]. Our findings of higher ST in the BP1 group compared with unaffected relatives or those with a lifetime diagnosis of MDD suggests that BP1 patients experience more otherworldly experience. Higher ST scores in bipolar patients have been reported elsewhere compared with unaffected controls [18, 20].
Table 2: Adjusted means of TCI scales and subscales found to be significant in original ANOVA corrected for mood at time of completing TCI questionnaire using total BDI score as a covariate.

<table>
<thead>
<tr>
<th></th>
<th>Bipolar I (N = 60)</th>
<th>Bipolar II (N = 33)</th>
<th>Major depressive disorder (N = 97)</th>
<th>Unaffected relatives (N = 87)</th>
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<th>P value</th>
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<tbody>
<tr>
<td><strong>F</strong></td>
<td></td>
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</tr>
<tr>
<td>HA1 (anticipatory worry versus uninhibited optimism)</td>
<td>16.99 (0.88)</td>
<td>15.82 (1.23)</td>
<td>15.97 (0.64)</td>
<td>13.65 (0.63)</td>
<td>3.52</td>
<td>.019</td>
</tr>
<tr>
<td>HA2 (fear of uncertainty versus confidence)</td>
<td>4.44 (0.31)</td>
<td>4.77 (0.41)</td>
<td>4.22 (0.24)</td>
<td>3.58 (0.23)</td>
<td>2.76</td>
<td>.047</td>
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<td>HA4 (fatigability and asthenia versus vigour)</td>
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<td>3.73 (0.46)</td>
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<td>5.89</td>
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<tr>
<td>SD1 (responsibility versus blaming)</td>
<td>33.47 (0.88)</td>
<td>32.21 (1.37)</td>
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<td>SD2 (purposefulness versus lack-of-goal direction)</td>
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<td>9.31 (0.42)</td>
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<td>ST3 (spiritual acceptance versus rational materialism)</td>
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<td>18.57 (1.69)</td>
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<td>15.69 (1.24)</td>
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<td>ST5 (idealistic versus practical)</td>
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<td>3.72 (0.45)</td>
<td>2.96 (0.23)</td>
<td>2.33 (0.2)</td>
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<td>ST3 (spiritual acceptance versus rational materialism)</td>
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<td>3.92 (0.43)</td>
<td>4.12 (0.26)</td>
<td>4.00 (0.3)</td>
<td>2.26</td>
<td>.088</td>
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</table>
and MDD [17]. It appears that the high HA predisposes towards mood disorder and high ST, which is associated with schizotypy [22], contributes a second hit towards the expression of a bipolar phenotype. The ST scores of the BP2 group were not statistically different from the other diagnostic groups but were intermediate. Given the small numbers of BP2 subjects, further research on ST in BP2 is indicated.

High ST has been associated with polymorphisms in three genes, vesicular monoamine transporter 2 (VMAT2), [23], the serotonin receptor 1A (HTR1A) [24], and glycogen synthase kinase 3beta (GSK3B). Recently, two risk haplotypes within the VMAT2 gene have been identified for bipolar disorder and schizophrenia in a Spanish cohort [25]. Possession of the T-A-G haplotype at markers rs363420-rs363343-rs363272 conferred a relative risk of 4.4, and the C-C-A conferred a relative risk of 1.8 for bipolar disorder versus controls. A polymorphism (-50T/C) in the promoter of glycogen synthase kinase 3β (GSK3B), associated with age of onset and lithium response in an Italian bipolar cohort, is associated with the ST subscale ST2 (transpersonal identification). Participants homozygous for the rare C allele were significantly higher than those with the TT and CT genotypes [26].

Differences in serotonin receptor 1A density measured by positron emission tomography (PET) have also been associated with ST, especially the subscale spiritual acceptance [27]. Another PET study using the VMAT2 specific ligand (+)-α-[11C] dihydrotetrabenzine found brain stem binding to be higher in bipolar disorder and schizophrenic patients compared to controls. Greater VMAT2 binding was observed in the thalamus of the bipolar patients compared with both schizophrenic and control groups [28]. Future investigation into the mechanisms of these two genes and their associations with bipolar disorder and self-transcendence is warranted.

High harm avoidance and neuroticism personality traits have been well established in unipolar depression. This analysis suggests that high harm avoidance increases disposition to mood disorder, with other modifying factors, genetic and otherwise, may allow the bipolar phenotype to be expressed. This data could be seen as consistent with the findings of McGuffin et al. who demonstrated the independent inheritance of depression and mania in a twin study [28]. The independence may arise from risk genes for high harm avoidance predisposing to mood disorders in general interacting with risk genes for high self-transcendence to increasing vulnerability to a bipolar mood disorder phenotype.

This is one of the larger studies to have used the TCI to compare the personality traits of individuals with bipolar disorder, with major depression, and with no mood disorder. Larger sample size increases the power of detecting true differences. Furthermore the inclusion of a comparison between BP and MDD allows the dissection of the relevance of personality to bipolarity and to mood disorders in general.

The correction of our data for current mood state is important [12]. The inclusion of BDI in the analysis enables us to infer with more certainty that the differences of personality are important in the context of the diagnostic grouping rather than how differences in current level of depression influence personality. The TCI-R is the most current and complete version available, including persistence subscales and two additional ST subscales.

In this investigation of the personality of bipolar disorder probands and their relatives, we have identified differences in the personality dimensions of HA and ST. High HA reflecting tendency to mood disorder and high self-transcendence appears to be specific to bipolar disorder. For future studies of the genetics of bipolar disorder, high ST may be of interest as an endophenotype, and equally genes that influence ST could be considered candidate genes for bipolarity.

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References


