

# TEMPERAMENT AND CHARACTER DOMAINS OF PERSONALITY AND DEPRESSION 2012

GUEST EDITORS: TOSHINORI KITAMURA, C. ROBERT CLONINGER, ANDREA FOSSATI,  
AND JÖRG RICHTER



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**Temperament and Character Domains of  
Personality and Depression 2012**

Depression Research and Treatment

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Guest Editors: Toshinori Kitamura, C. Robert Cloninger,  
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## Editorial

# Temperament and Character Domains of Personality and Depression 2012

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*Depression Research and Treatment* has issued a second compendium of papers focused on temperament, character, and depression. The psychobiology theory of personality proposed by Cloninger is a currently prevailing theory of personality that has been extensively investigated in the context of many different types of mental and personality disorders. This special issue reports up-to-date research findings on the psychobiology theory and depression from different countries.

The current issue consists of six reports. Miettunen and colleagues in Finland present findings from a longitudinal birth cohort study ( $N = 4941$ ). Participants with depression at 31 years of followup had higher rates of harm avoidance (HA) than participants without any psychiatric disorders. Participants without any psychiatric history were followed for another 12 years. Those who subsequently developed depression had high HA in 1997. The authors hypothesize that high HA is a potential indicator for subsequent depression. This study only used temperament scales and thus no information was available on the association between character and depression.

Students in senior high schools ( $N = 1234$ ) who were invited to participate in an internet-based intervention program for depression were studied by Christian and colleagues in Norway. High HA and low self-directedness (SD) emerged as strong predictors of adolescent depression. Interestingly, use of the internet intervention program was

associated with low reward dependence (RD) in addition to depression severity.

Garcia and colleagues studied an adolescent population ( $N = 304$ ) in Sweden. Based on positive affect (PA) and negative affect (NA) scores derived from the Positive Affect and Negative Affect Schedule, the participants were categorized into four groups: self-fulfilling (high PA and low NA), high affective (high PA and high NA), low affective (low PA and low NA), and self-destructive (low PA and high NA). The self-fulfilling group was characterized by higher persistence (PS), SD, and cooperativeness (CO) than the three other groups. The self-destructive group was characterized by high HA and RD. The authors claim character maturity (expressed as high SD and CO) is important for psychological well-being.

In Japan, Lu and colleagues followed graduate students ( $N = 184$ ) on two occasions separated by a five-month interval. In a structural regression model, they posited that trait anxiety and depression constructs were linked to high HA and low SD. Although trait anxiety and depression scores were moderately correlated with each other, these two constructs showed different associations with Temperament and Character Inventory (TCI) subscale scores. Thus, trait depression was linked to high self-transcendence (ST) whereas trait anxiety was linked to low RD, PS, and CO. The authors claim that character maturity is linked to trait rather than state aspects of depression and anxiety.

Directly exposed survivors of the Oklahoma City bombing randomly selected from a bombing survivor registry ( $N = 151$ ) were examined by North and colleagues in the USA. Posttraumatic stress disorder (PTSD) after the bombing was associated with low SD and CO together with high ST and HA. Postdisaster major depression (MD) was more prevalent among those with PTSD than those without it, but low SD and CO could not be predicted by post-disaster MD. The authors emphasized the importance of developing and validating measures of resilience.

A unique measure of temperament, the Temperament Evaluation of Memphis, Pisa, Paris, and San Diego (TEMPS), was used by Tei-Tominaga and colleagues to study job stress among employees in one Japanese company ( $N = 728$ ). Depression was predicted by high levels of cyclothymic and anxious temperament traits even after controlling for the effects of work-related stressors such as demanding work conditions and overcommitment.

These articles all indicate the importance of temperament and character traits in the development of depression among a variety of populations across different countries. Despite some differences between the studies, a common theme may be that low SD and high HA are predictors of depression either directly or being mediated by third variables.

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## Research Article

# Personality and Major Depression among Directly Exposed Survivors of the Oklahoma City Bombing

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*Background.* Few disaster studies have specifically examined personality and resilience in association with disaster exposure, posttraumatic stress disorder (PTSD), and major depression. *Methods.* 151 directly-exposed survivors of the Oklahoma City bombing randomly selected from a bombing survivor registry completed PTSD, major depression, and personality assessments using the Diagnostic Interview Schedule for *DSM-IV* and the Temperament and Character Inventory, respectively. *Results.* The most prevalent postdisaster psychiatric disorder was bombing-related PTSD (32%); major depression was second in prevalence (21%). Bombing-related PTSD was associated with the combination of low self-directedness and low cooperativeness and also with high self-transcendence and high harm avoidance in most configurations. Postdisaster major depression was significantly more prevalent among those with (56%) than without (5%) bombing-related PTSD ( $P < .001$ ) and those with (72%) than without (14%) predisaster major depression ( $P < .001$ ). Incident major depression was not associated with the combination of low self-directedness and low cooperativeness. *Conclusions.* Personality features can distinguish resilience to a specific life-threatening stressor from general indicators of well-being. Unlike bombing-related PTSD, major depression was not a robust marker of low resilience. Development and validation of measures of resilience should utilize well-defined diagnoses whenever possible, rather than relying on nonspecific measures of psychological distress.

## 1. Introduction

Most disaster mental health research has focused on PTSD. Less attention has been paid to major depression after disasters, and far less to personality in examining disaster mental health consequences. The role of personality in Axis I psychiatric disorders is well established [1]. Both anxiety and major depressive disorders are associated with high levels of harm avoidance and low self-directedness, but are distinguished by high persistence in those with anxiety and by low persistence in those with depression [1–3].

Another approach to understand the response to stress has been to characterize what distinguishes people who are resilient to stress from those who cope poorly [4]. Resilience is defined as the human ability to adapt and maintain well-being in the face of tragedy, trauma, adversity, hardship, and

significant life stressors [5, 6]. High levels of positive and resilient mental health have been attributed to personality traits associated with strong executive functions (such as self-directedness, a self-confident sense of competence and accomplishment, or psychological maturity), social relatedness (such as cooperativeness, social intelligence, social supports), and a positive affective balance (more positive than negative emotions, as with low harm avoidance and high persistence) [7–10]. When studied in samples representative of the general community, such personality traits promote positive well-being and are associated with a lower prevalence of many medical and psychiatric disorders, including anxiety, mood, and stress disorders such as PTSD [11, 12].

Studies of coping and resilience in the general community often accept minor forms of violence and danger as

trauma, so that most people are regarded as having experienced posttraumatic stress at some time during their lives [11]. PTSD has sometimes been confused with nonspecific psychological distress characterized by anxiety and depression [13–15]. Anxiety and depression can be nonspecific responses to stress even in people who do not have the avoidance behaviors and numbing symptoms characteristic of PTSD [16]. As a result, it remains unclear whether personality traits or other individual characteristics can differentially predict resilience to PTSD from other forms of psychopathology [17].

The 1995 Oklahoma City bombing was the most severe incident of terrorism in the United States at that time. In a study of 182 individuals randomly selected from a registry of directly-exposed survivors of the Oklahoma City bombing studied by this research team, PTSD was found to be the most prevalent diagnosis (34%); major depression was next in prevalence (23%) [16]. Personality in relation to PTSD was also studied in this sample [18] using the Temperament and Character Inventory (TCI) developed by Cloninger's group. Bombing-related PTSD was found to be significantly associated with low self-directedness, high self-transcendence, high harm avoidance, and the combination of low cooperativeness and low self-directedness. The association of PTSD with low cooperativeness, however, fell short of statistical significance ( $P = .065$ ). PTSD was also found to be negatively associated with the creative character configuration and to be positively associated with the disorganized (schizotypal) and autocratic character configurations and the explosive (borderline) temperament configuration. Although the association of preexisting psychiatric illness with bombing-related PTSD was predicted by personality characteristics, the relationship of personality to other disorders such as major depression was not specifically examined [19].

The TCI measures not just maladaptive but also adaptive character and temperament traits [20]. Character reflects the personal goals and values developed by the individual over the lifespan, and temperament represents the emotional core of personality that is largely innate and moderately stable throughout life [20]. Three character dimensions measured by the TCI are self-directedness (i.e., sense of responsibility, purposefulness, and resourcefulness), cooperativeness (i.e., tolerance, helpfulness, and compassion for others), and self-transcendence (i.e., intuitiveness, judiciousness, and spirituality). People with high levels of all three of these character traits have frequent positive emotions and infrequent negative emotions that are, in combination, fundamental to subjective well-being [2]. It is established that the combination of self-directedness and cooperativeness differentiates healthy and disordered personality functioning [20–22].

This paper focuses on personality factors associated with major depression in this sample of Oklahoma City bombing survivors. This study was designed to test the ability of TCI personality dimensions and profiles to differentiate resilience and vulnerability to major depression and PTSD. The causes of both PTSD and major depression are sometimes attributed to stressful life events in general community samples that measure symptomatic distress in a nonspecific way [11, 12]. This study's rigorous measurement of specific

diagnostic criteria and multidimensional personality assessment provided the opportunity to determine whether low resilience to postdisaster major depression and PTSD can be differentiated from preexisting psychopathology in a sample with a well-defined, highly traumatic event.

## 2. Methods

The Institutional Review Boards of Washington University School of Medicine and the University of Texas Southwestern Medical Center approved the research. All participants provided written informed consent before participating and were offered \$50 in appreciation of their time and effort.

*2.1. Sample Recruitment and Retention.* Survivors who were directly exposed to the Oklahoma City bombing were randomly selected from 1,092 survivors in a bombing survivor registry of the Oklahoma State Department of Health; 71% of those selected agreed to participate in the study, yielding a sample of 182 survivors. This was a highly exposed sample: 87% sustained injuries in the bombing. These survivors participated in research interviews approximately six months after the disaster. Further details on the sampling methods are provided in an earlier publication [16]. The personality assessment was completed by 151 participants (representing 83% of those who completed the research interviews and 59% of those selected from the registry). Completion of the personality measure by study participants was unassociated with gender, age, level of education, marital status, psychiatric diagnoses, injuries, other life events, or treatment received.

*2.2. Instruments of Assessment.* The Diagnostic Interview Schedule/Disaster Supplement (DIS/DS) [23, 24] provided data on psychiatric symptoms and diagnosis, disaster exposure, and other relevant variables including demographic information. The Diagnostic Interview Schedule (DIS) is a fully structured diagnostic interview with acceptable test-retest reliability [25, 26] and interrater reliability in comparisons of DIS with clinician diagnoses [27–29]. “Bombing-related” PTSD refers to PTSD that developed in association with the bombing. Postdisaster prevalence of bombing-related PTSD or major depression is defined as meeting criteria for these disorders at any time since the bombing.

Personality was assessed with the TCI, a self-administered 240-item, true/false self-report instrument measuring three dimensions of character and four dimensions of temperament. More detail about the TCI is available in previous publications demonstrating acceptable interrater reliability and validity in relation to structured interview diagnoses of personality disorder [22, 30]. The TCI character scales are self-directedness, cooperativeness, and self-transcendence. Self-directedness reflects willpower to adapt to or overcome any changes to one's environment. Cooperativeness represents the degree to which a person is agreeable as opposed to self-centered hostility and aggression. Self-transcendence indicates the extent to which one accepts and identifies oneself as an inseparable part of the universe. The TCI temperament scales are harm avoidance, novelty seeking,

reward dependence, and persistence. Harm avoidance is the proclivity to avoid signal of punishment, novelty, or frustrating nonreward. Novelty seeking is characterized as attraction to explore novel stimuli, seek excitement, pursue potential rewards, and avoid monotony. Reward dependence indicates pursuit of social attachment based on approval, warmth, and sentimentality. Persistence represents perseverance despite frustration and disappointment.

Character and temperament configuration variables were constructed based on distribution of scale scores either above (high) or below (low) the median across the three character scales and the four temperament scales. For example, disorganized (schizotypal) character type was defined as low in cooperativeness and self-directedness and high in self-transcendence; in contrast, moody (cyclothymic) character type was defined as high in cooperativeness and self-transcendence and low in self-directedness. High levels of cooperativeness and self-directedness are indicators of healthy personal functioning [20, 22]. The occurrence of low cooperativeness and low self-directedness together defines an unhealthy personality structure with underdeveloped executive functions, a core feature of personality disorders [22]. Additional detail about the construction of personality configurations based on TCI scales is available in a previous publication [3].

**2.3. Data Analysis.** SAS Version 9.2 was used for data analysis [31]. Summary results are presented as raw numbers, proportions, means, and standard deviations (SDs). Two dichotomous variables were compared using chi-square tests, and dichotomous variables were compared with numerical variables using Student's *t*-tests. Multiple linear regression models (PROC REG in SAS) were developed to predict dimensional character and temperament dimensions (dependent variables) from other (independent) variables such as psychiatric diagnosis, controlling for sex (because this variable was associated with psychiatric disorders) entered as a covariate independent variable in the models. Multiple logistic regression models (PROC LOGISTIC in SAS) were used to predict dependent dichotomous variables such as psychiatric diagnosis or character and temperament configurations from independent variables including gender entered as a covariate independent variable in the models.

### 3. Results

The study sample ( $N = 151$ ) was 52% male and 91% Caucasian. The mean age was 43, average education was two and a half years of college, and 66% were married. The most prevalent postdisaster psychiatric disorder was bombing-related PTSD, found in 32%. The next most prevalent disorder was major depression, identified in 21%. Compared to men, women had a higher postdisaster prevalence of both bombing-related PTSD (43% versus 19%,  $\chi^2 = 9.67$ ,  $df = 1$ ,  $P = .002$ ) and major depression (33% versus 8%,  $\chi^2 = 13.2$ ,  $df = 1$ ,  $P < .001$ ). Controlling for sex as a covariate independent variable entered into a multiple regression model to predict PTSD and major depression (dependent variables) in separate models, neither diagnosis was significantly

associated with age, race, marital status, or education also entered simultaneously as independent variables in the model.

Postdisaster major depression was significantly more prevalent among those with (56%) than without (5%) bombing-related PTSD ( $\chi^2 = 51.79$ ,  $df = 1$ ,  $P < .001$ ), and 84% of those with postdisaster major depression compared to 5% of those without this disorder also had bombing-related PTSD ( $\chi^2 = 51.79$ ,  $df = 1$ ,  $P < .001$ ).

Predisaster major depression was present in 12% of the sample. Postdisaster major depression was significantly more prevalent ( $\chi^2 = 31.86$ ,  $df = 1$ ,  $P < .001$ ) among those with (72%) than without (14%) predisaster major depression. Overall, 13% of the sample had an incident major depressive episode (i.e., new cases of major depression after the disaster in people without a predisaster history of the disorder). Most postdisaster major depression (60%) represented incident cases. Significantly more survivors with bombing-related PTSD (33%) than those without (3%) had incident major depression ( $\chi^2 = 27.55$ ,  $df = 1$ ,  $P < .001$ ).

Comparisons of character and temperament dimension *t*-scores, controlling for sex, found two scales to be significantly associated with postdisaster major depression: the character dimensions of low self-directedness (mean = 52.6, SD = 9.3 versus mean = 54.9, SD = 6.5;  $\beta = 5.23$ , SE = 2.23,  $t = 2.35$ ,  $P = .020$ ) and low cooperativeness (mean = 49.1, SD = 14.7 versus mean = 55.6, SD = 9.5;  $\beta = 3.01$ , SE = 1.50,  $t = 2.01$ ,  $P = .046$ ). More of those with postdisaster major depression (50%) than those without (27%) had the combination of low cooperativeness and low self-directedness (controlling for sex differences in a multiple regression model,  $\beta = 1.13$ , SE = 0.44; OR = 3.08; 95% CL = 1.30, 7.29; Wald  $\chi^2 = 6.57$ ,  $P = .010$ ). Similarly, more of those with postdisaster major depression (34%) than those without (13%) had the disorganized (schizotypal) character configuration ( $\beta = 1.66$ , SE = 0.53; OR = 5.28; 95% CL = 1.86, 15.00; Wald  $\chi^2 = 9.74$ ,  $P = .002$ ). Postdisaster major depression was associated with no other character configurations and no temperament configurations. Incident major depression (i.e., postdisaster major depression among individuals without predisaster major depression) was not associated with the combination of low cooperativeness and low self-directedness (present in 32% of those with incident major depression and in 32% of those without; controlling for sex differences,  $P > .05$ ).

A multiple logistic regression model was constructed to predict the combination of low cooperativeness and low self-directedness (dependent variable) from several independent variables entered into the model simultaneously: sex, predisaster and postdisaster major depression, predisaster PTSD, and bombing-related PTSD (see Table 1). In this model, predisaster but not postdisaster major depression and bombing-related PTSD but not predisaster PTSD were independently associated with the combination of low cooperativeness and low self-directedness.

Multiple logistic regression models were constructed to examine the association of postdisaster major depression (dependent variable) with dimensions in character configurations by varying a single dimension (high versus low

TABLE 1: Multiple regression model predicting the combination of low cooperativeness and low self-directedness (dependent variable).

Parameter	df	Estimate	SE	Wald chi-square	<i>P</i>	Point estimate	95% Wald CL	
Intercept	1	-1.60	0.36	19.53	<.001			
Male sex	1	0.54	0.40	1.79	.181	1.72	0.78	3.78
Predisaster major depression	1	1.23	0.60	4.16	.041	3.42	1.05	11.11
Postdisaster major depression	1	1.00	0.58	0.00	1.00	1.00	0.32	3.12
Predisaster PTSD	1	0.10	0.53	0.04	.843	1.11	0.40	3.12
Bombing-related PTSD	1	1.14	0.48	5.78	.016	3.13	1.24	7.95

ranking) while holding the other two dimension rankings constant, controlling for sex differences. Among all the character and temperament configurations examined in these models, only one dimension was associated with postdisaster major depression when holding the other dimensions constant: major depression was associated low cooperativeness when self-directedness was low and self-transcendence was high ( $\beta = 1.96$ ,  $SE = 0.86$ ; Wald  $\chi^2 = 5.21$ ;  $OR = 7.11$ ; 95%  $CL = 1.32, 38.30$ ;  $P = .022$ ). Thus, in people with low self-directedness and high self-transcendence, a low level of cooperativeness is the element that associates major depression with the disorganized (scT) character configuration, in contrast to the moody (sCT) character configuration. In a similar logistic regression model substituting incident major depression for postdisaster major depression, this character configuration association with major depression was no longer apparent ( $P > .05$ ). No other dimensions in character configurations and no dimensions in temperament configurations were associated with postdisaster major depression in similar models.

#### 4. Discussion

Both bombing-related PTSD and postdisaster major depression were associated with the combination of low cooperativeness and low self-directedness characteristic of unhealthy personal functioning and indicative of personality disorders, particularly the disorganized (schizotypal) character configuration. For major depression, however, these relationships held only for predisaster major depression and were not apparent for incident major depression that developed after the disaster. In contrast, only bombing-related PTSD (not predisaster PTSD related to other traumatic events) was associated with the combination of low cooperativeness and low self-directedness. Thus, personality variables in TCI data, while generally associated with major depression and PTSD in this sample, were specifically associated with development of PTSD related to the bombing but not with development of new cases of major depression after the bombing. Major depression did not reflect the additional associations found between bombing-related PTSD and TCI findings of high self-transcendence, high harm avoidance, and explosive temperament configuration, which seem to be unique to PTSD in these disaster survivors.

In general clinical terms, low resilience to bombing-related PTSD was specifically related to a combination of

emotional intensity and instability (i.e., explosive temperament) and magical or superstitious thinking (i.e., high self-transcendence combined with low self-directedness), which results in people having little capacity for emotional self-regulation when stressed. In contrast, people with a downcast character configuration (i.e., low scores in self-transcendence and the other character dimensions) are predisposed to chronic or recurrent depression and anxiety but not PTSD.

Because PTSD is a robust marker of vulnerability to a specific life stressor (trauma), this study's findings strongly indicate that PTSD is particularly useful in validation of the features of psychological resilience in posttrauma situations. Major depression is often associated with PTSD, but its causal determinants are more complex and not specific for assessing resilience in response to specific life stressors. These observations are basic for differentiating the antecedents of well-being in general from those of resilience. Resilience is the ability to adapt and maintain well-being in the face of trauma, adversity, and significant life stressors [5, 6]. Instruments proposed to assess resilience, however, have often been validated using nonspecific measures of psychological well-being or distress with uncertain antecedents [11, 12, 32, 33].

It is well established that PTSD can be distinguished from general psychological distress by the diagnostic requirements of exposure to trauma and the presence of avoidance and numbing symptoms specific to the traumatic event [15, 16, 34–40]. The current analysis has further demonstrated that well-defined PTSD is a robust marker of low resilience. It is doubtful that major depression and the measures of nonspecific psychological distress which are common in the general community provide rigorous indicators of resilience.

Previous work by this research team has shown that rigorously defined PTSD is strongly predicted by specific configurations of temperament and character [18]. Resilience is highest in people with creative character (SCT, i.e., high in self-directedness, cooperativeness, and self-transcendence) who are more resistant to developing PTSD and lowest in disorganized character (scT, i.e., low in self-directedness and cooperativeness, and high in self-transcendence). The presence of high self-transcendence at both extremes of high and low resilience indicates the need to understand the development of well-being and resilience as complex adaptive systems, rather than relying on questionable assumptions about the additive effects of their components [9, 41, 42]. The features that predict a person's positive health may be partly the same and partly different from those that predict resilience

to general stress and adversity [6]. PTSD but not major depression should be considered an indicator of resilience to distinguish it clearly from nonspecific measures of mature coping and health.

This study's strengths include the high trauma exposure level of the sample, the random selection of the sample from a disaster registry, and systematic assessment of psychiatric disorders using a structured diagnostic interview in conjunction with TCI data. Findings from this highly-exposed disaster sample may not generalize to survivors of other disasters or to other types of trauma. Despite this study's 17% rate of missing TCI data among study participants, missing TCI data were not associated with any identifiable source of bias in variables related to these analyses. Further details on the potential limitations of this study are provided in a previous publication [18]. It is recognized that associations of TCI scores with postdisaster psychopathology might relate either to effects of preexisting personality characteristics or to changes in personality features following trauma.

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## Research Article

# Effect of Affective Temperaments Assessed by the TEMPS-A on the Relationship between Work-Related Stressors and Depressive Symptoms among Workers in Their Twenties to Forties in Japan

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Relatively recently in Japan, *immature-type depression*, frequently classified in the bipolar II spectrum, has increased among workers in their twenties to forties. This study explored whether affective temperaments moderate the relationship between work-related stressors and depressive symptoms among this age group. In July 2004, self-administered questionnaires were distributed to all employees of a Japanese company. Eight hundred seventy-four employees (63%) returned the questionnaires, with 728 completed. Questionnaires included the 12-item General Health Questionnaire for assessing depressive symptoms, the Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-Autoquestionnaire version for assessing affective temperaments, the Effort-Reward Imbalance Questionnaire to assess work-related stressors and overcommitment, and questions regarding individual attributes and employment characteristics. Multivariate logistic regression analysis showed that affective temperaments moderated the relationship between work-related stressors and depressive symptoms. Effort (OR = 1.078), which represents job demands and/or obligations imposed on employees, and the upper tertile of overcommitment (OR = 1.589), which represents hyperadaptation to the workplace, were risk factors for depressive symptoms. Additionally, the results for cyclothymic (OR = 11.404) and anxious temperaments (OR = 1.589) suggested that depressive symptoms among this age group may be related to immature-type depression.

## 1. Introduction

In Japan, the number of domestic patients who had mood disorders with diagnosis codes from F30 (manic episode) to F39 (unspecified mood disorder) in the *International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10)* [1] was 1,041,000 in 2008 [2]. This was 2.4 times higher than in 1996. Employers must pay particular attention to depression in employees because it has a negative impact on productivity [3, 4]. Major depression is a multifactorial disorder [5], and examining risk factors can help employers and managers take measures toward the prevention of depression among workers.

Previous studies revealed that particular temperaments and personality profiles are risk factors for affective disorders [6]. Other risk factors include sociodemographic characteristics (sex [7, 8], age [7, 9], level of education [8], and marital status [7]), genetic factors [5], stressful life events [5, 10], and previous history of major depression [5].

Typus melancholicus, a personality type originally hypothesized by Tellenbach [11], is widely accepted by psychiatrists as a premorbid personality of patients with unipolar depression in Japan and Germany [12–14]. Typus melancholicus is essentially characterized by obsessionality directed to the pursuit of identification with social norms and excessive consideration for people around the individual [11].

Previous studies have revealed that this type of personality may be specifically related to unipolar depression [15–17].

Additionally, *typus melancholicus* may be associated with Japanese type A behavior [18], which is known as a risk factor for coronary heart disease and defined as a set of “behavioral dispositions” such as ambitiousness, aggressiveness, competitiveness, and impatience [19]. In Japan, however, a new type of depression, *immature-type depression*, which is frequently classified as belonging to the bipolar spectrum as defined by Akiskal et al. [20] has increased since the 1990s [21–23].

Immature-type depression is commonly observed among adults in their twenties to forties, and the clinical picture involves dependency and aggression towards others (e.g., authority figures) derived from anxiety/agitation and irritation based on patients’ immature personality [21, 22]. Abe [23, 24] revealed that patients with immature-type depression do not show *typus melancholicus* but do exhibit a cyclothymic temperament as defined by Akiskal et al. [20] and experience work-related stressors that cause a sense of frustration that might trigger their immature-type depression [23, 24].

According to K. K. Akiskal and H. S. Akiskal [25], affective temperaments play a fundamental role in the predisposition towards affective disorders and affective psychoses, and temperamental dysregulation leads to stressors that can in turn precipitate the development of affective disorders [25]. Akiskal et al. [26, 27] developed the self-rated Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-Autoquestionnaire version (TEMPS-A), a self-assessment tool suitable for measuring affective temperaments. The TEMPS-A, which has increasingly been used to assess affective temperaments, is rooted in an evolutionary biological perspective [28] and has been validated by genetic studies among healthy populations [29–31].

Previous epidemiological studies have demonstrated that work-related stressors (e.g., low social support at work, low decision authority, high job demands, and effort-reward imbalance) are risk factors for future psychiatric disorders (e.g., depression) among workers [32–34]. Abe [23] noted that patients with *typus melancholicus* tend to show a curative effect of pharmacological treatment. However, patients with immature-type depression can relapse even during pharmacological treatment if they return to work without a protective work environment (e.g., positive human relationships) [23].

It is important to focus on workers in their twenties to forties in order to understand affective temperaments as a risk factor for depressive symptoms and immature-type depression. A few studies have examined the influence of temperament and work-related stressors on depressive symptoms in Japanese individuals [35, 36]. However, none have explored whether affective temperaments moderate the relationship between work-related stressors and depressive symptoms among workers. Therefore, the aim of this study is to examine whether affective temperaments assessed by the TEMPS-A moderate the relationship between work-related stressors and depressive symptoms among workers in their twenties to forties.

## 2. Materials and Methods

**2.1. Participants.** Potential participants were all regular employees at six branches of an IT service company providing computer technical support services in Japan. All employees were working in clerical, managerial, or computer technical support positions ( $N = 1382$ ), and most of them were early middle-aged workers who were in their twenties to forties. The male:female ratio was 6:4, and the average age was 32.0 years.

**2.2. Ethical Considerations and Data Collection.** Approval for this study was obtained from the Institutional Ethics Committee at the University of Tokyo (no. 688). Participants were informed in writing on the first page of the questionnaire about the nature of participation (e.g., “participation was voluntary,” and “there was no compensation for participation”) and were assured of confidentiality in the handling of data. Participants were not required to sign consent forms; returning the questionnaire implied consent.

Self-administered questionnaires were distributed to all employees ( $N = 1382$ ) through the company postal system in July 2004. Of these, 874 employees returned the enclosed questionnaires to the researchers. The response rate of this study (63%) was sufficient compared to response rates of 65% [37] and 49%–68% [35] in previous studies.

The data of 728 complete questionnaires from 297 (41%) males and 412 (59%) females were analyzed. Average ages were 32.74 (SD = 5.99) years and 31.35 (SD = 5.03) years for males and females, respectively. According to statistical data on all workers in the information and communication industry in 2011, published by the secretariat of the Ministry of Economy, Trade and Industry in Japan, the male:female ratio was 7:3, and the largest age group was from 25 to 34 years for both sexes [38]. Although the male participation rate was relatively low in this study, the age group distribution was representative of this industry in Japan.

### 2.3. Measures

**2.3.1. Depressive Symptoms.** To assess depressive symptoms, the Japanese version of the 12-item General Health Questionnaire (GHQ-12) [39] was used, which screens for symptoms of both minor and severe mental disorders [40, 41]. The GHQ-12 has demonstrated high validity, internal consistency, and reliability as well as high sensitivity and specificity in Japanese workers [42]. The participants were asked whether they had recently experienced particular symptoms or behavior related to depression or anxiety. In this study, the GHQ-12 items were scored using the GHQ method because the original scoring is the most valid in its ability to identify psychiatric cases [43]. Each item response category was coded 0-0-1-1. If the answer to an item regarding the presence of a specific depressive type of feeling/symptom represented disagreement (“totally disagree” and “disagree”), it was coded as 0. If the answer indicated agreement (“totally agree” and “agree”), it was coded as 1. The total GHQ-12 score ranges from 0 to 12 points. To identify clinical problems associated with depressive symptoms, binary data were used

calculated by a cutoff point of 3/4, where 0 indicated a total score of 3 points or less (meaning low risk of depressive symptoms), and 1 indicated a total score of 4 points or more (meaning high risk of depressive symptoms) [44, 45].

**2.3.2. Affective Temperaments.** Affective temperaments were assessed by the self-rated Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-Autoquestionnaire version (TEMPS-A) developed by Akiskal et al. [26, 27]. The TEMPS-A comprises 110 items measuring affective temperaments that define the bipolar spectrum, with depressive, cyclothymic, hyperthymic, irritable, and anxious subscales [26, 27].

The TEMPS-A subscales measure not only emotional, cognitive, psychomotor, and circadian traits that might predispose one to major mood disorders, but also positive characteristics that could play an adaptive role in an evolutionary context [26] (see Table 6).

The TEMPS-A has been translated into 25 languages and validated across many cultures, including among Japanese adults [37, 46, 47], and concurrent validity against the Temperament and Character Inventory has been shown [26]. Participants were asked if they had particular ideas or attitudes regarding temperament. For each answer, a “no” was scored as 1 and a “yes” as 2. These scores were added and divided by the number of related questions to represent each temperament score.

**2.3.3. Work-Related Stressors and Overcommitment.** To assess work-related stressors and overcommitment, the Japanese short version of the Effort-Reward Imbalance (ERI) Questionnaire developed by Siegrist was included [48, 49]. High internal consistency, discriminant validity, and factorial structure of the ERI questionnaire scale were confirmed for a range of working populations in five European countries ( $N = 18,943$ ) [49]. The Japanese short version of the questionnaire, which has been culturally adapted and translated, has high internal reliability and validity for the Japanese working population [50–52].

The ERI questionnaire consists of two scales for measuring extrinsic components and one scale for measuring an intrinsic overcommitment component. The extrinsic components measured are *effort* (6 Likert-scale items), which refers to the demanding conditions of the work environment that employees face; *reward*, (11 Likert-scale items with three subscales), which refers to the three transmitters considered to be sources of reward for employees (money, esteem, and career opportunities). The overcommitment scale (6 Likert-scale items), which is an intrinsic personal dimension of ways of coping with demanding situations and of eliciting extrinsic rewards, is the intrinsic overcommitment component in the ERI questionnaire [48, 50].

Items measuring the extrinsic components were quantified in two steps using Siegrist’s ERI scale and scoring method. First, participants agreed or disagreed with an item describing a typical work-related situation or experience. For effort items (e.g., “I have constant time pressure due to a heavy workload”), “no” (participants disagreed with the

work-related situation or experience) answers were scored as 1. Participants who answered “yes” (participants agreed) were also asked to rate their degree of experienced distress on a scale from 2 (I am not at all distressed) to 5 (I am very distressed). Potential scores for effort ranged from 6 to 24, with higher total scores indicating greater participant effort.

For items related to reward (e.g., “My job promotion prospects are poor”), “no” (participants disagreed that their situation involved a lack of reward) answers were scored as 5. Participants who answered “yes” (participants agreed) were also asked to rate their degree of distress on a scale from 4 (I am not at all distressed) to 1 (I am very distressed). Potential scores for reward ranged from 11 to 44. The lower the total score, the more the participant was feeling stressed about rewards.

To assess the intrinsic overcommitment component, participants were asked to state their degree of agreement with six declarative statements (e.g., “I usually take criticism very seriously”) on a 4-point scale ranging from 1 (strongly disagree) to 4 (strongly agree). The theoretical range for the overcommitment scale is 4–24, with higher values indicating that participants are easily overwhelmed by time pressure at work or have problems relaxing and disconnecting from work during time off. The total score with upper tertiles was dichotomized in accordance with the Japanese version of the ERI questionnaire [52]. In the analysis, binary data were used: a value of 1 indicated the presence of overcommitment, whereas a value of 0 indicated a favorable condition (no overcommitment) in the participants.

Additionally, data on individual attributes (sex, age, marital status, and educational level) and employment characteristics (type of job, shift work, mean working hours per day, and frequency of working on days off per month) were collected.

**2.4. Data Analyses.** Descriptive statistics and Cronbach’s alpha coefficients for independent variables (e.g., ERI, overcommitment, and TEMPS-A) and the GHQ-12, the dependent variable, were calculated. As a preliminary analysis, the coefficient of association between each independent variable and the dependent variable was calculated (Phi coefficient or Cramer’s measure of association) to compare high-risk and low-risk groups of depressive symptoms. Additionally, Spearman’s correlation coefficients between the GHQ-12 and independent variables were calculated. Finally, to provide tangible data relating to factors associated with depressive symptoms, a multivariate logistic regression analysis for the GHQ-12 was performed.

In model 1, the subscales of the Japanese version of the ERI questionnaire (effort, reward, and overcommitment) were added to the equation as well as the independent variables that showed a significant relationship with the GHQ-12 in the preliminary analysis. Considering an interaction effect over the sum of the separate effects of effort and reward, data for the interaction of effort and reward were added to the equation. To examine the effect of temperament on the GHQ-12, in model 2, the five temperament variables (from the TEMPS-A) were entered into the equation. In both

models, the odds ratios (ORs) and 95% confidence intervals (CIs) for the independent variables that were significantly associated with the GHQ-12 in the preliminary analysis were also calculated. The statistics package used was SPSS 15.0J (SPSS Japan Inc., Tokyo, Japan).

### 3. Results

Among the participants, 327 (45%) had a university or higher degree. One hundred twenty-four participants (17%) were working more than 10 hours per day, and 147 (20%) were working on days off more than one day per month, on average (see Table 1).

Table 2 presents descriptive statistics and Cronbach's alpha coefficients for the dependent and independent variables. Cronbach's alpha coefficients for effort, reward, and overcommitment were 0.80–0.9. Coefficients for the five temperaments ranged from 0.69 to 0.89.

Table 3 presents the coefficients of association between each independent variable and the GHQ-12 (e.g., high-risk group and low-risk group). There were significant associations between the GHQ-12 and average working hours per day and frequency of working on days off per month.

Table 4 presents Spearman's correlation coefficients for each independent variable and the total GHQ-12 scores. All independent variables were significantly associated with the dependent variable. The highest correlation with the GHQ-12 was the cyclothymic temperament ( $r = 0.293$ ), and the second highest was the anxious temperament ( $r = 0.282$ ).

Table 5 presents the results of the multiple logistic regression analysis for the GHQ-12. In model 1, a high risk of depressive symptoms (GHQ-12 score of 4 points or more) was significantly associated with the following variables: female sex (OR = 1.461, 95% CI 1.022–2.089), age (OR = 0.964, 95% CI 0.936–0.994), effort (OR = 1.085, 95% CI 1.032–1.140), and upper tertile of overcommitment (OR = 2.113, 95% CI 1.409–3.169). In model 2, a high risk of depressive symptoms was significantly associated with the following variables: effort (OR = 1.078, 95% CI 1.023–1.135), upper tertile of overcommitment (OR = 1.589, 95% CI 1.015–2.485), the cyclothymic temperament (OR = 11.404, 95% CI 2.996–43.409), and the anxious temperament (OR = 1.589, 95% CI 1.015–2.485).

### 4. Discussion

*4.1. Affective Temperaments as a Predictor of Depressive Symptoms among Workers in Their Twenties to Forties.* Findings revealed that affective temperaments moderated the relationship between work-related stressors and depressive symptoms among workers in their twenties to forties. Additionally, the cyclothymic and anxious temperaments were high-risk factors for depressive symptoms after adjustment for sociodemographic variables and employment characteristics. This is a remarkable result, clarifying that temperament exerts a more important influence on depressive symptoms of workers in their twenties to forties than work-related

TABLE 1: Sociodemographic characteristics of the sample ( $N = 728$ ).

Variables	N	%
(1) Sex		
Male	297	41
Female	431	59
(2) Mean age $\pm$ SD		
Male	32.74 ( $\pm$ 5.99)	
Female	31.35 ( $\pm$ 5.03)	
(3) Marital status		
Single	222	30
Married	506	70
(4) Education		
Junior college or vocational school equivalency degree	401	55
College graduate or higher	327	45
(5) Type of job		
Clerical post	81	11
Computer technical support	636	87
Managerial post	11	2
(6) Shift work		
Without	252	35
With	476	65
(7) Mean working hours per day		
Less than seven or fewer hours per day	59	8
Eight hours per day	384	53
Nine hours per day	161	22
Ten hours per day	94	13
More than eleven hours per day	30	4
(8) Frequency of working on days off		
Non	581	80
More than one day on a monthly basis	147	20

predictors such as effort and the upper tertile of overcommitment.

A previous study examining the influence of affective temperaments assessed by the TEMPS-A and work-related stressors on employee depression in the information and communication industry revealed that predictors of depression were different between male and female workers [36]. However, sex was not a risk factor in the present findings. Among independent variables, the correlation between GHQ-12 and the cyclothymic temperament had the highest coefficient followed by the anxious temperament. This is in agreement with the findings of a previous study of undergraduate students aged 18–30 [53]. Cyclothymic and anxious temperaments may be common premorbid risk factors for depression among healthy young people (e.g., undergraduate students and workers in their twenties to forties).

Additionally, this study's findings suggest that participants at high risk for depressive symptoms may have been

TABLE 2: Descriptive statistics and Cronbach's alpha coefficients of dependent and independent variables (*N* = 728).

Variables	Mean	SD	Items	Range	The Cronbach's alpha
GHQ-12 <sup>(1)</sup>	29.77	5.56	12	17–48	0.84
GHQ-12 <sup>(2)</sup>	4.66	2.20	12	0–11	0.48
Effort <sup>(3)</sup>	13.69	4.74	6	6–30	0.87
Rewards <sup>(3)</sup>	39.92	8.29	11	11–55	0.91
Overcommitment <sup>(3)</sup>	13.60	3.48	6	6–24	0.80
Depressive <sup>(4)</sup>	1.42	0.17	21	1.00–1.86	0.69
Cyclothymic <sup>(4)</sup>	1.30	0.22	21	1.00–2.00	0.85
Hyperthymic <sup>(4)</sup>	1.27	0.18	21	1.00–1.86	0.78
Irritable <sup>(4)</sup>	1.18	0.18	21	1.00–1.86	0.85
Anxious <sup>(4)</sup>	1.24	0.21	26	1.00–1.96	0.89

<sup>(1)</sup> Scored using the Likert method (1-2-3-4).

<sup>(2)</sup> Scored using the GHQ method (0-0-1-1).

<sup>(3)</sup> Subscales of the Japanese short version of Effort-Reward Imbalance scale.

<sup>(4)</sup> Affective temperaments assessed by the TEMPS-A.

TABLE 3: Results of coefficient of association between each control variables and GHQ-12 (*N* = 728).

Variables			GHQ-12 <sup>(1)</sup>	<i>P</i> value
	Low risk ( <i>n</i> = 93)	High risk ( <i>n</i> = 537)	Coefficient of association <sup>(2)</sup>	
(1) Sex				
Female	81	216	−0.051	0.170
Male	138	293		
(2) Marital status				
Single	75	147	0.053	0.149
Married	144	362		
(3) Education				
Junior college or vocational school equivalency degree	121	280	0.002	0.952
University graduate or higher	98	229		
(4) Type of job				
Clerical post	27	54	0.061 <sup>(3)</sup>	0.258
Computer technical support	191	445		
Managerial post	1	10		
(5) Shift work				
Shift work with night shifts	79	173	0.020	0.588
Without night shifts	140	336		
(6) Average working hours per day				
Nine hours or less	190	414	0.066	0.074
Ten hours or more	29	95		
(7) Frequency of working on days off per month				
None	188	393	7.084	0.008
More than one day per month	31	116		

<sup>(1)</sup> High risk is those who scored 4 or more when the cut-off point of the GHQ-12 was 3/4. Low risk is those who scored 3 or less.

<sup>(2)</sup> Phi coefficient.

<sup>(3)</sup> Cramer's measure of association.

those with immature-type depression, in which cyclothymia is the premorbid personality [23]. Japanese researchers have found that patients with immature-type depression are more commonly confirmed among workers in their twenties to forties, are in the bipolar II category [23], and tend to show the cyclothymic temperament [23, 54, 55]. Cyclothymia is the core feature of the bipolar mood disorder spectrum [20].

In previous studies, the cyclothymic temperament assessed by the TEMPS-A showed a significant association with the allele of 5-HTTLPR [29, 30], which has been associated with affective disorders [56] and subthreshold forms of depression [57].

Furthermore, a previous study reported that the anxious temperament assessed by the TEMPS-A is highly correlated

TABLE 4: Correlation coefficients of independent and dependent variables (n=728)<sup>(1)</sup>.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) GHQ-12 <sup>(2)</sup>	1									
(2) Effort	0.239***									
(3) Rewards	-0.180***	-0.518***								
(4) Overcommitment	0.272***	0.467***	-0.384***							
(5) Upper tertile of overcommitment <sup>(3)</sup>	0.242***	0.428***	-0.341***	0.846***						
(6) <i>Depressive</i> <sup>(4)</sup>	0.202***	0.233***	-0.276***	0.438***	0.408***					
(7) <i>Cyclothymic</i> <sup>(4)</sup>	0.293***	0.210***	-0.169***	0.328***	0.295***	0.501***				
(8) <i>Hyperthymic</i> <sup>(4)</sup>	0.101**	0.049 n.s.	-0.007 n.s.	-0.061 n.s.	-0.032 n.s.	-0.111**	0.226***			
(9) <i>Irritable</i> <sup>(4)</sup>	0.204***	0.225***	-0.213***	0.334***	0.305***	0.421***	0.686***	0.206***		
(10) <i>Anxious</i> <sup>(4)</sup>	0.282***	0.287***	-0.246***	0.531***	0.459***	0.582***	0.622***	0.020 n.s.	0.640***	1

<sup>(1)</sup> Spearman correlation coefficient. Symbols indicate level of significance: \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

<sup>(2)</sup> 1 = when the cut-off point of the GHQ-12 was 3/4, those who scored 4 or more; 0 = those who scored 3 or less.

<sup>(3)</sup> 1 = those who are scored in the upper 30th percentile; 0 = others.

<sup>(4)</sup> Affective temperaments assessed by the TEMPS-A.

TABLE 5: Multivariate logistic regression model for the GHQ-12 ( $N = 728$ ).

Variables	Model 1 <sup>(1,2)</sup>			Model 2 <sup>(1,3)</sup>		
	OR	95% CI	$P$ value	OR	95% CI	$P$ value
Sex (reference category = female)	1.461	1.022–2.089	0.037	1.366	0.943–1.979	0.099
Age	0.964	0.936–0.994	0.019	0.977	0.947–1.009	0.157
Frequency of working on days off per month (reference category = one day or more)	1.551	0.965–2.492	0.070	1.372	0.837–2.249	0.210
Average working hours per day (reference category = 10 hours or more)	0.796	0.466–1.359	0.403	0.795	0.456–1.385	0.418
Effort	1.085	1.032–1.140	0.001	1.078	1.023–1.135	0.005
Rewards	0.975	0.949–1.001	0.056	0.978	0.951–1.006	0.116
Effort*Rewards	1.004	0.999–1.009	0.087	1.004	0.999–1.009	0.140
Upper tertile of overcommitment (reference category = present)	2.113	1.409–3.169	<0.001	1.589	1.015–2.485	0.043
<i>Depressive</i> <sup>(4)</sup>				0.624	0.164–2.368	0.488
<i>Cyclothymic</i> <sup>(4)</sup>				11.404	2.996–43.409	<0.001
<i>Hyperthymic</i> <sup>(4)</sup>				2.605	0.887–7.647	0.081
<i>Irritable</i> <sup>(4)</sup>				0.337	0.067–1.701	0.188
<i>Anxious</i> <sup>(4)</sup>				6.409	1.484–27.684	0.013

<sup>(1)</sup> OR: odds ratio; CI: confidence interval.

<sup>(2)</sup> Model 1: Hosmer-Lemeshow goodness of fit  $\chi^2 = 3.484$ ,  $df = 8$ ,  $P = 0.900$ .

<sup>(3)</sup> Model 2: Hosmer-Lemeshow goodness of fit  $\chi^2 = 6.072$ ,  $df = 8$ ,  $P = 0.639$ .

<sup>(4)</sup> Affective temperaments assessed by the TEMPS-A.

( $r = 0.759$ ) with neuroticism assessed by the Neuroticism, Extraversion, Openness, Five-Factor Inventory (NEO-FFI) [58]. The present finding that the anxious temperament was a high-risk factor for depressive symptoms supports that of a previous study of white-collar workers in Japan [35]. That study examined predictors of first onset of major depressive episodes, including work-related stress and temperaments assessed by the NEO-FFI. It revealed that neuroticism and overprotection were associated with the primary onset of depression among workers [35].

Psychosocial factors can protract immature-type depression. Thus, an understanding of the sociocultural background of patients with this type of depression is important

from the viewpoint of treatment [21]. Abe noted that in modern Japanese society following the postwar period of high economic growth, children have been raised with a lack of paternal authority and conformity to social norms compared to those raised a few generations ago in traditional communities in Japan. As a result, children tend to be narcissistic and dependent with a strong maternal attachment [21].

Patients with immature-type depression tend to overestimate their working ability and are not norm oriented. The clinical picture indicates dependency and aggression towards others derived from anxiety/agitation and irritation based on their immature personality. Thus, these patients can become depressed following trivial events at the workplace [21–24].

TABLE 6: Characteristics of each temperament.

Temperament	Characteristics of each temperament
Depressive temperament	Skeptical, hypercritical or complaining, conscientious or self-disciplining, self-critical, self-reproaching or self-derogatory, gloomy, pessimistic, humourless or incapable of fun, preoccupied with inadequacy, failure and negative events to the point of morbid enjoyment of one's failures, and brooding and given to worry.
Cyclothymic temperament	Introverted self-absorption alternating with uninhibited people seeking, marked unevenness in quantity and quality of productivity-associated unusual working hours, shaky self-esteem alternating low self-confidence and overconfidence, biphasic dysregulation characterized by abrupt endoreactive shifts from one phase to the other, each phase lasting for few days at a time, with infrequent euthymia, unexplained tearfulness alternating with excessive punning and jocularity, decreased verbal output alternating with talkativeness, mental confusion alternating with sharpened and creative thinking, and hypersomnia alternating with decreased need for sleep.
Hyperthymic temperament	Cheerful, overoptimistic or exuberant, vigorous, full of plans, improvident, carried away by restless impulses, overtalkative, warm, people-seeking or extroverted, uninhibited, stimulus-seeking or promiscuous, naïve, overconfident, self-assured, boastful, bombastic or grandiose, overinvolved, and meddlesome.
Irritable temperament	Habitually moody irritable and choleric with infrequent euthymia, impulsive, obtrusiveness, tendency to brood, dysphoric restlessness, indeterminate early onset, and ill-humored joking.
Anxious temperament	Worry, vigilance, tension, oversensitive, restless sleep, and gastrointestinal symptoms.

The characteristics of each TEMPS-A temperament adapted from previous studies [25–27].

They can recover from depression if they reenter protective work environments, but if they do not, repeated depressive phases will likely occur [23].

To prevent immature-type depression in high-risk individuals showing the cyclothymic temperament, it is important to understand their immaturity and help them become more independent in relationships, thus improving work adjustment [21, 23]. As a basic remedy for immature-type depression, detecting the affective temperaments of workers who are at high risk for depressive symptoms through screening and providing supportive psychotherapy from mental health professionals related to work adjustment can be effective in conjunction with pharmaceutical therapy [23].

*4.2. Work-Related Predictors of Depressive Symptoms among Workers in Their Twenties to Forties.* In this study, although its odds ratio was lower than for affective temperaments, effort predicted depressive symptoms among workers in their twenties to forties after adjusting for sociodemographic and employment characteristics. In agreement with this finding, two previous studies revealed that high effort, representing job demands and/or obligations imposed on employees [48, 59], was a risk factor for depression in workers assessed by the GHQ [33, 60]. Additionally, psychological job demand was a significant predictor of subsequent depressive symptoms [61, 62]. Together, these study findings suggest that the assessment of quantitative and qualitative workload to prevent the occurrence of depression among workers in their twenties to forties is important, regardless of the workers' temperaments.

In this study, the upper tertile of overcommitment was an independent, high-risk factor for depressive symptoms among participants, consistent with a previous review of 45 studies [59]. That review study revealed that employees characterized by high overcommitment were 1.92–5.92 times

more likely to suffer from various psychosomatic symptoms (e.g., depression) than less overcommitted employees. In addition, findings showed that overcommitment can have a direct effect on adverse health outcomes of employees [59].

Overcommitment results from excessive effort and perceptual distortion (in particular, an underestimation of challenges and overestimation of coping resources) are based on type A behavior [18, 59] that may be triggered by an underlying motivation to experience recurrent esteem and approval [48, 63]. Fukunishi et al. (1992) posited that *typus melancholicus* may be involved in Japanese type A behavior [18], defined as a set of “behavioral dispositions such as ambitiousness, aggressiveness, competitiveness, impatience, and emotional responses (e.g., irritability) [19].

*Typus melancholicus* embodies the very high demands of one's work ethic (e.g., concern with orderliness, conscientiousness, exaggerated sense of order, and elevated demand above one's average abilities) [11, 64]. Additionally, Sakai et al. [37] revealed that *typus melancholicus* is significantly correlated with job stress (e.g., change in work, quantitative workload, and role ambiguity) as well as affective temperaments assessed by the TEMPS-A, and that it manifests in workers as hyperadaptation to the workplace.

Although this study did not examine its effect, *typus melancholicus* might have influenced the results regarding overcommitment, via the mechanism of hyperadaptation to the workplace. Further studies are needed to examine the influence of *typus melancholicus*, affective temperaments assessed by the TEMPS-A, and overcommitment on depressive symptoms among workers in their twenties to forties. Given the current findings, it is suggested that preventive interventions (e.g., cognitive-behavioral therapy) may assist workers in adopting more constructive coping patterns when exposed to stressful work circumstances as well as help them reflect on the ideas and assumptions that drive overcommitment [63].

**4.3. Study Limitations and Directions for Future Research.** This study has some limitations. First, problems unique to workers in a company in the information and communication industry, of whom 87% were computer technical support staff, may be reflected in the results. Additionally, the findings might have been different in a clinical Japanese sample or a cohort of healthy employees from a different cultural background. Second, the present findings are based on data from 2004 and thus should be interpreted with caution. However, this study reveals new insights into Japanese workers in the age group most vulnerable to immature-type depression that other studies have not provided. Third, different methods of measuring temperament, personality traits, and work-related stressors may have influenced the results, perhaps causing the inconsistencies between this study and those conducted previously [35, 36]. In the future, it would be beneficial to conduct a cohort study in other occupational groups in different countries that examines affective temperaments measured by the TEMPS-A associated with work-related stressors and depressive symptoms among workers in their twenties to forties.

## 5. Conclusions

This research explored whether affective temperaments moderate the relationship between work-related stressors and depressive symptoms. It targeted workers in their twenties to forties, a group in which immature-type depression is commonly observed in Japan. Findings revealed that affective temperaments (cyclothymic and anxious) were high-risk factors for depressive symptoms. Additionally, high effort, which represents job demands and/or obligations imposed on the employees, and overcommitment or hyperadaptation to the workplace were also risk factors for depressive symptoms. These findings suggest that depressive symptoms among this age group may be indicative of immature-type depression, in which cyclothymia is the premorbid personality and classified in the bipolar II spectrum. For the prevention of immature-type depression in high-risk individuals showing the cyclothymic temperament, it is important to understand their immaturity and help them become more independent, especially in regard to human relations, thus contributing to better work adjustment.

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## Research Article

# Effects of Temperament and Character Profiles on State and Trait Depression and Anxiety: A Prospective Study of a Japanese Youth Population

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**Objective.** To examine the effects of temperament and character profiles on state and trait depression and anxiety in a Japanese youth population. **Method.** Japanese university students were solicited for participation in a two-wave study, with assessments performed at Time 1 (T1) and Time 2 (T2), separated by a five-month interval. A total of 184 students completed the Japanese version of the temperament and character inventory (TCI) at T1 and the Hospital Anxiety and Depression Scale (HADS) at T1 and T2. We posited two latent variables, trait depression and anxiety, composed of the T1 and T2 HADS depression and anxiety scores, respectively. We also posited that temperament domain traits would predict character domain traits, and that all the personality traits would be linked to trait depression and anxiety and also predict T2 depression and anxiety. **Results.** Structural regression modeling showed that (1) only high Novelty Seeking predicted T2 Anxiety score, (2) trait depression and anxiety were linked to high harm avoidance and low self-directedness, and (3) trait depression was linked to high self-transcendence whereas trait anxiety was linked to low reward dependence, persistence, and cooperativeness. **Conclusion.** The characteristic associations between TCI subscales and depression and anxiety were limited to the trait rather than state aspects of depression and anxiety.

## 1. Introduction

**1.1. Depression and Temperament and Character Domains.** Since the introduction of the seven-factor model of personality [1] and the temperament and character inventory (TCI) [2], many investigations have examined the links between temperament and character traits of depression and anxiety. Most of these have demonstrated that individuals with depression score higher in harm avoidance (HA) and lower in self-directedness (SD) than those without depression. However, the majority of these reports used a cross-sectional research design [3–17]. Such studies are not free from

state effects of depression on the self-report of the TCI. Several studies followed patients with depression before and after they achieved remission. Various investigations have reported increased postremission SD [18, 19], reduced HA [20], or both [21–24]. While in remission, however, patients with depression still showed higher HA [19, 20, 22, 25], lower SD [26, 27], or both [23, 24, 28–30] as compared with normal controls.

Changes in HA and SD scores before and after remission suggest that these TCI subscale scores can be influenced by the mood of the subject when filling in the questionnaire. However, significant differences in TCI scores between

patients with depression and normal controls, even during remission, indicate that depression severity may consist of two components: one derived from the state-dependent effects of depression and the other from the effects of the intrinsic association between personality traits and depression.

This issue may be further clarified by longitudinal studies. Such studies can predict the onset of depression or depression severity at later stages of followup by using baseline TCI subscale scores after controlling for baseline depression severity. This may rule out the state dependency effects of TCI scores on current depression severity. For example, Naito, Kijima, and Kitamura [31] studied university students on two occasions with a three-month interval. They found that after controlling for T1 depression severity, depression at Time 2 could be explained by low SD scores at Time 1 but not by high HA scores. In a 12-month follow-up study, Cloninger, Svrakic, and Przybeck [32] found that high HA and low SD at Time 1 explained 44% of the variance in the change in depression between Time 1 and Time 2. Farmer and Seeley [33] conducted a four-year follow-up study of more than 500 community residents. They divided participants into those with depression and those without based on the cutoff point defined by the Center for Epidemiologic Studies Depression Scale. They found that participants with depression severity that was low at Time 1 but high at Time 2 scored lower in SD as well as reward dependence (RD), and cooperativeness (C) than those with low depression severity at both Times 1 and 2. Recently, Josefsson et al. [34] followed community residents for 10 years. They found that high HA scores at Time 1 predicted depression severity at Time 2. The literature thus suggests that depression severity may be associated with low SD and high HA.

### 1.2. Anxiety and the Temperament and Character Domains.

Anxiety disorders have also been studied in terms of their relationship with TCI personality traits. People with panic disorder score high in HA and low in SD [35, 36]. Individuals with obsessive compulsive disorder are characterised by high HA [37–39], low SD [40], or both [12, 41–43], as well as, in a few studies, low NS [12, 41], low RD [43], or low C [12, 41–43]. Phobic disorders are also characterised by the combination of high HA and low SD [40, 44] in addition to low C and ST [45]. Specific phobias have been linked to high HA [40]. The combination of high HA and low SD is seen in people with posttraumatic stress disorder [46]. Anxiety symptoms in general have been linked to low SD [16] and high HA [10, 47].

**1.3. Methodological Considerations.** Although the abovementioned longitudinal studies elegantly controlled for the state dependency of TCI scores on depression severity by means of multiple regression analysis, they may not be free from flaws. Firstly, in such regression analyses, depression severity at Time 2 is primarily explained by that at Time 1, and only the remaining variance of the severity at Time 2 is explained by TCI scores. Hence, the portion of the covariance between

depression and personality traits at Time 1 that is related to their intrinsic association may be treated as a part of state-dependent effects, resulting in possible underestimation of the real predictive power of personality traits on later depression severity.

Second, these analyses are based on the assumption that depression severity is purely a “state” measure. There have been arguments that depression, like anxiety, may consist of trait and surplus components. The trait component is a temporally stable component reflecting enduring characteristics of individuals. The surplus component, on the other hand, is a variable one that reflects the current mood state. The state we observe is thus an amalgamation of these two components. Ritterband and Spielberger [48, 49] claimed that, like anxiety, depression is dividable into trait and surplus (which they termed “state”) components. Using the state depression and trait depression subscales of the Self-Analysis Questionnaire, Endler et al. [50] reported that the Beck Depression Inventory, a self-report measure of depression, was correlated more strongly with Trait-Depression subscale scores than state depression subscale scores. Nevertheless, the State-Trait Depression Scale [51] simply asks about participants’ current (i.e., state) as well as usual (i.e., trait) mind condition. Hence the two may influence each other. We thought that it would be difficult for research participants to disentangle trait and surplus elements of their mood. Rather, we considered that the mood experienced by an individual at a given point in time could be statistically divided into the enduring trait component and the temporally changeable surplus component. This could be achieved by means of structural equation modeling (SEM), discussed later.

Third, multiple regression analyses assume that all the variables are free of errors. This is an implausible assumption. Errors may blur what should otherwise be clearly observed. Thus, the addition of error variables in SEM may be a way to reduce such bias.

Fourth, past investigations have generally measured only depression. However, the oft-reported association between depression and anxiety suggests that caution is required when interpreting results concerning the association between depression and TCI subscale scores, because it may be confounded by anxiety scores.

Finally, many previous studies simultaneously entered TCI temperament and character subscale scores into the regression equation. However, a basic assumption of the psychobiology model of Cloninger, Svrakic, and Przybeck [1] is that temperament provides the basis for character development. Among Japanese populations [31, 52], for example, low HA is associated with high SD and C; high RD is associated with high C; high novelty seeking (NS) is associated with high self-transcendence (ST). Hence, the effects of a temperament trait such as high HA on depression may be either direct or mediated by a character trait such as reduced SD [53].

**1.4. The Present Study.** Taking into account these criticisms of longitudinal studies regarding the prediction of depression

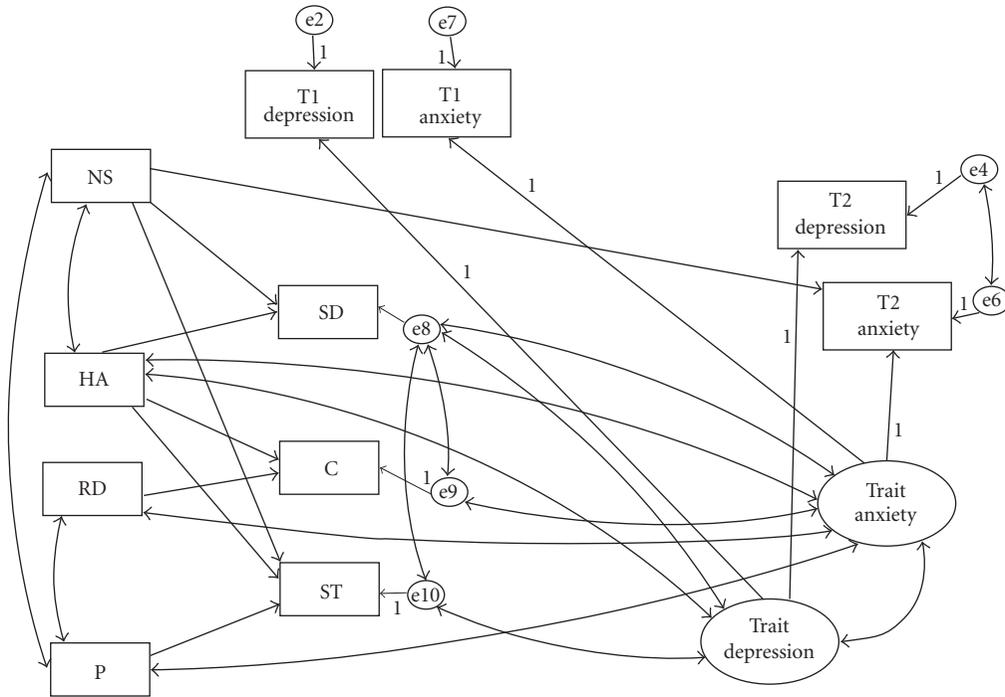


FIGURE 1: Structural regression path of the T1 HADS and T2 HADS dimensions and the TCI subscales. NS: novelty seeking; Ham: harm avoidance; RD: reward dependence; P: persistence; SD: self-directedness; C: co-operativeness; ST: self-transcendence.

from baseline TCI scores, we conducted a study in which university students were twice administered questionnaires containing both depression and anxiety measures, separated by a five-month interval.

In a structural equation model, we created latent variables comprised of trait components of both depression and anxiety (Figure 1). Observed (i.e., state) depression and anxiety scores consist of two components. One is the trait component, which is stable over the course of the investigation. The other is the surplus component, reflecting temporary ups and downs in mood. This component is unstable and is possibly responsive to the environment immediately before the assessment. We posited correlations between the trait depression and anxiety scores and the TCI subscale scores. This is because there are two alternative possibilities: mood effects on the self-report of the TCI and a real association between mood and personality. Then we posited that the three character subscale scores—SD, C, and ST—would be predicted by the four temperament subscale scores. This reflected the assumption that character develops based on temperament. Finally, we hypothesized that all seven TCI subscale scores would predict the states of depression and anxiety at Time 2.

## 2. Methods

**2.1. Participants.** University students in Kumamoto, Japan were solicited for participation in a two-wave study. Questionnaires were distributed to new students in May after they enrolled in college (T1) and again five months later

(T2). At Time 1, 525 questionnaires were distributed out of which 240 (46%) usable questionnaires were returned. Of these students, 184 (77%) students responded at Time 2. The data of these 184 students were used for subsequent analyses. There were no differences between the students who responded at two occasions ( $N = 184$ ) and who responded only at Time 1 ( $N = 56$ ) in terms of age, gender, and the Hospital Anxiety and Depression Scale, and TCI subscale scores at Time 1 except for harm avoidance being slightly higher among those students who responded at the two measurement occasions. The 184 students' age ranged from 18 to 30 years old. These included 61 men and 123 women. The mean age (standard deviation) was 18.7 (1.0), with no difference observed between men and women.

## 2.2. Measurements

**2.2.1. Temperament and Character Dimensions.** The TCI [1] was translated into Japanese [52] with the permission of Professor Cloninger. The Japanese items were retranslated back into English by an individual who was unaware of the original English in order for the original author to verify the wording. The TCI and its predecessor, the Tridimensional Personality Questionnaire, have been widely used both in Japanese patient and nonpatient populations [54, 55]. The TCI measures four temperament dimensions—NS, HA, RD, and Persistence (P)—and three character dimensions—SD, C, and ST. There are studies on the internal consistencies and factor structures of the Japanese versions [52, 56, 57]. These items were examined at T1.

TABLE 1: Correlations between variables used in the path analysis ( $N = 184$ ).

	1	2	3	4	5	6	7	8	9	10	11	12	13
(1) Gender (male—1; female—2)	—												
(2) Age	-0.09	—											
(3) NS	-0.08	0.03	—										
(4) HA	0.06	-0.02	-0.19*	—									
(5) RD	0.38**	0.07	0.14	0.08	—								
(6) P	0.09	0.00	-0.19*	-0.05	0.15*	—							
(7) SD	-0.02	-0.06	-0.25**	-0.36**	0.02	0.09	—						
(8) C	0.36**	0.07	0.01	0.07	0.57**	0.13	0.24**	—					
(9) ST	0.09	-0.07	0.20**	-0.23**	0.09	0.15*	-0.14	0.13	—				
(10) T1 HADS-D	0.07	0.03	0.10	0.35**	-0.08	-0.05	-0.54**	-0.18*	0.13	—			
(11) T1 HADS-A	-0.07	0.01	-0.01	0.24**	-0.30**	-0.15*	-0.43**	-0.40**	0.01	0.53**	—		
(12) T2 HADS-D	0.02	0.05	0.11	0.24**	-0.11	0.06	-0.43**	-0.16*	0.15*	0.56**	0.34**	—	
(13) T2 HADS-A	-0.10	-0.01	0.10	0.28**	-0.28**	-0.11	-0.43**	-0.32**	0.03	0.48**	0.56**	0.61**	—
Mean	1.67	18.3	26.3	34.9	31.6	16.6	39.0	50.5	17.1	5.4	4.3	5.5	4.6
Standard deviation	0.47	0.9	6.5	7.4	6.0	3.7	8.1	7.8	6.4	3.6	2.8	3.7	3.2
Cronbach alpha	—	—	0.72	0.78	0.72	0.62	0.78	0.82	0.80	0.78	0.61	0.76	0.69

NS: novelty seeking; HA: harm avoidance; RD: reward dependence; P: persistence; SD: self-directedness; C: cooperativeness; ST: self-transcendence. \* $P < 0.05$ ; \*\* $P < 0.01$ .

**2.2.2. Depression and Anxiety.** The Hospital Anxiety and Depression Scale (HADS [58]) is a self-report instrument designed to measure negative mood. The HADS consists of 14 items; the anxiety (HADS-A) and depression (HADS-D) subscales each include seven items. The psychometric properties of the Japanese version of the HADS [59] have been reported [60]. The HADS was included in the T1 and T2 surveys.

**2.3. Statistical Analysis.** We calculated the mean and standard deviation of each variable used in this study and examined the correlations between each pair of variables. We then constructed a path model using SEM based on our research hypotheses (Figure 1). We posited that (1) trait depression, a latent variable, would be composed of the T1 and T2 HADS-D; (2) trait anxiety, another latent variable, would be composed of the T1 and T2 HADS-A; (3) all the temperament subscales would be associated with all the character subscales; (4) all the TCI subscales would predict T2 depression and anxiety; (5) trait depression and anxiety would be associated with all the TCI subscales (or their error variables); (6) all the TCI subscales would be associated with T2 Depression and Anxiety; (7) trait depression and trait anxiety would be correlated with each other (Figure 1).

Covariances were added according to greater modification indices if such additions fit clinical and research assumptions. The fit of the model with the data was examined in terms of chi-squared (CMIN), 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  $< 2$ , CFI  $> 0.97$ , and RMSEA  $< 0.05$ , and an acceptable fit by CMIN/df  $< 3$ , CFI  $> 0.95$ , and RMSEA  $< 0.08$  [61]. All statistical analyses were conducted using the Statistical Package for Social Science (SPSS) version 19.0 and Amos 19.0.

**2.4. Ethical Considerations.** This project was approved by the Ethical Committee of Kumamoto University Graduate School of Medical Sciences.

### 3. Results

The correlations between all variables used in the present study are shown in Table 1. In bivariate correlations, some of the TCI subscale scores were correlated with each other. Thus, high NS was associated with low HA, low P, low SD, and high ST. High HA was associated with low SD and low ST. High RD was associated with high P and high C. High P was associated with high ST. SD and C were correlated with each other.

T1 and T2 HADS-D and HADS-A were significantly correlated with HA and inversely with SD and C. In addition, T1 and T2 HADS-A were inversely correlated with RD. T1 HADS-A was correlated inversely with P, and T2 HADS-D was correlated with ST (Table 1).

Because there were significant correlations between many of the variables examined in this study, we created an original path model (Figure 1). According to the modification indices as well as theoretical considerations, we added correlations between NS and HA, between NA and P, and between RD and P. Correlations were also added between the error variables of SD and those of C and ST.

Our final path model can be regarded as good: CMIN/df = 2.01, CFI = 0.991, and RMSEA = 0.074 (Figure 2). As expected, scores of some temperament scales predicted those of character scales: significant paths were found from NS to SD and ST; from HA to SD, C and ST; from RD to C; from P towards ST. Several TCI scale scores were found to be associated with the scores of depression and anxiety traits: both trait depression and trait anxiety were associated with high HA and low SD. In addition, trait

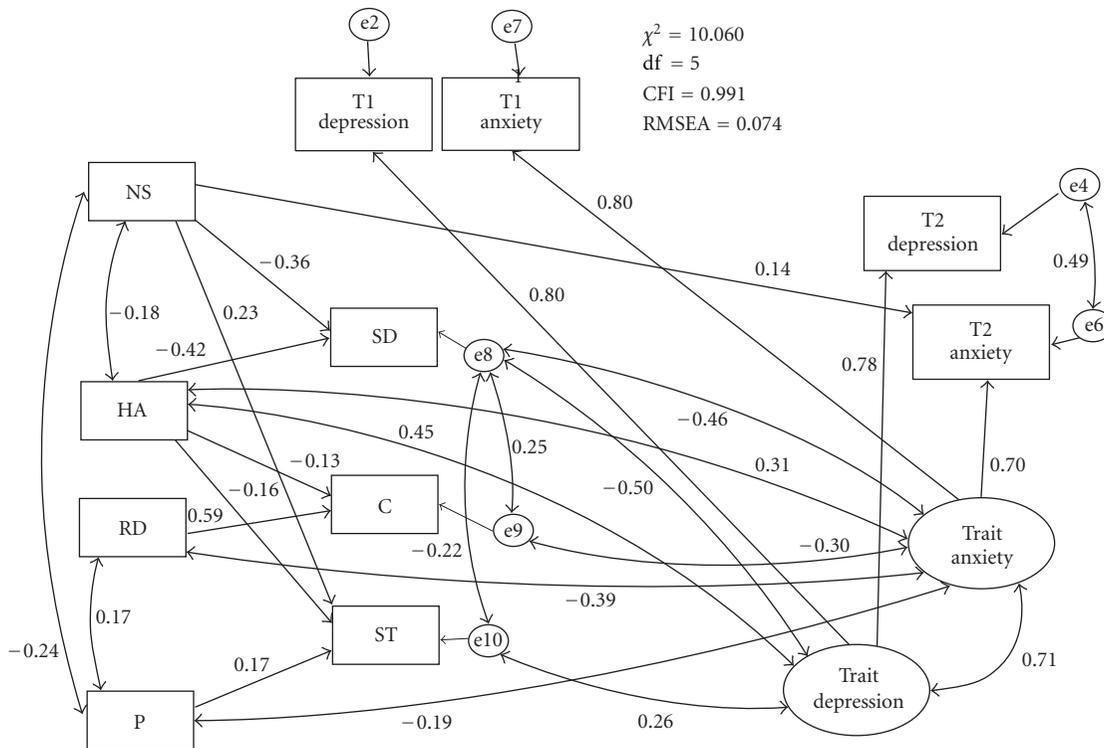


FIGURE 2: Final SEM model NS: novelty seeking; Ham: harm avoidance; RD: reward dependence; P: persistence; SD: self-directedness; C: cooperativeness; ST: self-transcendence. Paths without significance ( $<0.05$ ) are not shown in the Figure (but were not deleted).

depression was associated with high ST whereas trait anxiety was associated with low RD, P, and C. Among the T2 HADS scores, only T2 anxiety scores were predicted by high NS.

#### 4. Discussion

A primary finding of this longitudinal study was that it was not the surplus component of the mood measurement but rather trait depression and anxiety that were mainly associated with TCI subscale scores. Thus, trait depression was associated with high HA and low SD, as well as high ST. Trait anxiety was similarly associated with not only high HA and low SD, but also with low RD, P, and C.

People with high HA and low SD may be characterised by depressive and anxious traits that are part of their personalities. Such people may be more likely to develop clinical mood and anxiety disorders under stressful life situations. Previous studies have found links between high HA and low SD on the one hand and mood and depressive disorders on the other, but these findings may be biased by the fact that trait and surplus components were measured simultaneously as state components.

In this study, we observed a significant link between trait depression and high ST. This link has not been consistently reported. However, some investigators have found that people with bipolar disorder were characterised by high ST in addition to high HA and low SD [13, 26, 62, 63]. ST is a character dimension that is associated with spirituality.

This is an adaptive personality trait if combined with high SD and C, but is otherwise suggestive of schizotypal personality [1]. The slight but significant association between trait depression and ST in this study suggests that some students high in ST are prone to the future development of bipolar disorder.

Unlike trait depression, trait anxiety was also associated with low RD and C. It has been reported that low RD and C are characteristics of anxiety disorders such as obsessive compulsive and phobic disorders. The results of the present study are in line with these findings. People who are low in RD are practical and cold and can be withdrawn and detached. People who are low in C are socially intolerant, critical, revengeful, and destructive and may thus be more anxious when relating to others. We consider high HA and low SD to be personality traits that are related to dysphoric mood in general, including depression and anxiety, whereas low RD and C are specific to anxiety.

Strengths of the present study include a longitudinal research design and the statistical separation of the trait and surplus components of depression and anxiety. Past studies have usually treated scores of mood measures as state indicators. In our view, they fail to distinguish the temporary reactive components of dysphoric mood from the stable ones. The former are more likely to be induced and maintained by immediate environmental factors such as stressful life events and enacted social support. In contrast, the latter is more likely to be dispositional. Our finding that TCI profiles were associated with trait components is

in agreement with this notion. We expect that reanalysing the data produced by past investigations using our current statistical methods may cast more light on this issue.

Limitations of the present study should be noted. First, our sample size was modest. Given that SEM is a statistical method that requires a large sample size, further studies using a larger sample size are necessary. However, the good fit of the model to the relatively small current sample is encouraging. Second, we used a university student population. University students between 18 to 30 years of age constitute the study population. A few students were out of range of youth in this study. Nevertheless, the age range was narrow, and we should not extrapolate the data to older populations, particularly since TCI subscale scores vary with age [2]. Our approach distinguishing trait and surplus components should also be used to study clinical populations. The influence of mood state on the self-report of personality may be greater in a clinical population than a nonclinical population. We did not use diagnostic categories such as major depressive episode or generalized anxiety disorder. The use of structured diagnostic interviews will be necessary in further studies. A fourth shortcoming of the present study was that we assessed subjects at only two time points, and the time interval between the two assessments was five months. More assessment points may be required if we are to employ sophisticated statistical methods, for example, growth curve models. Furthermore, different results may emerge if a longer followup is employed.

The links between TCI subscales and trait depression and anxiety are the result of an inherent association combined with the effects of mood state on the self-report of personality. This issue is difficult to disentangle using the research design employed in the present study. One possible way to cast light on the distinction between the two components is to use multiple raters of each individual's personality, for instance the participant him- or herself as well as those who know him or her well (e.g., family members and friends). This approach is beyond the scope of the present study but would benefit from further study.

Taking into consideration these shortcomings, the present research showed that TCI profiles were associated with the trait components of depression and anxiety rather than their surplus components. Depression and anxiety traits shared several of the same TCI characteristics, including high HA and low SD, but differed in specific details, for instance with low C and RD being associated with anxiety only.

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## Research Article

# Predicting Depression with Psychopathology and Temperament Traits: The Northern Finland 1966 Birth Cohort

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We studied the concurrent, predictive, and discriminate validity of psychopathology scales (e.g., schizotypal and depressive) and temperament traits for hospitalisations due to major depression. Temperament, perceptual aberration, physical and social anhedonia, Depression Subscale of Symptom Checklist (SCL-D), Hypomanic Personality Scale, Schizoidia Scale, and Bipolar II Scale were completed as part of the 31-year follow-up survey of the prospective Northern Finland 1966 Birth Cohort ( $n = 4941$ ; 2214 males). Several of the scales were related to depression. Concurrent depression was especially related to higher perceptual aberration (effect size when compared to controls,  $d = 1.29$ ), subsequent depression to high scores in SCL-D ( $d = 0.48$ ). Physical anhedonia was lower in subjects with subsequent depression than those with other psychiatric disorders ( $d = -0.33$ , nonsignificant). Participants with concurrent ( $d = 0.70$ ) and subsequent ( $d = 0.54$ ) depression had high harm avoidance compared to controls, while differences compared to other psychiatric patients were small. Subjects with depression differed from healthy controls in most of the scales. Many of the scales were useful predictors for future hospital treatments, but were not diagnosis-specific. High harm avoidance is a potential indicator for subsequent depression.

## 1. Introduction

Several studies have attempted to predict psychiatric symptoms or disorders using various psychological and psychiatric instruments [1, 2]. These scales have clinical importance, for example, when identifying high-risk individuals. They may also help to detect intermediate phenotypes for psychiatric disorders [3]. Potential psychopathological intermediate phenotypes of depression include, for example, depressed mood and anhedonia [4]. The objectiveness of these scales adds to their usefulness in etiological research of psychiatric disorders [5].

Numerous instruments have been used to evaluate depressive symptoms in the general population. For instance, the Symptom Checklist was developed to screen for depression and anxiety in the general population [6]. Personality traits, such as those measured with Cloninger's [7] temperament dimensions, have been associated with several psychiatric disorders [8]. Particularly high harm avoidance has been associated with depression [8]. The previous longitudinal studies in relation to depression are very few and have included relatively short follow-up period [9, 10]. These studies indicate that harm avoidance may be a phenotypic indicator for risk of depressive episodes [10]. Schizotypal traits, such as anhedonia, are key features both in schizophrenia and depression. In patients with schizophrenia, anhedonia has been strongly associated with the depressive syndrome [11].

The aim of the present study was to evaluate the concurrent, predictive, and discriminate validity of several psychological scales for depression, using a large representative population based sample of adults, with adequate followup. Our hypothesis was that subjects with either concurrent or subsequent depression would score differently in schizotypal and depressive symptom scales and temperament dimensions, when compared to subjects with other psychiatric disorders or healthy controls.

## 2. Material and Methods

**2.1. Participants.** The Northern Finland 1966 Birth Cohort (NFBC 1966) is an unselected, general population-based birth cohort ascertained during mid-pregnancy. It comprised of 12,058 live-born children in the Finnish provinces of Lapland and Oulu [12]. We required that all subjects had been living in Finland at the age of 16 ( $n = 10,933$ ; 5,589 males and 5,344 females), as we have previously validated psychiatric diagnoses from the Finnish Hospital Discharge Register in this subsample [13, 14]. Permission to gather data was obtained from the Ministry of Social and Health Affairs and the study design has been approved by, and is under review of, the Ethical Committee of The Northern Ostrobothnia Hospital District. After complete description of the study, written informed consent was obtained from study participants.

In 1997, the questionnaires used for the 31-year followup of the cohort included a large collection of psychopathology scales and four temperament dimensions that were given to all cohort members who participated in a clinical examination [15]. Participants completed these scales at home and returned them in the envelopes provided. The 12-item version of the Infrequency Scale [16] was used to assess careless responding. It contains items that are very unlikely to be true and identifies random response styles. Participants who endorsed three or more items ( $n = 105$ ) on this scale were excluded from further analyses. The Symptom Checklist-25 [6, 17, 18] was sent, by post, in a different set of questions, together with several sociodemographic questions and an invitation letter for the clinical examination. In total, 4,941 participants (2,214 males and 2,727 females) adequately completed at least one of these scales.

The Finnish Hospital Discharge Register (FHDR) covers all mental and general hospitals as well as beds in local health centres, prison and military hospitals and private hospitals nationwide. All cohort members, over 16 years old, appearing on the FHDR until the end of 1997 for any mental disorder were identified and their diagnoses were rechecked twice by psychiatrists using DSM-III-R criteria [19]. The reliability of this procedure was moderate for depression  $\kappa = 0.57$ . A more detailed description of the validation process is presented elsewhere [13, 14].

Data was also collected from postal questionnaires sent to all subjects in 1977 and outpatient treatments with self-reported diagnoses. Subjects were asked whether they had any of the following: depression, psychosis, alcohol use disorder, other substance use disorder, or any other psychiatric disorder diagnosed by a medical doctor. Three groups were formed: "depressive disorder" ( $n = 204$ ; 68 males, 33%), "other psychiatric disorders" ( $n = 150$ ; 77 males, 51%), and "no psychiatric disorders" ( $n = 4587$ ; 2069 males, 45%). The "depressive disorder" group included subjects with validated hospital care diagnoses of psychotic depression (DSM-III-R codes: 296.24 and 296.34;  $n = 2$ ) or nonpsychotic depression (296.22, 296.23, 296.31, 296.33, and 311.00;  $n = 20$ ), or self-reported depressions ( $n = 182$ ). "Other psychiatric disorders" included subjects with other psychiatric diagnoses based on either hospital ( $n = 70$ ) or self-reported data ( $n = 80$ ). In the followup, the same groups were used, but only with nonvalidated data from the FHDR from 1998 to 2010, classified as described above. The distribution of the diagnoses for major depressive disorders (ICD-10 diagnoses: F32-F33 and F341) are presented in Section 3.

When comparing the final sample at the 31-year followup to subjects alive at the age of 16 years, females participated more commonly than males (51.4% versus 40.4%;  $\chi^2 134.81$ ,  $P < 0.001$ ) and those with tertiary (more than 12 years) and secondary level (10–12 years) education more commonly than those with basic level (9 or less years) education (49.5% and 49.7% versus 25.1%;  $\chi^2 343.73$ , degrees of freedom = 2,  $P < 0.001$ ). The attrition analyses for the 31-year followup study have previously been described in detail. For

individuals with psychiatric hospital diagnoses until 1997, the participation rate was 42% among those with mood disorders and 54% among controls [15].

**2.2. Instruments.** The questionnaire given to subjects consisted of mental health related true/false questions, which were collected from several psychopathology (e.g., schizotypal) scales and four temperament subscales. All these items, and the 12 items from the Infrequency Scale, were randomly rearranged into a 354-item questionnaire, called "Survey of Opinions and Experiences." We used the temperament subscales (novelty seeking, harm avoidance, reward dependence, and persistence) from the Temperament and Character Inventory (TCI). The schizotypal scales were the following: Physical Anhedonia Scale (PAS), Social Anhedonia Scale (SAS), Perceptual Aberration Scale (PER), Hypomanic Personality Scale (HPS), Bipolar II Scale (BIP2), and Schizoidia Scale (SCHD). From a separate survey, we included the depression subscale (15 items) of Symptom Checklist (SCL-D) in order to also assess depressive symptoms. The answers to SCL are scored on a scale from 1 (not bothered) to 4 (extremely bothered) [6]. The references and short descriptions for the scales are presented in Table 1. Firstly, we studied these scales in respect to previous hospitalization or current self-reported psychiatric diagnosis in 1997. Secondly, among those without previous psychiatric diagnosis in 1997, these scales were studied in respect to subsequent hospitalizations due to psychiatric causes between 1998 and 2010.

The original English versions of the scales, except SCL-25, were translated into Finnish by one investigator and then back-translated blindly to the original English scale by a professional English translator. The original version and the back-translation were compared, and corrections were made accordingly. The translation was tested in a sample of 50 laboratory workers, and the results indicated that no questions required revision. We used an earlier Finnish translation of the SCL in the current study. We have previously presented validity results in this sample for the SCL-25 [18], temperament [26], and schizotypal scales [27].

**2.3. Statistical Methods.** We present means, standard deviations (SD), and Student's *t*-tests for continuous variables. Mean scores between different groups were compared using effect sizes (Cohen's *d*) and two-way analysis of variance, where diagnostic group and gender were used as grouping variables and scale scores as dependent variables. Gender was used as a covariate, as previous meta-analyses have found gender differences in these scales [28, 29]. Cohen [30] interpreted *d* values of 0.2 to 0.5 as small, 0.5 to 0.8 as medium, and 0.8 or over as large effects. We studied associations of all the scales both to depressions and to other psychiatric disorders in order to estimate the specificity of the scales. As substance use disorder is a common diagnosis in other psychiatric diagnoses and a common comorbid diagnosis in depression, we performed additional analysis with substance abuse as a covariate in analysis of variance. All tests are two-tailed. The data was analyzed using the IBM SPSS v. 20.

### 3. Results

Table 2 shows mean (SD) values for the different scales in categories of concurrent depression, other psychiatric disorders, and no psychiatric disorders. In 1997, those with depression scored statistically significantly ( $P < 0.05$ ) higher than those without previous psychiatric disorders in all studied psychopathology scales, except PAS. The difference was highest in SCL-D (means 1.78 versus 1.33,  $d = 1.29$ ) followed by perceptual aberration scale (means 5.09 versus 2.24,  $d = 0.90$ ). In temperament dimensions, this difference was statistically significant only in TCI-HA, with higher scores among those with depression ( $d = 0.70$ ). Almost all the scales were related to depression. However, it was only in SCL-D that those with depression differed statistically significantly from those with other psychiatric disorders with a small effect size ( $d = 0.20$ ). No significant differences between these two groups were found in temperament dimensions (Table 2).

Among those with no psychiatric disorders until 1997, 51 (26 males, 51%) new cases with depression requiring hospitalizations emerged during the subsequent followup of thirteen years. This group included subjects with psychotic depression (F323, F333),  $n = 9$  and nonpsychotic depression (F32-F33, not F323, F33; F341),  $n = 42$ . In this followup, 57 (36 males, 63%) individuals were hospitalized for other psychiatric disorders. This group included various psychiatric diagnoses. The most common diagnoses were substance use disorder ( $n = 30$ ), nonaffective psychosis ( $n = 14$ ), and anxiety disorders ( $n = 12$ ).

Of the psychopathology scales, the bipolar II scale ( $d = 0.52$ ), SCL-D ( $d = 0.48$ ), SCHD ( $d = 0.46$ ), and SAS ( $d = 0.45$ ) were the strongest predictors for new cases of depression requiring hospitalization. However, the scales were not diagnosis-specific. The greatest difference between depression and other psychiatric disorders requiring hospitalization ( $d = -0.33$ ; NS) was found in PAS.

In temperament dimensions, new cases of depression requiring hospitalization scored high in the harm avoidance when compared to those with no hospitalization due to psychiatric causes (16.96 versus 13.77;  $P < 0.001$ ,  $d = 0.54$ ). No significant differences were found between the two psychiatric groups. Novelty seeking had the highest effect size (ns,  $d = -0.32$ ), with lower scores among those with hospitalization due to depression. In additional analyses, between those with depression and other psychiatric disorders we controlled for substance use disorders. The difference between these two groups was statistically significant in harm avoidance in concurrent analyses ( $F = 7.12$ ,  $P = 0.008$ ) with higher scores among those with hospitalization due to depression. Differences in other temperament traits or in predictive analyses were nonsignificant (Table 3).

### 4. Discussion

We studied the concurrent, predictive, and discriminate validity of several psychopathology scales and temperamental dimensions in relation to depression. Many of them were related to depression but also to other psychiatric disorders.

TABLE 1: Psychological scales used in the 31-year followup of the Northern Finland 1966 Birth Cohort.

Instrument (abbreviation)	Number of items	Description of high scorers	Reference(s)
Revised Physical Anhedonia Scale (PAS)	61	Lowered ability to experience physical and sensory pleasures	Chapman et al., [20]
Revised Social Anhedonia Scale (SAS)	40	Schizoid lack of interest in social interaction	Chapman et al., [20]; Eckblad et al., [21]
Perceptual Aberration Scale (PER)	35	Have distorted perception of own body and other objects	Chapman et al., [22]
Hypomanic Personality Scale (HPS)	48	Energetic, upbeat, gregarious people, often able to work long hours	Eckblad and Chapman, [23]
Bipolar II Scale (BIP2)	31	Designed to predict bipolar II disorder among unipolar subjects	Akiskal et al., [24]
Schizoidia Scale (SCHD)	7	Minnesota Multiphasic Personality Inventory (MMPI) items that as pooled best detect schizophrenia	Golden and Meehl, [25]
Symptom Check-List, Depression subscale (SCL-D)	13	Used as a screen for depression in normal population	Derogatis et al., [6]; Fink et al., [17]
Temperament and Character Inventory (TCI) subscales:			
(i) novelty seeking (TCI-NS)	40	Respond with intense excitement to novel stimuli	Cloninger et al., [7]
(ii) harm avoidance (TCI-HA)	35	Subjects with tendency to respond intensively to signals of aversive stimuli, thereby inhibiting/stopping behaviour	Cloninger et al., [7]
(iii) reward dependence (TCI-RD)	24	Respond intensively to signals of reward	Cloninger et al., [7]
(iv) persistence (TCI-P)	8	Subjects with tendency to persevere in behaviours associated with reward	Cloninger et al., [7]

Harm avoidance ( $d = 0.54$ ) as a temperament dimension and the bipolar II scale ( $d = 0.52$ ) best predicted depression, and also the depression subscale of the SCL associated with depression, especially concurrently ( $d = 1.29$ ). These findings reflect the relatively high predictive value of the scales and confirm their utility as clinical tools for the identification of individuals at risk for psychiatric disorders. None of the scales discriminated well subjects with depression from subjects with other psychiatric disorders. However, when we took into account substance use disorders as a covariate in concurrent analyses, individuals with depression scored statistically significantly higher in harm avoidance than those with other psychiatric disorders.

*4.1. Schizotypal Scales.* We found that many of the psychopathology scales related to both concurrent and subsequent depression. However, these scales were not diagnosis-specific as these traits were also common in other psychiatric disorders. In the schizotypal (PAS, SAS, and PER) scales, there have been some previous case-control studies in depression, with small sample sizes. These studies have found large effect sizes between psychiatric cases and healthy controls (e.g., students), with cases scoring higher in all of them. In physical anhedonia, effect sizes have varied between 0.92 [31] and 1.79 [32], and in social anhedonia between 0.86 [33]

and 1.19 [34]. In perceptual aberration, Katsanis et al. [33] found depressive patients scored higher than healthy controls, with an effect size of 0.57. Loas et al. [35] note that physical anhedonia in depressed patients seems to relate to the severity of the depression and does not appear to identify quantitatively distinct subgroup.

We have previously studied these schizotypal scales in schizophrenia [36]. Individuals with concurrent depression ( $n = 202$ ) scored lower than those with schizophrenia ( $n = 29$ ) in all schizotypal scales, for example, in physical anhedonia, mean score in schizophrenia was 18.38 and in depression 14.68. When predicting these disorders, differences in scores were smaller; however, those with subsequent schizophrenia scored substantially higher in perceptual aberration (means 4.30 versus 2.96) and hypomanic personality (17.10 versus 12.37) than those with subsequent depression. Interestingly, our results contradict some previous studies such as Blanchard et al. [34], who found that depressive patients had higher scores for social anhedonia than schizophrenia patients (means 18 versus 15). They concluded that schizophrenia patients seem to have stable high scores in social anhedonia whereas, in depressive patients, it correlates with the clinical state. These differences may relate to our sample being based on lifetime diagnoses in population, including also individuals without current treatment or symptoms.

TABLE 2: Mean and standard deviation (SD) of psychological scales in the 31-year followup (in 1997) for those with self-report or previous hospitalisation due to depression, other psychiatric disorders, and for those without psychiatric disorders.

	(A) Depression until 1997			(B) Other psychiatric disorders until 1997			(C) No psychiatric disorders until 1997			Effect sizes (Cohen's <i>d</i> )		
	<i>N</i>	Mean	SD	<i>N</i>	Mean	SD	<i>N</i>	Mean	SD	(A) versus (B) <i>F</i> ( <i>d</i> )	(A) versus (C) <i>F</i> ( <i>d</i> )	(B) versus (C) <i>F</i> ( <i>d</i> )
<b>Psychopathology scales:</b>												
Physical Anhedonia Scale (PAS)	202	14.68	8.19	149	16.34	7.86	4572	15.02	6.97	0.74 (-0.21)	0.49 (-0.05)	5.24* (0.19)
Social Anhedonia Scale (SAS)	200	11.60	6.78	146	11.99	6.75	4569	9.33	5.43	0.00 (-0.06)	48.43*** (0.41)	31.54*** (0.49)
Perceptual Aberration Scale (PER)	202	5.09	5.64	147	4.29	5.85	4568	2.24	3.04	3.86 (0.14)	149.00*** (0.90)	34.05*** (0.65)
Hypomanic Personality Scale (HPS)	201	15.11	7.44	147	15.07	8.78	4571	11.07	6.92	0.26 (0.01)	60.89*** (0.58)	29.44*** (0.57)
Bipolar II Scale (BIP2)	202	12.99	4.46	148	12.91	4.39	4577	10.47	3.73	0.57 (0.02)	88.75*** (0.67)	42.63*** (0.65)
Schizoidia Scale (SCHD)	202	3.51	1.61	147	3.31	1.56	4578	2.51	1.39	1.21 (0.13)	89.90*** (0.72)	39.89*** (0.57)
SCL-Depression (SCL-D)	202	1.78	0.58	144	1.66	0.56	4571	1.33	0.33	4.54* (0.20)	310.90*** (1.29)	92.19*** (0.97)
<b>Temperament dimensions:</b>												
novelty seeking (TCI-NS)	200	21.29	5.82	145	21.84	6.13	4534	20.34	5.86	0.83 (-0.09)	3.62 (0.16)	6.91** (0.26)
harm avoidance (TCI-HA)	200	18.09	7.36	145	17.21	6.64	4534	13.82	6.00	0.94 (0.12)	86.49*** (0.70)	42.03*** (0.56)
reward dependence (TCI-RD)	200	14.95	3.95	145	14.30	3.89	4534	14.74	3.78	0.23 (0.16)	0.31 (0.05)	1.40 (-0.12)
persistence (TCI-P)	200	4.28	1.86	145	4.09	1.89	4534	4.31	1.74	0.66 (0.10)	0.02 (-0.02)	2.76 (-0.12)

TCI: Temperament and Character Inventory. Mean values in categories are compared using two-way analysis of variance (ANOVA), with diagnostic group and gender as independent variables. Statistical significant effect sizes are marked with asterisks as follows: \*  $P < 0.05$ , \*\*  $P < 0.01$ , and \*\*\*  $P < 0.001$ .

TABLE 3: Mean and standard deviation (SD) of psychological scales in the 31-year followup (in 1997) for those with hospitalisation of depression or other psychiatric disorders and for those without hospitalization due to psychiatric disorders in 1998–2010.

	(A) Depression in 1998–2010			(B) Other psychiatric disorders in 1998–2010			(C) No psychiatric disorders until 2010			Effect sizes (Cohen's <i>d</i> )		
	<i>N</i>	Mean	SD	<i>N</i>	Mean	SD	<i>N</i>	Mean	SD	(A) versus (B) <i>F</i> ( <i>d</i> )	(A) versus (C) <i>F</i> ( <i>d</i> )	(B) versus (C) <i>F</i> ( <i>d</i> )
Psychopathology scales:												
Physical Anhedonia Scale (PAS)	51	15.88	6.08	57	18.07	7.24	4464	14.97	6.97	1.77 (–0.33)	0.43 (0.13)	6.16* (0.44)
Social Anhedonia Scale (SAS)	51	11.69	5.82	57	11.98	6.78	4461	9.27	5.39	0.00 (–0.05)	9.37** (0.45)	9.75** (0.50)
Perceptual Aberration Scale (PER)	51	2.96	2.75	57	2.95	3.45	4460	2.22	3.04	0.04 (0.00)	3.30 (0.24)	4.12* (0.24)
Hypomanic Personality Scale (HPS)	51	12.37	6.65	57	12.32	8.19	4463	11.04	6.91	0.00 (0.01)	2.10 (0.19)	2.62 (0.18)
Bipolar II Scale (BIP2)	51	12.37	3.56	57	11.68	4.50	4469	10.44	3.71	0.81 (0.17)	13.49*** (0.52)	5.75* (0.33)
Schizoidia Scale (SCHD)	51	3.14	1.66	57	2.65	1.62	4470	2.50	1.38	1.97 (0.30)	12.09*** (0.46)	1.77 (0.11)
SCL-Depression (SCL-D)	51	1.49	0.46	55	1.45	0.41	4465	1.33	0.33	2.38 (0.09)	12.46*** (0.48)	9.22** (0.36)
Temperament dimensions:												
novelty seeking (TCI-NS)	51	19.78	6.20	57	21.68	5.75	4426	20.33	5.86	3.30 (–0.32)	0.33 (–0.09)	4.08* (0.23)
harm avoidance (TCI-HA)	51	16.96	6.28	57	15.02	7.68	4426	13.77	5.96	1.44 (0.28)	16.11*** (0.54)	4.29* (0.21)
reward dependence (TCI-RD)	51	14.24	3.99	57	13.68	3.51	4426	14.76	3.78	0.22 (0.15)	0.52 (–0.14)	1.46 (–0.29)
persistence (TCI-P)	51	4.53	1.76	57	4.07	1.93	4426	4.31	1.73	1.86 (0.25)	0.65 (0.13)	1.91 (–0.14)

TCI: Temperament and Character Inventory. Mean values in categories are compared to using two-way analysis of variance (ANOVA), with diagnostic group and gender as independent variables. Statistical significant effect sizes are marked with asterisks as follows: \* $P < 0.05$ , \*\* $P < 0.01$ , and \*\*\* $P < 0.001$ .

**4.2. Depressive Symptoms.** Sandanger et al. [37] previously conducted a cross-sectional study of the specificity of SCL-25 for depression. They found that a cutoff of 1.75 points in average was a powerful predictor for depression (crude odds ratio, OR 14.0). However, the scale was also significantly associated with different anxiety disorders (ORs 2.2 to 4.4) and with any disorder (OR 3.9). In a previous study of the NFBC 1966, Veijola et al. [18] compared the SCL-25 with Structured Clinical Interview for DSM-III-R (SCID) diagnoses in a subsample of the cohort. They concluded that SCL-25 might be useful for screening purposes in primary health care and epidemiological surveys. They noted that cases with psychiatric comorbid disorders were screened successfully using the instrument. According to the present study, the depression subscale of the SCL was a quite good ( $d = 0.48$ ) predictor of new cases of depression requiring hospitalization, when compared to those with no new psychiatric disorders requiring hospitalization during the followup. However, specificity was poor ( $d = 0.09$ ), indicating that depressive symptoms also relate to other subsequent psychiatric disorders (Table 3).

**4.3. Temperament Dimensions.** We found a strong association between depression and harm avoidance, as has also been noted in a recent meta-analysis comparing different psychiatric disorders [8]. This meta-analysis also found a small negative effect size ( $d = -0.20$ ) of lower novelty seeking in major depression, whereas the effect in harm avoidance was very large ( $d = 1.64$ ) when compared to controls. High harm avoidance in depression has been shown to remain, after controlling for age, gender, diagnosis, and depressive state effects [38]. Harm avoidance has also been shown to decrease after treatment response [39]. Interestingly, never-depressed siblings of the probands with major depression are reported as having higher harm avoidance compared to never-depressed siblings of never-depressed controls. Thus, the authors suggested that harm avoidance might be a trait-like characteristic related to a familial vulnerability to depression [40].

In our sample, individuals with concurrent or previous depression had very similar temperament when compared to individuals with other psychiatric disorders, with all the effect sizes being below 0.20. In the extensive meta-analysis by Miettunen and Raevuori [8], depression (23 studies) had higher P, RD, and HA than schizophrenia, but quite similar temperament when compared to alcohol use disorders. It is worth mentioning that, in the present study, about half of the patients with subsequent other psychiatric disorder had a substance use diagnosis (as their only diagnosis or in addition to some other diagnosis). Because of this, we performed additional analyses substance use disorder as additional covariate. We found that in concurrent, but not in predictive analyses, individuals with depression scored significantly higher than those with other psychiatric disorders in harm avoidance.

When we compared current results to our previous schizophrenia study with the NFBC 1966 [36], in those who have already received a diagnosis, harm avoidance was lower

( $d = -0.50$ ) and novelty seeking higher ( $d = 0.48$ ) in depression than in schizophrenia. Those with subsequent depression substantially had higher scores, especially in reward dependency, than those with subsequent schizophrenia (mean scores 14.2 versus 11.8;  $d = 0.65$ ).

**4.4. Strengths and Limitations.** The sample was relatively large and population-based. Unlike many of the previous studies, we also included a comparison group with other psychiatric disorders. The extensive set of scales used is also an advantage. A limitation of the sample is that, although it was large, a low number of cases during the followup also meant that it was not possible to predict diagnoses more specifically. Due to cohort design, it only consists of one age group. As we used the nationwide hospital register to find new cases of depression, our outcome only indicates a very severe form of depression. We cannot avoid the possibility that, at the end of followup, high scorers without psychiatric diagnosis may have a depression diagnosis not requiring hospitalization, as most of the subjects with depressive episode are not treated in psychiatric hospital facilities [41]. It should also be noted that quite a large proportion of eligible subjects did not participate or gave inadequate answers [15].

## 5. Conclusions

In most of the scales, subjects with depression differed from healthy controls. Many of the scales were useful predictors for subsequent new hospitalisations due to depression. With lack of diagnosis specificity, these scales also predicted other psychiatric diagnoses. Thus, these scales are useful both in clinical work and in etiological research of psychiatric disorders.

## Conflict of Interests

The authors declare that they have no conflict of interests.

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## Research Article

# Does Personality Predict Depression and Use of an Internet-Based Intervention for Depression among Adolescents?

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*Background.* Focus upon depression and prevention of its occurrence among adolescents is increasing. Novel ways of dealing with this serious problem have become available especially by means of internet-based prevention and treatment programs of depression and anxiety. The use of Internet-based intervention programs among adolescents has revealed some difficulties in implementation that need to be further elucidated. The aim of this study is to investigate the association between personality and adolescent depression and the characteristics of users of an Internet-based intervention program. *Method.* The Junior Temperament and Character Inventory (JTICI), the General Self-Efficacy scale (GSE) and the Centre for Epidemiological Studies-Depression scale (CES-D) have been administered to a sample ( $n = 1234$ ) of Norwegian senior high-school students. *Results.* Multiple regression analysis revealed associations between depression and gender, and several JTICI domains and facets. In line with previous findings in adults, high Harm Avoidance and low Self-Directedness emerged as the strongest predictors of adolescent depressive symptoms. Further, in logistic regression analysis with the covariates JTICI, GSE and CES-D, the only significant variables predicting use/non-use were the CES-D and the temperament domain Reward Dependence. *Conclusion.* The results in this study revealed level of depressive symptoms as the strongest predictor of the use of the Internet based intervention and that personality might provide useful information about the users.

## 1. Introduction

The prevalence of depression in childhood is low, whereas adolescence is a period of life characterized by a substantial vulnerability to depression [1]. Accordingly, adolescent depression is highly prevalent [2], with a considerable risk of recurrence and is often followed by poor psychosocial functioning and scholastic outcome [3].

Factors affecting development and predisposition to depression are numerous [4]. Grant and colleagues [5] point to the importance of stressful negative life events in understanding the development of depression, while others [6] indicate the importance of genetic factors. Interpersonal vulnerabilities have also been investigated for significant factors that can contribute in the explanation of adolescent depression [4]. Cognitive vulnerability concerns mostly

about how an individual perceives, interprets, and reasons about experiences and relationships. Cognitive factors receiving most attention are negative inferential styles [7], dysfunctional attitudes [8], tendencies towards rumination [9], and self-criticism [10]. Based on various vulnerabilities, Hankin [4] suggested a multifactorial approach to the study of depression.

There is increasing evidence that psychiatric disorders have specific associations with underlying temperament and character traits among children and adolescents [11–13]. The interrelationships between personality, depression and anxiety have been studied over the last decades in adult populations [14–22], and several personality traits have been identified affecting mood disorders, such as neuroticism [23–25], tendencies towards rumination [25], immature personality styles, and personality disorders [26, 27].

A model to assess temperament and character to describe underlying biogenic structures of personality had been developed by Cloninger et al. [28] resulting in the Temperament Character Inventory (TCI) that measures personality by two higher-order dimensions: temperament and character. Temperament varies on an individual basis and reflects the fundamental organization of brain systems responsible for activating, maintaining and/or inhibiting behavior in response to stimuli [14, 28]. The four derived temperament dimensions are *novelty seeking (NS)*, *harm avoidance (HA)*, *reward dependence (RD)*, and *persistence (P)*. On the other hand, character refers to self-concepts and individual differences in goals and values, which in turn affect voluntary choices and intentions. According to Cloninger [29], character is moderately influenced by socio-cultural learning and matures gradually throughout life. The three described character dimensions are *self-directedness (SD)*, *cooperativeness (C)*, and *self-transcendence (ST)*. These aspects of personality interact to allow for adaptation to life experiences and also influence the vulnerability for emotional and behavioral disorders.

Scores on the TCI have shown to be variant between depressed individuals and nondepressed [28]. Elevated scores on HA and lower scores on SD and C have often been found associated with depression or depressed mood in adult populations [30–32].

Since the adult version of the TCI might be unsuitable for use in an adolescent population, Luby et al. [33] developed the Junior Temperament and Character Inventory (JTCI).

So far, research on the relationship between JTCI and depression among adolescents is sparse. A few studies have reported associations between JTCI and psychopathology in adolescents [34–38]. Schmeck and colleagues [34] reported a negative correlation between several forms of psychopathology, including anxiety and depression and SD. Others [37] have found high scores on NS and HA, while low on RD and P among dysregulated children. Elevated levels of HA have also been reported among depressed adolescents [36].

Different relationships between temperament and character traits and mental health are suggested to exist in adolescents and adults [39]. Therefore, more research is needed to improve our understanding of the relationship between adolescent depression and personality.

One might expect that many depressed adolescent individuals will never formally seek help or contact with health services [40], rendering many with an unmet need for treatment [41]. This is a strong argument for finding novel approaches to reach adolescents struggling with mental health problems. Internet-based interventions like computerized cognitive behavior therapy (cCBT) is one way to reach a broader spectrum of troubled youth. One of these interventions is the MoodGYM, which is a self-help program developed at the Australian National University based on the principles of cognitive behavioral therapy (CBT) [42–44]. It consists of a set of five training modules aimed at increasing the users' knowledge about their symptoms, negative automatic thoughts, dysfunctional attitudes, emotions, and coping strategies with regard to stress and interpersonal relationships. Furthermore, the MoodGYM

comprises a personal workbook that records and updates the user's responses and a feedback evaluation form.

The use of internet-based interventions among adolescent samples has revealed some difficulties in implementation [45]. Motivating young people to seek help for mental health problems also emerged as a challenge. One reason for low adherence might be that cCBT applications allow the users to enter and leave a treatment program and thus resulting in a lack of commitment to the treatment. Determining those using and benefiting from Internet interventions is an important issue. The identification of their characteristics could be useful for increasing adherence and for the prediction of treatment outcome [46–48]. Several hypotheses about possible relationship between different JTCI domains the use of MoodGYM can be formulated. It can be expected that high scores on SD and CO, and low scores on RD predict more use due to the nature of these domains [28]. It is reasonable to assume that a high score on SD to some degree reflects the internal drive and goal-orientation necessary to engage in a self-directed program such as MoodGYM. High scorers on CO might be more motivated to fulfill their commitment as participants in a research project and therefore be more likely to make use of the intervention. Individuals scoring low on RD are characterized as practical, socially distant, and independent. They might find this sort of intervention appealing because of the practical, socially independent nature of Internet-based interventions.

The concept of self-efficacy refers to a person's "conviction, that one can successfully execute the behavior required to produce the outcomes" (Bandura, 1977, p. 193 [49]) and thus is related to motivation and behavior. Self-efficacy has been found to be a significant predictor of motivation for learning-directed behavior [50]. With regards to help-seeking behavior in adolescents, Barker et al. [51] claim that research evidence on the influence of self-efficacy is conflicting. Nonetheless, it might represent a factor promoting help-seeking behavior and affecting the intervention outcome in mental health prevention programs. Contrary to their hypothesis, Pössel et al. [52] found students low on self-efficacy to benefit more from a depression prevention program. The current study will investigate whether self-efficacy can predict self-directed use of MoodGYM when presented to students in a school-based setting.

Being able to depict the role of personality and adolescent depression in this context it is important to understand fundamental and underlying mechanisms in order to get a better understanding and treatment of it. If researchers can understand what underlies the development and vulnerability towards depression among youth, treatment can be modified to better target key factors. Internet-based interventions for depression are, compared to traditional face-to-face treatment, easy to present and to implement.

## 2. Aims

The aims of the current study are twofold: firstly, to assess the predictive power of gender, age, and personality aspects

(Junior Temperament Character Inventory, JTCI) for the severity of depressive symptoms (Centre for Epidemiologic Studies Depression scale, CES-D), and secondly, to explore the characteristics of users versus nonusers of an Internet-based intervention program (MoodGYM) using the variables JTCI (domain and facets), GSE, gender, and CES-D.

### 3. Method

**3.1. Procedure.** Participants were recruited from four senior high schools in Troms County in Northern Norway as a part of a larger study with a four-arm randomized controlled trial design with repeated measures (pre- and post- intervention). Members of our research group visited the four participating schools for recruiting the participants. The recruitment process involved the delivery of a short informative lecture about mental health in general and a presentation of the MoodGYM program, followed by an invitation to the students to participate in the study. Students volunteering to participate signed a written consent form. If the students did not want to participate in the MoodGYM trial, they had the choice of participating in the preintervention survey only. As an incentive for becoming a participant, a lottery drawing was announced. There was an additional lottery for those participating in the MoodGYM trial.

The data collection for the current study was part of the preintervention survey, which was conducted by computer in a classroom setting on the day of the information session. The students without access to a computer completed a paper version.

Students willing to participate in the MoodGYM trial received username and passwords on e-mail within a week of recruitment for registration in the program. The use of MoodGYM was self-directed, without personal followup, and no time was allocated during school hours. Within 6–8 weeks, the research team returned to collect postintervention data.

The regional medical research ethics committee approved the study. Data of use of MoodGYM were securely stored on a server at the Australian National University and were retrieved for information about use/nonuse for participants in the trial.

**3.2. MoodGYM.** MoodGYM is an internet-based self-help program based on the principles of cognitive behavior therapy (CBT). It has been developed at the Centre for Mental Health Research at the Australian National University in Canberra. The aim of this program is prevention and treatment of depression by means of five modules and a personal workbook [53]. Each module has a specific theme and is designed for increasing the users' knowledge about their own symptoms, negative automatic thoughts, dysfunctional attitudes, emotions, and coping strategies with regard to stress and interpersonal relationships. Each module takes between 30–45 minutes to be completed.

### 4. Outcome Measures

**4.1. Depressive Symptoms.** Level of depression was measured using a Norwegian version of the Centre for Epidemiologic Studies-Depression scale (CES-D) [54], developed to measure depressive symptomatology in the general population. This 20-item self-report scale yields scores ranging from 0 to 60 (scores given from 0 to 3), with a score of 16 or above indicating a clinical level of depression. However, we used a cutoff score above 24 was used which is assumed to detect more accurately clinically cases among adolescents [55, 56]. The CES-Ds Cronbach alpha in the current study was .884.

**4.2. Self-Efficacy (GSE).** Self-efficacy was measured using the Norwegian version of the General Self-Efficacy Scale (GSE) [57]. The scale consists of 10 items and assesses the ability of an individual's beliefs in handling difficult situations in an appropriate way. Responses are reported on a four-point scale ranging from "not at all true" to "exactly true." Its Cronbach alpha in the current study was .882.

**4.3. Junior Temperament and Character Inventory (JTCI).** The JTCI is a self-administered questionnaire containing 106 items scored on a five-point scale (1 to 5) ranging from "totally agree" to "totally disagree." The Norwegian version of the JTCI was developed according to established guidelines following several steps based on the German version of the JTCI [58]. This procedure included translation, backtranslation by independent native speakers, and linguistic revision of items [59].

The Cronbach alpha for the current study were for NS = .795, HA = .846, RD = .792, P = .793, SD = .846, CO = .803, and for ST = .796.

**4.4. Demographics.** Demographic parameters were gender, age, and grade in high school.

**4.5. Statistical Analysis.** All statistical analyses were performed with the SPSS version 18 and 19 for Macintosh. To identify unique JTCI correlates and predictors of depressed mood, hierarchical regression methods were used. For the domain-level analysis, all JTCI domains were subjected to forced entry in the same analytic step and their unique contributions simultaneously evaluated. In the facet-level analysis all of the 29 facets scales were entered in the same model using forward entry.

Bonferroni adjustment was applied to the critical  $\alpha$  level and for significance tests involving the seven domains and the 29 facet scores on the JTCI. This adjustment resulted in a critical  $\alpha$  level of .0071 (.05/7) and .0017 (.05/29), respectively.

Direct logistic regression was run to assess the impact of nine independent variables (CES-D, GSE, and the JTCI subscales) on the likelihood that participants in the study would use MoodGYM or not.

Another direct logistic regression assessed in more detail the impact of JTCI facets on users versus nonusers of MoodGYM. The model contained thirty-two independent

TABLE 1: Mean scores and standard deviations for male and female ( $n = 1239$ ).

	Male ( $n = 604$ )		Female ( $n = 635$ )	
	$\bar{x}$	SD	$\bar{x}$	SD
CES-D	10.996	8.334	15.776	9.845
GSE	29.842	5.119	29.001	4.234
NS	47.200	8.433	46.106	7.877
HA	36.480	8.473	40.962	8.832
RD	56.551	9.201	60.243	9.092
P	47.124	7.500	45.847	7.591
SD	51.940	9.408	49.230	9.341
CO	62.810	8.721	65.984	7.984
ST	26.204	7.098	28.224	7.256

CES-D: Centre for Epidemiological studies-Depression Scale; JTICI: The Junior Temperament and Character Inventory; NS: novelty seeking; HA: harm avoidance; RD: reward dependence; P: persistence; SD: self-directedness; CO: cooperativeness; ST: self-transcendence.

variables (CES-D, GSE, gender, and the twenty-nine JTICI facets).

## 5. Results

This study was conducted on adolescents from Norwegian senior high schools. The sample comprised 604 males (48.7%) and 635 females (51.3%) with a mean age of 16.8 (range = 15–20). Women scored significantly higher on CES-D than men  $F(1, 1233) = 84.32, P < .001$  with a mean of 15.78 and 11.00, respectively (Table 1). The total mean score for CES-D in this sample was 13.45. The percentage scoring above the cut-off of 16 was 30.7%, whereas the percentage above the cut-off of 24 was 14.3%.

When CES-D scores were correlated with the seven JTICI domains all coefficients emerged as significant (Table 2). HA ( $r = .56, P < .01$ ) and SD ( $r = -.64, P < .01$ ) yielded the strongest association with depressed mood. Somewhat lower significant associations were obtained for P ( $r = -.34, P < .01$ ), while small ones emerged with NS ( $r = .09, P < .01$ ), RD ( $r = -.14, P < .01$ ), CO ( $r = -.12, P < .01$ ), and ST ( $r = .16, P < .01$ ).

**5.1. Regression.** A hierarchical multiple regression analysis was applied to assess the power of gender, age and personality to predict depressive symptoms (CES-D). A preliminary analysis was conducted to disclose any violations of assumptions. Gender and age were entered into step one, explaining 6.5% of the variance in depression (Table 3). After the entry of the JTICI at step two, the total variance explained totaled to 46.3%,  $F(9, 1221) = 118.88, P < .001$ . The JTICI explained an additional 40.2% of the variance in depression,  $R$  square change = .402,  $F$  change (7,1221) = 131.42,  $P < .001$ . In the final model the following measures were statistically significant: gender ( $P < .001, \beta = .144$ ), and after Bonferroni correction: NS ( $P < .001, \beta = .109$ ), HA ( $P < .001, \beta = .181$ ), RD ( $P < .001, \beta = -.089$ ), SD ( $P < .001, \beta = -.487$ ), and CO ( $P < .001, \beta = .110$ ).

**5.2. Facet-Level Analyses.** A more detailed analysis was performed on facet level of the JTICI domains to check for their ability to predict depression. For this analysis, facet scale scores were entered into the hierarchical regression analysis at the second step in the model using forward selection after age and gender were forcedly entered in step one. Nine of the 29 facet scales emerged as unique and significant predictors. Together with gender and age, they explained 52.8% of the variance in CES-D scores (Table 4). Gender was found significant ( $P < .001$ ). Significant facets, after Bonferroni correction, were SD4 (self-striving) ( $\beta = .24, t = -8.06, P < .001$ ), SD2 (lack of goal direction) ( $\beta = -.277, t = -10.72, P < .001$ ), HA1 (anticipatory worry) ( $\beta = .16, t = 5.56, P < .001$ ), and RD4 (independence) ( $\beta = -.80, t = -3.76, P < .001$ ).

**5.3. Logistic Regression of the JTICI Domains.** Direct logistic regression was performed to assess the impact of a number of factors on the likelihood that participants in the study would use MoodGYM or not. The number of users in this sample was not optimal, with only 51 (7.3%) participants actually logging in and using the MoodGYM program.

The model contained ten independent variables (CES-D, GSE, gender, and the JTICI subscales). The overall model was significant  $\chi^2(10, n = 691) = 20.71, P < .05$ , indicating that the model was able to distinguish between participants that used and those who did not use MoodGYM. The model as a whole explained between 3.2 (Cox and Snell  $R$  square) and 7.9% (Nagelkerke  $R$  square) of the variance in use/nonuse and correctly classified 45.2% (an improvement of 37.8% from the model where only the constant is included) of the cases. Further, the Hosmer and Lemeshow test has a significance level of .584, thus indicating that the model prediction does not significantly differ from the observed. The Wald criterion showed (Table 5) that only two of the independent variables made a unique statistically significant contribution to the model (CES-D and the subscale RD on the JTICI). Gender, GSE, and six of the JTICI domains were not significant predictors. The strongest predictor of use/nonuse was CES-D, yielding an odds ratio of 1.05 ( $P < .05$ ), and indicated that those who reported a higher level on CES-D were more likely to use MoodGYM than those who scored lower on CES-D, controlling for all the other factors in the model. This means that for every point a participant increased on the CES-D score, the odds of using MoodGYM increased with 5% (O.R. = 1.05). The odds ratio of .953 for RD (reward dependence) indicates that for every additional point on RD the odds were 4.7% less for the participants to use MoodGYM, controlling for other factors in the model.

**5.4. Logistic Regression on the JTICI Facets.** To investigate in more detail the traits of MoodGYM users, a direct logistic regression was performed to assess the impact of the JTICI facets on the likelihood that participants in the study would use MoodGYM or not.

The model contained thirty-two independent variables (CES-D, GSE, gender, and the twenty-nine facets of the JTICI). The overall model was significant  $\chi^2(31, n = 691)$

TABLE 2: Correlation table of the variables in the hierarchical multiple regression ( $n = 1231$ ).

	CES-D	Age	NS	HA	RD	P	SD	CO	ST
CES-D	—	.026	.093**	.559**	-.140**	-.339**	-.642**	-.115**	.155**
Age		—	-.037*	-.007	-.026	.018	.025	.079**	-.031
NS			—	-.059*	.216**	-.210**	-.109**	-.253**	.208**
HA				—	-.178**	-.427**	-.711**	-.153**	.261**
RD					—	.204**	.231**	.450**	.182**
P						—	.494**	.478**	-.001
SD							—	.305**	-.183**
CO								—	.111**
ST									—

CES-D: Center for Epidemiological studies-Depression Scale; JTCI: The Junior Temperament and Character Inventory; NS: novelty seeking; HA: harm avoidance; RD: reward dependence; P: persistence; SD: self-directedness; CO: cooperativeness; ST: self-transcendence. \*\* $P < .01$ , \* $P < .05$ .

TABLE 3: Hierarchical multiple regression analysis of CES-D as a function of JTCI domain scales after controlling for gender and age ( $n = 1230$ ).

Correlates	Standardized beta coefficients	
	Model 1	Model 2
Gender	.254***	.144***
Age	.032	.036
NS		.109****
HA		.181****
RD		-.089****
P		-.023
SD		-.487****
CO		.110****
ST		-.017
Adj $R^2$	.064	.463
$\Delta F$	42.76*	131.42*
$\Delta R^2$	.065	.402

CES-D: Centre for Epidemiological studies-Depression Scale; JTCI: The Junior Temperament and Character Inventory; NS: Novelty Seeking; HA: Harm Avoidance; RD: Reward Dependence; P: Persistence; SD: Self-Directedness; CO: Cooperativeness; ST: Self-Transcendence. For age, gender, and the evaluation of the  $\Delta F$  statistic: \*\*\* $P \leq .001$ , and \*\* $P < .01$ , and \* $P < .05$ . For the JTCI domains where Bonferroni adjustments were made on the critical  $\alpha$ , \*\*\*\* $P < .0071$ .

= 59.92,  $P \leq .001$ , indicating its ability to distinguish between participants who used versus not used MoodGYM. The model as a whole explained between 8.3 (Cox and Snell  $R$  square) and 20.3% (Nagelkerke  $R$  square) of the variance in use/nonuse and correctly classified 60.9% (an improvement of 53.5% from the model where only the constant is included) of the cases. Furthermore, the Hosmer and Lemeshow test yielded a significance level of .241, thus indicating that the model prediction does not significantly differ from the observed. The Wald criterion demonstrated (Table 6) that seven of the independent variables made a unique statistically significant contribution to the model (CES-D, gender, the JTCI facets ns4, ha1, ha4, rd4, p4, and sd3). The strongest predictor of use/nonuse was gender, yielding an odds ratio of 2.65 ( $P < .05$ ) indicating that female

students have a 26.5% increase of odds for using MoodGYM. Findings are reported in Table 6.

### 6. Discussion

The findings from this study underline the potential importance of personality in adolescent depression. The JTCI factors harm avoidance and self-directedness, yielded the strongest associations. In the regression model, JTCI domains explained additional 40.2% of the variance in CES-D after having controlled for age and gender. NS, HA, RD, SD, and CO emerged as significant correlates in explaining depression among adolescents, which is slightly different from an adult population [15, 16, 23]. Cloninger et al. [28] have described individuals with high scores on the temperament domain NS as exploratory and curious, impulsive and disordered while high scores on HA are associated with being worried and pessimistic, fearful, shy, and fatigable. Further, low scores on RD reflect a cold personality, detached and independent from others. Another association was found between CES-D and the character domains of SD and CO. Scoring low on SD is found to be associated with being immature and fragile, blaming, unreliable, ineffective, and having problems working towards long-term goals. Individuals scoring high on CO are described as socially tolerant, empathic, compassionate, and ethical. Studies report a significant negative correlation between depression and CO [15, 16, 23], which is confirmed in the current study. However, when included in the final regression model and considered together with other domains the negative correlation between CES-D and CO turns into a positive beta coefficient. This suppression effect seems to be due to variations of positive and negative correlations between the other personality domains and CES-D, but leaving the true direction of the association between CO and CES-D for this sample in a positive direction. As shown above, the strongest correlations toward CES-D occurred between SD and HA, which is in line with previous findings [15, 23]. Cloninger et al. [15] found that HA functions as a marker for vulnerability to depression, while SD was a marker of a central protective function towards depression. The current findings exhibit depressed individuals as

TABLE 4: Hierarchical multiple regression analysis of CES-D scores as a function of JTCl facet scales after controlling for age and gender ( $n = 1236$ ).

Correlates	Standardized beta coefficients											
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Gender	.254***	.112***	.119***	.087***	.094***	.115***	.109***	.101***	.112***	.115***	.115***	.115***
Age	.032	.044*	.021	.025	.024	.023	.018	.015	.020	.020	.020	.014
SD4: self-striving	-.608***	-.427***	-.310***	-.285***	-.285***	-.273***	-.272***	-.259***	-.258***	-.241***	-.240***	-.243***
SD2: lack of goal direction			-.306***	-.298***	-.296***	-.285***	-.297***	-.291***	-.283***	-.278***	-.268***	-.277***
HA1: anticipatory worry			.214***		.189***	.202***	.196***	.191***	.193***	.167***	.164***	.157***
ST1: self-forgetfulness					.099***	.092***	.087***	.080***	.068	.061	.068	.066
RD4: independence					-.080***	-.080***	-.088***	-.089***	-.086***	-.089***	-.084***	-.080***
CO2: empathy					.057			.071	.067	.069	.083***	.061
HA4: fatigability								.065	.065	.061	.056	.063
NS4: disorderliness								.048	.048	.056	.058	.060
HA2 fear of uncertainty									.067	.067	.077	.089
ST2: transpersonal identification											-.055	-.054
SD3: resourcefulness												.057
AdjR <sup>2</sup>	.064	.413	.474	.502	.509	.514	.517	.520	.552	.524	.526	.528
$\Delta F$	42.76	732.00	143.05	68.93	19.81	14.41	7.64	8.61	4.91	6.78	6.38	5.71
$\Delta R^2$	.065	.349	.061	.028	.008	.006	.003	.003	.002	.002	.002	.002

CES-D: Centre for Epidemiological studies-Depression Scale; JTCl: The Junior Temperament and Character Inventory. For ages, Gender, and the evaluation of  $\Delta F$  statistics, \*\*\* $P < .001$ ; \*\* $P < .01$ ; \* $P < .05$ . For the JTCl facets Bonferroni adjustments were made on the critical  $\alpha$  level, \*\*\*\* $P < .0017$ .

TABLE 5: Logistic regression predicting the likelihood of using MoodGYM ( $n = 691$ ).

	<i>B</i>	SE	Wald	df	<i>P</i>	Odds ratio	95% CI for odds ratio	
							Lower	Upper
CES-D	.046	.019	5.67	1	.017*	1.047	1.008	1.087
GSE	-.039	.033	1.39	1	.239	.962	.901	1.026
Gender	.477	.346	1.90	1	.168	1.611	.817	3.175
Novelty seeking	-.019	.022	.780	1	.377	.981	.940	1.024
Harm avoidance	-.047	.025	3.57	1	.059	.954	.909	1.002
Reward dependence	-.048	.018	6.87	1	.009*	.953	.920	.988
Persistence	.014	.025	.33	1	.564	1.015	.966	1.066
Self directedness	.021	.026	.64	1	.425	1.021	.970	1.074
Cooperativeness	.017	.023	.54	1	.461	1.017	.973	1.063
Self-transcendence	.016	.022	.55	1	.460	1.016	.974	1.060
Constant	-.214	2.654	.01	1	.936	.807		

Significant  $P < .05^*$ .

anxiety-prone and immature. The reason for the positive relationship between CO and depression might be due to being very empathic and considerate, thus experiencing an emotionally oversensitivity, leading to lowered mood states.

The facet level analysis reveals a more detailed picture of traits affecting depressed mood. The second regression model shows that the JTICI facets explain 46.4% of the variance in CES-D. The following facets emerged as significant associations with CES-D: SD4 (self-striving), SD2 (lack of goal direction), HA1 (anticipatory worry), and RD4 (independence). Cloninger et al. [28] described individuals low on SD4 as self-striving people, never accepting nor enjoying their actual mental and physical features. They also have severe problems adjusting perceptions of themselves when corrected by the environment. High scores on SD2 characterize persons having difficulties in finding direction and meaning in their lives and instead react to current situations and immediate needs. Scoring high in HA1 indicates two types of behavioral tendencies. Such individuals are pessimistic, expecting failure and harm, especially in adverse and unfamiliar situations. Further, these individuals have difficulties in forgetting embarrassment and a tendency to ruminate about stressful situations for long periods of time. And finally, scoring low on RD4 describes individuals who are independent and accordingly do not seek emotional support and approval from the environment. They appear insensitive to social pressure, criticism and rarely give in to the wishes of others.

The present study was conducted among a younger sample that might affect which domains and facets emerge as specific. The results from the facet level analysis reflect adolescents with elevated depressive symptoms as individuals lacking the ability to work towards long-term goals, which in addition, worry and expect the worse in situations even when there is support and assurance available. They resemble withdrawn, independent individuals, who apparently are insensitive to social pressure, which at first glance might display them with a strong personality, not vulnerable to depression. This finding might be a combined effect of

the other facets and seems like a natural response when individuals struggle with their self-image at the same time as they worry and expect negative outcomes and do not cope adequately with embarrassment. A subject with such a personality will most likely not express true feelings.

The challenges concerning adherence of online CBT users deserve further investigations [46, 47]. Describing the users of Internet interventions will probably increase the ability to predict adherence and intervention outcome. The results from the logistic regression used in the current study revealed that the only predictors for the use of MoodGYM were depression and RD (reward dependence). This is both in accordance with findings of some studies [47] but also contrasts others [48]. The indication that higher scores on CES-D predictive use of this online intervention tells us that presenting this kind of intervention to the population will most likely facilitate use among individuals with elevated symptoms on depression. This highlights the importance of finding effective strategies to maintain adherence among those who decide to use the program. Another significant predictor was reward dependence. Cloninger et al. [28] described individuals scoring low on this temperament trait as cold, socially insensitive, preferring to keep distance to others, and having objective views that are not romanticized by a desire to please others or wishful thinking. A possible explanation for this domain being a significant predictor for use might be that these individuals prefer a self-help approach to deal with their problems, rather than seek help from others.

In order to give a more detailed description of the users of MoodGYM, a second logistic regression was done including the same predictors, but based on the JTICI facets. Here, gender was the strongest predictor, indicating that female students are more likely than male students to use this kind of intervention. The level of depressive symptomatology also predicted its use, reflecting that depressed individuals might actively use this kind of program. The facet sd3 (resourcefulness) also emerged as a strong predictor of use, indicating that the users are resourceful and effective

TABLE 6: Logistic regression predicting the likelihood of using MoodGYM ( $n = 691$ ).

	<i>B</i>	SE	Wald	df	<i>P</i>	odds ratio	95% CI for odds ratio	
							Lower	Upper
CESD	.052	.023	5.01	1	.025*	1.054	1.007	1.103
GSE	-.057	.038	2.22	1	.136	.945	.877	1.018
Gender	.973	.415	5.50	1	.019*	2.646	1.173	5.969
ns1 (exploratory excitability)	.027	.071	.14	1	.704	1.027	.894	1.181
ns2 (impulsiveness)	.000	.072	.00	1	.999	1.000	.869	1.151
ns3 (extravagance)	.037	.067	.31	1	.580	1.038	.911	1.182
ns4 (regimentation)	-.154	.069	4.98	1	.026*	.858	.749	.981
ha1 (anticipatory worry)	-.163	.082	3.91	1	.048*	.850	.723	.999
ha2 (fear of uncertainty)	-.017	.068	.06	1	.804	.983	.861	1.123
ha3 (shyness with strangers)	.035	.081	.18	1	.671	1.035	.883	1.214
ha4 (vigor)	-.153	.075	4.22	1	.040*	.858	.741	.993
rd1 (sentimentality)	-.082	.064	1.65	1	.198	.921	.813	1.044
rd2 (openness to warm communication)	.049	.045	1.16	1	.281	1.050	.961	1.147
rd3 (detachment)	-.152	.091	2.80	1	.094	.859	.719	1.026
rd4 (independence)	-.124	.063	3.92	1	.048*	.883	.781	.999
p1 (eagerness to effort)	-.047	.082	.33	1	.563	.954	.812	1.120
p2 (work hardened)	.090	.081	1.26	1	.263	1.094	.935	1.282
p3 (ambitious)	.004	.071	.00	1	.958	1.004	.874	1.153
p4 (perfectionist)	-.230	.111	4.30	1	.038*	.795	.640	.987
sd1 (blaming)	-.034	.076	.20	1	.653	.966	.833	1.121
sd2 (purposefulness)	.003	.089	.00	1	.974	1.003	.842	1.194
sd3 (resourcefulness)	.373	.113	10.87	1	.001**	1.453	1.163	1.814
sd4 (self-striving)	-.018	.059	.09	1	.764	.982	.875	1.103
co1 (social acceptance)	.087	.092	.90	1	.342	1.091	.912	1.305
co2 (social disinterest)	-.152	.091	2.77	1	.096	.859	.719	1.027
co3 (helpfulness)	.111	.089	1.56	1	.212	1.117	.938	1.331
co4 (compassion)	.075	.097	.60	1	.438	1.078	.892	1.303
co5 (self-serving advantage)	-.081	.081	.99	1	.320	.922	.786	1.082
st1 (self-forgetfulness)	.011	.065	.03	1	.865	1.011	.890	1.148
st2 (transpersonal identification)	.173	.089	3.79	1	.052	1.188	.999	1.414
st3 (rational materialism)	-.056	.051	1.21	1	.271	.945	.856	1.045
Constant	2.017	3.28	.38	1	.539	7.513	—	—

Significant  $P < .05^*$  and  $P \leq .001$ .

individuals, focused on solving problems and are perceived by others as competent and productive. On the other hand, they score lower on p4 (pragmatic) [29], describing them as somewhat lazy underachieving individuals who can be seen as pragmatics accepting compromises easily [28]. Further, they obtain low scores on rd4 (independence) implying that they rarely seek emotional support from others, rather impress others as self-sufficient and they are not reacting to social pressure. Another significant facet, ha1 (anticipatory worry) describes individuals as worried and anticipating harm. Ha4 (vigor) also emerged as specific. Low scores on this facet depict individuals as energetic and dynamic, with less need for rest, who rarely have to push themselves. Further, ns4 (regimentation) emerged significant in predicting use, identifying individuals who tend to be

organized, methodical, and systematic. They prefer activities with strict rules and are able to postpone gratification longer than most of us.

This gives a picture of the MoodGYM users as effective and strict rule-followers, working effectively in order to achieve goals, at the same time as they seem similar to independent individuals reluctant to take into account what others do or mean. These individuals' worry of failure might function as worry of failure might function as a facilitator towards goal-directed behavior, at the same time as it reflects their vulnerability to depression. They also seem to be like resourceful individuals who are underachieving, holding a pragmatic view upon what they are doing. These aspects, together with the level of depression symptoms and gender, moderately predict use of MoodGYM, indicating that there

could exist other important factors that will better predict its use.

The assessment of the characteristics of internet-based intervention users is an intriguing aspect of online delivery healthcare research that needs further investigation. The fact that only a few students used the MoodGYM program might indicate that this kind of intervention is most appealing to and effective in individuals with specific characteristics. The delineated characteristics of MoodGYM users might aid us in the further development of internet-based programs, their implementation and last but not least facilitate uptake and adherence.

## 7. Limitations

Data collection occurred in a classroom environment, not ensuring sufficient privacy for the participants. Further, the effect sizes reported are small. Also the variables failed to explain a larger portion of the variance, indicating that definite conclusions of both predicting use/nonuse and depression cannot be drawn. A relatively small number of MoodGYM users (7.3%) also compromise the study. Further, the large sample size also raises concern about unreliable responses. To minimize the possible effect, repeated “data-washing” was made, and this effect is assumed to be minimal. Finally, this group of adolescents had not been specifically asked to take part in a treatment intervention, which may also affect the outcome and possibly the low rate of adherence to the intervention. Since this investigation represents part of a larger study on identifying and exploring different aspects of MoodGYM after its introduction in Norway, its results should be regarded as preliminary.

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## Research Article

# Temperament, Character, and Adolescents' Depressive Symptoms: Focusing on Affect

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Positive (PA) and negative affect (NA) are two separate systems markers of subjective well-being and measures of the state depression (low PA combined with high NA). The present study investigated differences in temperament, character, locus of control, and depressive symptoms (sleep quality, stress, and lack of energy) between affective profiles in an adolescent sample. Participants ( $N = 304$ ) were categorized into four affective profiles: “self-fulfilling” (high PA, low NA), “high affective” (high PA, high NA), “low affective” (low PA, low NA), and “self-destructive” (low PA, high NA). Personality was measured by the Temperament and Character Inventory and affective profiles by the Positive Affect and Negative Affect Schedule. The “self-fulfilling” profile was characterized by, compared to the other affective profiles, higher levels of sleep quality, less stress and more energy and also higher levels of persistence and a mature character (i.e., high scores in self-directedness and cooperativeness). “Self-destructive” adolescents reported higher levels of external locus of control, high scores in harm avoidance and reward dependence combined with less mature character. The results identify the importance of character maturity in well-being and suggest that depressive state can be positively influenced by promoting positive emotions which appears to be achieved by character development.

## 1. Introduction

Although most would agree in viewing positive and negative affect as opposite ends of a continuum, there is much evidence that they are best construed as two separate systems [1]. For example, the two dimensions are also measures of clinical diagnoses, such as depression, defining it as a mixed state of high negative affect (NA) and low positive affect (PA) [2]. An increase in the frequency of PA and a decrease in the frequency of NA, or a combination of both changes, may lead to an improvement of the depressive symptoms [3]. This simple observation might be crucial regard in adolescence—a period of life when daily problems (e.g., coping with a minor social conflict) seem to be equally stressful experiences as major life events (e.g., parent being remarried) [4].

Moreover, the two dimensions of affect are markers of subjective well-being (SWB), which is usually measured through subjective evaluation and involves both a cognitive and an affective component [5]. Life satisfaction is suggested as the cognitive component and refers to a comparison process in which individuals assess the quality of their lives on the basis of their own self-imposed standard [6]. The affective component of SWB is computed by subtracting the number of NA from the number of PA experienced by the individual, resulting in the so-called affect balance [7]. Seeing the affective component as a unidimensional model, with “ill-being” at one pole and “well-being” at the other, present qualitative differences between individuals that are high compared to low in both dimensions [8].

Along this line of reasoning, some researchers [9–11] have developed the affective personality profiles based on

self-reported affect measured by the Positive Affect and Negative Affect Schedule [12]. The combinations of these two variables generate four different profiles: self-fulfilling (high PA, low NA); high affective (high PA, high NA); low affective (low PA, low NA); and self-destructive (low PA, high NA). The affective personalities framework goes beyond the view of affect as a two separate systems, taking into account the interaction of both dispositions as recommended by Ito and Cacioppo [8] and also observations of two-system theories suggesting that, when using dichotomous features, combinations must be ruled out [13].

Studies among adults show that self-fulfilling and high affective profiles, compared to low affective and self-destructive profiles, perform better during stressful situations (e.g., Norlander et al. [9], induced stress using the Stroop Color and Word Test by Stroop [14]) have a more active life (i.e., exercise more often and more intensively). Even in physiological measures differences can be detected, such as they have lower blood pressure [9, 10] (see also Kunst [15] who showed that the self-destructive and high affective profiles were strongly associated with increased posttraumatic stress disorder symptoms severity). Nevertheless, while low affective profiles have responded maladaptive to induced stress, compared to self-fulfilling and high affective individuals [9], they have reported less stress in their life as the self-fulfilling profiles [10]. In the context of adolescence, low affective ones seem to avoid stressful situations by neutralizing negative and positive experiences (see Garcia and Siddiqui research [16], for results using the Interpretation and Recognition for Words in a Short Story measure [17], which indicate that low affective adolescents rate negative words in a short story as neutral). Self-fulfilling adolescents, just as adults, report feeling more energetic and optimistic than the other three affective profiles [11].

Moreover, self-acceptance [18, 19], locus of control [20], and self-efficacy [21] are also good predictors of adolescents' affective experience. These constructs are, at least in part, good definitions of character (i.e., concepts of the self, goals, and values) [22]. Although the concept of character holds a major position in psychology, see for example [23, 24], most research on happiness (e.g., high PA and low NA) has focused on traits models of personality, for example, the Big Five Model of personality [25].

According to Cloninger's psychobiological model of personality [26], temperament reflects the basic organization of independently different brain systems for the activation, maintenance, and inhibition of behaviour in response to stimuli. Hence, temperament may be responsible for our likes and dislikes or what Haidt [27] calls the "Like-o-Meter". Character is defined as what people make of them selves intentionally or individual differences in prepositional learning of personal goals, values, and even defence mechanisms [22]. Cloninger [22] has suggested that character modifies the significance or meaning of what is experienced, hence also changing emotional reactions and habits. In other words, understanding the self as a unity of being (the self as an autonomous individual, the self as an integral part of humanity or society, and the self as an integral part of the universe) leads to attitudes that increase

"personal satisfaction, sublimation, and flexibility regardless of external circumstances" ([22, page 126]; see Table 1 for a closer description of the different dimensions of Cloninger's psychobiological model).

Cloninger's psychobiological model of personality offers important contributions to the understanding of the role of personality on adolescents' emotional experience. Adolescents who seek novel experiences (high novelty seeking) and higher levels of reward (high reward dependence), for example, often engage in risky behaviors, without considering future outcomes or consequences [28], thereby explaining why some extrovert behaviours might be counterproductive and lead to high levels of NA in the context of adolescence. Moreover, self-directedness, a character dimension defined by autonomous and goal-directed behaviour, self-control, and the sense of responsibility is negatively related to NA, while harm avoidance, a temperament dimension characterized by excessive worrying, pessimism, and being fearful, doubtful, and easily fatigued, is positively related to NA [29]. Development of the self in adolescence may be focused on the concept of the self as independent (i.e., self-directed behaviour) [30] and that specific concept of the self may be another key element to understand the experience of high PA—being able to withstand peer pressure, for instance, gives feelings of personal integrity, honour, self-esteem, effectiveness, leadership, and hope. Such character strengths and feelings may lead to positive affect because they strengthen and prepare the adolescent to cope with different situations [31–34]. More recently, neuroimaging research suggests that cognitive and behavioral changes occurring during adolescence might be understood from the perspective of increased "executive functioning" (e.g., attention, response inhibition, regulation of emotion, organization, and long-range planning; for a review see [35]). This high orders functioning relies on frontal lobe circuitry and represents character maturing.

Accepting that PA and NA are different constructs, the present study investigates differences in temperament, character, locus of control, and symptoms of depression (sleep quality, stress, and lack of energy) between affective personality profiles in an adolescent sample. The hypothesis that self-destructive adolescents report most depressive symptoms compared to their classmates, and that personality profiles (including temperament and character) are distinct descriptive of affective profiles is tested.

## 2. Method

**2.1. Participants.** The 304 participants (183 boys, 121 girls) were high school pupils from west Sweden ( $M = 17.34$  years,  $SD = 1.16$ , range = 16–19). They were from different socioeconomic and cultural backgrounds and specializing in different subjects during their studies.

### 2.2. Instruments

*Positive Affect and Negative Affect Schedule (PANAS)* [12]. The Swedish PANAS version used in the present study has

TABLE 1: Temperament and character description (reproduced with permission of C. R. Cloninger).

	Temperament and character descriptors	
<i>Temperament</i>	<i>High scores</i>	<i>Low scores</i>
Harm avoidance	Worrying and pessimistic; fearful and doubtful; shy; fatigable.	Relaxed and optimistic; bold and confident; outgoing; vigorous.
Novelty seeking	Exploratory and curious; impulsive; extravagant and enthusiastic; disorderly.	Indifferent; reflective; frugal and detached; orderly and regimented.
Reward dependence	Sentimental and warm; dedicated and attached; dependent.	Practical and cold; withdraw and detached; independent.
Persistence	Industrious and diligent; hard working; ambitious and overachiever; perseverant and perfectionist.	Inactive and indolent; gives up easily; modest and underachiever; quitting and pragmatist.
<i>Character</i>		
Self-directedness	Mature and strong; responsible and reliable; purposeful; resourceful and effective; self-accepted; habits congruent with long-term goals.	Immature and fragile; blaming and unreliable; purposeless; inert and ineffective; self-striving; habits incongruent with long-term goals.
Cooperativeness	Socially tolerant; empathic; helpful; compassionate and constructive; ethical and principled.	Socially intolerant; critical; unhelpful; revengeful and destructive; opportunistic.
Self-transcendence	Wise and patient; creative and self-forgetful; united with the universe.	Impatient; unimaginative and self-conscious; pride and lack of humility.

been largely used in other studies among adolescents, for example, [36–39]. The PANAS instructs participants to rate to what extent they generally have experienced 20 different feelings or emotions (10 PA and 10 NA) for the last four weeks, using a 5-point Likert scale (1 = very slightly, 5 = extremely). The 10-item PA scale includes adjectives such as strong, proud, and interested. The 10-item NA scale includes adjectives such as afraid, ashamed, and nervous. In the present study, PA showed a Cronbach’s  $\alpha = .83$  and NA a Cronbach’s  $\alpha = .83$ .

Previous studies [9–11] have modified and developed the PANAS instrument further through a subject-response based derivation of the four types of affective personality profiles. This procedure was implemented in the present study through dividing the results on the PA scale into two parts thereby distributing the participants into one group with high PA and another group with low PA (cut-off point= 53.2%). The same procedure was implemented for the participants’ responses on the NA-scale (cut-off point = 48.9%). Following this, the results from these two scales were

combined according to the procedure that assigned each one of the participants into one of the four affective personality groups as follows: individuals showing high PA and low NA (self-fulfilling), high PA and high NA (high affective), low PA and low NA (low affective), and low PA and high NA (self-destructive).

*The Temperament and Character Inventory (TCI)* [26]. The TCI measures the seven factors of the psychobiological model of personality with a total of 238 items with forced binary answer (yes or no). The Swedish version of the TCI [40] was used in the present study. The four temperament dimensions are: harm avoidance (e.g., “I often feel tense and worried in unfamiliar situations, even when others feel there is little to worry about”), novelty seeking (e.g., “I often try new things just for fun or thrills, even if most people think it is a waste of time”), reward dependence (e.g., “I like to discuss my experience and feelings openly with friends instead of keeping them to myself”), and persistence (e.g.,

“I often push myself to the point of exhaustion or try to do more than I really can”). The three character dimensions are: self-directedness (e.g., “In most situations my natural responses are based on good habits that I have developed”), cooperativeness (e.g., “I often consider another person’s feelings as much as my own”), and self-transcendence (e.g., “I sometimes feel so connected to nature that everything seems to be part of one living organism”). Cronbach’s  $\alpha$  varied between .69 and .72 in the present study.

*Stress and Energy (SE)* [41]. The SE instrument is a self-estimation scale, consisting of 12 items that assess individuals’ experience of their own stress and energy. The test is divided into two subscales that express each participant’s level of mood in the two dimensions: “experienced stress” and “experienced energy”. Response alternatives are ordered within 6 points Likert scales (0 = not at all, 5 = very much). The Cronbach’s  $\alpha$  were .64 for stress and .66 for energy in the present study.

*Uppsala Sleep Inventory (USI)* [42]. The USI is a self-report instrument describing participants’ sleep profiles, as characterized by descriptions of potential difficulties falling asleep, psychophysiological problems (such as body aches, muscle tension, beating heart, “pins and needles”, anxiety feelings, etc.), and larger sleep problems. Here five response alternatives were available: “none”, “a little”, “about average”, “large”, and “very great”. The Cronbach’s  $\alpha$  were .71 for major sleep problems, .75 for difficulties falling asleep, and .72 for psychophysiological problems.

*Locus of Control* [43]. The Locus of Control scale is a modified version of the original Rotter scale [44]. The scale has a minimum score of 8 and a maximum of 40, with a lower score representing an external locus of control orientation and a higher score representing an internal locus of control orientation.

**2.3. Procedure.** All adolescents in the study had written parental consent. If parents wanted any further information about the study, they were asked to contact the researchers. All adolescents received cinema tickets for their anonymous participation.

For statistical analyses the multiple analysis of variance (MANOVA) test was applied in order to identify differences in depressive symptoms and personality between affective profiles, during what the affective profile was the independent variable and the dependent variables were depressive symptoms (i.e., levels of stress and energy, sleep problems, difficulties falling asleep, psychophysiological problems), personality (measured by the TCI), and locus of control (external and internal).

### 3. Results

The four defined affective profiles were characterized with different patterns of depressive symptoms. A significant effect emerged for levels of stress ( $F(3, 321) = 19.03$ ,

$P < .001$ ), energy ( $F(3, 321) = 20.31, P < .001$ ), large sleep problems ( $F(3, 321) = 18.01, P < .001$ ), difficulties falling asleep ( $F(3, 318) = 24.45, P < .001$ ), and for psychobiological problems ( $F(3, 321) = 11.19, P < .001$ ). Self-fulfilling adolescents reported significantly higher level of energy as well as in all cases lower (in most cases significantly lower) levels of stress, sleep, or psychobiological problems (Table 2). The group of high affective ones differed mostly from self-destructive ones in their increased energy. The low affective adolescents differed mostly from the self-destructive ones in their decreased level of stress and psychobiological problems.

In regard to personality profiles describing the four affective group self-fulfilling adolescents were characterized with significantly lower harm avoidance ( $F(3, 303) = 23.30, P < .001$ ), and significantly higher persistence ( $F(3, 303) = 7.63, P < .001$ ), than the other three groups of youngsters. Moreover, they possessed a more mature character, measured with significantly higher scores in TCI self-directedness ( $F(3, 303) = 20.55, P < .001$ ) and TCI cooperativeness ( $F(3, 303) = 2.59, P = .05$ ). On the other side, high affective and self-destructive groups were described by high reward dependence. Low-affective adolescents differed mostly in lower self-transcendence ( $F(3, 303) = 6.61, P < .001$ ) from their high affective classmates. Adolescents with a self-destructive profile reported higher external locus of control ( $F(3, 317) = 9.07, P < .001$ ) while no differences emerged for internal locus of control ( $F(3, 320) = 1.30, P = .263$ ) between any of the four groups (Table 3).

### 4. Discussion

In the present study, we tested the hypothesis that self-destructive adolescents report most depressive symptoms compared to their classmates, and that personality profiles (including temperament and character) are distinct descriptive of affective profiles. The results showed that adolescents expressing a self-fulfilling profile (i.e., high PA and low NA) report higher levels of sleep quality, less stress, and more energy than the other three profiles and had a more mature character and were more persistent. As suggested in the introduction, adolescents who seek novel experiences and higher levels of reward often engage in risky behaviours, without considering future outcomes or consequences [28]. In contrast, character strengths may lead to positive emotions because they strengthen and prepare the adolescent to cope with different situations [22, 31]. Although Cloninger [22] describes possible risks throughout life for persons with special combinations of “difficult temperament” mediated by psychosocial conflicts, the temperament is assumed to have a more pathoplastic effect while the character development is the key to understand and evaluate health. Recently, Brown and colleagues [45] found that, among adolescents, PA was positively correlated with mindfulness measured with Mindful Attention Awareness Scale Adolescent. Mindfulness, in turn, was positively related to higher life satisfaction and wellness. In day-to-day life, mindfulness is an awareness of the presence and a conscious processing based on experience [46]. Positive affect has also been found to be related to and associated with better stress handling [9, 47], better

TABLE 2: Mean ( $\pm$ SD) scores for stress, energy, large sleep problems, difficulties falling asleep, and psychobiological problems among affective profiles.

	Self-fulfilling (high PA and low NA)	High affective (high PA and high NA)	Low affective (low PA and low NA)	Self-destructive (low PA and high NA)
Energy	30.49 $\pm$ .86*	26.02 $\pm$ .89	23.90 $\pm$ .88	21.70 $\pm$ .73
Stress	15.94 $\pm$ .99	20.16 $\pm$ 1.13 <sup>▲</sup>	16.04 $\pm$ .86	26.50 $\pm$ 1.15 <sup>▲</sup>
Major sleep problems	15.50 $\pm$ 4.20	19.30 $\pm$ 4.19 <sup>▲</sup>	17.30 $\pm$ 4.69 <sup>▲</sup>	19.95 $\pm$ 4.86 <sup>▲</sup>
Difficulties falling asleep	17.42 $\pm$ 4.29	21.34 $\pm$ 4.96 <sup>▲</sup>	18.52 $\pm$ 4.88	23.52 $\pm$ 6.49 <sup>▲</sup>
Psychophysiological problems	20.61 $\pm$ .93	25.63 $\pm$ 1.07 <sup>▲</sup>	24.06 $\pm$ 1.09 <sup>▲</sup>	29.24 $\pm$ 1.09 <sup>▲</sup>

N = 304, \*higher than the other three groups, <sup>▲</sup>higher than self-fulfilling.

TABLE 3: Mean ( $\pm$ SD) scores for temperament, character, and locus of control among affective profiles.

	Self-fulfilling (high PA and low NA)	High affective (high PA and high NA)	Low affective (low PA and low NA)	Self-destructive (low PA and high NA)
Novelty seeking	56.06 $\pm$ 1.45	56.34 $\pm$ 1.58	55.37 $\pm$ 1.51	54.31 $\pm$ 1.53
Harm avoidance	33.22 $\pm$ 1.79	42.92 $\pm$ 1.35 <sup>▲</sup>	45.19 $\pm$ 1.80 <sup>▲</sup>	54.97 $\pm$ 1.93 <sup>▲</sup>
Reward dependence	53.31 $\pm$ 1.48	56.58 $\pm$ 1.61 <sup>▲</sup>	52.17 $\pm$ 1.55	57.06 $\pm$ 1.72 <sup>▲</sup>
Persistence	59.38 $\pm$ 2.52*	53.31 $\pm$ 2.72	43.50 $\pm$ 2.47	44.11 $\pm$ 2.41
Self-directedness	65.62 $\pm$ 1.45*	58.02 $\pm$ 1.27	60.43 $\pm$ 1.73	48.30 $\pm$ 1.57
Cooperativeness	69.37 $\pm$ 1.39*	67.13 $\pm$ 1.54	65.95 $\pm$ 1.59	63.05 $\pm$ 1.68
Self-transcendence	39.42 $\pm$ 1.87	48.61 $\pm$ 1.78*	34.77 $\pm$ 1.61	41.76 $\pm$ 1.73
External locus of control	7.11 $\pm$ 2.15	9.21 $\pm$ 2.33	7.25 $\pm$ 2.56	14.49 $\pm$ 2.32 <sup>▲</sup>
Internal locus of control	12.71 $\pm$ 2.37	12.65 $\pm$ 2.88	12.41 $\pm$ 2.59	12.02 $\pm$ 2.46

N = 304, \*higher than the other three groups, <sup>▲</sup>higher than self-fulfilling, \*higher than low affective.

sleep quality [48], and better coping resources [10, 47]. Even momentarily PA can be associated with such positive effects as survival in elderly people [49]. Together, these findings indicate that PA is associated with a more “mature” and health related character in adolescence.

In the present study, this mature character was defined by a higher autonomous self-concept (i.e., high in self-directedness) and a tendency to be more socially adapted (i.e., high cooperativeness). A self-directed adolescent might be described as mature and strong, responsible and reliable, purposeful, resourceful and effective, and self-accepted [22]. Similarly, an adolescent expressing high level of cooperativeness is socially tolerant, empathic, helpful, compassionate, and constructive [22]. Thus, interventions that promote such types of behaviours and attitudes to the self should be encouraged at home and in schools. Brown et al. [45] and Teasdale [46] suggests that interventions influencing adolescents to give and receive help (e.g., peer counselling) strengthens self-acceptance and fosters adolescents’ capacity to experience moments of happiness and identity formation. The benefits from such interventions are greater “self-esteem, sense of purpose and worth, feeling of accomplishment and mastery, and satisfying interaction with other humans beings [sic]” [50, page 192]. These benefits are, at least in part, a good definition of self-directedness. With respect to self-transcendence, Magen’s research suggests that adolescents address simple forms of this self-concept. Moreover, adolescents’ pursuit of positive emotions tend to be egocentric and directed by their own

desires [51]. Thus, these tendencies may be contradictory to the willingness to become dedicated to the well-being of others or prosocial causes that transcend the self [51]. Nevertheless, our findings show that high scores in the self-transcendence dimension might be related to high affectivity during adolescence.

Locus of control may be viewed as a prevailing expectancy, perceptions/cognitions that allow the evaluation of situations and circumstances. Individuals characterised by an internal locus of control (internals) believe that they control their own fate whereas those characterised by external locus of control (externals) are convinced that chance, luck, the stars, or behaviour of others determine the course of their lives. In the present study, individuals expressing self-fulfilling behaviour expressed markedly less (less than half) external locus of control than individuals expressing self-destructive. This observation associates high levels of external locus of control with depressive tendencies. Previously, in three different studies, Archer and colleagues [52] showed that external locus of control was predicted by NA and counter-predicted by PA and optimism. Higher scores of NA have also been found to be associated with a more externally based locus of control and a lower overall level of self-esteem among adolescents [53]. Marklund [54] obtained a strong positive correlation between “externals” and urgency (a factor involving impulsiveness) which implies that these individuals showed “difficulties resisting desires” and “temptations” together with the tendency to resort to impulsive behaviours in order to alleviate negative emotions;

these observations imply also that an “external” strategy in viewing events relates notably to temperament. Generally, “externals” express lower levels of satisfaction and rehabilitation and lesser health benefits compared to “internals” [52].

**4.1. Limitations and Further Questions.** Although the instruments used to measure PA and NA showed high reliability, appropriate measures for the two constructs have been developed and validated for use with adolescents (e.g., the PANAS-C) [55]. Nevertheless, evidence of the reliability and validity of the PANAS in adolescents can be found elsewhere [56]. It is also important to mention that there is a version for measuring the seven factors of Cloninger’s personality model among youth: the Junior Temperament and Character Inventory (JTCI). However, the JTCI was developed for use with children between the ages of 9 and 13 [57]. The version of the TCI used in the present study was found more appropriate because the participants in the present study were high-school pupils with an age range from 16 to 19.

Studies among preadolescent children may supply important insights of adolescents’ depressiveness and related symptoms since predictors of behavioural problems that persist from adolescence to adulthood (e.g., conduct problems) are best assessed prior to adolescence [58]. Neurodevelopmental aspects of affective disorders draw attention to adverse environmental influences during early and late childhood that need to be addressed [59].

## 5. Conclusions

The results presented here show an expected and well matching nomological network between the measures indicating a chance to influence a depressive state in a positive way by promoting positive emotions as well as encourage character maturation. With an investment in increasing character maturity in adolescents, an increase in life energy and decrease in less sleep and psychosocial problems could be achieved. These results together with other evidences from studies applying PANAS and TCI [60–62] suggest that the affective personality profiles provide clues regarding the emotional, cognitive, motivational, and somatic categories of well-being states.

*“Temperament lies behind mood; behind will, lies the fate of character. Then behind both, the influence of family the tyranny of culture; and finally the power of climate and environment; and we are free, only to the extent we rise above these.”*  
John Burroughs

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