The influence of childhood abuse, adult stressful life events and temperaments on depressive symptoms in the non-clinical general adult population

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Abstract

Background: Previous studies have shown the interaction between heredity and childhood stress or life events on the pathogenesis of major depression. We hypothesized that childhood abuse, affective temperaments, and adult stressful life events interact and influence depressive symptoms in the general adult population and tested this hypothesis in this study.

Methods: The 294 participants from the nonclinical general adult population were studied using the following self-administered questionnaire surveys: the Patient Health Questionnaire-9 (PHQ-9), Life Experiences Survey (LES), Temperament Evaluation of the Memphis, Pisa, Paris, and San Diego auto-questionnaire (TEMPS-A), and Child Abuse and Trauma Scale (CATS). The data were analyzed with single and multiple regressions and structural equation modeling (Amos 20.0).

Results: Childhood abuse indirectly predicted the severity of the depressive symptoms through affective temperaments measured by TEMPS-A in the structural equation modeling. Four temperaments - depressive, cyclothymic, irritable, and anxious - directly predicted the severity of depressive symptoms and the negative appraisal of life events during the past year. The negative appraisal of life events during the past year mildly, but significantly, predicted the severity of depressive symptoms.

Limitations: The subjects of this study were nonclinical. The findings might not be generalized to patients with mood disorders.

Conclusions: This study suggests that childhood abuse, especially neglect, indirectly increased depressive symptoms through increased affective temperaments, which, in turn, increase the negative appraisal of stressful life events. An important role of affective temperaments in the effect of childhood abuse and stressful life events on depressive symptoms was suggested.

Keywords: Childhood abuse; Depression; Affective temperaments; TEMPS-A; Stressful life events; Structural equation model

1. Introduction

Various factors, such as genetic factors, environmental factors, and personality traits, predispose individuals to depressive symptoms or the development of a major depressive disorder (Caspi et al., 2010; Mitsui et al., 2013). The heritability of major depressive disorders is low (37%) compared with schizophrenia (81%) and bipolar disorder (85%) (Bienvenu et al., 2011). Other environmental factors and personality traits likely contribute to the development of major depressive disorder. Adult stressful life events and child abuse are major environmental factors for major depressive disorder (Kendler et al., 1999; Kessler and Magee, 1993; Weich et al., 2009; Wise et al., 2001), and these two factors interact with genetic factors in Gene-by-Environment (GxE) interactions (Caspi et al., 2010; Caspi et al., 2003). An epidemiological study showed that *s*-carriers in a repeat length polymorphism in the promoter region of the human serotonin transporter gene (*5-HTTLPR)* exhibited elevated depressive symptoms, diagnosable depression, and suicidality after experiencing adult stressful life events and childhood mistreatment (Caspi et al., 2003). To the best of our knowledge, no study has reported an interaction of adult stressful life events and childhood mistreatment with depressive symptoms or a major depressive disorder.

Personality traits, another predisposition factor for depressive symptoms or major depressive disorders, are known to be a risk factor for major depression (Kendler et al., 2004; Kendler et al., 1993). Adult stressful life events interact with neuroticism and sex in the etiology of major depression, and the risk of neuroticism affecting illness is greater at high than at low levels of adult stressful life events (Kendler et al., 2004). Because neuroticism is related to the *5-HTTLPR* polymorphism and *s*-carriers have high levels of neuroticism (Greenberg et al., 2000; Lesch et al., 1996), the interaction between neuroticism and adult stressful life events might be partly explained by the *5-HTTLPR* GxE interaction (Caspi et al., 2003). Other personality traits shown on tests such as the Temperament and Character Inventory (TCI) and the Temperament Evaluation of Memphis, Pisa, Paris, and San Diego auto-questionnaire version (TEMPS-A) are related to neuroticism and

the *5-HTTLPR* polymorphism (Gonda et al., 2009). The items on the TEMPS-A, formulated on the basis of the diagnostic criteria for affective temperaments, are divided into five groups as follows: the cyclothymic, depressive, irritable and hyperthymic groups based on the subscales representing the Kraepelinian temperaments, and the anxious group, based on the subscale developed secondarily by Akiskal and coworkers (Akiskal et al., 2005; Akiyama et al., 2003). The subscales of the TEMPS-A provided unique profiles of major depressive disorder and bipolar disorder (Matsumoto et al., 2005; Mendlowicz et al., 2005a) and are very useful for clinical practice, especially for bipolar spectrum diagnosis. An interaction of personality traits (temperaments) measured by the TEMPS-A with childhood abuse and adult stressful life events in influencing depressive symptoms has not been reported, however, identifying such an interaction is important for psychological and psychiatric evaluation of the general and clinical population.

We hypothesized that childhood abuse, adult stressful life events (stressful events within the last year) and affective temperaments interact with one another and influence depressive symptoms or the development of major depressive disorder (Fig. 1). Temperaments identified on the TEMPS-A are the putative ‘fundamental states’ that Kraepelin considered to be enduring subclinical states without or before the florid symptoms of manic-depressive illness (Kraepelin E, 1913). For this reason, the factor 'temperaments' was located between two factors, childhood abuse and adult stressful life events, in this schema shown in Fig. 1. In this study, the effect and interaction of these three factors on depressive symptoms in the general adult population was examined, and we plan a further study that will examine these interactions in clinical subjects with mood disorder. The covariance structure analysis was used to analyze this sophisticated interaction model.

2. Subjects and methods

2.1. Subjects

This research was conducted during July 2011 and December 2011 on 500 Japanese

volunteers from the general adult population, who had no history of psychiatric disease. Of 500 volunteers, 294 subjects (58.8%) provided a complete response to the questionnaires. Five questionnaires, which are shown below (*2.2.*), and a questionnaire on demographic data (gender, age, education, marital status, family members, employment status, past history of physical and psychiatric diseases, and family history) were distributed. The completed questionnaires were returned anonymously to the research group by mail for complete confidentiality. Of the 294 subjects, 170 subjects (103 male, 67 female), who did not fulfill the criteria of the Mini-International Neuropsychiatric Interview screen (M.I.N.I screen) or did not fulfill the criteria of major or other depressive episode as screened by the Patient Health Questionnaire-9 (PHQ-9), were classified as 'healthy controls'. Written informed consent was obtained from all of the subjects. This study was performed in accordance with the Declaration of Helsinki and was approved by the institutional review board of Hokkaido University Hospital.

2.2. Questionnaires

2.2.1. Patient health questionnaire-9 (PHQ-9)

The Japanese version of the PHQ-9 was self-completed by the patient in written form (Muramatsu et al., 2007). Major depressive episodes were diagnosed in two ways using the PHQ-9: diagnostic algorithm and a summary score. This study employed the diagnostic algorithmic threshold for diagnosing a major depressive episode that was regarded as fulfilled if the answer to question #1a or question #1b and five or more questions from #1a–#1i was at least “more than half the days” (question #1i was counted if present at all) (Spitzer et al., 1999). The diagnostic algorithmic threshold for diagnosing other depressive episodes was regarded as fulfilled if the answer to question #1a or question #1b and two, three or four of the questions from #1a–#1i was at least “more than half the days” (question #1i was counted if present at all). This study employed a summary score for assessing the severity of depressive symptoms.

2.2.2. Life experiences survey (LES)

The LES is a 57-item self-report measure that allows respondents to indicate events that they have experienced during the past year (Sarason et al., 1978). The format of the LES calls for subjects to rate separately the desirability and effect of the events that they have experienced. They are asked to indicate those events experienced during the past year (0-6 months or 7 months-1 year) as well as (a) whether they viewed the event as being positive or negative and (b) the perceived impact of the particular event on their life at the time of occurrence. Ratings are on a 7-point scale ranging from extremely negative (-3) to extremely positive (+3). Summing the impact ratings of those events designated as positive by the subject provides a *positive change score.* A *negative change score* is derived by summing the impact ratings of those events experienced as negative by the subject.

In this study, the LES was translated from English to Japanese, and Dr. J. H. Johnson, one of the developers of the LES, confirmed the accuracy of this Japanese translation of the LES through back translation. Our previous study confirmed the validity and reliability of the Japanese version of the LES (Nakai et al., 2012) as follows: the negative change score was significantly and positively correlated with depressive symptoms measured by the PHQ-9 scores (Pearson r=0.21), state anxiety measured by the State-Trait Anxiety Inventory X (STAI-X) (Pearson r=0.22) and trait anxiety measured by the STAI-X (Pearson r=0.28). The positive change score was not correlated with depressive symptoms, state anxiety or trait anxiety. These results were consistent with the results of the English version of the LES (Sarason et al., 1978). The test-retest reliability of the LES was confirmed with a moderate intraclass correlation coefficient (ICC) of 0.47 for the positive change score and 0.45 for the negative change score when administered twice within an 8-week period.

2.2.3. Temperament evaluation of the Memphis, Pisa, Paris, and San Diego auto-questionnaire

(TEMPS-A)

The TEMPS-A is a self-rating questionnaire consisting of 109 items for men and 110 for women (Akiskal et al., 2005). The subjects completed the Japanese standardized version of the TEMPS-A, which is a true (=2) – false (=1) questionnaire measuring the following temperament dimensions: depressive, cyclothymic, hyperthymic, irritable and anxious (Matsumoto et al., 2005).

2.2.4. Child abuse and trauma scale (CATS)

The CATS is a 38-item scale. Initial findings have demonstrated that this measure has strong internal consistency (Cronbach's *alpha* = .63 to .90) and test-retest reliability (r = .71 to .91) (Sanders and Becker-Lausen, 1995). The CATS has been shown to correlate significantly with outcome measures such as dissociation, depression, stressful life events and interpersonal difficulties. On each item, participants rate how frequently a particular abusive experience occurred to them during their childhood and adolescence, using a scale of 0-4 (0 = never; 4 = always). The score for each subscale is the mean score on the items that make up that subscale. There are three subscales, measuring subjective reports of three aspects of adverse childhood experience—neglect /negative home atmosphere, punishment, and sexual abuse.

H. Tanabe, one of the authors, developed and validated the Japanese version of the CATS by the classic translation-back translation technique with the permission and confirmation of Dr. Sanders, the developer of the CATS (Tanabe et al., 2010).

2.2.5. Mini-international neuropsychiatric interview (M.I.N.I.) screen

The MINI screen version was self-completed by the subjects in written form to screen for the 13 putative major psychiatric disorders (Sheehan et al., 1998).

2.3. Data analysis

According to the hypothesis presented in Fig. 1, we designed a structural equation model, in which depressive symptoms were predicted by childhood abuse, temperaments and adult stressful life events. Two latent variables, childhood abuse and temperaments were composed of three and four observed variables, respectively, that were evinced from the original questionnaire subscales. We used AMOS 20.0 (SPSS, Chicago, IL) to perform this path analysis to obtain the direct and indirect effects among all of the variables, and we used maximum likelihood covariance estimation to analyze the model. For the inferential statistical evaluation of structural equation modeling (SEM), we calculated the indices of goodness of fit, such as the Goodness of Fit Index (GFI), Adjusted GFI (AGFI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). According to the conventional criteria, GFI greater than 0.90, AGFI greater than 0.85, CFI greater than 0.95, and RMSEA less than 0.08 indicate an acceptable fit; GFI greater than 0.95, AGFI greater than 0.90, CFI greater than 0.97, and RMSEA less than 0.05 indicate a good fit (Schermelleh-Engel et al., 2003). We standardized and indicated all of the coefficients (with a maximum of 1 and a minimum of -1) for the covariance structure analysis.

We conducted the Mann-Whitney U-test for comparison of the demographic characteristics and the questionnaire data between the two groups. Spearman's rank correlation coefficient and multiple regression analysis were used for correlation between the parameters and the predictive factors.

The statistical analyses were conducted using IBM SPSS AMOS 20.0 (SPSS, Chicago, IL) for the covariance structure analysis, Excel Statistics for Macintosh (Esumi Co, Ltd., Tokyo, Japan) for the multiple regression analysis, Spearman's rank correlation coefficient, and GraphPad Prism 4 (GraphPad Software, La Jolla, CA, USA) for the Mann-Whitney U-test.

The differences were considered to be statistically significant at $p < 0.05$.

3. Results

3.1. Demographic characteristics, PHQ-9, CATS, TEMPS and LES of the subjects

The demographic characteristics, PHQ-9, CATS, TEMPS and LES of 294 subjects are presented in Table 1. Gender (female), marital status (unmarried), and living-alone were associated with high PHQ-9 summary scores as determined by the Mann-Whitney U-test. Neglect and the total scores of the CATS, the depressive, cyclothymic, anxious, and irritable temperament scores of TEMPS-A, and the negative change scores of LES were significantly correlated with the PHQ-9 summary scores as determined by Spearman's rank correlation coefficients.

3.2. Stepwise multiple regression analysis of the putative explanatory variables on the PHQ-9 suggested from Table 1

The putative explanatory variables that showed significant correlations with the PHQ-9 as determined by Spearman's rank correlation coefficients or had significant effects on the PHQ-9 summary scores as determined by the Mann-Whitney U-test in Table 1 were further analyzed by a stepwise multiple-regression analysis.

Table 2 shows the results of a stepwise multiple regression analysis where a PHQ-9 summary score was the dependent factor, and gender (female=2, male=1), marital status (married=2, unmarried =1), living alone (yes=2, no=1), a neglect score on the CATS, depressive, cyclothymic, anxious, and irritable temperament scores on the TEMPS-A, and a negative change score on the LES were independent factors. A total score on the CATS that had a significant correlation with PHQ-9 (Table 1) was excluded from the stepwise multiple regression analysis because it had a high correlation with a neglect score on the CATS (ρ=0.84). When entering these independent factors in a stepwise multiple regression analysis, a neglect score on the CATS, cyclothymic and anxious scores on the TEMPS-A, and a negative change score on the LES were significant predictors of PHQ-9 (F=43.7, p<0.0001, adjusted R^2=0.38), whereas other factors were excluded from the model. Multicollinearity was denied in this multiple regression analysis.

3.3. Correlation between the CATS subscale scores and the temperament scores on the TEMPS-A

As shown in Table 3, four temperament scores (excluding the hyperthymic temperament score) were significantly and positively correlated with the neglect and punishment subscale scores. The sexual abuse subscale score was significantly and positively correlated with the cyclothymic and anxious temperament scores.

Multiple regression analysis was performed to identify the independent predictors of the CATS subscales for each affective temperament on the TEMPS-A. Table 4 shows the results of the multiple regression analysis where each temperament score was the dependent factor, and the neglect, punishment, and sexual abuse subscale scores on the CATS were the independent factors. The hyperthymic temperament score was not analyzed because Spearman's rank correlation coefficients showed no correlation between the hyperthymic temperament score and the three subscale scores of the CATS. Only the neglect subscale score was a significant predictor of four temperament scores (Table 4).

3.4. Analysis of the structural equation modeling

To examine the causality of all of the variables, we built a structure equation model based on the results of the above correlation analysis and multiple regression analysis (Fig. 2). The results of the path coefficients calculated by AMOS are shown in Fig. 2.

A good fit of the model was obtained as follows: RMSEA = 0.078, GFI = 0.951, AGFI = 0.904, CFI = 0.950. Only the path coefficient (0.11) of childhood abuse to the PHQ-9 summary score (depressive symptoms) was not significant (p=0.08). The other path coefficients were substantially significant (p<0.001) except for that relating the LES to the PHQ-9 summary score (depressive symptoms) (p<0.05). According to the structural equation modeling and consistent with the results of the multiple regression analysis (Table 4), four temperament scores on the TEMPS-A were significantly predicted by the subscales of the CATS. Hyperthymic temperament was excluded

from the observed variables of the latent variable "temperament" because hyperthymic temperament was not correlated with the PHQ-9 summary score (Table 1) nor correlated with any subscales of the CATS (Table 3). A neglect subscale score showed a very high-standardized coefficient with the latent variable "childhood abuse". The PHQ-9 summary score was significantly predicted by four temperament scores on the TEMPS-A and a negative change score on the LES. The effect of the CATS subscales on the PHQ-9 summary score was indirect and mediated by the effect of the CATS subscales on four temperament scores on the TEMPS-A (indirect path coefficient = 0.30). Four temperament scores on the TEMPS-A significantly predicted a negative change score on the LES, which, in turn, predicted the PHQ-9 summary score.

3.5. Comparison between the subjects with a major depressive episode and healthy subjects

The 294 subjects in this study did not have a history of psychiatric diseases, as indicated in the Subjects and methods section. The results of this study are associated with depressive symptoms in the general adult population, not with depressive symptoms of a major depressive episode. The PHQ-9, which could screen a major depressive episode, as mentioned in the Subjects and methods section (Furukawa, 2010), enables comparison between the subjects with a major depressive episode and the healthy subjects in terms of childhood abuse, negative stressful life events and temperaments. The diagnostic algorithmic threshold of the PHQ-9 for diagnosing a major depressive episode found 7 subjects (1 male, 6 female) with a major depressive episode, although these diagnoses were tentative because these subjects did not have psychiatric interviews. Because of the large gender imbalance, six female subjects with a major depressive episode were compared with 67 healthy female subjects (Table 5).

As shown in Table 5, the female subjects with a major depressive episode showed significantly higher scores on the PHQ-9, the neglect and total scores on the CATS, depressive, cyclothymic, anxious, and irritable temperaments, and a negative change score on the LES than the healthy female subjects, consistent with the model shown in Fig. 2.

4. Discussion

This study is the first report showing that childhood abuse indirectly predicted the severity of depressive symptoms through the affective temperaments measured by the TEMPS-A in the structural equation modeling of nonclinical general adult population. Four temperaments - depressive, cyclothymic, irritable, and anxious - directly predicted the severity of depressive symptoms and the negative change score on the LES during the past year. The negative change score of the LES during the past year mildly, but significantly, predicted the severity of depressive symptoms. Compared with the effect of the negative change score on the LES, the direct effect of temperament and the indirect effect of childhood abuse were more marked. The validity of this result of the structural equation modeling was supported by the results of the multiple regression analysis based on the clinical demographic characteristics and the questionnaire data that were correlated with the severity of depressive symptoms as follows: a stepwise multiple regression analysis showed that four factors -neglect, cyclothymic and anxious temperaments, and a negative change score on the LES - predicted the severity of depressive symptoms. These factors were statistically significant predictors or factors with high path coefficients in the structural equation modeling.

There has been no study that examined the effect of childhood abuse on the TEMPS-A. Pompili et al. reported that psychiatric inpatients with a history of childhood abuse showed a higher incidence of the irritable temperament trait than did the non-abused patients (Pompili et al., 2009). In the multiple regression analysis of this study, only neglect among the childhood abuse subscales significantly predicted high scores of depressive, cyclothymic, irritable, and anxious temperaments in the nonclinical general adult population. The affective temperaments measured by the TEMPS-A are considered antecedents or subsyndromal manifestations of mood disorders. The depressive, cyclothymic, and anxious temperaments scores of mood disorder patients are reportedly higher than

those of healthy controls (Matsumoto et al., 2005). In particular, cyclothymic temperament is more evident in bipolar disorders (Mendlowicz et al., 2005a; Mendlowicz et al., 2005b) and is the major and important factor in the soft bipolar spectrum (Akiskal and Pinto, 1999; Goto et al., 2011; Takeshima and Oka, 2013). This study suggests the possibility that childhood abuse might increase soft bipolarity in the general adult population, which, in turn, might affect the pathogenesis or clinical outcomes of mood disorders. Several studies have reported that the history of childhood abuse is closely related to the onset, course, and treatment response of mood disorders (Alloy et al., 2006; Caspi et al., 2003; Daruy-Filho et al., 2011; Levitan et al., 1998; Nanni et al., 2012). The results of this study link childhood abuse to affective temperaments in aspects of depressive symptoms. Because this study examined the nonclinical general adult population, which constitutes a limitation of this study, the linkage between childhood abuse and affective temperaments should be studied further in a large sample size of mood disorder patients. Although this study shows the relative importance of neglect compared with sexual abuse and punishment, the results with a different population such as psychiatric patients might show a different contribution from each abuse.

Among the five temperaments of the TEMPS-A, depressive, cyclothymic, irritable, and anxious, but not hyperthymic, temperaments, were significantly and positively correlated with depressive symptoms in single regression analyses. Similar findings have been reported in nonclinical subjects by earlier studies (Iliceto et al., 2011; Rozsa et al., 2008). The multiple regression analyses of this study clarified that only cyclothymic and anxious temperaments significantly predicted depressive symptoms. This finding was supported by higher path coefficients from the latent variable "temperament" to cyclothymic and anxious temperaments in the structural equation modeling. The earlier studies reported only correlations between temperaments and depressive symptoms, and they did not investigate the other factors that influenced temperaments (Iliceto et al., 2011; Rozsa et al., 2008). Our study revealed the direct effects of childhood abuse on temperaments, resulting in increased depressive symptoms.

In the LES, each subject rates separately the desirability and effect of events that they have experienced on a 7-point scale ranging from extremely negative (-3) to extremely positive (+3) (Sarason et al., 1978). A negative change score indicates the subjective severity of stressful life events rather than objective severity; i.e., it indicates a negative appraisal of life events. In the structural equation modeling of this study, four temperaments predicted negative scores on the LES, suggesting that these temperaments (depressive, cyclothymic, irritable, and anxious) might increase vulnerability to stressful life events. There has been only one report that studied the relationship between affective temperaments and stress. Sakai et al. (2005) showed that affective temperament measured by the TEMPS-A influenced interpersonal relationship stressors, i.e., conflicts, more than workload-related stressors and that irritable temperament was associated with the most prominent vulnerability, followed by cyclothymic and anxious temperaments. Their results are consistent with ours.

A positive correlation ($r=0.24$) between depressive symptoms and negative change scores on the LES in nonclinical university students was reported in the original manuscript of the LES (Sarason et al., 1978). In our study, this correlation coefficient between depressive symptoms and negative change scores on the LES ($\rho=0.29$) showed a similar value; however, it was unexpectedly much lower than those between depressive symptoms and temperaments in the single regression analyses (Table 1) and obviously lower than those between depressive symptoms and childhood abuse (indirect) or temperament (direct) in the structural equation modeling (Fig. 2). This finding indicates that baseline depressive symptoms in nonclinical adults are influenced more strongly by childhood abuse (indirect effect) and temperament (direct effect) than by negative life events. Because there has been no study that examined the complex interaction between childhood abuse, temperament, and negative life events, our results could not be compared with earlier studies.

This study, using the structural equation model, showed that childhood abuse, especially neglect, increases affective temperament, which, in turn, increases the negative appraisal of stressful life events and increases depressive symptoms. The important role of affective temperament in the

effect of childhood abuse and stressful life events on depressive symptoms was suggested. Further studies to investigate the effect of childhood abuse, affective temperaments, and adult stressful life events in mood disorder patients are necessary for further understanding.

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Table 1. Characteristics, PHQ-9, CATS, TEMPS-A, LES and correlation with PHQ-9 or effects on PHQ-9 in 294 general adult subjects

Characteristics or Measures		Value (number or mean ± SD)	Correlation with PHQ-9 (ρ) or Effect on PHQ-9 (mean ± SD of PHQ-9 scores, U-test)
Age		42.4±11.2	ρ= - 0.10, n.s.
Gender (male : female)		171 : 123	male 2.7 ± 3.3 vs female 4.6 ± 4.5** (U-test)
Education, years		14.9±2.2	ρ= - 0.12, n.s.
Employment status (employed : unemployed)		241 : 49	employed 3.4 ± 3.9 vs unemployed 3.8 ± 3.9
Homemakers of unemployed		43	n.s. (U-test)
Marital status	Never Married	45	Married 3.0 ± 3.6 vs Unmarried 5.3 ± 4.5** (U-test)
	Married	228	
	Divorce	16	
	Widowed	3	
Living-alone	(Yes : No)	62 : 222	Yes 4.0 ± 3.4 vs No 3.3 ± 4.1* (U-test)
Number of offspring		1.4±1.0	ρ= - 0.11, n.s.
Presence of offspring (Yes : No)		209 : 85	Yes 3.3 ± 3.9 vs No 4.1 ± 3.9, n.s. (U-test)
Comorbidity of physical disease (Yes : No)		63 : 229	Yes 3.5 ± 4.0 vs No 3.5 ± 3.9, n.s. (U-test)
1st-degree relative with psychiatric diseases (Yes : No)		40 : 254	Yes 3.8 ± 4.0 vs No 3.5 ± 3.9, n.s. (U-test)
PHQ-9 score		3.5±3.9	
CATS (average score)	Sexual Abuse	0.03±0.12	ρ=0.03, n.s.
	Neglect	0.58±0.66	ρ=0.32 **
	Punishment	1.50±0.64	ρ=0.06, n.s.
	Total	0.66±0.47	ρ=0.25 **
TEMPS-A (average score)	Depressive	1.33±0.17	ρ=0.40 **
	Cyclothymic	1.17±0.20	ρ=0.54 **
	Hyperthymic	1.25±0.21	ρ= - 0.04, n.s.
	Anxious	1.18±0.17	ρ=0.47 **
	Irritable	1.13±0.16	ρ=0.43 **
LES (change score)	Negative	2.25±4.28	ρ=0.29 **
	Positive	2.01±3.39	ρ=0.08, n.s.

Data presented as means ± SD or numbers.

ρ=Spearman's rank correlation coefficient

* P<0.05, ** P<0.01, n.s. not significant

Table 2. The results of a stepwise multiple regression analysis of PHQ-9

Positive variables selected	Beta	*p*
Cyclothymic score of TEMPS-A	0.29	<0.0001
Anxious score of TEMPS-A	0.18	0.0069
Neglect score of CATS	0.22	<0.0001
Negative change score of LES	0.16	0.0016
Adjusted R^2	0.38	<0.0001

Beta = standardized partial regression coefficient.

Dependent factor, PHQ-9 summary score.

Nine independent factors: gender (female=2, male=1), marital status (married=2, unmarried =1), living-alone (yes=2, no=1), neglect and total scores of CATS, depressive, cyclothymic, anxious, and irritable temperament scores of TEMPS-A, and a negative change score of LES. A total score of CATS, that had a significant correlation with PHQ-9 (Table 1), was excluded from the stepwise multiple regression analysis because it had a high correlation with a neglect score of CATS (ρ=0.84).

Table 3. Correlation (ρ) between CATS subscales and temperament scores of TEMPS-A

	neg	pun	sex	dep	cyc	hyp	anx	irr
neg	1.00	0.34**	0.23**	0.30**	0.32**	-0.01	0.38**	0.39**
pun		1.00	0.14*	0.17**	0.17**	-0.09	0.16**	0.20**
sex			1.00	0.08	0.12*	-0.09	0.15*	0.09
dep				1.00	0.47**	-0.22**	0.56**	0.37**
cyc					1.00	0.19**	0.61**	0.60**
hyp						1.00	0.01	0.26**
anx							1.00	0.53**
irr								1.00

ρ=Spearman's rank correlation coefficient, * P<0.05, ** P<0.01

neg, neglect subscale; pun, punishment subscale; sex, sexual abuse subscale; dep, depressive temperament; cyc, cyclothymic temperament; hyp, hyperthymic temperament; anx, anxious temperament; irr, irritable temperament

Table 4. Multiple regression analysis of each temperament score of TEMPS-A

	Dependent Factor			
Independent Factor	Depressive	Cyclothymic	Anxious	Irritable
Neglect subscale	0.31**	0.33**	0.43**	0.37**
Punishment subscale	0.06	0.03	-0.003	0.03
Sexual abuse subscale	0.03	0.003	0.06	-0.05
ANOVA	F=14.2**	F=13.0**	F=24.3**	F=15.3**
adjusted R^2	0.12	0.11	0.19	0.13

Figures except for F values and adjusted R^2 present beta values (standardized partial regression coefficients)

Hyperthymic temperament was not analyzed because it was not correlated with any CATS subscale score (Table 3).
** $p<0.01$

Table 5. Comparison of PHQ-9, CATS, and LES of 67 healthy female subjects and 6 female subjects with a major depressive episode

Characteristics or Measures		Healthy female subjects n=67	Female subjects with a major depressive episode (n=6)	
Age		44.6±11.4	50.0±16.5	
PHQ-9		2.2±2.5	16.5±3.2	**
CATS (average score)	Sexual Abuse	0.03±0.12	0.06±0.12	
	Neglect	0.50±0.52	1.64±0.80	*
	Punishment	1.57±0.56	2.03±0.42	
	Total	0.61±0.35	1.40±0.60	**
TEMPS-A (average score)	Depressive	1.34±0.14	1.50±0.16	*
	Cyclothymic	1.10±0.10	1.27±0.11	**
	Hyperthymic	1.19±0.15	1.17±0.09	
	Anxious	1.13±0.13	1.46±0.18	**
	Irritable	1.07±0.10	1.29±0.14	**
LES (change score)	Negative	1.6±4.0	8.6±7.7	**
	Positive	1.5±2.9	1.3±1.3	

Data presented as means ± SD.
Two groups were compared by Mann-Whitney U-test. * P<0.05, ** P<0.01

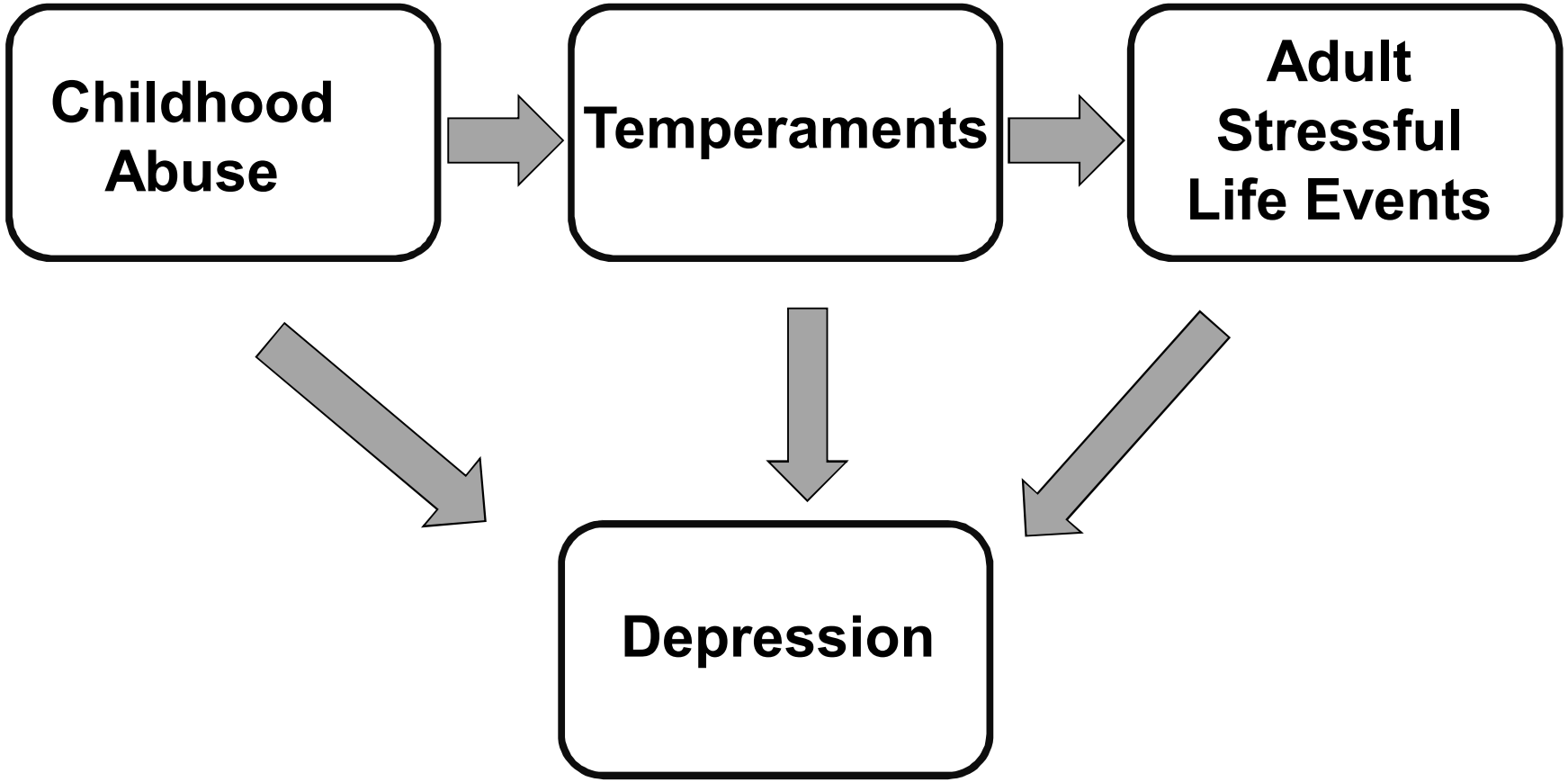
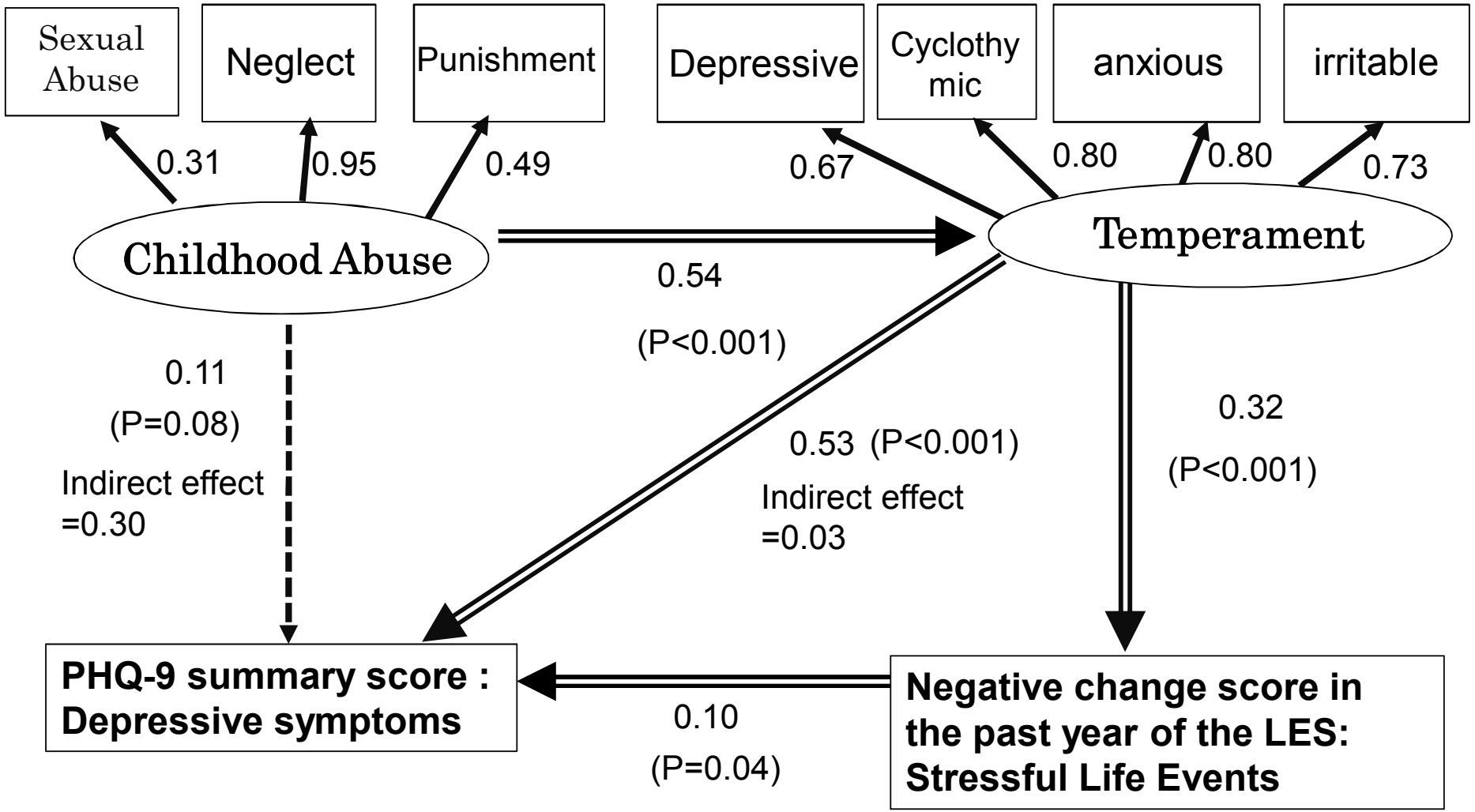

Childhood Abuse
Temperaments
Adult Stressful Life Events
Depression

Fig. 1.

Covariance structure analysis in 294 general adult subjects



square sums of multiple correlation coefficient = 0.41

Fig. 2.

Figure legends

Fig. 1. Structural equation model of the hypothesis of this study. In this model, depressive symptoms are predicted by childhood abuse, temperament and stressful life events in adulthood.

Fig. 2. The results of the covariance structure analysis in the structural equation model with childhood abuse (CATS), affective temperaments (TEMPS-A), adult stressful life events (LES), and depressive symptoms (PHQ-9): Results of 294 subjects from the nonclinical general adult population. Rectangles indicate the observed variables associated with the latent variables, which are shown as ovals. The arrows with double lines represent the statistically significant paths, and the broken lines show the non-significant paths. The numbers beside the arrows show the standardized path coefficients (minimum -1, maximum 1). The *P* values reveal the levels of statistical significance. Indirect effects indicate the effect mediated by the other variables.