Article

Korean Validation of the TEMPS-A Short Version (Temperament Evaluation of Memphis, Pisa, Paris and San Diego Autoquestionnaire) in Patients with Mood Disorder

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Abstract: Background and Objectives: The Temperament Evaluation of Memphis, Pisa, Paris and San Diego Autoquestionnaire (TEMPS-A) is designed to assess affective temperaments. The short version of TEMPS-A (TEMPS-A-SV) was translated into diverse languages for its broad application in research and clinical settings. However, no study was conducted to validate the Korean version of TEMPS-A-SV among patients with mood disorders. The purpose of this study is to examine the reliability and validity of the TEMPS-A-SV in mood disorder patients of the Korean population. Materials and Methods: In this cross-sectional retrospective study, a total of 715 patients (267 patients with major depressive disorder, 94 patients with bipolar disorder I, and 354 patients with bipolar disorder II) completed the Korean TEMPS-A-SV. Cronbach's alpha and McDonald's omega was used to assess reliability. Exploratory factor analysis (EFA) was also performed. Spearman's correlation coefficient was used to examine associations between five temperaments. The difference in five temperament scores between gender or diagnosis groups were analyzed, and the correlation between five temperament scores and age were tested. Results: The Korean TEMPS-A-SV displayed good internal consistency (α = 0.65–0.88, ω = 0.66–0.9) and significant correlations between the subscales except one (correlation between hyperthymic and anxious). Using EFA, a two-factor structure was produced: Factor I (cyclothymic, depressive, irritable, and anxious) and Factor II (hyperthymic). The cyclothymic temperament score differed by gender and the anxious temperament score was significantly correlated with age. All the temperaments, except for irritable temperament, showed significant differences between diagnosis groups. Conclusions: Overall, our findings indicate that TEMPS-A-SV is a valid and reliable measure of estimating affective temperaments among Koreans. Our results confirm validity of TEMPS-A-SV among Korean patients with mood disorders. However, more study is required on affective temperaments and associated characteristics in people with mood disorders.

Keywords: temperament; measurement; mood disorder; validation; Korean

1. Introduction

In 5th century B.C., Greek physician Hippocrates suggested that the four humors (blood, phlegm, yellow bile, and black bile) significantly contribute to physical and psychological health (American Psychological Association, 2022). Regarding psychological health, the four humors are considered to be associated with temperaments: blood with sanguine type, phlegm with phlegmatic type, yellow bile with choleric type, and black

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bile with melancholic type. This idea later led Kraepelin to introduce four basic affective temperaments: cyclothymia, depression, mania, and irritability (Kraepelin, 1921), and Akiskal et al. added anxious temperament to the concept and made a five-temperament system (Akiskal, 1998).

The Temperament Evaluation of Memphis, Pisa, Paris, and San Diego Autoquestionnaire (TEMPS-A) was developed by Akiskal et al. (2005) to evaluate five affective temperaments. TEMPS-A has demonstrated efficacy in comparing patients with mood disorders and between individuals with or without relatives who are patients (Nowakowska et al., 2005; Vázquez et al., 2008) as well as making prediction of medication adherence and clinical course in patients (Bahrini et al., 2016; Rybakowski et al., 2013; Shamsi et al., 2014). The TEMPS-A has been translated into different language versions including Polish (Borkowska et al., 2010), German (Erfurth et al., 2005), Italian (Pompili et al., 2008), Japanese (Matsumoto et al., 2005), Arabic (Karam et al., 2005), and Korean (Yu et al., 2022), for further use. However, it is difficult to apply the full-length TEMPS-A, which comprises 110 items, for patients with severe symptoms in the clinical setting because it demands a lot of time and effort. Akiskal and colleagues created a short, 39-item version of TEMPS-A to make evaluation easier, and with less time and effort. This short version of TEMPS-A has been translated into diverse languages including German (Erfurth et al., 2005), Italian (Preti et al., 2010), Chinese (Lin et al., 2018), and Spanish version (Zapata-Téllez et al., 2021). The TEMPS-A-SV has also demonstrated its efficacy and usefulness as it can be utilized to distinguish between patients with major depression disorder and patients with bipolar disorder (Morishita et al., 2021; Yuan et al., 2015). Hyperthymic, cyclothymic, and anxious temperament scores are found to be able to differentiate patients with BD from MDD. Also, the TEMPS-A-SV shows capability as a screening tool to detect non-clinical individuals who are susceptible to mood disorder (Yuan et al., 2015).

Despite its importance, however, the TEMPS-A-SV has yet to be developed and validated in Korean. Therefore, this study intends to validate the short version of Korean TEMPS-A among clinical populations. Additionally, we seek to compare the temperaments of patients with different mood disorders.

2. Materials and Methods

2.1. Subjects

This study analyzed data from 715 patients (267 patients with major depressive disorder [MDD], 94 patients with bipolar disorder I [BD I], and 354 patients with bipolar disorder II [BD II]) from July 2013 to February 2021. The sample comprised 222 men and 493 women ranging from 16 to 71 years old. The patients were from the mood disorder clinic of Seoul National University Bundang Hospital (SNUBH). Their medical records were used to acquire all pertinent information. Board-certified psychiatrists (T.H.H. and W.M.) confirmed diagnoses according to Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5) (American Psychological Association, 2013) based on a structured diagnostic interview (Mini-International Neuropsychiatric Interview [M.I.N.I]) (Sheehan et al., 1998) and review of case records. We further collected relevant information including age, gender, education, employment status, marital status, smoking status, alcohol use status, psychiatric family history, and psychiatric hospitalization history.

This study was approved by the Institutional Review Board of Seoul National University Bundang Hospital (protocol code B-2205-756-111, approved May 2, 2022). Patient informed consent was waived because data was gathered retrospectively through a medical chart review.

2.2. Measurement and procedures

Five temperamental features (cyclothymic, depressive, irritable, hyperthymic, and anxious) were evaluated using the Korean short version of TEMPS-A questionnaire (39 questions). The following were the items that belonged to each subscale: cyclothymic temperament comprised items 1–12 (12 questions), depressive temperament comprised items

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13–20 (8 questions), irritable temperament comprised items 21–28 (8 questions), hyperthymic temperament comprised items 29–36 (8 questions), and anxious temperament comprised items 37-39 (3 questions). Each item received a dichotomous score (Yes = 1 and No = 0).

Two psychiatrists (THH and WM) translated TEMPS-A-SV into Korean and reviewed the items. The translated version was further forwarded to psychiatrists, psychologists, psychiatric nurses, and clinical researchers for their expert opinion. After the review, the questionnaire was modified appropriately to increase validity.

2.3. Statistical analysis

This study used mean values as the scores for each temperament. Mean values were calculated as follows: sum of items' scores of each subscale/number of items. Shapiro-Wilk test was used to ascertain if the score distribution was normal. Non-parametric analyses were used since the parameters did not follow a normal distribution. Spearman's correlation test was employed to test the correlation between five temperaments. Partial Spearman's correlation test was used to test the correlation between five temperaments and age after adjusting for covariates (gender, primary diagnosis, education level, employment status, marital status, first-degree family history of psychiatric disorders, alcohol use status, and smoking status). Median regression was conducted to ascertain differences in scores of five temperaments according to gender or diagnoses (MDD, BD I or BD II) after controlling covariates. For comparison, the temperament scores are presented as median and interquartile range. Cronbach's alpha and McDonald's omega was used to evaluate the internal consistency of the questionnaire and its subscales. Exploratory factor analysis was performed with varimax rotation. R 4.1.2 (Vienna, Austria; http://R-project.org/) software and Stata SE 17 (https://www.stata.com/) were used for analyses.

3. Results

3.1. Clinical and Demographic Characteristics

The participants were 34.5 years old on average (SD = 12.4), with 69% of them being female. **Table 1** shows the other clinical and demographic characteristics.

Table 1. Participants' demographic and clinical features (n=715).

Characteristics	All patients (n=715)	Major Depressive Disorder Patients (n=267)	Bipolar Disorder I Patients (n=94)	Bipolar Disorder II Patients (n=354)	p^1
Age (years)	34.5 ± 12.4	38.8 ± 12.6	33.0 ± 11.2	31.8 ± 11.6	<0.001
Gender (%)					0.043
Male	222 (31.0%)	70 (26.2%)	37 (39.4%)	115 (32.5%)	
Female	493 (69.0%)	197 (73.8%)	57 (60.6%)	239 (67.5%)	
Education (%)					0.787
High school or below	489 (68.4%)	180 (67.4%)	67 (71.3%)	242 (68.4%)	
Others	226 (31.6%)	87 (32.6%)	27 (28.7%)	112 (31.6%)	
Employment status (%)					0.616
Employed	249 (34.8%)	99 (37.1%)	32 (34.0%)	118 (33.3%)	
Unemployed	466 (65.2%)	168 (62.9%)	62 (66.0%)	236 (66.7%)	
Marital status (%)					<0.001
Married	267 (37.3%)	139 (52.1%)	25 (26.6%)	103 (29.1%)	
Others (Single, divorced, or widowed)	448 (62.7%)	128 (47.9%)	69 (73.4%)	251 (70.9%)	
Psychiatric Family history (%)					0.303
Yes	235 (32.9%)	80 (30.0%)	29 (30.9%)	126 (35.6%)	
No	480 (67.1%)	187 (70.0%)	65 (69.1%)	228 (64.4%)	
Alcohol use status (%)					0.011
Former or Current	424 (59.3%)	140 (52.4%)	63 (67.0%)	221 (62.4%)	
Never	291 (40.7%)	127 (47.6%)	31 (33.0%)	133 (37.6%)	

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	Smoking status (%)			0.004
Former or Current	219 (30.6%)	62 (23.2%)	32 (34.0%)	125 (35.3%)
Never	496 (69.4%)	205 (76.8%)	62 (66.0%)	229 (64.7%)

[1]Statistical significance among MDD, BP I, and BP II patient groups. p-value of age was measured by ANOVA, and other characteristics' p values were measured by Pearson's chi-squared test.

3.2. Reliability analysis

Table 2 shows the Cronbach's alpha coefficients and McDonald's omega coefficients of individual temperaments (cyclothymic, depressive, irritable, hyperthymic, and anxious) and the whole questionnaire. Cronbach's alpha values for the five temperaments were 0.85 (cyclothymic), 0.78 (depressive), 0.79 (irritable), 0.74 (hyperthymic), and 0.65 (anxious). Cronbach's alpha value for the whole questionnaire was 0.88. McDonald's omega coefficients for the five temperaments were 0.87 (cyclothymic), 0.83 (depressive), 0.82 (irritable), 0.79 (hyperthymic), and 0.66 (anxious). McDonald's omega coefficient for the whole questionnaire was 0.9. All alpha and omega coefficients were higher than 0.6.

Table 2. Results of the Cronbach-alpha and McDonald's omega reliability analysis.

Temperament	Cronbach-alpha	McDonald's omega
Cyclothymic	0.85	0.87
Depressive	0.78	0.83
Irritable	0.79	0.82
Hyperthymic	0.74	0.79
Anxious	0.65	0.66
Total	0.88	0.9

3.3. Exploratory factor analysis

Table 3 displays the results of the exploratory factor analysis carried out using varimax rotation. Two superfactors were formed by integrating factors with loadings higher than 0.4. Factor I (33.0%) contained cyclothymic, depressive, irritable, and anxious temperaments, whereas Factor II (17.6%) only included hyperthymic temperament. **Figure 1** shows the projection of the factor analysis findings. **Supplementary Figure S1** further shows the path diagram of the factor analysis.

Table 3. Factor loadings for 5 temperaments using exploratory factor analysis (varimax rotation).

	Factor 1	Factor 2
Cyclothymic	**0.69**	0.16
Depressive	**0.76**	-0.17
Irritable	**0.65**	0.25
Hyperthymic	0.04	**0.87**
Anxious	**0.42**	-0.00
Explained variance (%)	33.0	17.6

Factor loadings higher than 0.4 were grouped. Factor 1 (Cyclothymic, Depressive, Irritable, Anxious), Factor 2 (Hyperthymic).

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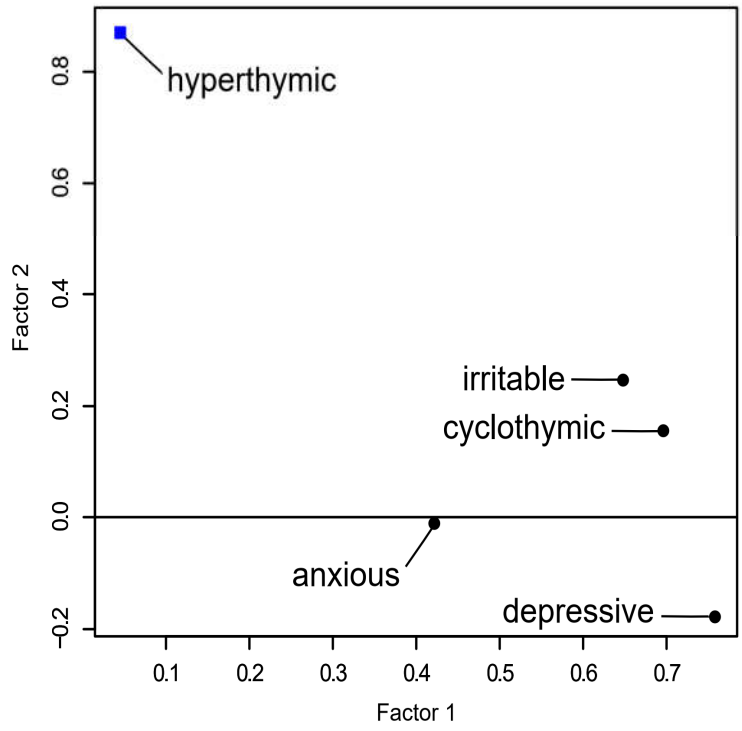

Figure 1. Exploratory factor analysis factor plot of five temperaments (varimax rotation).

3.4. Correlations within the scales of TEMPS-A-SV

Table 4 displays the outcomes of the subscales' Spearman's correlation test. All the correlations among the temperaments except one (correlation between hyperthymic and anxious) were significant. Also, only the depressive and hyperthymic temperaments were negatively correlated (*rho* = -0.12, $p < 0.01$). Cyclothymic and irritable temperaments displayed the highest positive correlation of all correlations (*rho* = 0.50, $p < 0.001$). Other correlations among the temperaments were as follows: cyclothymic and depressive temperaments (*rho* = 0.49, $p < 0.001$), depressive and irritable temperaments (*rho* = 0.44, $p < 0.001$), depressive and anxious temperaments (*rho* = 0.32, $p < 0.001$), cyclothymic and anxious temperaments (*rho* = 0.31, $p < 0.001$), irritable and hyperthymic temperaments (*rho* = 0.25, $p < 0.001$), irritable and anxious temperaments (*rho* = 0.23, $p < 0.001$), and cyclothymic and hyperthymic temperaments (*rho* = 0.18, $p < 0.001$).

Table 4. Spearman's correlation result of 5 temperaments in TEMPS-A short version.

	Cyclothymic	Depressive	Irritable	Hyperthymic	Anxious
Cyclothymic	1	0.49***	0.50***	0.18***	0.31***
Depressive		1	0.44***	-0.12**	0.32***
Irritable			1	0.25***	0.23***
Hyperthymic				1	0.01
Anxious					1

Correlation significance $^{**}p < 0.01$, $^{***}p < 0.001$.

3.5. Correlations between five temperaments and age

Table 5 displays the findings of the partial Spearman's correlation test between five temperaments and age. All temperaments, except anxious temperament, were significantly and negatively correlated with age: depressive (*rho* = -0.27, $p < 0.001$), cyclothymic (*rho* = -0.26, $p < 0.001$), irritable (*rho* = -0.15, $p < 0.001$), and hyperthymic (*rho* = -0.08, $p < 0.05$).

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Table 5. Partial Spearman's correlation between 5 temperaments and age.

Partial correlation	Cyclothymic	Depressive	Irritable	Hyperthymic	Anxious
Age	-0.26***	-0.27***	-0.15***	-0.08*	-0.00

Correlation significance $^{*}p < 0.05$, $^{***}p < 0.001$. Gender, major diagnosis, education, employment, marital status, psychiatric first-degree family history, alcohol use status and smoking status were controlled.

3.6. Discrepancies between groups in TEMPS-A-SV scores

The median regression analysis showed that the TEMPS-A-SV scores between the two genders and three patient groups (MDD, BD I, and BD II) differed significantly (**Figure 2**).

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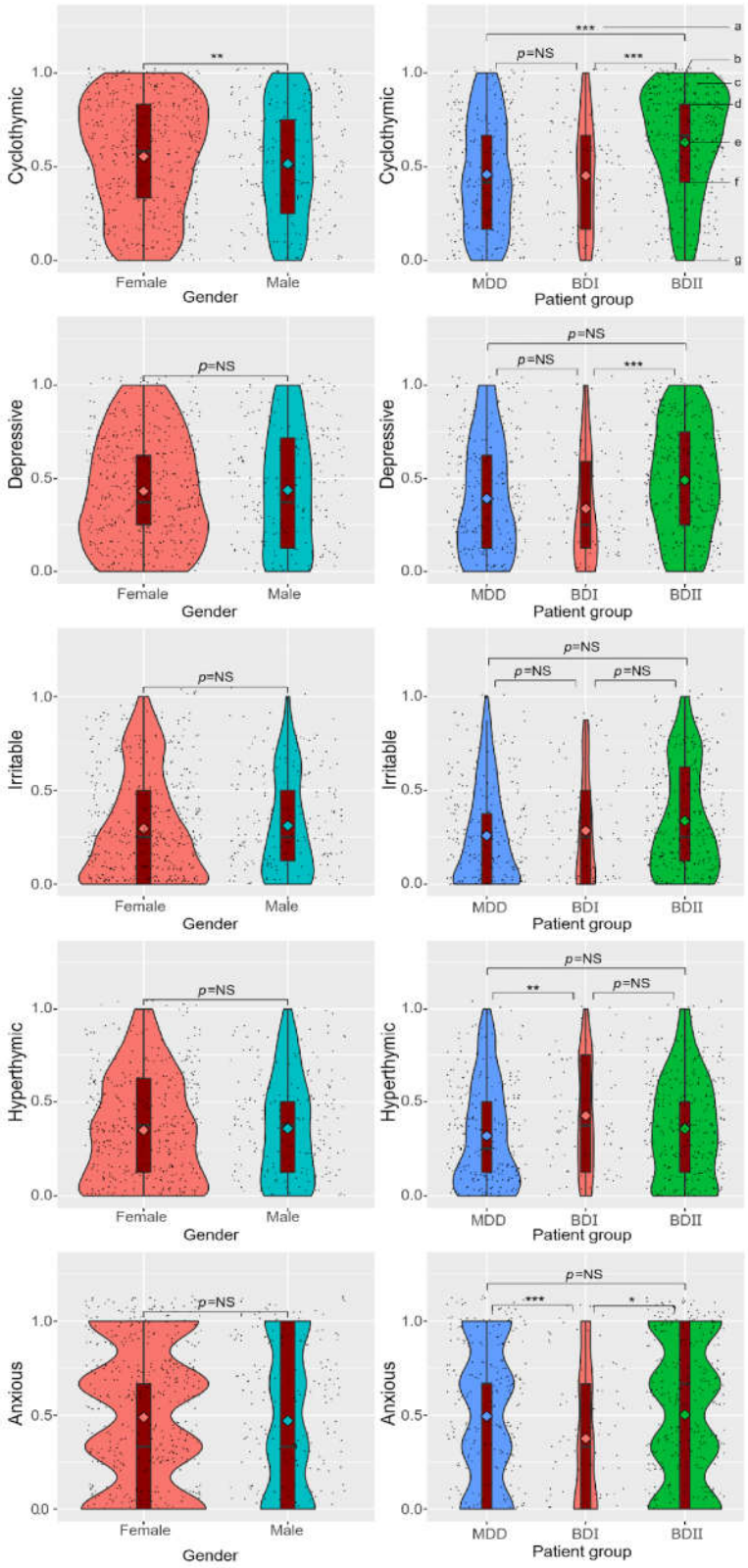

Figure 2. Violin plots depicting the distribution of five temperaments by Gender or patient group. a. p-value of median regression; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, NS = No significance. b. Upper Adjacent Value; c. Distribution of temperaments; d. Third Quartile (75%ile); e. Median; f. First Quartile (25%ile); g. Lower Adjacent Value.

Females scored much higher on the cyclothymic scale than males did (Female: [0.583, 0.333–0.833] vs Male: [0.500, 0.25–0.75], $p < 0.01$). The score of cyclothymic temperament

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of the BD II group (0.667, 0.417–0.833) was significantly higher than that of the MDD (0.417, 0.167–0.667, $p < 0.001$) and BD I group (0.458, 0.167–0.667, $p < 0.001$). Regarding depressive temperament, the score of the BD II group (0.500, 0.25–0.75) was significantly higher than that of the BD I group (0.250, 0.125–0.594, $p < 0.001$). Regarding hyperthymic temperament, the score of the BD I group (0.375, 0.125–0.750) was significantly higher than that of the MDD group (0.250, 0.125–0.500, $p < 0.01$). Regarding anxious temperament, the score of the BD I group (0.333, 0–0.667) was significantly lower than that of the MDD (0.667, 0–0.667, $p < 0.001$) and BD II group (0.667, 0–1.000, $p < 0.05$).

4. Discussion

This study developed and validated the short version of Korean TEMPS-A. The Korean TEMPS-A-SV demonstrated strong reliability and validity. Regarding reliability, Cronbach's alpha and McDonald's omega coefficients indicated significant internal consistency. All coefficients except anxious temperament were higher than the commonly accepted standard of 0.7: cyclothymic ($\alpha = 0.85$, $\omega = 0.87$), depressive ($\alpha = 0.78$, $\omega = 0.83$), irritable ($\alpha = 0.79$, $\omega = 0.82$), hyperthymic ($\alpha = 0.74$, $\omega = 0.79$), and anxious ($\alpha = 0.65$, $\omega = 0.66$). As the number of items plays a role in the Cronbach's alpha and McDonald's omega (Cortina, 1993; Viladrich et al., 2017), $\alpha = 0.65$ and $\omega = 0.66$ are acceptable values, considering the small number of items evaluating anxious temperament (3 items).

Our results related to the validity of TEMPS-A were similar to the previous studies for other languages (Lin et al., 2013; Ristić-Ignjatović et al., 2014; Vázquez et al., 2007; Woodruff et al., 2011). By exploratory factor analysis, five temperaments were divided into two superfactors, one with cyclothymic (0.69), depressive (0.76), irritable (0.65), and anxious (0.42) temperaments, and the other one with hyperthymic (0.87) temperament. This result was similar to that of the Brazilian and Serbian version of TEMPS-A-SV (Ristić-Ignjatović et al., 2014; Woodruff et al., 2011), which also found a two-factor structure. Such structure was not only found in studies validating the TEMPS-A-SV but also in studies investigating full versions of TEMPS-A in different languages (Lin et al., 2013; Vázquez et al., 2007). The consistency in structure strongly supports the construct validity of the short version of Korean TEMPS-A.

The Spearman's correlation noted prominent correlations among the cyclothymic, depressive, and irritable temperaments: cyclothymic and depressive (r = 0.49), cyclothymic and irritable (r = 0.50), and depressive and irritable (r = 0.44) (**Table 4**). The correlations among these temperaments were consistent with the previous validation of the Italian short version in healthy controls (Preti et al., 2010). Cyclothymic, depressive, and irritable temperaments among BD and MDD patients were also significantly correlated (Dolenc et al., 2015; Perugi et al., 2012). There was a tenuous negative association between hyperthymic and depressive temperament (r = -0.12), which is consistent with earlier research (Blöink et al., 2005; Vázquez et al., 2007). This result was expected because hyperthymic temperament is considered a protective factor for psychiatric disorders, including depression (Karam et al., 2010).

By partial Spearman's correlation, we found that all correlations between age and temperaments, with the exception of anxious temperament, were significant. All temperaments, except anxious temperament, were negatively correlated with age: cyclothymic (r = -0.26, p < 0.001), depressive (r = -0.27, p < 0.001), irritable (r = -0.15, p < 0.001), and hyperthymic (r = -0.08, p < 0.05). Although the research on the correlation between age and temperaments is scant, this result was slightly different from previous studies. A review paper of several TEMPS-A studies in the non-clinical population noted that age affected only the depressive temperament (Vázquez et al., 2012). Also, Kawamura et al. (2010) found that temperaments remained constant throughout time in a six-year longitudinal study. There are two speculations related to the difference in findings. First, the difference in study population (general population vs mood disorder patients) could affect correlation between temperaments and age. For instance, a recent TEMPS-A validation among patients with bipolar or cyclothymic disorder has noted that temperaments, with the exception of

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hyperthymic temperament, are negatively correlated with age (Fico et al., 2020). Second, as culture significantly influences temperaments, cultural differences might drive the discrepancy (Chen, 2018). Previous study noted that attitudes toward self-expression are different in Western cultures and non-Western cultures, which can give a foundation for developing temperamental traits (Chen & French, 2008).

Our study compared TEMPS-A scores in men and women by median regression. Only cyclothymic temperament showed significant differences. Women scored considerably higher on the cyclothymic temperament scale than males, which is consistent with earlier research (Placidi et al., 1998; Vázquez et al., 2012). Considering that patients with BD II are more likely to have cyclothymic temperaments than those with BD I (Rihmer et al., 2010), our result could support findings that suggest bipolar II disorders are more common in women than bipolar I disorders (Benazzi & Akiskal, 2003; Hendrick et al., 2000; Perugi et al., 1990).

The TEMPS-A scores differed according to diagnosis of mood disorder (**Figure 2**). First, BD II group showed significantly higher scores in cyclothymic temperament than MDD and BD I groups. Previous studies have suggested that cyclothymic temperament may contribute to distinguishing BD II from MDD (Kochman et al., 2005; Morishita et al., 2020). The findings of our study are in line with those of the previous studies. This finding suggests that assessment of temperaments among patients with mood disorders could contribute to differential diagnosis between BD II and MDD. Previous studies noted that unlike BD I, the most prevalent temperament among BD II patients is cyclothymic (Rihmer et al., 2010), and that cyclothymic temperament is a particularly sensitive indicator of BD II (Hantouche et al., 1998). Thus, our results provide support for temperamental mood lability being a risk factor for developing bipolar II disorder (Akiskal, 1995; Akiskal et al., 1995; Hantouche et al., 1998). There is a need for further research to comprehensively ascertain the cyclothymic temperament differences between MDD, BD I, and BD II.

The depressive scores between BD I and BD II groups differed significantly. BD II group showed significantly higher scores in depressive temperament than BD I group. Although no study has compared the TEMPS-A scores of patients with BD I and BD II, research has shown that the proportion of time spent in depression and recurrence rate were higher in BD II than in BD I (Tondo et al., 2017). BD II patients have longer and more severe periods of depression than BD I patients, and this may lead to higher depressive scores of BD II patients.

Regarding hyperthymic temperament, significantly higher scores were obtained by the BD I group than by the MDD group. However, there was no significant difference in hyperthymic score between MDD and BD II group. Previous studies reported mixed results for the difference in hyperthymic temperaments between MDD and BD II (Iasevoli et al., 2013; Pompili et al., 2014; Yang et al., 2021). The varying results of studies may be due to the differing sample sizes.

Compared to MDD and BD II group, BD I group had considerably lower scores on the anxious temperament. Previous researchers sought to ascertain the differences in the anxious temperament between MDD and BD in several ways, but various results were found: no differences between the two groups (Kesebir et al., 2014), BD group was found to be more anxious (Tavares et al., 2008), and MDD group was found to be more anxious (Miola et al., 2021). Considering the fact that these research studies did not differentiate between the two types of BD, we can speculate that these mixed results may be due to the different level of anxious temperament in BD I and BD II. As BD I showed lower anxious temperament scores than MDD and BD II group showed similar scores to MDD, mixed findings can result when BD I and BD II groups are integrated. Although further studies are essential to identify the differences of anxious temperament scores of MDD and BD, our results contribute to the discussion of the anxious temperament in MDD and BD.

This study has several limitations. First, because only clinical participants were included in the validation, there is a need for further studies that apply the TEMPS-A-SV to examine the general Korean population. Second, this study was a cross-sectional, retrospective study and, thus, follow-up assessments were not conducted. Lastly, test-retest

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reliability was not evaluated. Despite these limitations, it is notable that our study is the first to validate the short version of Korean TEMPS-A and suggest the clinical correlates of TEMPS-A among patients with mood disorders.

5. Conclusion

In this study, the short version of Korean TEMPS-A performed well in terms of validity and reliability among clinical population. Cronbach's alpha and McDonald's omega coefficients were significant, and exploratory factor analysis found two superfactors among the five temperaments, in line with previous research. TEMPS-A score variations between patient groups implied some new findings about mood disorders, although further studies need to follow. Our study is the first to adopt the short version of Korean TEMPS-A, and more studies could be done to support this study or to make new findings. The short version of Korean TEMPS-A can be validated in the non-clinical sample to compare TEMPS-A scores between the clinical and non-clinical sample. Also, the cultural effects on the TEMPS-A scores can be examined based on results from diverse countries.

Supplementary Materials: Figure S1: Exploratory factor analysis path map of the five temperaments on the plane of Factor 1 and Factor 2 (varimax rotation).

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Institutional Review Board Statement: This study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board of Seoul National University Bundang Hospital (protocol code B-2205-756-111, approved May 2, 2022).

Informed Consent Statement: Patient informed consent was waived because data was gathered retrospectively through a medical chart review.

Data Availability Statement: The data presented in this study are available within the article and the Supplementary Materials.

Conflicts of Interest: The authors declare no conflict of interest.

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