

The Role of the Harm Avoidance Personality in Depression and Anxiety During the Medical Internship

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Abstract: To determine whether physicians with harm avoidance (HA) personality traits were more prone to developing increased anxiety and depression during the medical internship.

A prospective longitudinal study of 74 medical interns was carried out using repeated measures of symptoms of anxiety and depression with the Beck Anxiety and Depression Inventories (BAI and BDI) before, at the 3rd, 6th, and 12th months during the internship, and 2 weeks after the internship was completed. Baseline personality was assessed by the Tridimensional Personality Questionnaire with 3 dimensions: novelty-seeking, HA, and reward dependence (RD).

Levels of both depression and anxiety increased (6.4 and 3.4 on scores for BDI and BAI, respectively) during the internship and returned to baseline 2 weeks after it ended. HA scores were significantly correlated with depression and anxiety (0.3 scores on both the BDI and the BAI) and the scores for RD were significantly correlated with anxiety but not with depression. The interaction of HA and point in internship showed no significant differences.

Internship plays a major role in the increase in depression and anxiety. A HA personality was also associated with the development of both depression and anxiety.

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Abbreviations: BAI = Beck Anxiety Inventories, BDI = Beck Depression Inventories and, GEE = generalized estimating equation, HA = harm avoidance, RD = reward dependence, TPQ = Tridimensional Personality Questionnaire.

INTRODUCTION

A number of cross-sectional studies have found the prevalence of depression among physicians in training to be higher than that in the general population,¹⁻⁷ and related to

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stress.^{7,8} Prospective studies of depression during internship have yielded inconsistent findings, as some reported that factors such as female sex and neuroticism were associated with increased depression, but other studies failed to replicate these results.^{6,8-13} A review of these studies concluded that it was difficult to draw firm conclusions because each of the studies had significant limitations.¹⁴

Several studies have examined the correlation between personality traits and stress during internship.¹³⁻¹⁵ Harm avoidance (HA), a personality trait characterized by excessive worrying, pessimism, shyness, and being fearful, doubtful, and easily fatigued, is suggested to be related to low serotonergic activity.^{16,17} Previous research has investigated the link between HA and components of the serotonin system, for example, genetic variation in 5-HTTLPR in the serotonin transporter gene.¹⁸ Other studies have suggested a role for that genetic variation in precipitating depression in the face of stress.¹⁹ The medical internship provides a rare instance in which the onset of a major stressor can be predicted for a defined population. The subjects' ages, life styles, and educational backgrounds are similar and they receive a similar stress during internship. Furthermore, medical interns in Taiwan have 2 weeks of free time after their internship; therefore, the internship provides a good model to study the relationship between stress, mental symptoms, and recovery.

The specific aim of the present prospective longitudinal study was to use the diathesis-stress model to identify personality traits associated with the development of depression and anxiety during the stressful internship year.

METHODS AND MATERIALS

Participants

In this prospective longitudinal study, we recruited 74 (46 males, overall mean age, 24.8 ± 1.2) of the 136 medical interns in training at the Chang Gung Memorial Hospital between May 2011 and June 2012. One female intern was lost to follow-up due to nonacademic leave. The participants were volunteers recruited from the 7th year of a medical college student population. All participants were healthy and none showed evidence of mental illness. The assessments took place before and at the 3rd, 6th, and 12th months of their internship. An assessment also took place 2 weeks after the internship ended. During their internship, participants worked an average of 86.7 hours per week, including 33.5 consecutive work hours and an average of 10 on-call duties per month, which they had not done before their internship.¹⁵⁻¹⁹ This is equivalent to Accreditation Council for Graduate Medical Education' guidelines in the United States (<https://www.acgme.org/acgmeweb/tabid/271/GraduateMedicalEducation/DutyHours.aspx>).

Participants completed a baseline survey 1 to 2 months before commencing the internship. This survey assessed general demographic factors (age, sex) and the following psychological measures: Tridimensional Personality Questionnaire (TPQ),

the Beck Depression Inventory (BDI), and the Beck Anxiety Inventory (BAI). Participants also completed the BAI and BDI at the 3rd, 6th, and 12th months of their internship year and 2 weeks after the internship. All participants provided informed consent in written form and were given 1000 New Taiwan Dollars after they finished the study. The study protocol was approved by the Ethics Committee of Chang-Gung Memorial Hospital.

Measurements

TPQ

TPQ is based on Cloninger's psychobiological model of personality.²⁰ The questionnaire consists of 3 genetically independent dimensions: novelty-seeking, HA, and reward dependence (RD). The Chinese version of the TPQ contains 100 "true" or "false" items covering the 3 dimensions, with 4 subscales each.²¹ NS is composed of NS1 (exploratory excitability), NS2 (impulsivity), NS3 (extravagance), and NS4 (disorderliness). HA consists of HA1 (anticipatory worry), HA2 (fear of uncertainty), HA3 (shyness with strangers), and HA4 (fatigability and asthenia). RD includes RD1 (sentimentality), RD3 (attachment), and RD4 (dependence). RD2 (persistence) has been shown to be a concept independent of the other RD subdimensions, and, therefore, is not included in the RD total score. Chen et al²¹ translated the TPQ into Chinese, and this was the version used in our study.

BDI and BAI

BDI is a widely used self-administered instrument to detect symptoms of depression and anxiety and to screen subjects with possible clinical depression.²² In this study, we used the Chinese version of the BDI, which includes 21 statements, each of which is rated from 0 to 3. In this version, depression is rated by the total score as follows: 0 to 13 = normal, 14 to 19 = mild depression, 20 to 28 = moderate depression, and 29 to 63 = severe depression.^{23,24}

BAI is a 21-question multiple-choice self-reported inventory that is used to measure the severity of an individual's anxiety and is designed for individuals aged 12 and above.²⁴ In

this study, we used the Chinese version, which includes 21 statements and is rated on a scale from 0 to 3. In this version, anxiety is rated as: 0 to 7 = minimal level of anxiety, 8 to 15 = mild anxiety, 16 to 25 = moderate anxiety, and 26 to 63 = severe anxiety.²⁵

Statistical Analysis

Generalized estimating equation (GEE) methods were used to examine the effects of the internship 2 weeks after the internship ended with regard to the BAI and BDI scores. The GEE is a generalized linear model estimation method for longitudinal data in which the within-group correlation can be specified. It fits a population-averaged model. Thus, the method accounted for the repeated measures obtained from each participant at different stages of the internship.²⁶

Tables 3 and 4, respectively, show the 3 predictive models designed to examine the predictors of depression and anxiety. The effect of the internship, TPQ scores, and sex were included in these models. The models had different combinations of variables: in model 1, only before/during/after internship, sex, and TPQ were included; in model 2, the interaction of internship and HA was considered; in model 3, 4 subscales of HA were investigated, whereas interaction was not included. The autoregressive model was used as a variance-covariance matrix in all GEE models.

All analyses were performed using Statistical Analysis System (SAS) 9.2 software (SAS Institute, Cary, NC, USA), PROC GENMOD and PROC MIXED. Statistical significance was considered to be at the level of a 2-tailed *P* value <0.05.

RESULTS

For the TPQ, the means and standard deviations of NS, HA, and RD and their subscale scores for the medical interns are shown in Table 1. Table 2 shows that the depression scores increased from those indicating minimal depression (11.1 ± 6.9) to mild depression (17.6 ± 6.9 , 16.9 ± 7.5 , 17.7 ± 7.8) during the 3rd, 6th, and 12th months of the internship, respectively, and recovered to baseline 2 weeks after the internship ended

TABLE 1. Medical Interns' Tridimensional Personality Questionnaire Scale and Subscale Scores (n = 73)

	Total (n = 73)	Men (n = 46)	Women (n = 27)
NS*	13.4 ± 4.4	13.4 ± 4.6	13.4 ± 4.1
NS1 (exploratory excitability)	3.8 ± 1.8	4.0 ± 1.9	3.4 ± 1.8
NS2 (impulsivity)	2.5 ± 1.7	2.5 ± 1.7	2.6 ± 1.8
NS3 (extravagance)	2.9 ± 1.7	2.4 ± 1.7	3.7 ± 1.5
NS4 (disorderliness)	4.1 ± 1.7	4.4 ± 1.8	3.7 ± 1.6
HA*	19.8 ± 6.8	19.2 ± 7.1	20.7 ± 6.1
HA1 (anticipatory worry)	4.9 ± 2.8	4.8 ± 2.9	5.1 ± 2.8
HA2 (fear of uncertainty)	5.1 ± 1.6	4.8 ± 1.6	5.7 ± 1.3
HA3 (shyness with strangers)	4.1 ± 1.9	4.1 ± 2.0	4.0 ± 1.7
HA4 (fatigability and asthenia)	5.7 ± 2.7	5.5 ± 2.8	6.0 ± 2.4
RD*	13.5 ± 3.8	13.6 ± 4.1	13.3 ± 3.4
RD1 (sentimentality)	3.9 ± 1.2	3.9 ± 1.2	3.8 ± 1.0
RD2 (persistence)	4.1 ± 1.8	4.2 ± 1.9	4.0 ± 1.7
RD3 (attachment)	6.3 ± 2.7	6.5 ± 2.8	6.1 ± 2.6
RD4 (dependence)	3.3 ± 1.1	3.2 ± 1.2	3.4 ± 1.0

HA = harm avoidance, NS = novelty-seeking, RD = reward dependence.

* NS = NS1 + NS2 + NS3 + NS4, HA = HA1 + HA2 + HA3 + HA4, RD = RD1 + RD3 + RD4. Data are displayed as mean ± standard deviation.

TABLE 2. The Scores on the Beck Depression Inventory and the Beck Anxiety Inventory at Baseline, During Internship, and After the Internship

	Before Internship	During Internship			2 Weeks After Internship
		3rd Month	6th Month	12th Month	
Depression	11.1 (6.9)	17.6 (6.9)*	16.9 (7.5)*	17.7 (7.8)*	11.6 (8.2)
Anxiety	6.6 (6.4)	10.2 (6.4)*	10.5 (8.9)*	10.3 (8.4)*	7.0 (7.5)

Data are displayed as mean ± standard deviation.
 * $P < 0.05$ indicates significant changes from baseline

(11.6 ± 8.2). Similarly, the anxiety scores increased from those indicating minimal anxiety (6.6 ± 6.4) to mild anxiety (10.2 ± 6.4, 10.5 ± 8.9, 10.3 ± 8.4, respectively) during the internship, and recovered to baseline 2 weeks after the internship ended (7.0 ± 7.5).

Table 3 shows the results of the GEE model, which examined the effects of NS, HA, RD, and the interactions of internship and HA on BDI scores. Model 1 shows that the scores for HA and internship were positively correlated with interns' depression. There was no significant interaction effect of internship and HA on subjects' depression in Model 2. In Model 3, the subscale HA1 (anticipatory worry) as well as stress during internship were positively correlated with the depression score, but other subscales (HA2, HA3, and HA4) were not.

The 3 models in Table 4 also demonstrate the role of HA and the stress of internship in medical interns' anxiety symptoms. Model 1 shows that the scores for HA, RD, and point in the internship were positively correlated with interns' anxiety. There was no significant interaction between HA and the stress of internship on subjects' anxiety in model 2. No subscales of HA were correlated with the anxiety score in model 3.

DISCUSSION

The present study is the first to investigate the role of the HA personality in depression and anxiety during the medical

internship. The increased depression and anxiety during the internship were consistent with the results of a previous large sample study.²⁷ We found that the impact of stress during internship played a more important role than did personality. The depression and anxiety scores significantly increased within the first 3 months, persisted through the internship, and recovered 2 weeks after the internship ended. This is consistent with the concept of a stress-related disorder, such as an adjustment disorder with anxiety and depressed mood. That is, the symptoms of anxiety and depression of an adjustment disorder developed within 3 months after the onset of the stressor and resolved within 6 months of the termination of the stressor;²⁷ however, the average depression (16.9–17.7) and anxiety scores (10.2–10.5) within the range of mild depression and anxiety may not meet the DSM IV criteria of “marked distress that is in excess of what would be expected given the nature of the stressor, or by significant impairment in social or occupational functioning”.²⁷ Furthermore, only 1 female intern in this study was lost to follow-up due to nonacademic leave, so it is conceivable that the increased symptoms of depression and anxiety did not result in significant impairment in occupational functioning.

The distinguishing feature of our study was to determine whether the HA personality trait had an association with depression and anxiety during the internship. HA includes

TABLE 3. Models of Personality Traits As predictors for Scores on the Beck Depression Inventory During Internship

Effect	Model 1		Model 2		Model 3	
	Estimate β (SE)	P Value	Estimate β (SE)	P Value	Estimate β (SE)	P Value
Before Internship	Reference		Reference		Reference	
During internship	6.4 (0.9)	<0.001*	6.4 (0.9)	<0.001*	6.4 (0.9)	<0.001*
After internship	0.5 (1.1)	0.636	0.5 (1.1)	0.636	0.5 (1.1)	0.636
HAc	0.3 (0.1)	<0.001*	0.3 (0.1)	0.035*		
HA1 (anticipatory worry)					0.5 (0.2)	0.014*
HA2 (fear of uncertainty)					0.3 (0.4)	0.412
HA3 (shyness with strangers)					0.1 (0.3)	0.844
HA4 (fatigability and asthenia)					0.3 (0.2)	0.226
HA* before internship (Reference)			Reference			
HA* internship			0.1 (0.1)	0.528		
HA* after internship			0.2 (0.2)	0.361		
RDc	0.0 (0.1)	0.954	0.0 (0.1)	0.953	0.0 (0.1)	0.905
NSc	0.0 (0.1)	0.922	0.0 (0.1)	0.923	0.0 (0.1)	0.951
Sex (male vs. female)	-1.3 (1.0)	0.202	-1.3 (1.0)	0.202	-1.2 (1.0)	0.240

HA = harm avoidance, HAc = centralized harm avoidance, NS = novelty-seeking, NSc = centralized novelty-seeking, RD = reward dependence in the Tridimensional Personality Questionnaire, RDc = centralized reward dependence.

* $P < 0.05$ indicates a significant influence on BDI score.

TABLE 4. Models of Personality Traits as Predictors for Scores on the Beck Anxiety Inventory During Internship

Effect Before Internship	Model 1		Model 2		Model 3	
	Estimate β (SE) Reference	P Value	Estimate β (SE) Reference	P Value	Estimate β (SE) Reference	P Value
During internship	3.7 (0.9)	<0.001*	3.7 (0.9)	<0.001*	3.7 (0.9)	<0.001*
After internship	0.4 (1.2)	0.745	0.4 (1.2)	0.746	0.4 (1.2)	0.746
HAc	0.3 (0.1)	<0.001*	0.2 (0.1)	0.095		
HA1 (anticipatory worry)					0.3 (0.2)	0.115
HA2 (fear of uncertainty)					0.5 (0.4)	0.181
HA3 (shyness with strangers)					0.3 (0.3)	0.279
HA4 (fatigability and asthenia)					0.2 (0.2)	0.454
HA* before internship (Reference)			Reference			
HA* internship			0.1 (0.1)	0.464		
HA* after internship			0.2 (0.2)	0.341		
RDC	0.4 (0.1)	0.002*	0.4 (0.1)	0.002*	0.4 (0.1)	0.005*
NSc	-0.2 (0.1)	0.185	-0.2 (0.1)	0.185	-0.1 (0.1)	0.303
Sex (male vs. female)	-1.5 (0.9)	0.111	-1.5 (0.9)	0.112	-1.4 (1.0)	0.160

HA = harm avoidance, HAc = centralized harm avoidance, NS = novelty-seeking, NSc = centralized novelty-seeking, RD = reward dependence in the Tridimensional Personality Questionnaire, RDC = centralized reward dependence.

* $P < 0.05$ indicates a significant influence on BAI score.

anticipatory worry, fear of uncertainty, shyness with strangers, and fatigability and asthenia.²¹ It is highly correlated with neuroticism in the Five-Factor Personality Model²⁷ and appears to be a precursor to the stressful experience of medical internship resulting in depression and anxiety. The most relevant subscale, the relationship between pessimistic worry in anticipation of problems (HA1), and depression in our study was consistent with a similar cross-sectional study.²⁸ The relationship between HA personality and anxiety and depression during internship provided further evidence for Cloninger neurobiological personality model. HA has not only been shown to correlate with the severity of depression, but other studies have also reported a significant association between serotonergic transport and the HA dimension. Pharmacological studies have demonstrated that harm avoidant behaviors decreased when individuals were given serotonergic agents.^{21,29} Genetic studies have specifically shown the 5-HTTLPR gene to be related to neuroticism and HA.^{18,28,30} Genetic polymorphism in this serotonin transporter protein gene located on chromosome 17 increases the probability that life stress will precipitate depression. Subjects with at least 1 copy of a less-transcribed 5-HTTLPR-short(S) allele reported an increase in symptoms of depression during internship.^{19,31} Previous studies did not show whether symptoms of depression improved after the internship ended and our study did.

Our results supported the viewpoint that HA results in an “anxiety proneness personality,” as a recent review article showed that almost all anxiety disorders, that is, panic disorder, obsessive-compulsive disorder, social anxiety, specific phobia, posttraumatic stress disorder, and generalized anxiety disorder, were associated with a high HA trait.²⁹ High RD was also associated with anxiety during the internship, whereas the role of RD was relatively controversial in anxiety disorders in previous studies.²⁹ Our study did show that high RD and HA were correlated with the severity of posttraumatic stress disorder.³¹ RD describes the maintenance and continuation of behavior, especially sociability, that is rewarded.²⁰ We suggest that the association between RD and anxiety during internship

may be caused by social interactions, which might easily trigger interns’ anxiety, as new clinical practitioners, during the medical internship.

Several features demonstrate the strength of this study. First, we outlined the time course of the development and recovery of depression and anxiety during the internship. Second, we quantified the contributions of the HA personality trait and stress during internship to the development of depression and anxiety. Third, this study identified symptoms of anxiety, which had received less attention than interns’ depression in previous studies.³² We also used the BAI, which was developed to minimize overlap with depression as measured by the BDI³⁰ so that different features of anxiety and depression could be identified. In the present study, we demonstrated the role of HA in both depression and anxiety but that RD was associated only with anxiety.

There are several methodological limitations that should be noted when interpreting our findings. First, there may have been recall bias among interns when reporting symptoms of depression and anxiety during each 3-month course and the study lacked a more structured interview that would be needed to confirm the symptoms of depression and anxiety. Second, all investigations were self-reported, and a more objective method would be required to understand the underlying mechanisms. For example, the measurement of autonomic modulation, such as heart rate variability, would make it possible to examine the corresponding physiological reactions in the development of anxiety and depression during the internship,^{15,17} as well as any association with personality.^{33,34} Third, we did not record every intern’s physical activity, sleep schedule, actual working hours, or medical errors, which might have contributed to their depression and anxiety.^{15,17}

In conclusion, stress during the internship plays a major role in increasing depression and anxiety. The HA personality was also associated with the development of both depression and anxiety. Our results provide new insights into the characteristics of depression and anxiety during internship. We also pointed out the role of the HA personality when depression and anxiety among medical interns are considered. A more comprehensive

study design is needed to validate the phenomenon and to further explore the underlying mechanisms.

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