



# Medical Student Personality Factors and Test Anxiety

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## Abstract

Test anxiety limits the performance of some medical students, and whether baseline personality factors affect students' test anxiety and exam performance is not known. We performed a repeated measures study of test anxiety among 20 second-year medical students, comparing results with historical controls, baseline personality assessment, and examination scores. We measured test anxiety using the Test Anxiety Inventory (TAI) and personality using the Big Five Inventory (BFI). These instruments were highly reliable in our sample, and moderate correlations were seen among personality factors and test anxiety. Test anxiety scores were similar to a historical cohort of medical students, and the personality factor Neuroticism was highly correlated with the Worry component of test anxiety. There was a significant negative correlation between test anxiety and scores on standardized examinations. Our study was limited by a small sample yet provides evidence to support the use of the BFI and TAI in modern medical students. This study also suggests that test anxiety affects student performance on written examinations.

**Keywords** Personality factors · Personality · Test anxiety · Testing · Undergraduate medical education · USMLE

## Background

Medical students represent a unique group of learners who pass through a rigorous selection process and are expected to perform at important levels of competence. Despite increasing refinement of the methods of candidate selection, some students experience unanticipated academic difficulty. Early identification of students at risk of difficulty would allow for additional support where needed, and focus resources on areas of greatest benefit. Test anxiety, an increased sense of worry or emotion related to testing, is a recognized phenomenon that in some students can be maladaptive [1]. An individual's personality can be summarized in several ways, and much psychological research has centered around five particular traits that help differentiate personality types. Known as the "big five," the traits of Openness, Conscientiousness, Emotionality, Agreeableness, and Neuroticism have proven resilient across

multiple research settings [2]. Given the ubiquity of testing in medical school, certain personality factors or the presence of test anxiety may help identify such at-risk students.

Current norms of test anxiety in medical students are not available. Measurements obtained in the mid-1980s suggest that medical students experienced less test anxiety than undergraduate students [3]. Though the Test Anxiety Inventory used by Harvill was revalidated after 30 years [4, 5], repeat measurement in medical students was not performed.

Among medical students, personality factors may also be important predictors of success. In a large group of Flemish medical students, extraversion and agreeableness were found to be highly prevalent but did not predict performance in school. Among these students, high scores in conscientiousness did predict final scores in the preclinical years [6]. However, caution must be exercised in leaning too much on this predictive value of conscientiousness. In a group of 220 UK medical students [7], the presence of moderate anxiety seemed to enhance the acquisition of clinical skills, while high levels of conscientiousness reduced the acquisition of clinical knowledge. The relationship of personality factors to test anxiety in medical students has not been reported.

The current project sought to understand the current amount of test anxiety and the distribution of personality factors in a modern American medical school class, as well as their correlation with each other and with preclinical and licensing examination results.

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**Table 1** Reliability measures (Cronbach's alpha) of TAI and BFI components ( $n = 21$ )

TAI-T	TAI-W	TAI-E	E	A	C	N	O
0.944	0.913	0.901	0.851	0.785	0.783	0.547	0.780

Test Anxiety Inventory (TAI): *TAI-T* Total, *TAI-E* Emotionality, *TAI-W* Worry

Big Five Inventory (BFI): *E* Extroversion, *A* Agreeableness, *C* Conscientiousness, *N* Neuroticism, *O* Openness.

## Activity

We recruited medical students at the beginning of their second year and obtained informed consent to participate in this research study (Wake Forest IRB ID: IRB00033636). Using Research Electronic Data Capture (REDCap) Survey software, baseline, day 30 and day 90 assessments for test anxiety (Test Anxiety Inventory, TAI, Spielberger, 1980), and personality factors (Big Five Inventory, BFI, John, Donahue, & Kentle, 1991) were collected [8].

Scores from two course written examinations (in-house and Customized Assessment System or CAS), and the US Medical Licensing Exam (USMLE) Step 1 were included. In-house examination questions are developed by faculty and evaluate course learning objectives. The CAS examination is composed of retired Step 1 questions that focus more on the clinical application of course material.

The BFI comprised 44 items each ranked using a five-pointed scale (1 = strongly disagree; 2 = disagree a little; 3 = neither agree or disagree; 4 = agree a little; 5 = agree strongly). Scoring the BFI results in a value for each personality factor ranging between 1 and 5 that indicates that person's relative

agreement with the factor. The TAI contains 20 items that describe test-related situations, each ranked using a four-pointed scale of agreement (almost never, sometimes, often, almost always). The TAI results are scored in three values: a total test anxiety score (range 20–80), a score for Worry (range 8–32), and a score for Emotionality (range 8–32).

The instrument reliability of the TAI and BFI was assessed using Cronbach's alpha. Personality factor distribution and test anxiety scores were analyzed utilizing descriptive statistics. Repeated measures analysis of variance was used to establish whether there were any changes in test anxiety scores between baseline, day 30 and day 90, and one-way analysis of variance was utilized to examine for differences between male and female participants. TAI results were compared to a historical cohort[3] using a two sample *t* test for summary data [9]. Finally, Pearson's *r* was used to examine correlations between all components of the TAI, BFI, and examination scores.

## Results and Discussion

Out of 120 invited to participate, 21 students joined the study. Reliability of the TAI scores demonstrated high internal consistency (.901 to .944), while BFI scores demonstrated acceptable-to-high consistency (.547 to .851). Complete results are presented in Table 1.

Mean (SD) personality factor scores for males and females, respectively, are as follows: Extraversion 3.43 (0.71) and 3.71 (0.99); Agreeableness 3.96 (0.54) and 3.47 (0.59); Conscientiousness 3.84 (0.57) and 3.93 (0.61); Neuroticism 2.36 (0.85) and 2.69 (0.91); and Openness 3.73 (0.54) and

**Table 2** Correlations between TAI, BFI, and exam performance ( $n = 21$ )

	IN	CAS	S1	E	A	C	N	O	ET0	WT0	TAI0
IN	1										
CAS	.469*	1									
S1	.348	.652**	1								
E	-.225	-.017	.254	1							
A	.263	.013	-.174	-.652**	1						
C	.198	.023	.122	-.155	.024	1					
N	.161	-.136	-.309	.094	-.325	-.299	1				
O	-.130	.180	.205	.123	-.038	.015	-.571**	1			
ET0	.089	.056	-.359	.168	-.388	-.256	.766**	-.308	1		
WT0	-.032	-.030	-.542*	-.116	.025	-.109	.429	-.354	.701**	1	
TAI0	.071	.023	-.458*	.009	-.218	-.207	.704**	-.380	.943**	.889**	1

IN: (in-house examination), CAS CAS examination, S1 USMLE Step 1

Big Five Inventory (BFI): *E* Extroversion, *A* Agreeableness, *C* Conscientiousness, *N* Neuroticism, *O* Openness

Test Anxiety Inventory: *ET0* Emotionality Time 0, *WT0* Worry Time 0, *TAI0* Total Anxiety Time 0

\* $p < 0.05$ , two-tailed

\*\* $p < 0.01$ , two-tailed

3.68 (0.74). No statistically significant differences between male and female participants were found.

Mean (SD) baseline anxiety scores for males and females, respectively, are as follows: TAI-E 13.2 (4.9) and 14.8 (4.8); TAI-W 10.8 (4.0) and 11.9 (3.9); and TAI-T 30.2 (9.9) and 33.4 (10.1). There were no statistically significant differences between males and females and repeated measure ANOVA revealed no significant changes in test anxiety scores from baseline, day 30 to day 90. Results from a two sample *t* test for summary data indicated no statistically significant differences between the study cohort and the historical cohort on anxiety scores.

Complete Pearson's correlation results for the TAI, BFI, and examination scores are presented in Table 2. TAI results were statistically significant between all three components: Emotionality and Worry ( $r = 0.701$ ,  $p < 0.01$ ); Emotionality and Total ( $r = 0.943$ ,  $p < 0.01$ ); and Worry and Total ( $r = 0.889$ ,  $p < 0.01$ ). Between the BFI factors, there was a significant negative correlation between Extroversion and Agreeableness ( $r = -0.652$ ,  $p < 0.01$ ) and Neuroticism and Openness ( $r = -0.571$ ,  $p < 0.01$ ). Examination results indicated a positive correlation between in-house and CAS examinations ( $r = 0.469$ ,  $p < 0.05$ ) and CAS and USMLE Step 1 ( $r = 0.652$ ,  $p < 0.01$ ).

Pearson's correlations were significant between Emotionality (TAI) and Neuroticism (BFI) ( $r = 0.766$ ,  $p < 0.01$ ), and Total (TAI) and Neuroticism (BFI) ( $r = 0.704$ ,  $p < 0.01$ ). There was a significant negative correlation between Worry (TAI) and USMLE Step 1 scores ( $r = -0.542$ ,  $p < 0.05$ ) and Total (TAI) and USMLE Step 1 scores ( $r = -0.458$ ,  $p < 0.05$ ).

We suggest that personality factors and test anxiety can be reliably measured in medical students using the BFI and TAI. In our sample, the personality factors Agreeableness and Conscientiousness emerged as the strongest factors though neither was significantly correlated with exam performance. Interestingly, a report of Norwegian medical students' personality factors (using a 3-factor model) found high conscientiousness to be predictive of increased stress [10].

Test Anxiety measures in our study were similar to a historical cohort of medical students and did not change over time. Personality factors were not significantly correlated with examination performance; however, the negative correlation associated with TAI-W, TAI-T, and Step 1 scores suggests the higher the test anxiety, the lower the Step 1 score (or the lower the anxiety the higher the Step 1 score). This is consistent with other published data that the Worry component of test anxiety impacts performance more than the Emotionality component.

A limitation of the study is the sample size, which leaves open the possibility of participation bias and Type II error. Despite this, these results suggest that medical students with higher test anxiety (particularly the Worry component) demonstrate lower results on a national licensing examination. Early identification of students with high test anxiety may provide opportunity to implement measures aimed at reducing anxiety and thereby improve test performance. Further research is necessary to confirm our study findings and explore methods of reducing test anxiety in medical students.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest.

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