The importance of personality traits for predicting clinical clerkship grades and USMLE scores [version 1; peer review: awaiting peer review]

Matthew A. Tucker, Benjamin T. Griffeth, Christy Lee, April O. Buchanan

Biomedical Sciences, University of South Carolina School of Medicine Greenville, Greenville, SC, 29605, USA

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Abstract

Background: Important aspects of medical school success are thought to rely on non-cognitive attributes such as personality traits.

Methods: In a sample of medical students who completed their 3rd-year clerkships, the current study examined the impact of personality traits on performance on four measures of 3rd-year clerkship grades and United States Medical Licensing Examination (USMLE) Step 2CK (Clinical Knowledge) scores.

Results: We found that specific personality traits, including conscientiousness, achievement-striving, morality, and self-efficacy predicted multiple outcome measures, including Step 2CK performance. However, while we observed a clear link between personality and success during the 3rd year, we also found that Step 1 scores, not specific or grouped personality traits, best predicted all measures of clerkship performance except clerkship evaluations and, as expected, best predicted Step 2CK performance. Additionally, we created a composite personality profile for our sample by averaging the high and low scores of the Big Five personality trait scales and their subscales. However, this personality composite, which included the traits agreeableness, cooperation, Conscientiousness, and cautiousness, did not predict any of our outcome measures.

Conclusions: These findings indicate that personality traits individually and in combination predict 3rd-year medical school success, especially when performance may rely less on intellectual prowess, and more on personality factors. Importantly, however, Step 1 scores were usually much better predictors not only of Step 2CK and shelf exam performance, but even overall clerkship grades and Objective Structured Clinical Examination (OSCE) performance. We hope these results can be used to help clerkship directors and faculty understand that personality factors impact medical school performance and that they should be considered when evaluating the more non-cognitive aspects of student achievement.
Keywords
Clerkship performance, personality, USMLE Step 1, USMLE Step 2

Corresponding author: Matthew A. Tucker (arnoldii@yahoo.com)

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Introduction

It is well known that successful scores on USMLE Step 1 and Step 2 are critical for matching into competitive residency programs (Gauer & Jackson (2017); Mitsouras et al. (2019)). Performance on these exams is largely determined by the ability to memorize and synthesize a vast amount of medical knowledge. In parallel with intellectual capacity, personality factors also predict success in medical school, especially during the clerkship years. Studies of personality in a medical school context often focus on the “Big 5” personality traits: extraversion, Agreeableness, Openness, Conscientiousness, and Neuroticism (Goldberg et al. (2006); John & Srivastava (1999)). Each of these traits can be viewed on a continuum between two poles (e.g., the introversion-extraversion continuum; see Figure 1), and each may predict, individually or in combination, important elements of academic success. Descriptions of each Big 5 trait and each trait’s subscales can be found in Appendix A (Tucker, 2021b).

Personality traits and clerkship performance

Of the Big 5 personality traits, a small body of research reveals that some may stand out as important predictors of success in the clinical learning environment. Traits like Extraversion may facilitate patient-student and preceptor-student relationships. Lievens et al. (2009), for example, found that Extraversion did not influence students’ grades during the pre-clerkship years of medical education, but did predict higher overall grades throughout their clinical years. Importantly, the contribution of Extraversion to academic success in the clinical years was related to the ability to apply clinical information and develop interpersonal relationships (“getting along”), rather than purely cognitive abilities such as the memorization of medical knowledge. Corroborating this finding, Davidson et al. (2015) found that clerkship evaluation tools may be biased toward extraverts to the extent that they value interpersonal warmth in communication. Haight et al. (2012) found that Extraversion predicted higher evaluation scores on skills involving communication, patient rapport, patient care, and teamwork.

Evaluations of students by clerkship faculty and directors are also an important gauge of student success, as they represent an expert perspective that provides students real-world feedback about performance in clinical settings. Indeed, personality traits, such as Extraversion, Agreeableness, and Conscientiousness have been shown to elicit more favorable clerkship evaluations (Chibnall et al. (2008)). Conscientiousness has been associated with higher clerkship evaluations of 11 areas, including general knowledge, history taking, physical exam, and diagnostic/therapeutic planning by Haight et al. (2012).

While the literature is much smaller, personality traits have also been shown to predict standard measures of academic success, such as class rank and test performance. Like the findings of Sobowale et al. (2018), who found that Conscientiousness benefited clerkship performance, Lievens et al. (2002) found that Conscientiousness also predicted pre-clerkship grades, suggesting that this personality trait may be better than other traits as a predictor of success throughout medical school. Another study demonstrated that students in the top 15% of the class tend to score lower on Agreeableness and Openness than lower performing students.

![Figure 1. Characteristics of individuals scoring at the low and high end of the continuum for each of the Big 5 personality traits. Retrieved from: https://courses.lumenlearning.com/boundless-psychology/chapter/trait-perspectives-on-personality/](https://courses.lumenlearning.com/boundless-psychology/chapter/trait-perspectives-on-personality/)
students (Plaisant et al. (2011)), while high Neuroticism scores, on the other hand, which are suggestive of anxiety and unhappiness, were associated with poorer overall grades in most specialties (Sobowale et al., 2018). Tyssen et al. (2007) also found that high Neuroticism and high Conscientiousness predicted higher stress levels, while high Extraversion, low Neuroticism, low Conscientiousness were associated with lower stress, which may benefit performance in medical school.

The current study
Most medical schools, in evaluating the progress of students during their clinical years, emphasize the development of inter-personal relationships of students with their peers, preceptors, and patients. The current study examines whether the Big 5 personality traits (Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism) contribute to key aspects of student performance in their clinical clerkships, which consist of overall clerkship grades, clinical evaluations of students by faculty and residents (competency-based), OSCE (Objective Structured Clinical Examination) grades, shelf exam scores, and scores on USMLE Step 2CK using the International Personality Item Pool (IPIP-NEO; Buchanan et al., 2005; Johnson, 2014). Despite the paucity of research on this topic, we did expect several associations to emerge. First, we expected that extraverted students would receive higher scores on their clinical performance evaluations, and that students who are more conscientious would receive higher overall clerkship grades than their lower-scoring counterparts. To our knowledge, no studies have examined whether personality traits predict Step 2CK performance. However, based on past studies, we expected that Conscientiousness would benefit Step 2CK performance.

Note: Big 5 personality traits (Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism) are capitalized throughout, while the subscales are in lower case followed by the Big 5 trait each subscale corresponds to in parentheses (Open, Consc, Extra, Agr, Neurotic).

Methods
Ethics and consent
This study was deemed exempt from approval by the Prisma Health Institutional Review Board (#00075870, 3/30/2018) under Exempt Category 2 (research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (I) information obtained is recorded in such a manner that human subjects can be identified, directly or indirectly through identifiers linked to the subjects; AND (ii) any disclosure of the human subjects’ responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects’ financial standing, employability, or reputation). It was therefore not necessary to collect consent from participants to gather and analyze their data. To make student grades available for publication, participants signed a Family Educational Rights and Privacy Act (FERPA) release. Participants could withdraw from the study by contacting one of the authors (BTG).

Participants
Participants were 87 medical students (N=51 female, Age: 26.4±1.7yrs) who completed the IPIP-NEO at the end of their 3rd or 4th year at the University of South Carolina School of Medicine, Greenville. The IPIP-NEO was completed after completing the following 3rd year clerkships: Psych/Neuro, Surgery, OB/Gyn, Family Medicine, Internal Medicine, and Pediatrics. At the University of South Carolina School of Medicine Greenville, overall clerkship grades consist of OSCEs, clinical performance evaluations from residents and attendings, and NBME subject test scores. This study was approved by the Prisma Health Institutional Review Board (Study#: 00075870; Approved: 3/30/2018).

Personality inventory: IPIP-NEO
The International Personality Item Pool (IPIP-NEO; iPIP.ori.org) is a 120-item measure of the Big 5 personality traits (Openness to experience (Openness), Conscientiousness, Extraversion, Agreeableness, and Neuroticism) and the six subscale traits that load on each of those traits (Digman et al. (1989); Goldberg et al. (2006); Johnson (2014)) Each of the Big 5 personality trait scales is composed of six sub-scales that provide added detail. Scores on each scale and subscale range from 1-100 and represent percentiles within the specific age range of the test-taker. Scores above 70th percentile represent “high” scores, and scores below the 30th percentile are considered “low” scores. Results do not reveal hidden, secret information about the subject (propensity to lie) nor does the IPIP-NEO assess psychological disorders.

Procedure
Approximately 200 students were invited to participate in the study during the Spring semester of 2018 and 2019 following completion of their third-year clerkships. They were recruited by email sent to the entire class followed by a visit from one of the authors (BTG) to a class meeting to promote the study and answer questions. Participants signed a FERPA release to make their grades available for publication. Participants completed the IPIP-NEO online and submitted the results via email to one of the authors, and data were de-identified prior to publication.

Statistical analysis
Data analyses were conducted using SPSS (version 23). Relationships between clerkship performance measures (shelf exam, evaluations, OSCEs, and overall grade) and Big 5 trait scales and their subscale scores were analyzed using linear stepwise regression. Percentage of the variance explained in the regression models is reported as the adjusted-R². Because each Big 5 personality scale score is derived from its 6 subscales, Big 5 personality scale scores were entered as a group, while subscale scores were entered as a separate group in the regression analysis. Individual correlations were conducted using Pearson correlations. Z-scores were calculated for each clerkship outcome measure within each clerkship so that average performance across clerkships could be examined.
Results
Medical student personality characteristics
To identify the personality traits, we selected the IPIP-NEO scales and subscales with percentile scores falling in the ‘High’ (≥70) and ‘Low’ (≤30) range according to the guidelines set forth in Johnson (2014). The 4 traits that met the criterion for inclusion in the high category (scores≥70) were Agreeableness (70.1), cooperation(Agr) (70.5), Conscientiousness (70.2), and cautiousness(Consc) (71.6). Personality traits in the ‘low’ scoring category (scores≤30) were excitement-seeking(Extra) (30.3) and imagination(Open) (28.1) (See Table 1 for a full listing of scores). Anger(Neurotic) (35.4) and depression(Neurotic) (34.3) did not quite reach the criterion for the low range. After averaging the top four trait scores to create a composite score we did not find any significant correlations with our four clerkship measures (evaluations, OSCEs, shelf exam scores, and overall grade) or Step 2CK performance. The composite score for the lowest-scoring two traits correlated negatively only with overall clerkship grade (r =-0.26, p=0.02), but neither explained a significant amount of the variance in clerkship grades in the regression model.

Personality traits and clerkship performance
Overall clerkships grades. The overall clerkship grade represents an average of grades on the NBME subject exam, clerkship evaluations by clinical faculty, and OSCEs. The Big 5 personality trait Conscientiousness alone accounted for a significant amount of the variance in overall clerkship grades (9.2% (Adj-R²), F₁,₈₅=8.60, p=0.004). Three subscale traits, two Conscientiousness subscales (self-efficacy and achievement-striving) plus morality(Agr), accounted for 28.6% of the variance in overall clerkship grades (F₃,₈₃=12.51, p<0.001). There were no other Big 5 traits or subscales that significantly predicted overall clerkship grades. See Table 2 for a summary of significant predictors of the four clerkship measures. Step 1 scores, however, when added to the regression analysis, accounted for 61.4% of the variance in overall clerkship grades (F₁,₈₅=138.09, p<0.001).

Table 1. Scores on the IPIP-NEO scales and subscales.
Each of the Big 5 personality trait scores (old/capitals) is derived from scores of the six subscales. Scores for scales/subscales that met criterion for the ‘high’ and ‘low’ category are shaded green and orange, respectively.

| IPIP-NEO Scales               | Mean (n=87) | Mean of Big 5 personality trait + trait subscales |
|------------------------------|-------------|--------------------------------------------------|
| EXTRAVERSION (Extra)         | 49.16       |                                                  |
| Friendliness                 | 55.70       |                                                  |
| Gregariousness               | 45.26       |                                                  |
| Assertiveness                | 52.78       |                                                  |
| Activity level               | 56.06       |                                                  |
| Excitement-seeking           | 30.30       |                                                  |
| Cheerfulness                 | 57.08       | 49.48                                            |
| AGREEABLENESS (Agr)          | 70.05       |                                                  |
| Trust                        | 63.95       |                                                  |
| Morality                     | 58.70       |                                                  |
| Altruism                     | 64.30       |                                                  |
| Cooperation                  | 70.51       |                                                  |
| Modesty                      | 57.17       |                                                  |
| Sympathy                     | 67.11       | 64.54                                            |
| CONSCIENTIOUSNESS (Consc)    | 70.18       |                                                  |
| Self-efficacy                | 63.36       |                                                  |

Table 2. IPIP-NEO Scales and Mean (n=87) of Big 5 personality trait + trait subscales

| IPIP-NEO Scales         | Mean (n=87) | Mean of Big 5 personality trait + trait subscales |
|-------------------------|-------------|--------------------------------------------------|
| Orderliness             | 62.32       |                                                  |
| Dutifulness             | 65.02       |                                                  |
| Achievement striving    | 63.76       |                                                  |
| Self-discipline         | 62.08       |                                                  |
| Cautiousness            | 71.64       | 65.48                                            |
| NEUROTICISM (Neurotic)  | 40.86       |                                                  |
| Anxiety                 | 51.05       |                                                  |
| Anger                   | 35.37       |                                                  |
| Depression              | 34.32       |                                                  |
| SELF-consciousness      | 51.45       |                                                  |
| Immoderation            | 46.23       |                                                  |
| Vulnerability           | 42.41       | 43.10                                            |
| OPENNESS to EXPERIENCE (Open) | 36.71 |                                        |
| Imagination             | 28.09       |                                                  |
| Artistic interests      | 40.33       |                                                  |
| Emotionality            | 48.46       |                                                  |
| Adventurousness         | 37.32       |                                                  |
| Intellect               | 43.92       |                                                  |
| Liberalism              | 54.94       | 41.40                                            |
**NBME subject exam performance.** Averaged across clerkships, only higher scores on the Openness to Experience scale predicted higher NBME subject exam scores, accounting for a modest 6.1% of the variation in test scores ($F_{1,85}=5.52$, $p=0.02$). The subscales morality(Agr) and achievement-striving(Consc) combined accounted for 13.5% of the variance in test scores ($F_{2,84}=7.71$, $p=0.001$). Not surprisingly, Step 1 scores predicted 70.0% of the variance in NBME scores ($F_{1,85}=198.22$, $p<0.001$).

**Clerkship evaluations.** Of the Big 5 personality traits, Extraversion accounted for a modest, though significant, 6% of the variation in evaluations of students by faculty and residents ($F_{1,85}=6.59$, $p=0.01$), but the combined contribution of the three subscales assertiveness(Extra), achievement-striving(Consc), and artistic interests(Open) accounted for 21% of the variance ($F_{3,83}=8.56$, $p<0.001$). When Step 1 scores were added to the model, they explained an additional 4.1% of the variance in clerkship evaluations ($F_{1,84}=4.19$, $p=0.04$).

**OSCE grades.** Conscientiousness predicted 14% of the variation in OSCE grades ($F_{1,85}=14.93$, $p<0.001$) as did the combination of two subscales (self-efficacy(Consc) and adventurousness(Open)), which explained 20.5% of the variance ($F_{2,84}=12.12$, $p<0.001$). However, when Step 1 scores were added to the regression model, they accounted for 32.6% of the variation in OSCE grades ($F_{3,83}=42.53$, $p<0.001$), while Conscientiousness explained an additional 10% of the variance in the model ($F_{1,84}=14.70$, $p<0.001$). Among the subscales, self-discipline(Consc) added significantly to the variance explained by Step 1 scores (+7.4%, $F_{1,84}=10.42$, $p=0.002$), but self-efficacy(Consc) and adventurousness(Open) no longer made a significant contribution to the regression model.

**Step 2CK scores, personality traits and Step 2CK performance**

While none of the Big 5 personality traits predicted performance on the USMLE Step 2CK exam, the combination of three subscales (self-efficacy(Consc), morality(Agr), and depression(Neuroticism)) accounted for 18.5% of the variation in Step 2CK scores ($F_{3,77}=7.04$, $p<0.001$). When Step 1 scores were added to the regression model, none of the above subscales contributed significantly to the predictive ability of Step 1 scores, which accounted for 62.5% of the variation in Step 2CK scores ($F_{1,79}=134.20$, $p<0.001$).

**Discussion**

Research on the personality factors that predict clerkship performance in medical school and especially USMLE Step 2CK performance is still quite limited. In the current study, we found that certain personality traits consistently predicted performance on these two outcomes. Of the Big 5 personality traits and their subscales on the IPIP-NEO, we find that Conscientiousness and two of its subscales (self-efficacy and achievement-striving), as well as assertiveness were the most important for predicting success in clinical clerkships and USMLE Step 2CK performance. Indeed, Conscientiousness has consistently been associated with a range of performance metrics in medical school (Doherty & Nugent, 2011). The modest association between the trait of Extraversion and clinical evaluations is also notable, as Extraversion may enhance compassion and interprofessional collaboration, and may suggest that students with a more introverted personality style may be negatively impacted (Lievens et al., 2009).

By examining the IPIP-NEO Big 5 scales and their subscales on which students scored in the high and low range,
we found that Agreeableness, cooperation(Agr), Conscientiousness, and cautiousness(Consc) were prominent in our sample, while excitement-seeking(Extra) and imagination(Open) were less expressed, with anger (35.4) and depression (34.3) not quite reaching criterion for the low range (≤30). Despite the face validity of these traits as representing a possible medical student personality type, we did not find a relationship between this type and clerkship performance, and when regressing these traits individually against each outcome measure, we found only that Conscientiousness predicted OSCE grades and overall grades for the clerkships. This finding, however, suggests that Conscientiousness may be an important personality trait that more broadly predicts clerkship success and that the other traits on which students scored highly may represent aspects of success not observed here, or that they are simply less essential to clerkship success. Low scores on excitement-seeking(Extra) and imagination(Open) are less amenable to interpretation, as they did not produce significant positive or negative correlations with any of the aspects of performance in our study. Low imagination(Open) scores are thought to represent more fact-based thinking, while low excitement-seeking(Extra) scores represent an avoidance of thrill-seeking (see Appendix A), which may simply play less of a role (or a supportive role) in the promoting success during 3rd-year clerkships. As we have shown, personality traits do predict important aspects of clerkship performance and Step 2CK scores. However, a finding of this study which deserves attention was that USMLE Step 1 scores, not personality traits, accounted for much greater variation in all measures of clerkship performance (except clerkship evaluations) and, of course, Step 2CK performance. However, while Step 1 scores significantly correlated with all clerkship outcome measures, we found that Extraversion alone, as well as the combination of three personality traits (assertiveness(Extra), achievement-striving(Consc), and artistic interests(Open)) were better predictors of clerkship evaluations. These findings, especially, demonstrate the potential importance of considering personality traits as predictors of clerkship performance.

Limitations
While this study provides clear evidence for relationships between personality and clerkship success, this was a retrospective analysis, with students completing the IPIP-NEO after completion of their clerkships. While personality traits are, by nature, stable over time, it is not known whether results would have been affected by having students complete the inventory before or during clerkships. This study does, however, benefit from a relatively large sample and a robust statistical approach (stepwise multiple regression analyses) that provided clear outcomes. Regarding the personality profiles that were created based on average high and low IPIP-NEO scale scores for the sample, these ‘types’ do not account for individual variation, and may not apply to samples from other medical schools. Future studies will need to determine whether medical students tend to have similar personality profiles. However, specific personality traits (or clusters of traits) may be associated with greater ability to interact with and care for patients, to build cohesion within interprofessional teams, and demonstrate these skills to supervising residents and attending physicians, which will benefit medical students (Lievens et al., 2002). Indeed, personality traits such as extroversion may create an unintentional bias in evaluation by faculty and residents.

Conclusion
This study provides good evidence that certain personality traits are associated with success in 3rd-year clerkships, especially Conscientiousness (especially achievement-striving and self-efficacy), Extraversion and assertiveness, even though objective measures, such as USMLE Step 1 scores were often very strong predictors of clerkship performance. Hopefully, these findings will prompt clinical faculty to consider the importance of personality factors for medical school success, and to provide assistance and guidance for students whose personality traits do not align as well with the profile of the ‘model’ medical student.

Data availability
Underlying data
Harvard Dataverse: Personality and Clerkship Performance Study – Dataset. https://doi.org/10.7910/DVN/H6SOIG (Tucker, 2021a)

This project contains the following files:
- Personality Clerkship Study Data 12-17-21.tab: raw data scores
- Personality Clerkship Study – Variable Key List.docx: data key for raw data

Data are available under the terms of the Creative Commons Zero “No rights reserved” data waiver (CC0 1.0 Public domain dedication).

Extended data
Open Science Framework: Appendix A. Descriptions of each of the Big 5 personality scales and their subscales (from Johnson (2014)). https://doi.org/10.17605/OSF.IO/NZDR4 (Tucker, 2021b)

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