

Associations of Medical Student Personality and Health/Wellness Characteristics With Their Medical School Performance Across the Curriculum

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Abstract

Purpose

To assess the relationships of cognitive and noncognitive performance predictors to medical student preclinical and clinical performance indicators across medical school years 1 to 3 and to evaluate the association of psychological health/wellness factors with performance.

Method

In 2010, the authors conducted a cross-sectional, correlational, retrospective study of all 175 students at the Saint Louis University School of Medicine who had just completed their third (first clinical) year. Students were asked to complete assessments of personality, stress, anxiety, depression, social support, and community cohesion. Performance measures included total Medical College Admission Test (MCAT)

score, preclinical academic grades, National Board of Medical Examiners subject exam scores, United States Medical Licensing Examination Step 1 score, clinical evaluations, and Humanism in Medicine Honor Society nominations.

Results

A total of 152 students (87%) participated. MCAT scores predicted cognitive performance indicators (academic tests), whereas personality variables (conscientiousness, extraversion, empathy) predicted noncognitive indicators (clinical evaluations, humanism nominations). Conscientiousness predicted all clinical skills, extraversion predicted clinical skills reflecting interpersonal behavior, and empathy predicted motivation. Health/wellness variables had limited

associations with performance. In multivariate analyses that included control for shelf exam scores, conscientiousness predicted clinical evaluations, and extraversion and empathy predicted humanism nominations.

Conclusions

This study identified two sets of skills (cognitive, noncognitive) used during medical school, with minimal overlap across the types of performance (e.g., exam performance versus clinical interpersonal skills) they predict. Medical school admission and evaluation efforts may need to be modified to reflect the importance of personality and other noncognitive factors.

It's time to stop talking about the [medical training] continuum, and to start truly creating it. Do we really connect the whole process from admissions, through UGME, graduate medical education, CME, are we really thinking about it in a unified competence-based framework? ... Do we need admissions criteria and admissions tools that are focused on predicting success in the basic science years? Or on how well somebody will do in a lifelong competence-based continuum?

—Darrel G. Kirch, MD, 2010¹

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Doherty and Nugent² recently provided the fourth review of the literature on the relationships between medical student personality and performance in medical school. They reviewed seven articles published since 2000 and concluded that “conscientiousness, as measured by the NEO-PI-R [a personality inventory], is an important personality factor which has been found to predict long-term success in medical training” and that “social traits such as extraversion and levels of self-esteem and sociability may be important mediating factors in the clinical years.”

There have been three previous reviews of the literature regarding personality traits, psychological characteristics (e.g., stress, depression, anxiety), and medical training. Mitchell and colleagues³ review of resident performance research included five articles that measured personality. Personality characteristics were shown to correlate with both clinical

and multiple-choice exam performance. Constructs pertaining to extraversion consistently correlated positively with performance on exams and in the clinical setting, whereas introversion and being easily bored correlated with poorer clinical performance. Personality scores were also shown to be stable throughout residency.

Dyrbye and colleagues⁴ reviewed the literature on psychological distress and concluded that medical students experience levels of stress that are similar to those experienced by physicians, with both groups' stress levels well above general population norms. They also noted that the personality traits of self-actualization, self-awareness, and sense of fulfillment may lower the risk of depression, whereas perfectionism, Type A personality, and anger suppression may increase the risk.

Last, Ferguson and colleagues⁵ published a review demonstrating that academic performance prior to medical school was

more useful in predicting undergraduate medical school performance than in predicting postgraduate-level (i.e., residency-level) competence. Their review did not, however, keep separate performance criteria for preclinical and clinical phases of medical school. Ferguson and colleagues also reported that higher levels of conscientiousness and extraversion appeared to be beneficial to more successful medical training, but they noted that there was insufficient literature available at the time to form firm conclusions.

These reviews indicate that although some work has been done on the relationships of personality and psychological characteristics to medical student performance, more research is needed to more specifically examine these relationships, particularly given the uncontrolled nature of much of the research. In fact, many of the previous studies have been restricted with respect to time periods covered and the number and type of personality, psychological, and performance measures included. Thus, one must piece together individual studies to begin to identify patterns. Research is clearly needed that attempts to address relationships between multiple individual factors and multiple performance measures across multiple years.

Standard measures of cognitive ability used to assess medical school applicants—for example, the undergraduate grade point average (GPA) and scores on the Medical College Admission Test (MCAT)—have been shown to be predictive of performance in preclinical course work, National Board of Medical Examiners (NBME) subject examinations, United States Medical Licensing Examination (USMLE) Step 1–3 exams, and Comprehensive Osteopathic Medical Licensing Examination 1 and 2 exams.^{6–12} These assessments have not, however, been shown to consistently correlate with assessments of medical student clinical skills or subsequent performance in residency.^{6,7,10,11}

Medical student performance in the clinical setting, as assessed through preceptor evaluations and objective structured clinical examinations, has been found to be more dependent on noncognitive factors such as emotional

intelligence,^{13,14} self-esteem and sociability,¹⁵ empathy,^{13,16} verbal skills,¹⁷ and personality dimensions, particularly conscientiousness and extraversion.^{10,18–21} In fact, conscientiousness has been shown to correlate with performance in multiple work and academic settings.^{22,23} Conscientiousness appears to provide its effect through increased academic effort and higher levels of perceived academic ability and competence,²⁴ in addition to beneficial health behaviors.²⁵ Higher levels of conscientiousness and extraversion and lower levels of neuroticism appear to decrease the incidence of stress in physicians and medical students.^{26,27} Generally little overlap has been shown among predictors of preclinical performance relative to clinical performance. Some research has found that noncognitive skills do not correlate with preclinical performance.^{17,28} Other studies have demonstrated modest correlations between personality (particularly conscientiousness) and preclinical performance, but the available data indicate that the personality–performance association is much stronger later in medical school, when clinical performance is being evaluated.^{5,20,29,30} Taken together, these individual studies suggest that two independent skill sets are used during medical education: cognitive/test-taking skills that predominate during the early preclinical years, and noncognitive/interpersonal skills that predominate during the later clinical years. Most recently, Lievens and colleagues²⁰ reinforced this idea by demonstrating that personality characteristics became increasingly predictive of performance as students progressed through seven years of medical education in Belgium.

However, it is premature to make conclusive statements about this body of research because of several factors. First, many of these studies were done outside of the United States.^{12,13,20,26,30,31} Not only do the characteristics of the student population vary substantially between countries (e.g., age, previous education, admission requirements, cultural traits), but the curricula and logistics of medical education vary wider still. Attrition presents a special challenge to those studies done at schools where students are admitted after secondary school or early in their undergraduate education. For example, attrition caused the study

by Lievens and colleagues,²⁰ conducted in Belgium, to lose 50% of its participants over time. This is significantly higher than that seen in U.S. medical schools, which generally feature a four-year curriculum entered into by students who already have four-year undergraduate university degrees. Second, few studies have included multiple performance criteria over multiple years. Fewer still have included both cognitive and noncognitive performance outcomes or multiple individual characteristic variables (e.g., personality and psychological factors). One of the more comprehensive studies, by Hojat and colleagues,²⁹ included cognitive and noncognitive factors as well as performance outcomes that spanned the preclinical and clinical phases of medical school. That study found that MCAT scores and psychosocial characteristics of the students predicted preclinical exam performance as well as clinical exam performance, but only psychosocial measures correlated with ratings of clinical competence. Nevertheless, the study included only two personality factors (extraversion and neuroticism) and one measure of clinical performance, and it did not include USMLE Step 1 scores. Further, the age of the study means that the previous iteration of the MCAT (1978–1991 version) was used.

Psychological distress (e.g., anxiety, stress, depression) can negatively influence performance in any profession. However, this is an especially important consideration among medical students because of the increased rates of depression, anxiety, burnout, and suicidal ideation in this population.⁴ Studies have shown that, at any given time, nearly half of all medical students are experiencing burnout,³² 13.6% have major depressive symptoms (with an additional 8.1% with mild-moderate depression),³³ and 11.2% had suicidal ideations within the past year.³² Despite these alarming numbers, there are limited data on the impact of psychological distress on the performance and development of medical students.⁴ The available research data suggest that indicators of psychological distress such as depression, anxiety, stress, and burnout correlate with poorer general academic test performance,³⁴ poorer preclinical performance,^{12,29,31,35} poorer clinical performance,^{29,36,37} unprofessional behavior and less altruistic professional values,³⁸ diminished empathy,^{4,39}

increased academic dishonesty, substance abuse, and cynicism,^{4,39} poorer performance on certification examinations such as the USMLE Step 1 and 2,^{35,37} and less inclination to care for the chronically ill.⁴

The purpose of the present study was to provide a more comprehensive view on cognitive and noncognitive predictors of medical student performance and to include both preclinical (cognitive) and clinical (cognitive and noncognitive) performance measures. To that end, this study included a comprehensive personality assessment of the “big five” domains of personality (neuroticism, extraversion, openness, agreeableness, and conscientiousness), psychological factors that we refer to as “health/wellness” variables (stress, anxiety, depression, social support, and community cohesion), and all major performance criteria for years 1 to 3 of medical school. The first goal of the study was to examine the associations between personality characteristics and medical school performance. We hypothesized that personality characteristics would correlate with performance in the clinical setting, but less so with preclinical performance, similar to the results that Lievens and colleagues²⁰ found. Second, we evaluated multivariate relationships between personality, MCAT scores, and all performance variables of medical school years 1 to 3 (preclinical performance, USMLE Step 1 scores, NBME shelf exams, clinical evaluations, and nominations to the Arnold P. Gold Foundation Humanism in Medicine Honor Society). Third, we assessed the degree to which current levels of health/wellness contributed to the various types of medical student performance.

Method

Participants

All members of the class of 2011 at the Saint Louis University School of Medicine (N = 175) in St. Louis, Missouri, were asked to participate in the study. The students had just completed their first clinical (third) year of medical school.

Materials and procedure

The research was approved by the school of medicine’s institutional review board, and all participants gave written consent.

Consent to participate included completion of the study questionnaires and permission to link questionnaire responses to student performance data maintained by the school of medicine.

Personality assessment. Participants completed the NEO Five-Factor Inventory (NEO-FFI), a short-form version of the Revised NEO Personality Inventory (NEO-PI-R).⁴⁰ The NEO-FFI yields five norm-referenced, gender-combined T scores (mean = 50, SD = 10) corresponding to the five major personality domains of neuroticism, extraversion, openness, agreeableness, and conscientiousness. Domain scores are categorized as “very low” (T ≤ 34), “low” (T = 35–44), “average” (T = 45–55), “high” (T = 56–65), and “very high” (T ≥ 66). Individuals who are high in neuroticism exhibit a tendency toward negative affect (e.g., anxiety, anger, sadness, shame), impulsivity, and vulnerability under stress. High extraversion conveys a tendency toward interpersonal warmth, gregariousness, social assertiveness, energy, excitement seeking, and positive emotions. People high in openness tend toward imagination and fantasy, appreciation for aesthetics and feelings, curiosity, and a willingness to experiment with alternative behaviors and values. High agreeableness indicates a tendency toward trust of others, sincerity, altruism, cooperation, humility, and empathy. Those high in conscientiousness tend to display competence, orderliness, dutifulness, self-discipline, need to achieve, and circumspection. Personality characteristics have been shown to be highly stable across 6 to 45 years.^{3,41–46}

Participants also completed the medical student version of the Jefferson Scale of Physician Empathy.⁴⁷ This 20-item scale yields a total score ranging from 20 to 140, with higher scores indicating stronger empathy in medicine. Empathy is conceptualized as a personality trait that enables identification with another person’s thoughts or condition by putting oneself in the other’s place.⁴⁸

Health/wellness assessment. Participants completed the State Anxiety scale of the Spielberger State-Trait Anxiety Inventory for Adults (SSAI). The SSAI is a 20-item measure of context-dependent anxiety that yields a total score ranging from 20 to 80, with higher scores indicating more

anxiety. It has well-established psychometric properties.⁴⁹ The Center for Epidemiological Studies Depression scale (CESD), a well-validated and reliable measure, was used as the measure of depression symptoms.⁵⁰ This 20-item scale yields a total score that ranges from 0 to 60, with higher scores indicating more depressive symptomatology. Current levels of stress (during the last month) were assessed with the Perceived Stress Scale (PSS), a 10-item scale with a total score ranging from 0 to 40, with higher scores indicating higher stress. The reliability and validity of the PSS are well established.⁵¹ Social support was assessed with the five-item Social Support Inventory (SSI) derived from the Medical Outcomes Study.^{52,53} The SSI scores range from 5 to 25, with higher scores indicating greater amounts of social support. The Perceived Cohesion Scale was used to measure participants’ perceptions of the cohesiveness of their medical school community.⁵⁴ The scores from this six-item scale range from 1 to 11, with higher scores indicating stronger perceptions of cohesion. It is worth noting that unlike personality characteristics, these measures of health/wellness are labile constructs and are more prone to fluctuation.

All personality and health/wellness assessments were completed in a group format at the annual convocation of medical students who were about to begin their fourth and final year of medical school.

Academic performance assessment.

Records maintained by the school of medicine were used to match academic performance data to students’ personality and health/wellness data. Externally generated academic performance indicators included the MCAT total score, the USMLE Step 1 score, and NBME subject exam scores (national percentile rank) for surgery, family medicine, neurology, psychiatry, pediatrics, internal medicine, and obstetrics–gynecology. The NBME subject exam scores were averaged to create a total score for each student. Internally generated academic performance indicators included clerkship evaluations for each of the seven clerkships. A core of 11 common evaluation items across clerkships was used: general knowledge of the specialty, history taking, physical examination (in

psychiatry, this item was the mental status examination; in neurology, this item was the neurological exam), differential diagnosis, diagnostic and therapeutic planning, communication with colleagues, organizing information and reporting data, patient rapport, patient care, health care team rapport, and motivation. These items were evaluated on a 1 (lowest) to 5 (highest) scale, with anchors appropriate to the type of performance being evaluated. Two types of clinical evaluation scores were calculated: (1) All clinical evaluations were averaged by item across all evaluators (subtype grouping), and (2) all clinical evaluations were averaged across all items and evaluators (aggregate clinical evaluation score). Other academic performance indicators included points earned in the first two years toward Alpha Omega Alpha Honor Medical Society. These points were earned on the basis of student grades in courses during years 1 to 2 and were thus used to provide an aggregate preclinical performance measure. Points assigned for grades of Honors were weighted by a factor of 2, then combined with points assigned for grades of Near Honors to create a score that ranged from 0 to 144 for the current sample. Last, students were categorized into two groups regarding nominations received for the Arnold P. Gold Foundation Humanism in Medicine Honor Society: 0 to 1 nominations versus ≥ 2 nominations. The Gold Foundation Humanism in Medicine Honor Society recognizes third- and fourth-year medical students who exemplify the tenets of humanistic patient care: empathy, integrity, compassion, respect, and altruism. All nominations were made by students for their fellow classmates; students were able to nominate up to three different individuals.

Statistical analysis

The primary analysis methods were multiple linear regression and multiple logistic regression. All regression models were calculated in a hierarchical, forward inclusion fashion. For the primary analyses, the six personality variables (neuroticism, extraversion, openness, agreeableness, conscientiousness, and empathy) were considered for inclusion in stage 1, and the five health/wellness variables (anxiety, depression, stress, social support, and community cohesion) were considered for inclusion in stage 2.

The academic performance indicators functioned as the criterion variables. In addition, regression analyses were computed that included all personality, health/wellness, and academic performance indicators as predictors of each type of medical school performance. Principal components analysis was also used to create composite scores for the performance variables.

Results

The response rate was 87%, with 152/175 students agreeing to participate. There were 87 men (57%) and 65 women (43%), with a mean age of 26.2 years ($SD = 6.4$), with gender and age distributions corresponding nearly exactly with the class as a whole. Descriptive data for the study variables appear in Supplemental Digital Table 1 at <http://links.lww.com/ACADMED/A78>. In comparison with national normative data, NEO-FFI mean scores for neuroticism, agreeableness, and conscientiousness were in the average range, the mean openness score (54.3) was at the upper limit of average (45–55), and the mean extraversion score (55.6) was between average (45–55) and high (56–65). Anxiety levels, assessed with the SSAI, were high. Humanism in Medicine nominations ranged from zero to eight nominations.

In the first analysis, multiple linear regression was used to predict each of the performance variables (MCAT, USMLE

Step 1, NBME subject examination total, preclinical performance, and clerkship evaluation total) from the personality and health/wellness indicators. Stage 1 of the equation was forward inclusion of personality variables, and stage 2 was forward inclusion of health/wellness variables. As displayed in Table 1, personality and health/wellness indicators were not significantly associated with MCAT or USMLE Step 1 performance. The CESD depression score was negatively associated with NBME subject exam performance, and the PSS score was negatively associated with preclinical performance. Both conscientiousness (positively) and depression (negatively) were associated with overall clinical clerkship evaluations.

The second set of linear regression analyses looked deeper into clinical clerkship performance by separating the individual performance subcategories. These were used as criterion variables, and, as displayed in Table 2, conscientiousness was significantly associated with each of the 11 individual clerkship evaluation subcategories. Extraversion was significantly associated with all subcategories indicative of interpersonal behavior: communication, patient rapport, team rapport, and patient care. These two personality variables together explained 10% to 13% of the variance in these clerkship performance subcategories. Last, for clerkship evaluations of student motivation, empathy was a significant

Table 1

Multiple Linear Regression Prediction of Academic Performance From Personality and Health/Wellness Indicators, Saint Louis University School of Medicine, 2010*

Criterion variables	Model [†]	Predictors	β	P value	R ² change
MCAT	Stage 1/2 [‡]	—	—	—	—
USMLE Step 1 score	Stage 1/2 [‡]	—	—	—	—
NBME subject exam total	Stage 1	—	—	—	—
	Stage 2	Depression	-0.22	.008	0.05
Preclinical performance	Stage 1	—	—	—	—
	Stage 2	Stress	-0.19	.02	0.04
Clerkship evaluation total	Stage 1	Conscientiousness	0.21	.02	0.08
	Stage 2	Depression	-0.18	.04	0.03

* The authors carried out a cross-sectional, retrospective study of 152 medical students at one medical school who had just completed their third year. The authors analyzed the associations between cognitive and noncognitive variables and all performance measures encountered in medical school years 1–3. USMLE indicates United States Medical Licensing Exam; NBME, National Board of Medical Examiners.

[†] Stage 1 was forward inclusion of personality variables; stage 2 was forward inclusion of health/wellness variables. See the text for descriptions of the variables.

[‡] No predictor entered the model at either stage 1 or stage 2.

Table 2

Multiple Linear Regression Prediction of Clerkship Evaluation Subtypes From Personality and Health/Wellness Indicators, Saint Louis University School of Medicine, 2010*

Clerkship evaluation subtypes	Model†	Predictors	β	P value	R ² change
General knowledge	Stage 1	Conscientiousness	0.28	.001	0.08
History taking	Stage 1	Conscientiousness	0.30	<.001	0.09
Physical examination	Stage 1	Conscientiousness	0.28	.001	0.08
Differential diagnosis	Stage 1	Conscientiousness	0.31	<.001	0.09
Diagnostic/therapeutic planning	Stage 1	Conscientiousness	0.27	.001	0.07
Organization	Stage 1	Conscientiousness	0.32	<.001	0.10
Communication	Stage 1	Conscientiousness	0.21	.01	0.07
		Extraversion	0.17	.049	0.03
Patient rapport	Stage 1	Conscientiousness	0.22	.009	0.09
		Extraversion	0.21	.01	0.04
Patient care	Stage 1	Conscientiousness	0.23	.008	0.08
		Extraversion	0.17	.04	0.03
Team rapport	Stage 1	Conscientiousness	0.20	.02	0.07
		Extraversion	0.19	.03	0.03
Motivation	Stage 1	Conscientiousness	0.19	.02	0.06
		Empathy	0.20	.02	0.04

* The authors carried out a cross-sectional, retrospective study of 152 medical students at one medical school who had just completed their third year. The authors analyzed the associations between cognitive and noncognitive variables and all performance measures encountered in medical school years 1–3.

† Stage 1 was forward inclusion of personality variables; stage 2 was forward inclusion of health/wellness variables. In all models, stage 2 is omitted here because no significant predictors emerged in that stage. See the text for descriptions of the variables.

predictor as well as conscientiousness. None of the health/wellness variables significantly correlated with any of the clinical evaluation subcategories.

Multiple logistic regression was used to evaluate associations of personality and health/wellness indicators with Humanism in Medicine Honor Society nominations (a dichotomous outcome variable). Table 3 displays the results. Higher levels of extraversion and empathy were associated with greater

odds of having received ≥2 nominations for the Humanism in Medicine Honor Society. None of the health/wellness variables were significant.

Principal components analysis was used to create two composite scores representing test performance (test performance factor: MCAT, preclinical performance, USMLE Step 1, and NBME subject exam total) and clinical/interpersonal performance (interpersonal behavior factor: clinical evaluation total

Table 3

Multiple Logistic Regression Prediction of Humanism in Medicine Honor Society Nominations From Personality and Health/Wellness Indicators, Saint Louis University School of Medicine, 2010*

Criterion variable	Model†	Predictors	OR (95% CI)	P value	R ² change
Humanism in Medicine Honor Society nominations	Stage 1	Extraversion	1.04 (1.01–1.08)	.01	0.06
		Empathy	1.03 (1.00–1.06)	.04	0.04
	Stage 2	—	—	—	—

* The authors carried out a cross-sectional, retrospective study of 152 medical students at one medical school who had just completed their third year. The authors analyzed the associations between cognitive and noncognitive variables and all performance measures encountered in medical school years 1–3.

† Stage 1 was forward inclusion of personality variables; stage 2 was forward inclusion of health/wellness variables. See the text for descriptions of the variables.

and total number of Humanism in Medicine Honor Society nominations). Using multiple linear regression, only neuroticism predicted the test performance factor score (negatively; see Table 4). The interpersonal behavior factor, however, was predicted by conscientiousness, extraversion, empathy (all positively), and depression (negatively).

Table 5 presents a comparison of univariate correlations of MCAT and NEO-FFI personality factors with the performance variables. For this analysis, principal components analysis was first used to create two composite clinical evaluation subscores based on the 11 clinical evaluation items: (1) diagnosis-planning skills (DPS: general knowledge, history taking, physical examination, differential diagnosis, diagnostic and therapeutic planning, organizing information and reporting data, motivation) and (2) interpersonal skills (IPS: patient care, patient rapport, health care team rapport, communication). MCAT scores were positively correlated with preclinical performance, USMLE Step 1 scores, and NBME subject exam scores. MCAT scores did not correlate with clinical evaluations or Humanism in Medicine Honor Society nominations. Personality factors correlated positively with IPS clinical evaluations (extraversion and conscientiousness), DPS clinical evaluations (conscientiousness), and number of nominations for the Humanism in Medicine Honor Society (extraversion). No statistically significant correlations were found for the personality characteristics of neuroticism, openness, or agreeableness. None of the personality characteristics correlated with cognitive testing measures (preclinical performance, USMLE Step 1, NBME subject exams).

In a final set of multivariate analyses, all performance, personality, and health/wellness variables were considered for inclusion in regression analyses to predict each type of medical school performance. This was considered the most conservative method for describing the relationships of interest in the research. To that end, forward inclusion regression analyses were conducted to predict each performance indicator (preclinical performance, USMLE Step 1 score, NBME subject exam total score, clinical evaluations of DPS and IPS, and number of Humanism in Medicine nominations) from the personality, health/

Table 4

Prediction of Test Performance Factor and Interpersonal Behavior Factor From Personality and Health/Wellness Indicators, Saint Louis University School of Medicine, 2010*

Criterion variables	Model [†]	Predictors	β	P value	R ² change
Test performance factor	Stage 1	Neuroticism	-0.18	.03	0.03
	Stage 2	—	—	—	—
Interpersonal behavior factor	Stage 1	Conscientiousness	0.20	.02	0.07
		Extraversion	0.18	.03	0.03
		Empathy	0.18	.03	0.03
	Stage 2	Depression	-0.20	.04	0.03

* The authors carried out a cross-sectional, retrospective study of 152 medical students at one medical school who had just completed their third year. The authors analyzed the associations between cognitive and noncognitive variables and all performance measures encountered in medical school years 1–3.

[†] Stage 1 was forward inclusion of personality variables; stage 2 was forward inclusion of health/wellness variables. See the text for descriptions of the variables.

wellness, and nonredundant performance measures. Table 6 displays the results. It is notable that MCAT scores, preclinical performance, and USMLE Step 1 scores did not predict any of the clinical performance indicators (clinical evaluations and Humanism in Medicine nominations), whereas the personality factors did not predict any of the preclinical performance indicators. More important, conscientiousness significantly predicted both IPS and DPS clinical evaluations, even after controlling for the inclusion of NBME subject exam total in the equation. Further, extraversion and empathy significantly predicted Humanism in Medicine nominations, even after controlling for IPS clinical evaluations in the equation. Health/wellness variables did not contribute to prediction with the performance and personality variables already included in the regression models.

Discussion and Conclusions

Our hypothesis regarding personality characteristics was supported in that multiple analyses showed that conscientiousness, extraversion, and empathy were correlated with clinical evaluations, and extraversion and empathy were associated with number of Humanism in Medicine Honor Society nominations. These results are consistent with Lievens and colleagues²⁰ findings that personality characteristics of Flemish medical students (conscientiousness, extraversion, and openness) became stronger predictors of performance as students progressed to the later years of medical school.

Our data also suggest that health/wellness variables may have an impact on the performance of medical students. Depression was negatively associated with

NBME subject exams, total clerkship evaluation, and the interpersonal behavior factor. Stress was negatively associated with preclinical performance. We offer caution when evaluating these data, however, because health/wellness data are reflective of each participant's psychological state at the point of study participation, and not when much of the participant's medical school performance was occurring. In other words, because the participants in this study completed the health/wellness questionnaires at the completion of year 3 (well after the completion of some performance measures), we cannot assume that these data indicate their state of mind in the past. Instead, these findings should serve to encourage future research into the effects of health/wellness variables on medical student performance. For example, higher levels of depression and stress at any given point in the medical school experience may be indicative of a heightened risk for symptoms of depression and stress over time for any given student. In other words, a student may demonstrate depression and stress symptoms more as a stable characteristic rather than as a temporary state.

By separating the clinical evaluation subcategories, we demonstrated that individual personality characteristics are associated with different clinical skills—namely, that extraversion is associated with interpersonal/communication skills but not diagnostic/planning skills, empathy is associated with motivation, and conscientiousness is associated with all aspects of clinical performance. This is important because when the total

Table 5

Univariate Correlations Between MCAT or Personality With Medical School Performance,* Saint Louis University School of Medicine, 2010[†]

Predictor	Preclinical performance	USMLE Step 1	NBME subject exam	Interpersonal skills clinical evaluation [‡]	Diagnosis planning skills clinical evaluation [§]	Humanism in Medicine Honor Society nominations
MCAT	0.2	0.34	0.20			
NEO [¶]				E 0.17 C 0.22	C 0.30	E 0.19

* All correlations listed have significance of $P < .05$.

[†] The authors carried out a cross-sectional, retrospective study of 152 medical students at one medical school who had just completed their third year. The authors analyzed the associations between cognitive and noncognitive variables and all performance measures encountered in medical school years 1–3. USMLE indicates United States Medical Licensing Exam; NBME, National Board of Medical Examiners.

[‡] Clinical evaluation of patient care, patient rapport, team rapport, communication.

[§] Clinical evaluation of physical exam, motivation, general knowledge, history taking, differential diagnosis, planning, organizing information.

[¶] NEO refers to the NEO Five-Factor Inventory, a personality measure.

Table 6
Standardized Regression Coefficients From Multivariate Analysis*

Predictor	Criterion variable						
	MCAT	Preclinical performance	USMLE Step 1	NBME subject exams	Interpersonal skills clinical evaluation [†]	Diagnosis planning skills clinical evaluation [‡]	Humanism in Medicine nominations [§]
MCAT	N/A	—	0.19	—	—	—	—
Preclinical performance	—	N/A	0.32	0.24	—	—	—
USMLE Step 1 Exam	—	0.43	N/A	0.51	—	—	—
NBME subject exams	—	0.32	0.49	N/A	0.31	0.40	—
Interpersonal skills clinical evaluation	—	—	—	0.23	N/A	N/A	4.8
Diagnosis planning skills clinical evaluation	—	—	—	—	N/A	N/A	—
Humanism in Medicine nominations	—	—	—	—	—	—	N/A
NEO-N [¶]	—	—	—	—	—	—	—
NEO-E [¶]	—	—	—	—	—	—	1.04
NEO-O [¶]	—	—	—	—	—	—	—
NEO-A [¶]	—	—	—	—	—	—	—
NEO-C [¶]	—	—	—	—	0.26	0.26	—
Empathy	—	—	—	—	—	—	1.03

* The authors carried out a cross-sectional, retrospective study of 152 medical students at one medical school who had just completed their third year. The authors analyzed the associations between cognitive and noncognitive variables and all performance measures encountered in medical school years 1–3. All correlations listed have significance of $P < .05$. USMLE indicates United States Medical Licensing Exam; NBME, National Board of Medical Examiners.

[†] Clinical evaluation of patient care, patient rapport, team rapport, communication.

[‡] Clinical evaluation of physical exam, motivation, general knowledge, history taking, differential diagnosis, planning, organizing information.

[§] Receipt of ≥ 2 nominations for Humanism in Medicine Honor Society; associations listed as odds ratios.

[¶] NEO refers to the NEO Five-Factor Inventory, a personality measure. NEO-N measures neuroticism; NEO-E, extraversion; NEO-O, openness; NEO-A, agreeableness; and NEO-C, conscientiousness.

clerkship evaluation score was considered alone, only conscientiousness was associated with it. This is a novel distinction that has not been reported by other studies assessing student clinical performance. Our study shows that interpersonal/communication versus diagnostic/planning clinical skills are related to different personality variables and, as such, should be kept separate in studies assessing medical student performance.

In a head-to-head comparison of the predictive value of the MCAT and personality characteristics, the results showed that these two variables predict very different types of performance. Performance on the MCAT was predictive of subsequent preclinical performance (based primarily on multiple-choice examinations), USMLE Step 1 scores, and NBME subject exam scores, but it did not have any correlation with clinical performance. Personality characteristics, on the other hand, were predictive of clinical evaluation scores

and number of Humanism in Medicine Honor Society nominations but were not correlated with examination scores (preclinical performance, USMLE Step 1, and NBME subject exams).

In summary, this study expands the growing body of work indicating that there are two independent sets of skills that are used and assessed during medical education: (1) cognitive, or test-taking skills, which correlate with success on preclinical-phase examinations, the USMLE board exams (Steps 1, 2, 3), and the NBME subject exams taken at the completion of clinical rotations, and (2) noncognitive, or interpersonal/communication skills, which are illustrated by personality profiles and correlate with success in the clinical setting as assessed through clinical evaluations by preceptors and clinical awards for humanistic care. Our study takes this idea a step further by also showing that there are essentially two different types of clinical evaluations: those assessing diagnosis/planning skills

and those assessing interpersonal skills. It will be important to remember these distinctions for future studies on medical student performance in order to avoid grouping dissimilar performance outcomes or predictors.

Although we cannot definitively state that students who excel in the clinical phase of medical school will go on to become the best residents and physicians, there is growing evidence to support this theory. A recent systematic review on the factors influencing resident performance highlighted several studies in which personality characteristics correlated with resident performance across multiple specialties.³ Other authors have found personality characteristics such as motivation, professionalism, communication skills, and other noncognitive factors to be better predictors of residency performance than past cognitive performance.^{6,55–58} Noncognitive factors have been shown to be the most desired characteristics of practicing physicians. According to

patients, medical students, residents, and a panel of “excellent” academic clinicians, these qualities include empathy, respectfulness, communication and interpersonal skills, professionalism, and humanism.^{59–62} Personality and learning style have also been associated with levels of stress, burnout, and work satisfaction.²⁶ As Hojat and colleagues⁶³ pointed out in 2005, there has been extensive research establishing the role of empathy in the patient–doctor relationship. Empathy and emotional intelligence are associated with increased patient satisfaction and compliance with treatment regimens, more accurate diagnoses, a reduction in malpractice litigation, more humanistic care, better stress management and leadership, and greater competence in history taking, resource utilization, and performance of physical examinations.^{63–67}

In light of our findings and previous research, a call for attention to personality factors as a standard aspect of the medical education and residency admission processes is timely. Personality assessment tools such as the NEO Personality Inventory appear to be good candidates to join with, if not replace, our current methods of evaluating applicant character and communication skills (e.g., letters of recommendation, personal statements, interviews). These currently used tools have shown modest usefulness. Consistent with our conclusion, past studies found personal statements to have more utility in predicting clinical, as opposed to preclinical, medical student performance.^{5,17} However, as Musson⁶⁸ points out, the usefulness of personal statements is limited because they are often “read by untrained readers and scored using dubious criteria.” Some, but not all, studies found that interviews done rigorously and systematically were able to assess personality characteristics, identify more morally developed applicants, and predict the quality of a student’s dean’s letter better than his or her undergraduate GPA or MCAT score.^{5,69–71} However, interviews are rarely done in such a way, and interviewers are, primarily, minimally trained volunteers. One study on residency interviews found that a significant amount of luck is involved in the process, as it showed that an interviewee was more likely to get a favorable review if he or she was fortunate enough to be matched with an

interviewer with a similar personality.⁷² Lastly, similar to the conclusions of studies done in other professions, letters of recommendation have shown virtually no value in predicting performance in medical school.⁵

It is important to interpret the present results in light of the cross-sectional nature of the study design. Our assessment of personality and health/wellness occurred at a single point in time and thus was limited by post hoc prediction of previous behavior. Notably, this limitation has less relevance to the personality data because personality characteristics are stable over the course of years and decades. Our study’s generalizability may be limited in that we studied students from just one medical school, although this student population came from diverse geographic and ethnic backgrounds. Another limitation is that all study participants had already been accepted into medical school, so we cannot assume that identical results would be found in a population of medical school applicants. We also recognize the challenge posed by clinical evaluations; we cannot assume validity of preceptor assessments of clinical skills. One final limitation is that we did not include year 4 clinical performance data. This was done because of the variability of courses taken during the final year of medical school.

In conclusion, we must heed the words of Dr. Kirch quoted at the start of this report and work to better connect all stages of the medical training continuum. Toward this end, we need application tools that look beyond how a student will fare in the preclinical and other strictly cognitive or test-taking aspects of medical training. Our study adds to the growing body of literature illustrating the importance of noncognitive skills, particularly as one progresses through medical training. Our study also shows that personality profiles are useful tools in the identification of beneficial or deleterious personality characteristics. Much work is still needed to evaluate whether the predictor–outcome relationships described above hold true later on in residency training and decades later, long after one has completed his or her formal medical education. Additional research is needed to compare personality profiles with currently used noncognitive assessments such as interviews, small-

group observed interactions, personal statements, and letters of recommendation. Additional research is also needed to more deeply examine the effects of health/wellness variables (stress, anxiety, depression, and others) on medical student performance. This will be a challenge because these are labile constructs requiring frequent data collection, but few would argue with the value of such an endeavor.

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Teaching and Learning Moments

PPQRST Revisited

In this very column in November of 2003, I reflected on the Longitudinal Patient-Centered Experience at the Michigan State University College of Human Medicine, suggesting the use of an additional *P* to denote *person* in the trusted mnemonic categorizing the characteristics of a patient's chief complaint—*PPQRST*, or palliative, provocative, quality, radiation, severity, and timing.

Now, nearly a decade later, I am a fellow in cardiology at Mount Sinai Medical Center in New York City and a faculty preceptor to two wonderful students, who remind me of myself as a medical student—enthusiastic and untainted. Like I did, they have the good fortune of attending a medical school that believes strongly in teaching about chronic illness and longitudinal patient-centered relationships. My students have followed one of my sickest patients, a chronically ill gentleman whom I met over a year ago after he was admitted to our hospital with a storm of

ventricular tachycardia. Since then, I've seen him through heart failure exacerbations, life-threatening gastrointestinal bleeds, good times, brushes with near death, firings of his implantable cardioverter-defibrillator (ICD), lower extremity vascular bypass surgery, toe amputations, and recurrent *Clostridium difficile* colitis, although the list could unfortunately go on for much longer.

Through all of this, my students have not been spectators. They have participated in his care, learning along the way how to manage a chronically ill patient. The students also completed a life history assignment, writing about my patient—his reputation as the class clown as a child; his best friends; his frustrations with his recent trip to Aruba, where he found himself unable to do much at all; his concerns about his fading memory.

I must concede that much of this information was new to me. My attention has been so focused on

minimizing the firings of his ICD or keeping his INR in range, lest he develop another gastrointestinal bleed. At times, I have, perhaps, forgotten my own lesson about that additional *P*, person. The students' life history assignments were a gentle reminder about good doctoring, particularly for a patient whose illness is so advanced that devices or a cardiac transplant are simply not feasible options. The most realistic option is to optimize his medical care, based on his preferences. If his fading memory is his most prominent concern, then I should address it, even at the expense of doing away with some medications that may be optimizing his cardiovascular status.

That *P* is here to stay.

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