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Mental Well-Being in First Year Medical Students: A Comparison by Race and Gender:

A Report from the Medical Student CHANGE Study

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Abstract

Purpose—In this study, authors sought to characterize race and gender disparities in mental health in a national sample of first year medical students early in their medical school experience.

Method—This study used cross-sectional baseline data of *Medical Student CHANGES*, a large national longitudinal study of a cohort of medical students surveyed in the winter of 2010. Authors ascertained respondents via the American Association of Medical Colleges questionnaire, a third-party vendor-compiled list, and referral sampling.

Results—A total of 4732 first year medical students completed the baseline survey; of these, 301 were African American and 2890 were White. Compared to White students and after adjusting for relevant covariates, African American students had a greater risk of being classified as having depressive (relative risk (RR)=1.59 [95 % confidence interval, 1.37–2.40]) and anxiety symptoms (RR=1.66 [1.08–2.71]). Women also had a greater risk of being classified as having depressive (RR=1.36 [1.07–1.63]) and anxiety symptoms (RR−1.95 [1.39–2.84]).

Conclusions—At the start of their first year of medical school, African American and female medical students were at a higher risk for depressive symptoms and anxiety than their White and male counterparts, respectively. The findings of this study have practical implications as poor mental and overall health inhibit learning and success in medical school, and physician distress negatively affects quality of clinical care.

Keywords

Depression; Anxiety; Medical students; Race; Gender

Medical school, particularly the preclinical years, is conceivably one of the most stressful times in a promising physician's life. It is not surprising that medical students experience high levels of psychological distress and mental illness [1–13]. Studies of the prevalence of anxiety among medical students revealed that between 40 and 79 % of medical students experience high levels of anxiety [14]. This is in comparison to approximately 14 % in the general population of the same age group [15]. In addition, depression among medical students is more prevalent than among demographically comparable groups (e.g., 12.9 versus 7.8 %) [16] and higher than among students pursuing other graduate degrees [17]. Estimates of the prevalence of depression in medical school range from 2 to 35 % [4, 9, 11]. This wide range likely reflects differences in depression by year of training; in general,

depression and other forms of psychological distress progressively increase throughout the 4 years of medical training [4, 5, 7, 9, 11, 13, 18–26].

It is important to understand and find ways to improve the mental health of medical students for a number of reasons. First and foremost, poor mental health can interfere with functioning across all areas of life, causing an inability to participate fully in life. Second, experiencing poor mental health may have potential adverse consequences on one's ability to learn and work and subsequently impacts academic performance [27]. This issue is particularly relevant for African American students who have been found to experience more academic difficulties in medical school [28]. Poor mental health among medical students also contributes to academic dishonesty [29–33], substance abuse [13, 34–36], and increased cynicism and decreased compassion [37–39]. Psychological distress can also impact future physicians' career trajectory, causing them to apply to less competitive residency programs [1]. Poor mental health also contributes to poor overall health [13, 40–43].

There is a growing literature on the health and well-being of medical students in general, yet few studies have had a large enough sample to make comparisons based on sociodemographic characteristics such as race and gender (often due to low response rates among minority students [44] and low representation of minority students in medical school [45]). The few studies examining depressive symptoms among minority medical trainees relative to White trainees have had mixed results, reporting no differences, lower levels, or higher levels [46]. Studies comparing depressive symptoms by gender among medical students are also inconclusive, showing either no difference by gender or higher rates among female medical students [47]. While there is some evidence to suggest that African American and female medical students may suffer from higher levels of distress in medical school, we were unable to identify any studies that also investigate the intersection of these sociodemographic characteristics (e.g., African American female).

While little is known about the mental health and well-being of African American and female medical students, a larger body of evidence has documented the mental health of these groups during their undergraduate years. For example, African American college students are at a greater risk for psychological distress due to lack of a strong social support system [48]. Stereotype threat, a disruptive psychological state experienced when individuals feel at risk for confirming a negative stereotype about their group, is detrimental to the psychological well-being of African American and female college students [49–53]. For instance, awareness of stereotype threat can provoke responses that impair both academic performance and psychological well-being for African American college students [54]. Women in undergraduate education, particularly those with Science, Technology, Engineering, and Math (STEM) majors, are more likely to experience stereotype threat which has been linked to poor self-esteem and poor mental health [55]. Taken together, these findings suggest that African American and female students likely enter medical school already at a greater risk for poor mental health.

Psychosocial resources, which include coping style, social support, a sense of mastery or personal control, and self-esteem, all influence mental well-being [56, 57]. The resiliency

framework put forward by Howe et al. [58] suggests that these psychosocial resources are central to resilience in medical school [59]. Students with more social support, an active coping style (e.g., taking action or exerting efforts to remove or circumvent the stressor), a strong sense of personal control, and high cognitive ability self-esteem (e.g., confidence regarding intellectual and cognitive abilities) are in some ways more successful at warding off poor mental health and/or accessing the resources necessary to combat it [60, 61]. However, little is known about whether these psychosocial resources are differentially distributed by race and gender, among medical students, as appears to be the case in the general population [62, 63].

In this study, we sought to characterize race and gender disparities in mental health in a national sample of first year medical students early in their medical school experience. We also examined race and gender differences in several factors known to increase resiliency to stress. We hypothesized that African American and female medical students begin medical school at a greater risk of depressive symptoms and anxiety compared to their White and male counterparts, respectively. We also hypothesized that African American and female medical students begin medical school with worse self-rated health and fewer psychosocial resources to cope with or protect themselves from the effects of stress, including practice with active coping techniques, social support, cognitive ability self-esteem, and mastery. Finally, we hypothesized that when examining the interaction of race and gender, African American female medical students will have worse self-rated health, fewer psychosocial resources, and be at a greater risk for symptoms of depression and anxiety than their White male counterparts.

Materials and Methods

Data Source

This study uses baseline data collected as part of Medical Student Cognitive Habits and Growth Evaluation Study (CHANGES), a large longitudinal study of student experiences among first year medical students who matriculated in US medical schools in the fall of 2010. For detailed study protocol information, please refer to Supplemental Digital Content 1. Briefly, we sampled medical students using a stratified multistage sampling design. In the first stage, we sampled selected 50 medical schools from a total of 131 MD-granting US schools using a proportional to (class) size sampling methodology [64]. One of the 50 schools sampled for our study was a military school that had highly unique features, including acceptance policies, curriculum structure, and student characteristics. Due to concerns about the generalizability of our study findings, we excluded this school (n=169) from analysis.

In the second stage, we recruited first year students from the selected schools using a combination of three strategies: (1) emails of students interested in participating in the study obtained through a question included as part of the Association of American Medical Colleges (AAMC) Matriculating Student Questionnaire, a voluntary annual survey sent to all students entering medical school; (2) a list of first year medical students (incomplete) purchased from an American Medical Association (AMA) licensed vendor; and (3) referral (i.e., snowball) sampling through recruited survey respondents. Ascertained students were

invited to participate in the CHANGES study via email and/or regular mail. Those who consented completed an extensive online survey questionnaire and were randomized to complete various implicit attitude tests (e.g., race, sexuality, obesity). The University of Minnesota and Mayo Clinic Internal Review Boards (IRB) approved the study. All students who completed the survey received a $50 incentive for participation.

Study Sample

Between October 2010 and January of 2011, a total of 4732 first year medical students completed the baseline survey representing 81 % of the 5823 students invited to participate in the study and 55 % of all 8594 first year students enrolled at the 49 sampled schools (see Figure, Supplemental Digital Content 2, for participant recruitment flowchart). Our overall response rate was comparable to other published studies of medical students [47, 65]. The demographic characteristics of students in our sample were similar to the demographics of all students who enrolled in medical schools in 2010, as reported by the AAMC (see Supplemental Digital Content 3 in Przedworski J, et al., 2015) [66].

Study Measures

Depression, Anxiety, and Self-Rated Health—Depressive symptoms were assessed using the Patient Reported Outcomes Measurement Information System (PROMIS) Depression short form, a validated, 8-item instrument [67]. Participants responded to questions on a 5-point Likert-type scale. Example questions include “In the past 7 days...I felt helpless and I felt I had nothing to look forward to.” The PROMIS Depression scale had a Cronbach's alpha of 0.92. Raw scores were standardized, where a score of 50 is the average for the USA general population with a standard deviation of 10, as per PROMIS scoring manual [68]. A higher PROMIS T-score represents more of the concept being measured; therefore, a T-score of 60 is one SD worse than average. For study analysis, we defined students who had a score greater than 60 (i.e., one standard deviation above the general population mean) as exhibiting depressive symptomology [69]. This represents a score that exceeds the minimally important difference from the mean as established by Yost et al. [69].

Anxiety was assessed using the PROMIS Anxiety short form, a validated 7-item instrument [70]. Participants responded to questions on a 5-point Likert-type scale. Example questions include “In the past 7 days...I felt worried and I worried about what could happen to me.” The PROMIS Anxiety scale had a Cronbach's alpha of 0.94. Similar to the depression instrument, a standardized anxiety score of 50 represents a general population mean, with a standard deviation of 10. However, the mean anxiety score in our sample (57.6(8.05)) of medical students was higher than the general population average, so a cutoff of 70 (i.e., two standard deviations above the general population mean) was selected instead, in order to increase the likelihood of capturing a meaningful difference between anxious and non-anxious medical students and representing a score that exceeds the minimally important difference from the mean [69]. It is important to note that in a comparison analysis using a 1-standard deviation cutoff, we found a statistically significant, though smaller, effect size.

Self-rated health was assessed by asking medical students, “In general, would you say your health is: excellent, very good, good, fair, or poor?” Respondents who indicated “fair” or “poor” were categorized as having low self-rated health, and those who selected “good,” “very good,” or “excellent” were categorized as having high self-rated health [71, 72].

Psychosocial Resources—We also evaluated the differences in psychosocial factors (reported by medical students). Active coping was adapted from the Brief COPE Inventory [73], a 28-item self-report measure. Four of 28 items specifically measured active coping. Participants responded on a 4-point Likert-type scale ranging from 1 “I don't do this at all” to 4 “I do this a lot.” Sample questions included “I get help and advice from other people” and “I try to come up with a strategy about what to do.” Cronbach's alpha for the active coping subscale was 0.59. Social support was assessed using the Medical Outcomes Study (MOS) Social Support Survey [74], a 19-item self-report measure. Participants responded on a 5-point Likert-type scale ranging from 1 “None of the time” to 5 “All of the time.” Sample questions included “Do you have: someone you can count on to listen to you when you need to talk” and “Do you have someone who shows you love and affection.” Cronbach's alpha was 0.96. Mastery was measured with Pearlin's Mastery Scale, a 7-item self-report measure of one's feeling of control over his or her life [75]. Participants responded on a 7-point Likert-type scale ranging from 1 “Strongly disagree” to 7 “Strongly Agree.” Sample questions included “I have little control over the things that happen to me” and “What happens to me in the future mostly depends on me.” The scale had a Cronbach's alpha of 0.82.

Cognitive ability self-esteem captures medical students’ confidence regarding their intellectual and cognitive abilities. It was measured using 4 of the 20 items of the cognitive esteem subscale of the State Self-Esteem Scale [76]. Participants responded to statements with 5-point Likert-style responses ranging from 1 “Not at all” to 5 “Extremely.” Sample questions included “I feel as smart as others” and “I am worried about looking foolish.” Cronbach's alpha for the cognitive ability subscale was 0.82.

Other Variables—Standard demographic questions were used to measure student race, gender, age, relationship status, and parental status (whether students have children). Age was included as a covariate given that being older in age has been found to be associated with burnout and serious thoughts of dropping out of medical school [47]. Parental status and relationship status were included as covariates given that both are significantly associated with medical students’ mental health [77]. Socioeconomic status was captured in three different ways. We used the highest education level of either parent as a proxy of socioeconomic status (SES) of family origin. We also included family income as a proxy of SES of family origin. Finally, we created a variable assessing students’ self-reported percentage of medical school costs they plan to finance using loans. Additionally, to assess social desirability response bias, an abridged version of the Marlowe-Crowne Social Desirability Scale was included in the CHANGES survey [78]. Time in medical school was measured based on the start date of medical school for each student and the time that the student completed our survey.

All scale variables are based on principal component analyses conducted for each set of scale and subscale items in the overall sample and separately for African American and White students. Scales performed similarly for both groups.

Analysis

Frequencies and summary statistics for sample characteristics were calculated for both African American and White students. Race and gender were examined separately to identify their bivariate associations with depression, anxiety, and self-rated health. Treating the three dependent variables (depression, anxiety, and self-rated health) as dichotomous outcome measures, we estimated relative risks (RR) using generalized linear models (GLM) with a Poisson regression family distribution, log link, and a robust sandwich estimation of the error variance, an analytic approach demonstrated to reliably estimate relative risks for binary outcomes [79, 80]. We chose to use RR due to concerns that odds ratios tend to exaggerate the effect size as compared to the RR [81–83]. We implemented these analyses after observing a convergence problem when fitting log-binomial generalized linear models.

In multivariate analyses, we adjusted models for age, relationship status, parental status, parental education, family income, and percentage of loans used to finance medical school. We also adjusted for social desirability bias and the number of days the student had spent in medical school at the time of survey completion to account for varying levels of exposure to the medical school environment. The same analyses were conducted to examine the associations between race and psychosocial resources and gender and psychosocial resources.

All of the generalized linear regressions took into account the sampling probability, stratification, and clustering in the two-stage design of the *CHANGES* survey. We obtained 95 % confidence intervals and *P* values for the model-estimated associations between each outcome and the independent variable. Statistical significance threshold was set a priori at alpha equal to 0.05.

We performed all analyses using SPSS PASW© Statistics 21. Given the complex stratified two-stage cluster sample design of the CHANGES survey, statistical analyses were weighted to account for this sampling design with the standard design weights for the respondents at a specific school upweighted to match the class size.

Results

Sample Characteristics

Demographic characteristics of African American (*N*=301) and White students (*N*=2890) in our sample are shown in Table 1. A greater percentage of African American students were female (66 %) compared to their White counterparts (48 %, *P*<.001). African American and White students differed in parental status (*P*<.001) such that a larger percent of African American students were parents. African American and White students differed in age (*P*=.017) such that a larger percent of African American students were older than the average age of medical students (25–35). African American students were also different than their White counterparts with respect to socioeconomic status (family income and parental education)

(*P*<.001) with 10 % classified as upper income in comparison to 22 % of White students. Table 2 describes the demographic characteristics of the sample based on gender.

Depression, Anxiety, and Self-Rated Health

There were no significant racial or gender differences with respect to self-rated health. African American first year medical students were significantly more likely than their White counterparts to report symptoms of depression (17 versus 9 %, *P* <.001) and anxiety (6.6 versus 4.0 %, *P*=.028) (Table 3). Female first year medical students were significantly more likely than male students to have symptoms of depression (10 versus 8.7 %, *P* <.01) and anxiety (5.5 versus 2.8 %, *P* <.001). A table of mean scores broken down by each of the race×gender interactions for each dependent variable can be found in Supplemental Digital Content 3.

The bivariate and multivariate analyses are shown in Table 4 for both race and gender. In multivariate analyses, African American students had a 59 % greater risk of being classified as having depressive symptoms than White students (95 % confidence interval (CI), 1.37 to 2.40) and 66 % greater risk of being classified as having anxiety symptoms (95 % CI, 1.08 to 2.71). Female medical students had a 39 % greater risk of being classified as having depressive symptoms than male students (95 % CI, 1.07–1.63) and 95 % greater risk of being classified as having anxiety symptoms (95 % CI, 1.39–2.84).

We also examined the interaction effect of race and gender to explore whether the effect of race on mental health and self-rated health changes depending on the gender of the medical student. There was not a significant interaction effect for the unadjusted bivariate model for depressive symptoms (Table 4). However, we found a significant interaction between race and gender in the multivariate model (*P* <.05). This interaction effect appears to be mitigating the individual effect of race on depression suggesting that gender matters differently for depression by race. Thus, the significant interaction effect present illustrates that the impact of race on depression depends on gender such that being an African American woman means being at slightly less risk (50 %) than would be expected by their African American or female status alone. The multivariate model for anxiety symptoms showed a similar finding such that African American women are at slightly less risk (52 %) of having anxiety symptoms than would be expected by their African American or female status individually.

Psychosocial Resources

The bivariate and multivariate analyses for psychosocial resources are shown in Table 5 for race and gender. In multivariate analyses, African American students had a 83 % greater risk of lacking social support (95 % CI, 1.08 to 2.49) and 84 % greater risk of having low levels of mastery (95 % CI, 1.15 to 2.60). Female medical students had a nearly 24 % greater likelihood of having social support (95 % CI, 1.08–2.49). Women also had a 87 % greater risk of having low levels of mastery (95 % CI, 0.99 to 1.60) and were 55 % more likely to have low levels of self-esteem (95 % CI, .47 to 1.22).

We also examined the interaction effect of race and gender to explore whether the effect of race on psychosocial factors changes depending on the gender of the medical student. The only significant interaction effect found in bivariate and multivariate models was for social support where we found that African American women were 74 % more likely to have social support than would be expected given only information about one demographic characteristic (95 % CI, 1.68 to 1.88).

Discussion

In this study, we sought to address a gap in the literature by investigating the impact of race and gender on depressive symptomology, anxiety, and self-rated health for a cohort of first year medical students. We also sought to understand which groups have more psychosocial resources based on their race and gender.

Consistent with our hypotheses, at the start of their first year of medical school, African American and female medical students were at a higher risk for depression and anxiety than their White and male counterparts, respectively. We also found an interaction effect suggesting that African American females were at slightly less risk for depressive symptomology and anxiety than would be expected given the main effect of race or gender. This finding is of particular interest and suggests that without considering the intersection of two social identities (race and gender), we may not truly understand who is suffering the most. Thus, this result speaks to the need to incorporate an intersectional approach when seeking to elucidate disparities and document the experiences of multiple marginalized groups. Future work must seek to understand if these findings persist throughout 4 years of undergraduate medical training and explore ways to mitigate their impact on the medical school experience, particularly for African American and female students.

In addition to being at a higher risk for depression, African American students in our study were found to have lower levels of social support to cope with the rigors of medical school. Numerous studies have shown that social support is linked to psychological and physical health outcomes [84, 85] and can enhance mental health [86]. Future research might focus on understanding the kinds of social support that will be effective in mitigating poor mental well-being among African American medical students and helping medical schools to provide it. Women on the other hand, while at a greater risk for depression, were found to have more social support than their male counterparts. Future studies might focus on the relationship between social support and mental well-being for female medical students, particularly given Rospenda and colleague's finding that higher levels of outside social support were associated with poorer clerkship grades for women in their third year of training [87]. Additionally of interest is the significant interaction effect showing that the effect of race on social support changes depending on the gender of the medical student. This interaction effect appears to be mitigating the individual effect of race on social support suggesting that gender matters differently for levels of social support by race such that African American women in our sample are likely to have more social support. It is possible that this finding is due to the fact that African American women are benefitting from the effects of greater social support and more active coping skills documented for the female medical students in our sample. Indeed, African American women did not have significantly

different levels of social support in comparison to their White counterparts both male and female, while their African American male counterparts appeared to be at greatest risk of lacking social support. These findings may also be explained by the literature, which suggests that although African American students are more vulnerable than White students and female students are more vulnerable than male students, African American women may be less vulnerable than their African American male counterparts [88, 89].

African American students were also at a greater risk of lower cognitive ability self-esteem. Cognitive ability self-esteem is important in that it represents the feelings of confidence medical students have about their intellectual capacities as a medical student. Mental health may have its most devastating impact on individuals when they have low cognitive ability self-esteem [90]. While for medical students, cognitive ability is higher in comparison to other populations [91], the fact that a sub-group of the first year medical student population is suffering from lower levels at the start of training is concerning.

The findings of this study have practical implications for both medical education and clinical care. First, poor mental and overall health inhibit learning and success in medical school [27]. Additionally, physician distress yields poor quality of clinical care [92–94]. Identifying and developing strategies to improve medical trainee well-being in general and for African American students in particular is an important goal. To do so, medical schools must support efforts, including further research studies, to identify the causes and consequences and solutions to this problem. Schools must also work to create “identity-safe environments” which may produce a more inclusive environment that values diversity [95]. African American students were at a greater risk of lower cognitive ability self-esteem than their White counterparts. Cognitive ability self-esteem is important in that it represents the feelings of confidence medical students have about their cognitive ability and their intellectual capacities as a medical student. Studies have found that mental health may have its most devastating impact on individuals when they have low-performance self-esteem [90]. While in general, studies have found that for medical students, cognitive ability is higher in comparison to other populations [91], the fact that a sub-group of the first year medical student population may be suffering from low self-esteem at the start of their medical training is concerning. The strong link between mastery and self-esteem has been noted in other studies of medical trainees where it was found that students who were likely to experience more stress had both lower levels of mastery and had lower levels of self-esteem than their classmates [87]. Cognitive ability self-esteem has also been associated with high rates of burnout in medical school trainees [16, 91].

Consistent with the literature, women were found to have more active coping and social support than their male counterparts [96]. Active coping can potentially help individuals maintain psychosocial adaptation during stressful periods [6] such as the first year of medical school. Thus, the combination of more active coping and social support suggests that women should not be at a higher risk for depression and anxiety than their male counterparts. Conversely, women were found to have lower mastery than their male counterparts. It is not clear how mastery works with or against active coping and social support to impact depression and anxiety among these women.

Increasing attention and resources have been committed to reducing psychological distress and improving well-being among US medical students. Certainly, there is a significant need to address modifiable stressors that affect medical students overall; however, it is doubtful that these programs will effectively address the mental health disparities we observed. The findings of this study have practical implications for both medical education and clinical care. First, poor mental and overall health inhibit learning and success in medical school [27]. Additionally, physician distress (e.g., depression and anxiety) yields poor quality of clinical care [92–94]. Identifying and developing strategies to improve medical trainee well-being in general and for African American medical students in particular is an important goal. To do so, medical schools must support efforts, including further research studies, to identify the causes and consequences and solutions to this problem. Schools must also work to create “identity-safe environments” which may produce a more inclusive environment that values diversity [95]. An identity-safe environment is one in which individuals believe that they will not be judged in terms of the negative stereotypes associated with their social identities. Contextual cues such as high minority representation, an explicit valuing of diversity, and publically stated information about the existence of auditing practices to monitor discrimination are all examples of an identity-safe environment [95, 97].

This study had several limitations. First, it is cross-sectional and therefore limits our ability to examine causal and mediational relationships between race and gender, mental health outcomes, and psychosocial resources. Further studies are warranted to understand psychosocial factors as potential mediators of the relationship between gender, race, and mental health. Given the longitudinal nature of this study, future analyses will allow us to examine this temporal relationship. A second limitation was caused by our inability to ascertain and invite all first year medical students in the school sample, creating potential sample bias. Despite a robust response rate (55 % of all first year medical students at the 49 schools), it is possible that the results do not generalize to the students who did not participate.

Conclusion

This study represents a recent stratified random sample of 49 US medical schools, which resulted in responses from 301 African American medical students, thereby providing the first national sample of African American medical students large enough to characterize their health. We found that African American and female medical students experienced a higher mental health burden than their White and male counterparts, respectively. This is important because there are both a great need to increase the number of African American physicians as well as strong reason to be concerned that historical and current racial and gender discrimination may put African American medical students at risk for increased poor mental health outcomes and worse overall health during their medical school experience.

The findings of this study are particularly disturbing given the fact that these students are just at the beginning of their medical school experience, and results from others studies suggest that their mental health will continue to decline [27].

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Characteristics of a national sample of White and African American first year medical students attending a stratified sample of 49 US medical schools in 2010

	White (*n* = 2890)	African American (*n* = 301)	*P* value
Gender			.001
Female	1390 (48 %)	198 (66 %)	
Male	1517 (52 %)	103 (34 %)	
Parental status			.001
Have children	79 (3 %)	19 (6 %)	
Do not have children	2833 (97 %)	281 (93 %)	
Age			.017
18–24	2085 (72 %)	195 (65 %)	
25–35 or older	811 (28 %)	104 (35 %)	
Relationship status			.277
Not in a relationship	1227 (42 %)	163 (54 %)	
In a relationship	1684 (58 %)	105 (46 %)	
Family income			.001
Low-middle income	618 (23 %)	145 (52 %)	
Upper-middle income	1501 (55 %)	105 (38 %)	
Upper income	588 (22 %)	29 (10 %)	
Parental education			.001
PhD	1084 (37 %)	79 (26 %)	
Masters	752 (26 %)	74 (25 %)	
Bachelors	687 (24 %)	64 (21 %)	
Less than Bachelor degree	387 (13 %)	82 (27 %)	
Percentage of loans to finance medical school			.218
More than 50 % loans	1950 (68 %)	190 (64 %)	
Less than 50 % loans	939 (33 %)	107 (36 %)	

Data are provided by the Medical Student CHANGES Study

Table 2

Characteristics of a national sample of male and female first year medical students attending a stratified sample of 49 US medical schools in 2010

	Male (*n* = 1517)	Female (*n* = 1390)	*P* value
Race			.001
African American	103 (34 %)	198 (66 %)	
White	1517 (52 %)	1390 (48 %)	
Parental status			.031
Have children	60 (4.0 %)	38 (2.0 %)	
Do not have children	1558 (96 %)	1550 (98 %)	
Age			.019
18–24	491 (31 %)	424 (27 %)	
25–35 orolder	1116 (69 %)	1158 (73 %)	
Relationship status			.014
Not in a relationship	666 (41 %)	723 (45.5 %)	
In a relationship	952 (59 %)	865 (55.5 %)	
Family income			.226
Low-middle income	370 (24 %)	392 (27 %)	
Upper-middle income	838 (55 %)	765 (52 %)	
Upper income	310 (20 %)	306 (21 %)	
Parental education			.001
PhD	585 (36 %)	575 (36 %)	
Masters	378 (23 %)	448 (28 %)	
Bachelors	387 (24 %)	363 (23 %)	
Less than Bachelor degree	266 (16 %)	201 (13 %)	
Percentage of loans to finance medical school			.964
More than 50 % loans	1078 (67 %)	1058 (67 %)	
Less than 50 % loans	526 (33 %)	518 (33 %)	

Data are provided by the Medical Student CHANGES Study

Table 3

Prevalence of depression, anxiety, and self-rated health among a national sample of first year medical students attending a stratified sample of 49 US medical schools in 2010, by race and gender

	No./total (%)		
	African American	White	*P* value[a]
Depressive symptoms[b]	50/295 (16.9)	267/2860 (9.3)	.001
Anxiety symptoms[c]	19/289 (6.6)	111/2863 (3.9)	.028
Worse self-rated health	22/301 (7.3)	164/2896 (5.7)	.246
	Female	Male	*P* value[a]
Depressive symptoms[b]	178/1557 (11.4)	138/1592 (8.7)	.010
Anxiety symptoms[c]	86/1558 (5.5)	44/1588 (2.8)	.001
“Low” self-rated health	92/1580 (5.8)	94/1611 (5.8)	.988

Data are provided by the Medical Student CHANGES Study

[a] *P* value calculated by Pearson χ^2 test

[b] Depression score 1 SD (10 points) above PROMIS standardized general population mean score of 50

[c] Anxiety score 2 SD (20 points) above PROMIS standardized general population mean score of 50

Table 4

Depressive symptoms, anxiety, and worse self-rated health among a national sample of first year medical students attending a stratified sample of 49 medical schools, by race, gender, and race × gender interaction

	Bivariate		Multivariate[a]	
	RR[b]	95 % CI	ARR[b]	95 % CI
Race				
Depressive symptoms[c]	1.29***	1.12 to 2.12	1.59**	1.37 to 2.40
Anxiety symptoms[d]	1.70*	1.09 to 2.40	1.66*	1.08 to 2.71
Self-rated health	1.81	1.21 to 2.82	1.20	1.15 to 2.60
Gender				
Depressive symptoms[c]	1.32***	1.22 to 2.12	1.36**	1.07 to 1.63
Anxiety symptoms[d]	1.99**	1.09 to 2.40	1.95***	1.39 to 2.84
Self-rated health	0.99	755 to 1.32	1.00	788 to 1.60
Interaction effect of race×gender				
Depressive symptoms[c]				
African American female	.55	49 to 1.12	.50*	40 to .62
Anxiety symptoms[d]				
African American female	.51*	50 to 1.44	.52*	44 to .74
Self-rated health				
African American female	1.47	1.39 to 1.57	1.32	1.29 to 1.43

Data are provided by the Medical Student CHANGES Study. Social desirability bias and time in medical school were excluded from final models because they did not substantively change any of the coefficients. Estimates are weighted to account for probability of selection, stratification, and clustering

RR relative risk, *CI* confidence interval, *ARR* adjusted relative risk

* $p<.05$

** $p<.01$

*** $p<.001$

[a] Multivariate analysis estimates adjusted for, age, gender, relationship status, parental status, SES (parental education, percentage of medical school financed by loans, family income)

[b] Relative risks were estimated through Poisson regression model with a log link function

[c] Depression score 1 SD (10 points) above PROMIS standardized general population mean score of 50

[d] Anxiety score 2 SD (20 points) above PROMIS standardized general population mean score of 50

Table 5

Psychosocial factors a national sample of first year medical students attending a stratified sample of 49 medical schools, by race, gender, and race × gender interaction

	Bivariate		Multivariate[a]	
	RR[b]	95 % CI	ARR[b]	95 % CI
Race				
Active coping	1.01	76 to 2.01	1.01	1.24 to 2.04
Social support	.79**	56 to 2.33	.83*	45 to 2.49
Mastery	.95	78 to 2.44	.84**	56 to 2.60
Cognitive ability self-esteem	.77**	52 to 2.21	.86	67 to 2.43
Gender				
Active coping	1.02	1.32 to 2.12	1.03	1.24 to 2.04
Social support	1.19***	1.09 to 2.40	1.24***	1.08 to 2.49
Mastery	.87***	75 to 1.32	.87**	99 to 1.60
Cognitive ability self-esteem	.65	57 to 1.12	.55***	47 to 1.22
Interaction effect of race × gender				
Active coping				
African American female	.91	82 to 1.10	.91	82 to 1.09
Social support				
African American female	1.70*	1.38 to 2.20	1.74*	1.68 to 1.88
Mastery				
African American female	1.08	1.02 to 1.17	1.14	91 to 1.23
Cognitive ability self-esteem				
African American female	1.31	1.29 to 1.35	1.27	1.20 to 1.32

Data are provided by the Medical Student CHANGES Study. Social desirability bias and time in medical school were excluded from final models because they did not substantively change any of the coefficients Estimates are weighted to account for probability of selection, stratification, and clustering

RR relative risk, *CI* confidence interval, *ARR* adjusted relative risk

* $p<.05$

** $p<.01$

*** $p<.001$

[a] Multivariable analysis estimates adjusted for, age, gender, relationship status, parental status, SES (parental education, percentage of medical school financed by loans, family income)

[b] Relative risks were estimated through Poisson regression model with a log link function