

Title: Cross sectional analysis of depression and stress in medical students

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Abstract

Medical student wellbeing is a topic of growing concern. Medical students experience high levels of stress and burnout and are at increased risk for depression and suicidal ideation compared to the general population.¹ Even more concerning, medical students are disproportionately less likely to seek help for their mental health issues.² Identifying and preventing these problems early can have lasting positive consequences over the course of a physician's lifetime. We implemented a wellness program at our medical school in the spring of 2016 with the goals of decreasing burnout and depression, heightening awareness of mental health issues, and encouraging help-seeking behaviors. To analyze the impact of our program, we have implemented a quality assurance survey. Here we report lifestyle factors associated with positive screens for depression from that data and propose institutional initiatives that can be spearheaded by medical students for medical students to impact positive change.

Introduction

Medical school is a challenging time. Stressors associated with the transition to undergraduate medical education include adjusting to a new lifestyle, rigorous academics, financial strain, ethical conflicts, exposure to death and human suffering, and reduced time spent with family and friends.³ All these factors can reduce medical student well-being and have long-term consequences for the medical community. The required lifestyle changes often lead to decreased healthy habits which put medical students at further risk.

Anxiety and depression are both more prevalent in medical students than in their age-matched peers.^{1,4-6} However, symptoms of decreased well-being manifest in insidious ways, before reaching diagnosable anxiety and depression, making their measurement challenging. More overt changes including decreased exercise and socialization as well as increased alcohol consumption take place in the first year alone.⁷

Poor wellness is associated with impaired academic performance, cynicism, substance abuse, and suicide.³ Negative stressors among physicians have been shown to decrease the quality of patient care.^{8,9} The same could be expected for medical students; students with poor wellness markers may be more likely to perform poorly during clinical years and may themselves negatively impact patient care. The amount of perceived stress, and risk of depression have both been shown to increase as students progress through medical school.¹⁰

A systematic review and meta-analysis from 2016 found a 27.2% prevalence of depression and a 11.1% prevalence of suicidal ideation among medical students across multiple countries including the United States.¹ Another systematic review and meta-analysis found a similar prevalence of depression of 28.8% in resident physicians.¹¹ Comparing these figures to the national average of 8.1% (5.5% in men and 10.4% in women) suggests either those who choose to pursue a career in medicine are more at risk for developing depression or exposure to medical training increases one's risk for developing depression.⁴

Further, while medical students experience disproportionately high rates of burnout, depression, and suicidal ideation when compared to the general population, they are disproportionately less likely to receive treatment for mental health issues.² According to the aforementioned systematic review and meta-analysis, only 15.7% of students who screened positive for depression reported seeking treatment.¹ It is widely accepted that stigma surrounds mental illness and its treatment, particularly in the medical student population. This can be characterized by fears of being perceived as being unable to

adequately cope or being unable to handle their responsibilities as medical professionals, and thus, losing respect.²

The prevalence of burnout in medical students has previously been reported as 52.8%.¹² Medical students with higher burnout scores show lower empathy and professionalism.^{13,14} Burnout prevalence among residents is estimated around 28%, with those suffering from burnout showing a decreased resilience factors and increased stress, fatigue, worry, and depressive symptoms.¹⁵ Interventions aimed at reducing burnout in attending physicians have shown small but significant effects.¹⁶ Nevertheless, such interventions are not a substitute for preventive measures among physicians in training. Rather, measures must be taken earlier in medical training to protect future physicians from developing depression and burn out. Based on our findings, we suggest ways to accomplish this goal.

Our program is a student-run organization which aims to decrease symptoms of student burnout and increasing well-being. Our focus is to promote healthy lifestyles, foster the development of strong social support networks, heighten awareness of mental health, and destigmatize barriers to help-seeking behavior. Part of our mission is to better monitor our students to identify those at risk for depression. Many medical schools and graduate medical education programs have developed similar programs and demonstrated promising results.^{10,17,18} Strategies that promote self-care, supportive relationships, and positive outlook have all been associated with increased well-being among physicians.¹⁹ Promoting well-being has positive effects both on clinicians and their patients. Physicians with higher empathy have better clinical outcomes for their patients.^{20,21} Medical students demonstrating higher levels of wellness show higher levels of professionalism, and resident well-being was associated with increased empathy.^{8,22}

Methods

All medical students at the State University of New York: Stony Brook School of Medicine were asked to fill out an anonymous, voluntary survey with questions about lifestyle, substance use, stress, and depression. Students were split between two clinical campuses; the main clinical campus contained students of all four years and the secondary campus contained third- and fourth-year clinical students. The perceived stress scale was scored using the standardized cutoffs of 0-13 for low stress, 14-26 for moderate stress, and 27-40 for high stress.²³ The PHQ-9 questionnaire was used to screen for depression, with a positive depression screen being determined as a cutoff value of ≥ 10 on the PHQ-9.^{1,11,24}

All analysis was done using SAS (version 9.4; SAS Institute, 100 SAS Campus Drive, Cary, NC 27513). Logistic regression was used to examine the effects of various predictors on depression related to demographics, diet, exercise, stress and unhealthy self-reported behaviors (Table 1). Class year was measured both ordinally (to determine whether depression increased over time) and categorically (to determine whether depression varied between class years). Exercise frequency was dichotomized as greater or less than 3 times weekly. Weight was dichotomized as normal BMI (BMI < 18.5 or ≥ 25) vs. non-normal BMI (all other responses). Eating habits when stressed was dichotomized into no change vs. change (all other responses).

A cumulative proportional-odds logistic regression was used to test the effect of variables on perceived stress category, an ordinal outcome. For proportional-odds models, score tests for the proportional-odds assumption were used to assure that the estimates and resulting inferential procedures (p-values)

were valid. We controlled for clinical campus, class year, and gender identity for all logistic and cumulative logistic models except when estimating the effects of class year, weight and eating habits on depression. When estimating the effect of class year on depression as an ordinal variable, we did also control for class year as a categorical variable. The effects of weight and eating habits were estimated independent of each other, in addition to controlling for clinical campus, class year, and gender identity. The two respondents who answered the gender question with non-male/female genders were excluded from the adjusted models, as the number of observations belonging to those categories was too small to estimate effects size. One student had missing values for the PHQ-9 questions such that a depression status could not be determined. Normal approximation confidence intervals were used to test whether the depression rate significantly deviated from 27.2% and 8.1%. P-values less than 0.05 were used to determine statistical significance.

We hypothesized (1) the overall rate of depression would not differ significantly from previous prevalence measurements of depression among medical students (27.2%)¹; (2) the depression rate would increase with class year; (3) depressed students would be more likely to indicate poor nutritional and/or exercise habits and be more likely to demonstrate risky behaviors; and (4) female students would be more likely to suffer from depression compared to male students, similar to the general (non-medical student) population.

Results

In total, 181 students of 536 (33.8%) elected to provide survey data. Response rates between class years and gender identities were similar (Table 2) with clinical campus response rates differing due to number of students at each site.

Overall, 29 respondents (16.1%) had a positive depression screen (95% CI (10.47, 21.48)). Depression odds were not significantly affected by gender identity (OR=0.53; 95% CI (0.23, 1.22); $p=0.14$), clinical campus (OR=1.45; 95% CI (0.52, 4.08); $p=0.48$), or class year as measured ordinally (OR=0.82; 95% CI (0.56, 1.2); $p=0.3$). There was no difference between the class years in depression incidence when class year was looked at categorically ($p=0.71$). We found 7.7% ($n=14$) of respondents had at least one self-harm or suicidality thought within the last year.

Table three summarizes the distribution of our sample's stress level, stratified by depression. The effect of stress on depression odds was highly significant (OR=13.58; 95% CI (4.5, 40.98); $p<0.001$). This finding is similar to previous work which found stress determined by the perceived stress scale was correlated with a positive screen with the Beck Depression Inventory.²⁵

When examining the diet and exercise of the respondents we found no statistically significant difference between diet and exercise habits categories with respect to depression. This includes weekly intake of vegetables (OR=0.98; 95% CI (0.79, 1.21); $p=0.84$), fruits (OR=1.02; 95% CI (0.78, 1.34); $p=0.86$), soda (OR=0.96; 95% CI (0.48, 1.92); $p=0.92$), or snacks (OR=0.88; 95% CI (0.59, 1.32); $p=0.54$) and workout frequency (OR=1.17; 95% CI (0.44, 3.13); $p=0.76$). Similarly, those who changed their eating habits when stressed were not more likely to screen positive for depression (OR=4.71; 95% CI (0.59, 37.68); $p=0.14$). However, while specific surveyed eating behaviors were insignificant, individuals with non-normal BMIs were 4 times more likely to be positive for depression (OR=4.02; 95% CI (1.61, 10.07); $p=0.003$).

No statistically significant difference was seen in current alcohol or drug use between those who screened positive for depression (OR=1.13; 95% CI (0.73, 1.74); p=0.58) and those who did not (OR=0.3; 95% CI (0.04, 2.41); p=0.26). Among participants, 23.3% (n=42) reported partaking in binge drinking. When compared, those who screened positive for depression were no more likely to binge drink than those who screened negative (OR=1.10; 95% CI (0.42, 2.85); p=0.84). The effects of current smokers on depression could not be estimated due to the small number of reported current smokers (n=2). However, we found a 2.9 fold increase in odds of positive depression screen for individuals who had ever smoked (OR=2.89; 95% CI (1.09, 7.62); p=0.03).

Finally, our survey attempted to gauge support network perception. Specifically, we asked “If you have a health problem (physical or mental), how likely are you to seek help from family or friends?”. The response distribution, stratified by depression, is summarized in Table 4. Based on cumulative logistic regression, those who flagged positive for depression were not significantly more likely to answer this question in higher response categories (OR=1.28; 95% CI (0.61, 2.66); p=0.52). In other words, those who are depressed are not more or less likely to seek help from family or friends for health problems.

Discussion

The number of medical students who screened positive for depression at our NY state medical school was significantly less than the national average prevalence across medical schools, but significantly more than the national average prevalence among the general population.^{1,4}

Our findings provide further evidence that depression is an evenly spread problem across all stages of medical training- an important reminder that depression affects medical community members at multiple level of training and timepoints. We failed to find differences in the rate of positive depression screen between the class years; meaning, those further along in medical school were not more likely to struggle with mental health under the weight of stressors. Alternatively, as students were surveyed during the fall, this could indicate students entering medical school already represent a higher prevalence of, or are at a higher risk for, depression than the general population. To examine this possibility, future studies at the undergraduate education level should consider the effects of demanding pre-medical coursework, exams, and admissions process on students prior to medical school matriculation.

Based on our findings, self-reported levels of moderate or high stress and non-normal BMI could be considered early indicators of depression among medical students from our cohort. The latter suggests that significant weight loss or weight gain is a physical manifestation of stress levels and/or depression risk that should be more carefully noted by concerned friends, family, and peers. Interestingly, however, we failed to find differences in eating habits or exercise, including exercise frequency, vegetable intake, fruit intake, or soda intake, that correlated with depression. This suggests that an overall increase in food intake or decrease in exercise intake (positive energy balance), as opposed to binge-like behavior, underlies changes in BMI in response to stress.

Our research had several limitations. Since this survey was voluntary, it suffers from response and non-response biases; the number of respondents was small (1/3 of the total enrolled medical student population). It is possible, our sample size was underpowered to assess certain relationships such as lifestyle factors. This is most evident in our data’s lack of support for an association between current alcohol or illicit drug use and depression risk. We attribute this surprisingly finding to a limited sample

size of students who reported current drug and alcohol use. Notedly, alcohol and illicit drug use are notoriously underreported and likely more so in our targeted population.

One concerning finding was that those with reflags for depressive symptoms were no more willing to seek help than those feeling well. This may reflect the fact that students who screening positive for depression do not self-identify as being unwell. In addition, substantial prior research has shown there is considerable stigma around depression and asking for help.² This is a strong indication that more work needs to be done to destigmatize mental illness among medical students and their future resident and physician counterparts.

Our findings, and those of previous research, lead us to conclude we have a moral obligation to do better by our medical students, future residents and attendings. Access to mental health resources alone appears to be insufficient for addressing the on-going needs of our target population. That is, a more proactive approach aimed at prevention and early detection is necessary. We see it prudent to implement mandatory depression screening at regular intervals during medical education, ideally to help students become more self-aware and encourage them to seek of their own accord. In addition, we encourage educational initiatives that help peers recognize signs of depression and burnout in each other and provide a practical toolset for how to help. We propose grassroot initiatives like own as a good starting point for this goal- our program works to further address the need to prevent burnout and depression among our peers. Finally, we encourage other student-directed programs to qualitatively assess the needs of their respective student populations and the efficacy of their efforts as has been our aims here. Assessment of the effectiveness of our program in achieving this goal requires comparative data from this baseline.

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Table 1: Relevant survey questions and response choices

Variable	Answer Options
Demographics	
Gender Identity	Male Female Prefer not to say Other
Campus	Stony Brook (main campus) Winthrop (secondary)
Class	First Second Third Fourth
Diet and Exercise	
Vegetables consumed yesterday	0 , 1, 2, 3, 4, 5, 6, 7, 8, >8
Fruit consumed yesterday	0 , 1, 2, 3, 4, 5, 6, 7, 8, >8
Sodas, fruit drinks, juices, sports drinks (e.g. Gatorade) consumed yesterday	0 , 1, 2, 3, 4, >4
Snacks (candy, chips, junk food etc.) consumed yesterday	0 , 1, 2, 3, 4, >4
Workout frequency for past week (enough to sweat)	0 , 1, 2, 3, 4, >4
Risk Behaviors	
Drinks consumed weekly	I don't drink, 1 or less, 2-4, 5-7, 8-10, 11-14, >14
Days of alcohol consumption weekly	I don't drink, less than 1, 2-4, 5-7, 8-10, 11-14, >14
Drinks typically consumed at once	I don't drink, 1, 2, 3, 4, 5+
Binge Drinker (male and 5+ response for above or female and 4 or 5+ response for above)	Yes, No
Smoke Currently	Yes, No
Smoke Ever	Yes, No
Cigarette packs/day	<1, 1, 2, 3+, I don't smoke
Illicit Drugs/week	0, 1-2, 3-4, 5-6, 7+
Other	
Eating Habit when Stressed	Eat more Eat less No change
Self-described weight/BMI	Underweight Healthy Overweight Obese
Likelihood of seeking help from family/friend	Very unlikely somewhat unlikely

	neutral somewhat likely very likely
Thoughts of hurting yourself or being better off dead (past two weeks)	Not at all several days more than half the days nearly every day
Stress level	Low Moderate High

Table 2: Demographics table

Class Year	
First	54 (29.8%)
Second	33 (18.2%)
Third	57 (31.5%)
Fourth	37 (20.4%)
Clinical Campus	
Main	134 (74%)
Secondary	47 (26%)
Gender Identity	
Male	86 (47.5%)
Female	93 (51.4%)
Other	2 (1.1%)

Table 3: Stress Distribution by Depression

Stress Level	Overall	Not Depressed	Depressed
Low	50	49 (98%)	1 (2%)
Moderate	111	95 (85.6%)	16 (14.4%)
High	17	6 (35.3%)	11 (64.7%)

Table 4: Likelihood to Seek Help for Problems, by Depression

Seek help from family or friend	Overall	Not Depressed	Depressed
Very unlikely	14	13 (92.9%)	1 (7.1%)
Somewhat unlikely	19	15 (79.0%)	4 (21.0%)
Neutral	27	24 (88.9%)	3 (11.1%)
Somewhat likely	65	54 (83.1%)	11 (16.9%)
Very likely	53	43 (81.1%)	10 (18.9%)