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The prevalence of depression among physician assistant students in comparison to medical students

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THE PREVALENCE OF DEPRESSION AMONG PHYSICIAN ASSISTANT STUDENTS IN COMPARISON TO MEDICAL STUDENTS

by

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ABSTRACT

Background

The physician assistant (PA) profession growth rate was 31% in 2019 and is projected to continue to increase in the upcoming years. The rates of depression amongst the general population has been rising over the recent years. Currently, 7.1% of Americans are diagnosed with depression, however, approximately 30% of medical students carry this same diagnosis. Unfortunately, there is minimal data on the prevalence of depression amongst PA students.

Literature Review

The literature review for this study is composed of past research on the prevalence of depression among medical students at various different programs. Some studies accounted for variable study measures including a previous diagnosis of mental illness, demographics including race, ethnicity, etc. while others did not. One study that was reviewed assessed if there is correlation between depression and work-related personality traits including: commitment, discipline, dominance, stability, cooperation, and social competence. In summary, the comprehensive review showed significant evidence that the prevalence of depression among medical students, and the small sample size of PA students, is greater than the general population. Studies showed that there is a significant association between the prevalence of depression and certain socio-demographics and work-related personality traits.

Proposed Research

This thesis proposes a multi-program, prospective cohort study to identify the prevalence of depression in PA students and identify potential factors that may be associated with the development of depression in PA school. The results of this study will then be compared to the general population's rate of depression.

Conclusion

This study will include various PA programs throughout the United States and assess the prevalence of depression among PA students while also accounting for potential variable measures including: sex, age, marital status, race, ethnicity, previous or current diagnosis of mental illness, and familial history. This data will be analyzed utilizing the chi-square test enabling for sub-group analysis as needed. The purpose of this research is to determine if the prevalence of depression among PA students is significantly greater than that of the general population. By identifying the prevalence of depression in PA students there is potential to decrease burnout in the PA profession and prevent potential detrimental effects such as suicide.

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LIST OF ABBREVIATIONS

AAMC	Association of American Medical Colleges
AAPA	American Academy of Physician Assistants
APA	American Psychological Association
ARC-PA	Accreditation Review Commission on Education for the Physician Assistant
BDI	Beck Depression Inventory
BIP-6F	Business-Focused Inventory of Personality 6 Factors
CES-D	Center for Epidemiologic Studies Depression Scale
CBT	Cognitive Behavioral Therapy
ECT	Electroconvulsive Therapy
DSM-5	Diagnostic and Statistical Manual of Mental Disorders
IRB	Institutional Review Boards
MCAT	Medical College Admission Test
NIH	National Institute of Health
PA	Physician Assistant
PAEA	Physician Assistant Education Association
PANCE	Physician Assistant National Certification Exam
PHQ-9	Patient Health Questionnaire
PRIME-MD	Primary Care Evaluation of Mental Disorders
PROMIS	Patient-Reported Outcomes Measurement Information System
SSRI	Selective Serotonin Reuptake Inhibitor

INTRODUCTION

Background

Mental illnesses are a medical disorder that plagues close to 20% of the US population, with depression being the most common diagnosed mental illness amongst young adults. [1] The presentation of depression can manifest in various ways, but most commonly is characterized by two weeks of feelings of sadness or loneliness daily or a loss of interest in daily activities. The length of one's depressive episode may last anywhere from days to months. [2] Depression rates have been increasing over the last decade according to a National Survey on Health and Drugs that analyzed data from 2005 and 2014. The results showed an increase in 12 month major depressive episodes from 8.3% to 11.7% from 2005 to 2014 whereas treatment rates from 2005 to 2014 ranged from 35% to 37%. [3]Although over the course of the past decade, there has been an increase in depressed patients seeking more specialized treatment from a psychiatrist or mental health specialist, there has not been an increase in the prevalence of those who seek treatment overall.

Studies have consistently shown that medical students suffer higher rates of depression than the general population. Approximately 30% of medical students experience symptoms of depression with only around 15.7% receiving treatment. [4] Between standardized tests, intensive curriculum, lack of sleep, and competitive nature of these programs, it is not shocking that it comes at the expense of some people's mental health. There are PA programs such as Boston University Physician Assistant Program and Iowa State University that integrate their students with second year medical students.

Although PA students do not undergo as extensive education and training as medical students, there is significant overlap between the educational models. The consolidation of the PA didactic curriculum into an average of 24 months makes the findings of the prevalence of depression in medical students' generalizable to the PA student population as well. With the PA profession being relatively new there are limited studies on the mental health issues amongst PA students specifically. Various studies have been conducted around the mental health adversities medical students face, specifically those who report feelings of depression. Furthermore, there is a need to research the management of depression among medical students to determine what percentage seek out treatment and those who face disposition to seeking treatment. Physicians have higher suicide rates than the general population and there is potential to reduce the long term, detrimental effects depression may have on medical or PA students who defer treatment and continue to do so throughout their career. [5]

Statement of the Problem

Although extensive research has been done on the development of depression and suicidal ideations in medical students, there has been minimal research conducted on the prevalence of depression or suicidal ideations amongst PA students. With knowledge that the prevalence of depression in medical students is greater than that of the general population, [4] it is critical to investigate mental health amongst various PA cohorts to determine if findings are similar. The PA profession was established in the mid 1960's and is projected to grow 31% from 2018 to 2028. [6] Results from the National American Academy of PA survey showed that PA's experience "moderate levels" of burnout and

27% of PAs reported leaving a job at one point due to stress. [7] As a rapidly growing profession, identifying depression rates amongst PA students may help reduce the burnout rate in the profession. The rigorous curriculum and learning environment are similar between medical school and PA school, indicating the dire need for research on PA mental health. It is important to attempt to identify the factors for developing depression in PA school and despite the similarities between medical school and PA school curriculums, further research is warranted to understand the prevalence of depression specifically in PA students.

Hypothesis

PA students have a higher likelihood of developing depression or experiencing suicidal ideations than the general population. The prevalence of depression in PA students is expected to be similar to that of medical students due to the extensive overlap between the curriculums as well as the competitive and rigorous nature of the academic and clinical setting.

Objectives and Specific Aims

Data on depressive symptoms, suicidal ideations, and familial history or previous diagnosis or treatment of depression will be obtained and analyzed to better understand whether PA students experience higher rates of depression than the general population.

- Determine the prevalence of depression among PA students by screening them prior to didactic year and contiuously throughout didactic and clinical year in order to compare it to that of the general population.

- Assess for potential associated risk factors for developing depression including familial history, past medical history, socio-demographic factors, and personality traits.
- Obtain depression rates of PA students between various cohorts in numerous programs to ensure results are generalizable and reflective of a diverse population.

REVIEW OF THE LITERATURE

Overview

Epidemiology of Depression in General Population and Healthcare Professionals

Mental illness is a serious condition that alters an individual's behavior, thinking, or emotional state. There is stigma against mental illness that is slowly being addressed over the last decade in our society. Mental illness is a true medical disorder and affects 19% of the US adult population regardless of one's race, socioeconomic status, or gender. [8] Depression is among the most common mental illnesses in the United States, impacting 17.3 million US adults, accounting for 7.1% of the US adult population. Depression is almost two times more prevalent in females than males and is most prevalent in those between the ages of 18 and 25. Of those that suffered from major depressive disorder in the US in 2017, 44% were treated with both psychotherapy and medication, 6% were using medication alone, and 15% were only receiving psychotherapy, and 35% weren't receiving treatment. [9]

Depression most commonly presents in late adolescence to early adulthood, but can occur at any age. People may experience episodes of depression that vary from weeks, months, or years and severely impact their daily life. [2] Depression can arise as a result of genetic, environmental or influences of both factors. It is a complex disorder that is continuously being researched for better understanding of its etiology.[10]

Medical students have a higher prevalence of depression than the general population. A meta-analysis conducted in 2016 showed that 27.2% of medical students were depressed and 11.1% had suicidal ideations and only 15.7% of those who were

depressed sought treatment.[4] As a result of the low treatment rate in medical students, the prevalence of depression is also higher in physicians. The prevalence of depression in female physicians was 20% whereas in males it was 13%. [11] A multitude of factors were identified as predictors of depression among physicians including sleep deprivation, medical errors, self-criticism, and feelings of loneliness. Physicians who are depressed may experience personality changes and their depression may impact their work performance and decision making. [12]

As found in medical students, physicians are less likely to seek treatment than those depressed in the general population. There are many barriers that have been identified on physicians' disposition to treatment. A prospective study conducted across thirteen community and University Hospitals in 2008 found that of the 42.5% of physicians who screened positive for depression, only 22.7% were being treated. The study concluded that physicians were reluctant to seek treatment due to time constraints, concerns about confidentiality, and a desire to manage treatment on their own. [13]

Pathophysiology of Depression

Major depressive disorder is a complex disorder whose etiology may be contributed by both genetic and environmental factors. The exact pathophysiology of depression is continuously being studied, as it is not fully understood. Stress was identified as a risk factor for depression and excess cortisol has been found to be elevated in people with depression. Cortisol is considered the “stress hormone” that is released as the body's physiological response to stress. Women tend to be more physiologically reactive to stress, which could explain why the prevalence of depression is also higher in

women.[14] Other contributors to the pathophysiology of depression are the levels of monoamines such as serotonin and dopamine. Serotonin and dopamine are neurotransmitters, which are key regulators of mood, attention, appetite, reward and cognition. Depression is most directly correlated with a deficiency in serotonin. Serotonin is typically derived from tryptophan and tryptophan is found to be depleted in some patients with depression leading to the presentation of depressive symptoms.[15] Although most research has investigated the relationship between serotonin and major depressive disorder, one randomized control trial found that patients given a dopamine agonist, pramipexole, saw a 48% improvement of their depressive symptoms on the Hamilton depression score scale, in comparison to those taking a placebo. This study concluded that not only do patients with major depressive disorder have a deficiency in serotonin, but dopamine as well. [16] There have been various studies conducted utilizing neuroimaging to attempt to identify which regions of the brain may possess abnormalities or dysfunction in patients with major depressive disorder. A meta-analysis study found that the frontal and temporal cortex, as well as the cerebellum showed some abnormalities and decreased function in major depressive patients, yet when given an SSRI, these cortices functions increased. [17]

Another study showed evidence that GABA, an inhibitory neurotransmitter, and glutamate, an excitatory neurotransmitter, are depleted in the prefrontal and occipital cortex, particularly in acute depression. In chronic major depressive disorder, it was found that the GABA-receptor activity is decreased. These findings were supported by magnetic resonance spectroscopy. [18]

Changes in sleep patterns, such as insomnia, are part of the diagnostic criteria in the DSM5 for major depressive disorder, yet there is some evidence that supports circadian abnormalities and sleep disturbances may be associated with development of depression rather than just symptoms of depression. [18] Some studies have found that circadian abnormalities may lead to depression due to the decrease in REM sleep and excess cortisol secretion.[19]

Risk Factors for Depression

As with most diseases, there are a multitude of risk factors that have been identified to increase the likelihood of one developing depression. An individual who possesses personality traits such as low self-esteem, or someone who is pessimistic are more likely to be depressed. Self-esteem is how one perceives their worth or value. [20] A longitudinal study was conducted on adolescents that were referred to a child psychiatrist from ages 13 to 18. The children completed a survey on their first visit asking questions that assessed their symptoms for anxiety or depression as well as questions evaluating their self-worth which were graded on The Rosenberg Self Esteem Scale and were then reassessed three years later. The study concluded that children who had higher self-esteem scores had less severe symptoms of anxiety and depression, indicating that higher self-esteem may reduce the likelihood of developing depression. [21]

People who have experienced adverse life events such as trauma, abuse, death of a loved one, significant stress or financial hardships are susceptible to depression. A study conducted in 2011 at a primary care clinic surveyed 50 to 70-year olds to assess the relationship between an adverse childhood event and depression. 23.7% of subjects

(N=2,047) had experienced an adverse childhood event were three times as likely to be diagnosed with depression in comparison to someone who had not been exposed to an adverse childhood event. [22] Those with a familial history or personal history of mental illnesses such as depression, anxiety or substance use disorder are also more at risk. Although there is not a direct inheritance pattern for depression, those who have first degree relatives with depression are two to three times more likely to develop depression. [23] Individuals who identify as gay, lesbian, bi, or transgender also have an increased risk of depression. The depression prevalence amongst transgender subjects (N= 158) in one study was 63.5%. These subjects were also at higher risk for substance use disorder and experienced higher rates of suicidal ideations than subjects that were heterosexual. [24] A study was conducted to identify the prevalence of depression in homosexual men versus heterosexual men and found that 29.3% of homosexual men had major depressive disorder in comparison to 10.2% of heterosexual men. [25] People with a chronic or terminal illness also have a greater chance of developing depression due to the stress it may add to their daily life. Results from a study that investigated the prevalence of depression in patients with eight various chronic medical conditions was 24.7%, in comparison to 17.5% prevalence of depression in random subjects that did not report having a chronic condition. [26]

Diagnostic Criteria

Depression is a feeling of constant sadness, hopelessness, or lack of desire to participate in activities the individual typically enjoys. The American Psychiatric Association created the Diagnostic and Statistical Manual of Mental Disorders (DSM-5)

to aid clinicians in the diagnosis and assessment of various mental health disorders and to ensure standardization of diagnoses. The DSM-5 criteria for depression is defined as at least two weeks of depressed mood for a majority of the day or loss of interest in participating in daily activities as well as one or more of the following symptoms: weight loss, decreased appetite, fatigue, feeling of worthlessness, insomnia, decrease in concentration, or suicidal ideations.[2]

Depression differs from sadness and can vary from mild, moderate, to severe. It can have a negative impact on one's emotional, physical and cognitive well-being. Depression may arise as a result of social, psychological and biological influences. People who have experienced adverse life events such as the loss of a spouse, loss of a job, or abuse are more at risk of developing depression. [27] In 2013, the DSM-5 was revised and now excludes bereavement from inclusion criteria for major depressive disorder unless the patient's symptoms last longer than two months, they experience psychotic behavior, or have suicidal ideations. [2] When assessing medical students and looking at previous research one must take into consideration the time at which the diagnosis was made to ensure the depression was not actually bereavement.

Complications of Depression

Depression is a medical illness that can lead to various comorbid conditions particularly if it goes untreated. The results of a survey done by University of Michigan showed that approximately 50% of patients diagnosed with major depressive disorder also had a comorbid anxiety disorder. A third of patients with depression also were suffering from a substance use disorder and 20% also had a comorbid diagnosis of post-

traumatic stress disorder.[28] Thus, those with a known mental illness are more at risk for developing another mental illness. A meta-analysis longitudinal study looked at the prevalence of obesity in depressed individuals. Among the 33,000 subjects included, they had a baseline measure of depression and were followed closely to track changes in weight. Results showed that there was an association between depression and obesity, particularly in female adolescents. Depressed female adolescents were 2.5 times more likely than non-depressed female adolescents to become obese.[29]

Finally, studies have shown that major depressive disorder is the most common mental illness connected with suicide. A study conducted in a primary care setting in 2017 found that 60% of people who commit suicide had a diagnosis of major depressive disorder. [30] The complications and comorbidities of depression have provided researchers even more incentive to identify barriers to treatment to help prevent comorbidities such as death by suicide.

Treatment of Depression

The treatment for depression may consist of either pharmacological or psychotherapy or a combination of both. The standard of care for treatment of depression pharmacologically is a selective serotonin reuptake inhibitor (SSRI) such as fluoxetine. The mechanism of action of SSRIs is to prevent the reuptake of the neurotransmitter, serotonin, which is typically low in patients with depression. SSRIs increase the concentration of serotonin in the synaptic cleft by inhibiting monoamine oxidase. A meta-analysis study published by JAMA, collected data from 1980-2009 comparing SSRIs to a placebo. Results of this study found that the more severe the depression, the

more effective the SSRI was in comparison to the placebo. [31] Cognitive behavioral therapy (CBT) is a specific psychotherapy that helps patients to identify, comprehend, and alter their thoughts and behavioral patterns. Cognitive behavioral therapy includes the patient in the treatment process and helps the patient obtain coping skills and identify triggers of a depressive episode. One randomized control study published in 2014 researched the efficacy of treatment among adolescents with depression. The interventions investigated included patients receiving monotherapy with fluoxetine, an SSRI, monotherapy with CBT, combined therapy of CBT and fluoxetine, or a placebo. The patients were placed on their randomized treatment regimen for 12 weeks and assessed utilizing a standardized depression scale. Results showed that fluoxetine alone had more significant results than CBT alone. 60.6% of patients on fluoxetine had a decrease in their depression ratings whereas only 43.2% on CBT did. The placebo response rate was 34%. However, the most significant response was from the group who received a combination of CBT and fluoxetine with 71% noting a decrease on the depression rating scale. [32] As a result of this study, it is evident that both SSRIs and CBT have proven to be effective in treatment of major depressive disorder, but the highest efficacy is achieved when combining therapies.

Treatment of refractory depression can entail electroconvulsive therapy (ECT). Refractory depression is depression that does not respond to pharmacological or psychotherapy. ECT has also been used in patients with high risk of suicide. [33] A prospective study was conducted in 2008 on 38 subjects all who had failed to respond on average to 5.4 pharmacological treatments and had been experiencing a depressed

episode for more than a year. The subjects attended six ECT sessions and results found that 65.8% responded to ECT and 53% achieved full remission, concluding that ECT is the best treatment for refractory depression. [34]

Comparing Physician Assistant and Medical School Curriculums

A PA is a dependent provider who provides care to patients with a team-based approach. PAs have the ability to diagnose, prescribe medications, construct treatment plans, and manage patient care. They are trained as generalists to work in an interprofessional environment and are not required to specialize or complete a residency prior to obtaining certification. [35] Standard PA programs consist of an intensive 24 to 28-month program following the medical model to complement physician training. The required courses include basic medical sciences, anatomy, physiology, pharmacology, pathophysiology, genetic and molecular mechanisms of health and disease, as well as patient evaluation, diagnosis and management. Programs are required to include instruction that covers all organ systems and teach their students interpersonal and communication skills. Education in patient evaluation, diagnosis and management is required to cover the complete life span. PA training continues after a year of didactic with mandatory clinical rotations in surgery, internal medicine, pediatrics, obstetrics and gynecology, emergency medicine, and psychiatry[36] In order to become a licensed PA, one must pass the Physician Assistant National Certification Exam (PANCE).

Medical school traditionally consists of four years of schooling followed by a residency, which is anywhere from three to seven years depending on the specialty. The first year of medical school covers the basic medical sciences including anatomy,

physiology, biochemistry, histology, pharmacology, and pathophysiology. The second year of medical school emphasizes an organ systems-based approach with courses focused on disease pathophysiology, diagnosis, and management. Following the second year of medical school, students complete STEP 1, a standardized exam for medical licensure. Third- and fourth-year medical students' complete rotations in internal medicine, psychiatry, emergency medicine, pediatrics, general surgery, women's health, radiology, neurology, and family medicine. Typically during the fourth year of medical school, students complete STEP 2 of the US medical licensure exam. [3738]

Existing Research

Physician Assistant is a relatively new profession and there have been very few studies conducted on the mental health of PA students. However, there have been numerous studies showing that medical students have higher rates of depression, which lead to higher rates of suicidal ideation and burnout in the profession. [39] Cocke et al. conducted a study at the University of Texas Southwestern by administering the Patient Health Questionnaire 9 (PHQ-9) and Patient Health Questionnaire 2 (PHQ-2) to students in their first, second, and final semester of PA school.

The response rate to the survey was 79% (N=123). The PHQ-9 included questions that were framed for students to reflect on their feelings, mood, and activity/energy level over the past two weeks and targeted to assess the symptoms associated with depression according to the DSM-5. Students had answer options of "not at all," "several days," "more than half the days," or "nearly every day." Overall, 26.83% of students from all three cohorts had little interest or pleasure in activities for several days over the last two

weeks, 34.95% expressed feelings of sadness, depression, and hopelessness for “several days” over a two-week time period and 16.26% of students reported feeling tired and having minimal energy almost daily.

The PHQ-2 and PHQ-9 were both used in the scoring process. There were two methods of scoring, one with a cutoff score and one without. The first method used included a screening process utilizing the PHQ-2 scoring two questions asking if in the last two weeks “have you had little interest in doing activities or experienced feelings of depression or hopelessness?” If the student scored above a 3 then it was considered positive and all nine questions from the PHQ-9 were scored to assess severity. Results based on the PHQ-2 method found that 18.13% of students screened positive for depression.

The second method of scoring did not have a cut off and it utilized the PHQ-9 to both screen and monitor and then assigned a severity based on the score. This method using the PHQ-9 found that 98.37% of students were positive for at least minimal depression, and 47.15% for mild to severe depression.

Upon further analysis, results were obtained to look at the difference of depressive symptoms found among the different classes. Results were statistically significant showing that first and third year cohorts reported feeling more tired or having little energy in comparison to the second year ($P< 0.01$). This could be due to the first-year students having a difficult time adjusting to the rigor and stress of PA school and the third-year students feeling burnt out from clinicals and preparing for the stress of the PANCE. Other statistically significant results indicated differences between cohorts in

changes of sleep patterns ($P < 0.0436$). However, there were no other statistically significant results found between classes when analyzing the other questions on the PHQ-9. This study concludes that there is no difference in depression severity amongst cohorts. [40]

This was the first study to address the prevalence of depression in PA students and was able to obtain a large response rate of 79%. However, its only subjects were from one PA program making the study less generalizable since there have been no other studies done at other PA schools to compare to. The prevalence of depression at the University of Texas Southwestern may be higher or lower at another school depending on the learning environment and structure of the curriculum. The timing of the survey helped to eliminate skewing of responses because the survey was conducted at a time that was neither prior to or after an examination or vacation time. The study incorporated both the PHQ-2 and PHQ-9 yet when comparing the depression rate between the two questionnaires there was a drastic difference indicating that the PHQ-2 may be underrepresenting the prevalence of depression. The PHQ-9 has been utilized in a variety of studies and its purpose is to score the nine DSM5 criteria for depression based on a scale. The scale ranges from 0 to 3 with 0 indicating the patient is not experiencing any symptoms at all and 3 indicating that they are experiencing symptoms "nearly every day." [41] The PHQ-9 has a sensitivity and specificity of 88%, whereas the PHQ-2 has a sensitivity of 83% and specificity of 92%. [42] The difference in sensitivity between the PHQ-2 and PHQ-9 test attests for the importance in utilizing the second scoring method that this study had, which found that 98.37% of students were experiencing at least

minimal depression, whereas the PHQ-2 only found that 18.13% were screened positive for depression. However, the PHQ-9 has a scale of 1 to 27 with 1 to 4 accounting for minimal depression. Including scores as low as one to four, which is the marker for minimal depression, may be too low of a cutoff and lead to false positive screenings. [41] PA schools, as well as many other graduate level programs induce stress on students and due to the rigor and course load, some students may be more tired than normal or have minimal energy for outside activities, but not necessarily be depressed. Also, confounding variables were not accounted for in this study. The questionnaire did not ask students if they had a previous diagnosis of depression, prior or current treatment for depression, or a family history of depression. These are factors that could skew the results of the PHQ-9 because students in treatment may not be experiencing as many symptoms or as severe of symptoms and students who have a familial history are more at risk for depression than someone without a familial history. Overall, this study concludes that the prevalence of depression in PA students is comparable to that found in medical students and further research must be done on a larger sample size and include more PA programs.[4]

A cross sectional survey conducted at The University of Michigan Medical School by Schwenk, et al. researched the prevalence of depression and suicidal ideations in first through fourth year medical students, as well as the perceived stigma around depression. Students completed an anonymous web survey which contained the PHQ-9 with self-reported responses about experiencing feelings of depression, suicidal ideations, and the stigma around depression. This questionnaire was designed to aid clinicians in

assessing their patient's score and correlating it with that of the diagnostic and statistical manual of mental disorders (DSM-5) [42] The response rate of the survey was 65.7%(N=505). Female medical students' response rate was 78.9% compared to the male response rate of 54.6**%.** To eliminate dilution of the analysis of answers to the questions regarding stigma around depression and health care providers, the answer choices did not include a "neutral" option to ensure an "opinion" was captured. The survey results showed that 29.5% of medical students scored within the mild range for depression and 14.3% (95% CI of 11.3-17.3%) in the moderate to severe range, with little variation between first- and second-year students compared to third and fourth year, indicating statistically insignificant differences in depression rates between didactic and clinical years. 4.4% of students (95% CI of 2.6-6.1%) expressed suicidal ideations at one point throughout their medical education. Findings showed that 7.9% of students in their third and fourth year of medical school reported suicidal ideations which was more significant ($P < 0.01$) than the findings amongst first and second years, where only 1.7% had reported suicidal thoughts. The suicidal ideations may be greater in third- and fourth-year medical students as they now are providing care to patients and adapting to the clinical environment, while still studying for their STEP 2 exam. Along with the PHQ-9, the survey accounted for variables such as past history of depression diagnosis or a current diagnosis of depression, as well as students who have had both prior or current treatment for depression. 70 to 80% of students who scored in the moderate to severe depression range, based on the PHQ-9, did not have a past history of depression, nor prior treatment. Of the 14.2% of students who scored in the moderately to severe category, only 16.6%

were currently in treatment. These results indicate that the diagnosis of depression in medical school can be independent of a previous diagnosis or familial history.

Despite the 43% of students experiencing depressive thoughts and feelings, the sought-out treatment rates were remarkably low. Researchers assessed the stigma responses and their correlation with depression severity. When asked if "other students and faculty members would view me as unable to handle my responsibilities if I was depressed," 83.1% with moderate to severe depression scores responded "yes," whereas only 55.1% with none or minimal depression agreed with that statement (95% CI: 16.1 to 39.8, $P < 0.001$). When asked if "most people believe that depressed medical students would provide inferior treatment to their patients," 73.7% of medical students responded "yes." 45.9% of medical students with moderate to severe depression felt that "seeking help for depression would make me feel less intelligent as a medical student" (95% CI: 11.1 to 38.3, $P < 0.001$). 41% of medical students with moderate to severe depression believed that most other medical students would not want to work with a depressed medical student (95% CI: 17.3 to 47.3, $P < 0.001$). Finally, when asked "If I were depressed, I would not feel embarrassed or ashamed," 82.5% of respondents disagreed. This study concluded that there is an association between the severity of depression and the support of the stigmatization of depression, which may be a contributory factor to the lack of sought out treatment.

Results were also statistically significant ($P< 0.01$) while comparing male responses to females to four of the 27 stigma questions. A greater percentage of males

agreed that "most medical students would not want to work with a depressed medical student" and "depressed medical students are viewed as dangerous to their patients." [43]

This study is generalizable to medical students as a whole; (N=505) as The University of Michigan follows the standardized four-year curriculum approved by the AAMC, making findings applicable to students enrolled at other US medical schools. However, women had a much higher response rate and it is known that women have a higher prevalence of depression compared to men, meaning that this study may not reflect the true depression prevalence among all medical students due to the somewhat low response rate from men. [9] This survey utilized dichotomous variables through the portion of the survey that was assessing perceived stigma towards depression in medical students. Using dichotomous variables introduces a bias because some students may have felt indifferent to certain questions. The elimination of a "gray zone" answer choice in order to generate a concrete response could have affected the results.

Strengths of this study included an extensive analysis of responses to 27 questions regarding the perception of stigma around depression in medical students. The analysis included comparing and contrasting results between those who tested positive for moderate to severe versus those with minimal to no depression. Also, comparing answer differences between genders lead to the conclusion that males are more likely to yield responses that support the stigma around depression.

Depression is the most common mental illness in the general population. [44] Tija, et al. conducted a study at the University of Pennsylvania Medical School to attempt to identify the causes of undertreatment of medical students with depression. Various

studies have been conducted to identify the depression rate of medical students and to identify the factors that contribute to feelings of depression, yet few studies have been as extensive as this one to determine the prevalence of both pharmacological and psychological treatment of depression in medical students as well as what influences students to seek treatment. Addressing the factors that cause medical students to defer treatment may in turn help to decrease the suicide rate amongst physicians, which is almost two times higher than the general population. [45]

A cross sectional survey was conducted in 2001-2002 and included an anonymous self-report questionnaire. The questionnaire was designed to capture the severity of depression utilizing the 13-item Beck Depression Inventory (BDI) which assessed the symptoms of depression while also correlating it to the DSM-5 to ensure it's of aid to clinicians during their assessment and diagnostic process. [46] In order to determine suicidal ideation prevalence in medical students, the students were asked "Have you ever considered committing suicide" with answer choices of "yes, during medical school, yes before medical school, yes before and during, or no."

The response rate to the survey was 71.6% (N= 322). Results showed that 15.2% of students were depressed with Hispanics having 3.4 times greater risk of depression (95% CI: 1.32-8.4)**.** The results were statistically insignificant when comparing depressed to non-depressed students in regards to other demographics such as age, sex, or year of medical school. Of the students who were classified as being depressed based on the BDI scoring, 14% had severe depression, 18.4% had a past diagnosis of depression, and 20.4% experienced suicidal ideations. In regards to treatment, 26.5% of patients who

screened positive for depression on the BDI scale were receiving either therapy or taking antidepressants. Of those in treatment, 6% were in counseling, 8% were taking antidepressants and 12% were using both therapeutic modalities. Upon analysis of the demographics, the two most significant predictors of who sought treatment were found to be previous or current diagnosis of depression and family history of depression (both with P <0 .01). 76.9% of students who had a previous or current diagnosis of depression were in treatment, and 58.8% of students with a family history of depression were also receiving treatment. Additionally, patients older than 25 were more likely to seek treatment than patients younger than 25 (P < 0.012). In this study, students who expressed suicidal ideations were no more likely to receive treatment than those without suicidal ideations. This study concluded that the greater the severity of depression and suicidal ideation did not lead to a higher prevalence of treatment. [47]

This study is generalizable with a sample size of 322 and including subjects from all four years of medical school. Although the response rate was relatively high at 71.6%, the survey was only administered to students who attended lecture and class meetings. In order to obtain a truer reflection of the potential sample size, an online survey would have been more accessible to students to complete at their leisure, as some medical students attend lectures virtually. This study identified factors that led to increase in treatment such as a past history of depression or students above 25. It is critical that future research looks at other confounding variables to the barriers that medical students may be facing when it comes to accessing treatment or hesitancy to seek treatment considering that only around 25% of depressed students sought help. We must also consider that some students

may be reluctant to share that they are in treatment due to fear of not remaining anonymous or the stigma around depression and other mental illnesses noted in other studies. [43] The prevalence of depression was notably higher in Hispanic students. This could be due to an alpha error from a wide 95% CI (1.32 to 8.3) or a small sample size. Although, Hispanic students may have a slightly higher risk of depression, 3.4 times greater is most likely an overrepresentation. This study did not find that third- or fourth-year medical students with depression were any more likely than first or second years to obtain treatment. This indicates that schools may want to implement mental health screenings early on and address mental health specifically in medical students, rather than assuming students will take what they learn in a psychiatric module or a disease and diagnostic course and apply their knowledge of depression to themselves.

It is common knowledge that medical school and residency is a stress provoking time for students and trainees due to the extensive course load, pressure to perform well on examinations, and extended hours of work during training. The physical and emotional demand from medical school and residency often takes a toll on one's physical and psychological being. [48] A multi-site study was conducted at six medical school and residency programs throughout the US to assess the prevalence of depression and suicidal ideations in medical students and residents while accounting for socio-demographic factors such as ethnicity, gender, year of training and also the average amount of sleep.

The response rate of this survey was 89% (N=2,193) with medical students' response rate of 95% compared to resident's response rate of 88%. The survey consisted of one suicidal ideation question asking "how often they were bothered by thoughts that

they would be better off dead or in hurting themselves in some way in the last two week?" and 20 questions to assess for depression symptoms utilizing the Center for Epidemiologic Studies Depression Scale (CES-D).

Based on the CES-D scale, 12% screened positive for major depression and 9.2% for mild to moderate with prevalence being higher with those with a familial history of depression. 11.9% of residents screened positive for depression in comparison to 25% of medical students who did. Prevalence of mild to moderate (9.4%) and major depression (15.1%) were highest in second year medical students compared to any other year. This may be attributed to studying for their first STEP examination at the end of their second year. The prevalence of depression during the first two years of medical school was statistically significant when comparing it to third and fourth-year medical students ($P < 0.006$). However, more years of experience in residency did not translate to a lower prevalence of depression. Results were statistically insignificant ($P > 0.05$) when looking at rates of depression by race. However, there were statistically significant differences amongst ethnicities in regards to suicidal ideations with 13% of African Americans expressing suicidal ideations, whereas only 4.5% of Caucasians did. Suicidal ideations occurred in 68.5% of respondents with major depression symptoms and 20.4% of respondents with mild to moderate depression symptoms. There is a positive correlation between depression and suicidal ideation as respondents with a history of depression are 3.7 times more likely to express suicidal ideations ($P < 0.001$). The prevalence of suicidal ideations in medical students was 6.6% compared to 3.9% amongst residents. This is not surprising considering the higher prevalence of depression in medical students in this

study compared to residents. Another finding of this study was that the more severe the depression, the less cumulative hours of average sleep nightly (P< 0.001). [49] This finding aligns with the DSM-5 criteria which includes insomnia, or changes in sleep patterns as a symptom of depression. [2]

The strength of this study is its generalizability since it included six different medical school and residency programs dispersed throughout the United States to obtain the most diverse sample size possible. The validity of CES-D as a screening tool for depressive symptoms was assessed in a previous study which found that when using a cutoff score of 16, CES-D had low false negative and low false positive rates. With a sensitivity of 88%, people who screen positive using the CES-D most likely will end up with a diagnosis of depression by a clinician. [50] The results found that the prevalence of depression in medical students was 25%, yet in other studies it was found to be around 15 to 23%.[47] However, the higher prevalence of depression in this study may be a result of the diversity captured in this sample size. 61.5% of respondents identified as a minority and depression rates are higher in minority ethnicities. [51] Although the findings were statistically significant for African Americans having higher risk of suicidal ideation, this was a small sample size (N=67), so results may have been greater or less than in actuality. It is critical to identify depression in medical students early on, as death by suicide has been directly correlated to major depressive disorder and studies have found that suicide rates in physicians are 1.5 times greater in males than the general population and 2.3 times more prevalent in female physicians than the general population. [52]

Dyrbye et al. did a four-year longitudinal prospective study across 49 US medical schools to identify the risk of developing depressive symptoms during medical school. A survey was sent to incoming first year students to complete in an attempt to obtain measures on demographic and socioeconomic info, depressive symptoms, perceived stress, and amount of social support. The survey was then repeated during the medical students' fourth year.

The response rate was 55% for first year medical students and 79% responded to the second survey during their fourth year (N=3,743). The prevalence of depressive symptoms at year four was 31.2%. 39% of non-white medical students screened positive for experiencing depressive symptoms (95% CI 1.46 to 1.95, $P < 0.001$). Medical students who were single also were more at risk for depression with 32% of single medical students expressing symptoms (95% CI 1.15 to 1.75, $P < 0.001$) This may be explained by lack of consistent emotional support that a significant other can provide during a stressful time in one's life. Those with a familial income below the US median average income had an increased risk for depression symptoms with 37% of medical students who were a part of families who made less than 50,000 per year scoring positive for depression on the Patient-Reported Outcomes Measurement Information System (PROMIS) (95% CI 1.109 to 1.79, $P < 0.01$). The relationship between perceived stress and the development of depression was statistically significant with 49% of medical students that had perceived stress also developing depression symptoms by their fourth year. Social support was also assessed and those with less social support were more at risk ($P < 0.001$). After analyzing school related variables and the risk of students

developing depression, the only statistically significant result was found between medical schools with middle tuition cost and the risk of developing depression ($P < 0.03$). Results were insignificant for a relationship between developing depression and classroom size or average MCAT scores. Further analysis was done on the independent variables that were found to have a relationship with developing depression to determine if these factors truly could predict depressive symptoms in medical students. It was found that students with baseline depression symptoms at year one was three times more likely to still have depressive symptoms during year four than first year medical students without depressive symptoms (95% CI 2.49-3.89, $P <0.001$). Students with perceived high stress or low social support had a greater likelihood of developing depression symptoms by year four ($P< .001$). A depression risk score was calculated using predefined risk categories and accounting for independent factors and then the prevalence of depression in year four was assessed. Of those who were categorized as "high risk, 62.6% had depressive symptoms by year four compared to those with low risk scores where 15.4% had depressive symptoms by year four. [53]

This study was well conducted and is generalizable to the medical student population across the US due to the large sample size (N= 3,743), inclusion of almost 50 US medical schools and a diverse response population with 35% of respondents being non-white. This was the largest longitudinal study conducted to assess depression risk in US medical students. The measurement tools also proved to have strong validity. PROMIS is validated by the National Institutes of Health (NIH) Sensitivity of PROMIS was 83.1%, making it a reliable screening tool for depression, yet not as reliable as the

PHQ-9 which has 88% sensitivity. The perceived stress scales validity and reliability has been assessed in various studies including one where it used the stress scale to assess for tension headaches or migraines and another study where it was used to measure stress of medical students in China. [5455] Overall, the analysis of this study was well conducted because in order to account for variation in the relationship between student's independent factors and depression symptoms this study established a weighted risk score for each factor based on their odds ratio. This is beneficial because the risk scores could potentially be utilized by other schools to help establish which students may need extra support, early intervention, or continuous screening. Although this study accounted for baseline depression symptoms during the first year, they did not ask about previous treatment or diagnosis of depression or family history which could put students more at risk for developing depression by their fourth year. This was a longitudinal study, but there may be benefit to assessing symptoms in the second and third year as depression may be episodic. Overall, this study concluded that by year four, 31.2% of medical students will have depressive symptoms during their fourth year, and those who are single, have minimal social support, and are non-white are more at risk. [53]

As with any disease, prevention is even more important than treatment. Evidence shows that medical students are at increased risk of depression in comparison to the general population. Knowing that prevention is key, Chow et al. conducted a prospective cross-sectional study to identify personality traits, specifically work-related traits that may increase one's risk for depression or suicidal ideations.

Outcomes measured upon completion of students' first year of medical school were depression prevalence, suicidal ideation, and work-related personality traits. Depressive symptoms were screened using the PHQ-9 and suicidal ideation was assessed. The six personality traits being evaluated were commitment, discipline, dominance, stability, cooperation, and social competence. These six traits were measured using the "Business-focused Inventory of Personality 6 Factors" (BIP-6F). Statistical analysis was done via three methods with one of the methods adjusting for demographic information and another for socioeconomic factors.

The response rate for this study was 53.4% (N=437) with the average response age being 22. Results found that the prevalence of depression after one year of medical school was 20.7% and suicidal ideations was 14.7%. Without accounting for socio-economic or demographic information, stability and social competence were found to be associated with depression and suicidal ideation. However, once accounting for confounding variables, stability still had statistically significant results for association with depression and suicidal ideation, and dominance did for depression. In the models that accounted for age and gender and socioeconomic demographics, stability was protective against depression (OR: 0.19, 95% CI: 0.09–0.42, $p < 0.001$) and suicidal ideations (OR: 0.37, 95% CI: 0.16–0.87, $p < 0.01$). The higher one's score of stability on the BIP-6F, the lower the risk of depression and suicidal ideations. Upon adjusting for socio-economic demographics, those with "dominance" as a personality trait were more at risk for depression (OR: 2.46, 95% CI: 1.22-4.97, $p <.001$). Results were statistically

insignificant for a correlation between other personality traits such as commitment, discipline, and cooperation and the risk of depression and suicidal ideations. [56]

The generalizability of this study may be limited as it was the first study to assess work related personality traits and their association with depression and suicidal ideation, as well as the fact that it was conducted at only one medical school in Germany. This may be less generalizable to medical students in the US since the average age of the respondents in this study was 22, whereas in the US the average age for first year medical students is 24. [38]Also, about 73% of respondents were female, and females are known to have a higher risk of depression. [9] This study showed that when you find a potential risk factor for depression, it is important to screen for prevention to help eliminate long term effects of depression in medical students such as burnout and suicide. Personality traits have also been found to predict the trajectory of success for individuals in academia, therefore researchers should also be able to identify if there is a positive correlation between one's personality and development of a mental illness or if certain personality traits are protective against mental illness.[57]

The findings that stability is protective against depression and suicidal ideation is not surprising as stability was assessed in another study which found that medical students who had more stability were at less risk for burnout as well. [58] The prevalence of depression in medical students was 20.7% after their first year, however since the average age was 22 and a familial and past history of depression or mental illness were not assessed in this study, researchers may want to account for these factors in future studies. Also, the onset of depression typically presents in one's early 20's so it may be hard to

draw a definitive conclusion for a causal relationship between personality traits and the development of depression in medical students.[9] We can conclude that personality traits have the potential to identify which students may need more psychological support during medical school. There is benefit to screening for certain personality traits early in medical education to potentially prevent the development of depression and suicidal ideations.

There is significant evidence from various studies that supports higher prevalence of depression in medical students compared to the general population. [4] Other studies have been able to identify possible risk factors for depression in medical students [56] and shown that even with higher rates of depression the treatment rate is low. [4] Medical students must adapt readily to their rigorous academic environment in order to perform well on frequent examinations, all while attempting to maintain their physical and emotional wellbeing and relationships. Knowing the high prevalence of depression in medical students, Thompson et al. conducted a study that identified the prevalence of depression and suicidal ideations in two cohorts at the University of Hawaii JABSOM and implemented various programs and services to assess if there would be a decrease in depressive symptoms and suicidal ideations by comparing the pre-implementation vs post-implementation cohorts.

Depressive symptoms were measured in third year medical students using the Center for Epidemiologic Studies Depression Scale (CES-D). Suicidal ideations were assessed from the Primary Care Evaluation of Mental Disorders Patient Health Questionnaire (PRIME-MD). Following administration of the surveys, changes were

made to three different components of the program including: faculty education, medical student education, and medical student counseling. The program changes were decided based on the findings from another study which identified the barriers to treatment that medical students face including stigma, lack of time, cost and fear of loss of confidentiality. [47] The symptoms that were assessed via the CES-D were reviewed with the faculty in hopes that they would be able to better identify students that may be struggling. To enhance access to mental health care, students were made aware of individual counseling and psychiatry resources both on and off campus. The off-campus psychiatrists had agreed to see students for minimal cost ($25) to ease financial stress. Off campus services were offered for students who were concerned about their confidentiality being breached. In regards to medical student education changes, each student in every cohort received a handbook that addressed areas of stress that medical school students may need guidance on coping with such as maintaining relationships, making time to exercise, decreasing anxiety about finances, and managing stress. First and third year students both received lectures that helped students identify the risk factors for depression. Students were also provided mental health resources and first years were given the option to participate in a program that held small group discussions to discuss ways that people in healthcare can maintain their happiness and find purpose in their career. Upon implementation of this program, 33% of students participated.

The response rate for pre-implementation group was 75.9% (N=44) whereas the post-implementation groups response rate was 93.5% (N=58). 59.1% from the pre-implementation group had symptoms of mild to probable depression ($P < 0.01$) and

30.2% had suicidal ideations (P< 0.001). The post-implementation group was assessed after a year of exposure to the program changes and additional medical educational and mental health resources. Findings showed that 24.1% of students from post-implementation group experienced symptoms of mild or probable depression (P <0.01) and that 3% had suicidal ideations (P <0.001). This study was unable to obtain the number of students that received counseling due to confidentiality. Thompson et al. was able to conclude that implementing changes in medical student and faculty education on depression, and making resources more readily available led to statistically significant results in decreasing the depressive symptoms and suicidal ideations amongst medical students.[59]

Overall, this study was well conducted and results showed that implementing programs and making resources more accessible to both faculty and staff has the ability to decrease depressive symptoms and suicidal ideations amongst medical students. This study's generalizability may be minimal due to the low number of subjects in both pre and post-implementation groups as well as the fact that it was only conducted at one school. The validity of CES-D to measure depressive symptoms has been verified in multiple studies and in various ethnic groups. A study assessing depression following a cerebrovascular accident found the CES-D sensitivity to be 86% with 90% specificity. [60] The suicidal ideation question was derived from PRIME-MD Patient Health Questionnaire. PRIME-MD PHQ screening diagnosis has been compared to a clinician's and was found to have 85% sensitivity, indicating its validity as a screening tool.[61] The educational changes were strategically planned out, such as receiving lectures during first

and third year on risk factors for depression due to a previous study that noted symptoms of anxiety and depression are highest during these years. [62] The findings of this study showed a 35% decrease in depressive symptoms upon implementation of the program. However, the post-implementation program found that 24.1% of students experienced depression, which is on par with other medical schools' depression prevalence who do not have a program in place. [4] This indicates that The University of Hawaii JABSOM may have independent school variables that may be contributing to a higher prevalence of depression (59.1% pre-implementation), but does not take away from the statistically significant ($P< 0.01$) results that found medical education, faculty education, and more awareness of mental health resources leads to a decrease in depressive symptoms and suicidal ideations. Another potential limitation of this study was not accounting for ethnicity or previous history of depression or familial history. As the only medical school in Hawaii, the depression prevalence could be an overrepresentation of depression in Pacific Islanders. Studies have shown that Pacific Islanders have a higher prevalence of depression (21%) compared to the general population (7%). [63] We can infer that the post-implementation groups increased awareness of identifying depressive symptoms and more knowledge on access to services led to more treatment and less depressive symptoms and suicidal ideations.

METHODS

Study Design

To achieve the study aims, researchers will conduct a multi-program, prospective cohort study to identify the prevalence of depression in PA students and identify potential factors that may be correlated with the development of depression in PA school. Factors that will be assessed include demographic information as well as a familial and personal history of mental illness. Depressive symptoms will be measured utilizing the PHQ-9 and questionnaires will be distributed to obtain information related to demographics and mental health history.

Study Population and Sampling

PA programs will be included based on their attendance to the Physician Assistant Education Association (PAEA) conference and willingness to participate in the study. The PAEA has pre-defined regions of PA programs distributed across the country including: West, Mid-west, South, and Northeast. [64] Within each region, two PA programs that are willing to participate will be randomly selected and PA students entering each of these schools will be asked to participate in the study. PA students with a history or current diagnosis of depression will be included to assess whether the severity of their symptoms worsen during PA school.

There is limited data on the prevalence of depression amongst PA students, yet there is significant evidence supporting that medical students have a higher prevalence of depression than the general population. [43] With approximately 20% of medical students

experiencing depression during medical school, this study will require a sample size of 265 PA students to achieve a power of 80% with a level of significance being 5% in order to determine if PA students have a comparable prevalence of depression to medical students. PA students who participate in this study will receive a questionnaire at the beginning of their program to obtain demographic information and familial and personal mental health information, as well as the PHQ-9 to assess their baseline depression symptoms. Following the initial surveys, students will continue to complete the PHQ-9 at 6-month intervals until they graduate to determine the prevalence of depression in PA students.

Study Variables and Measures

Demographic information will be collected utilizing the Red-Cap database. The information obtained will include sex, age, single or married, race, and ethnicity. Age will be made into a categorical variable by giving participants the option to select 20 to 25, 25 to 30, or greater than 30. This will enable researchers to identify if any of these individual demographic factors are correlated with an increased risk of developing depression in PA school.

Familial and personal mental health history will be assessed in the format of a questionnaire in Red-Cap. Participants will be given a list of mental health disorders such as depression, anxiety, bipolar, and schizophrenia and will have the ability to select any that apply to a first degree relative or to themselves. The participant will also be asked if they have previously or are currently on any pharmacological treatment or enrolled in psychotherapy. This information will be secured in the Red-Cap database.

The primary outcome that is being measured is the severity of depression symptoms amongst PA students using the PHQ-9 (Appendix A). The PHQ-9 is comparable to the PRIME-MD clinician administered assessment but offers easier accessibility with equivalent sensitivity. [61] The validity of the PHQ-9 was investigated in a large multi-specialty study (N=6000) and was found to have a sensitivity and specificity of 88%. [41] The PHQ-9 scoring scale ranges from 0-27. Participants with a score > 4 will be considered to have experienced depression (Table 1) and all participants' depression symptom severity will be measured in six-month time intervals to assess if there is worsening of symptoms.

Table 1. Interpretation of the PHQ-9[65]

Diagnosis	Total score
No depression	0-4
Mild depression	5-9
Moderate depression	10 - 14
Major depression	> 14

Recruitment

Physician Assistant programs will be recruited primarily based on their attendance to the PAEA national annual conference. The programs will be informed about the new regulations set out by Accreditation Review Commission on Education for the Physician Assistant (ARC-PA) regarding the requirements needed to meet the standards of mental health for accreditation. By enrolling in this study, programs will be more likely to be successful in their compliance to the ARC-PA standards.

Programs that wish to participate will be randomly selected based on their geographical location. Two programs minimum from each of the pre-defined four regions will be selected. PA students attending these programs will learn about the details of this study and the requirements to participate.

The students that choose to participate will receive an email link to the Red-cap survey that includes demographic and familial/ personal mental health history, as well as access to the PHQ-9. Students who participate in each six-month interval survey will be placed in a raffle for one of four $250 amazon gift cards.

Data Collection

Demographic information and familial/personal mental health information will be obtained via a secure Red-Cap survey database. Participants will receive a link to their school email to complete this information.

Participants then will receive access to the PHQ-9 every six months to complete. The students will be given a one-week time frame to complete the questionnaire and will receive two reminder emails to complete the PHQ-9.

Anonymity will be maintained as each participant will receive a number that will serve as their identification number. Consent will be obtained from willing participants prior to the completion of any surveys or questionnaires.

Data analysis

Demographic information and familial/personal mental health history will be obtained utilizing the survey feature of the Red-Cap database system.

All demographic and familial history will be analyzed using chi square test to assess if there is a positive correlation between any of the study variables assessed and a new diagnosis of depression.

Data from the PHQ-9 will be obtained in six-month intervals starting at orientation and then throughout the duration of the program until graduation. The PHQ-9 will be scored utilizing the pre-existing scoring method. Depression will be defined as a score > 4. At each time interval, the prevalence of newly diagnosed depression will be reported as a proportion amongst those that did not previously have depression in the cohort. Those that have a previous or current diagnosis of depression will be analyzed in a sub-group.

Repeated measures ANOVA will be used to assess the PHQ-9 scores for each individual at each time interval to assess whether the depression symptoms have worsened. The repeated measures ANOVA will include those with a previous or current diagnosis of depression as well as those with a new diagnosis.

Timeline and Resources

This study will require two investigators. The first investigator's role will be to recruit PA programs at the PAEA conference. This investigator will be in charge of educating PA programs on the importance of identifying mental health issues amongst their students and how to stay in accordance with the ARC-PA standards. The first investigator will also obtain formal consent from all participants. The other investigator will gather demographic, familial and personal mental health information, and distribute the PHQ-9 to all consented participants.

Resources required to complete this study include access to the Red-Cap database as well as a biostatistician to analyze the results. This study will follow a strict timeline (Table 2) that includes recruitment, IRB approval, and analysis of the data obtained. All participants will receive two weekly reminders to complete both the Red-Cap survey as well as the PHQ-9. The initial data will be analyzed and those with a previous or current diagnosis of depression will be placed in a separate group for ANOVA analysis. Follow up PHQ-9's will be distributed every six months for the duration of the participants PA program, which is typically two to two and a half years. Lastly, the final data analysis will occur in summer of 2024 and submission for peer review will follow in the fall of 2024.

Table 2. Timeline of Proposed Goals

Time Frame	Objective
Fall 2021	Submission for IRB approval Recruit PA programs from the PAEA conference.
Winter 2022	Obtain funding Obtain access to Red-Cap Finalize consent amongst participating PA programs
Spring 2022	Red-Cap survey sent to participating PA students

	PHQ-9 Sent to participating PA students Obtain consent from all participants
Summer 2022	Data analysis of initial responses
Fall 2022	Second PHQ-9 sent to PA students
Winter 2023	Third PHQ-9 sent to PAa students
Summer 2023	Fourth PHQ-9 sent to PA students
Winter 2024	Final PHQ-9 sent to PA students
Spring 2024	Analysis of all data

Institutional Review Board

Institutional Review Board (IRB) board approval including approval as exempt status will be required for this study protocol. This study poses minimal risk to the human subjects as it involves completion of surveys in which the subjects will consent to. The data that is collected and recorded will remain anonymous in order to protect the identity of the subjects involved. As such, this study qualifies under Common Rule Category 2.[66]

CONCLUSION

Discussion

The prevalence of depression amongst medical students has been well researched and documented. Medical students experience higher rates of depression (27.2%) in comparison to the general population (7.1%). [49] The physician assistant profession growth rate was 31% in 2019, yet there has only been one study conducted on the mental health of physician assistant students. [640] This study determines the prevalence of depression amongst PA students with a study sample that includes various PA programs throughout the United States. The purpose of this study is to assess if PA students have a higher prevalence of depression in comparison to the general population.

The existing literature on the prevalence of depression among PA students is minimal. The one study that has been published was conducted at The University of Texas Southwestern (N=123). This study did not account for variable measures including previous history of mental illness, familial history, or race. [40] This study model would enable subgroup analysis by collecting data on potential variables including race, age, familial or personal history of depression or other mental illnesses. This study will also incorporate a larger sample population to allow for more generalizability.

Potential limitations of this study include non-response bias due to limited survey responses. Results may not be as generalizable as subjects may be lost in follow-up. This study model requires completion of survey in six-month time intervals to assess the severity of depressive symptoms and their changes throughout PA school.

The benefits of this study will outweigh the potential limitations as this will be amongst the first studies to determine the prevalence of depression among PA students. This study will be the first to include subjects from various programs across the United States to help eliminate any bias that may be introduced as a result of variability in education models. The results of this study will be comparable to the multitude of studies done to assess the prevalence of depression among medical students. This study utilizes the PHQ-9 which is a survey that is commonly used to screen for depression. [65]

Summary

The collective literature review of research done on the prevalence of depression among medical students resulted in similar findings. The results of various studies conducted on medical students have shown that the prevalence of depression is significantly greater amongst medical students than the general population. [4 9]

Studies in the above literature review had consistent findings with the prevalence of depression being >20% in medical students with most experiencing worsening severity throughout their education. [4349 59] Overall, the studies were generalizable and can be compared to the general population as the screening modalities used in these studies are popular in a majority of clinical settings for assessing for symptoms of depression. [65] Screening modalities for depression included CES-D and PHQ-9 which both had sensitivity rates of 88%.[42 50]

Some of the studies included in the literature review accounted for sociodemographic measures, yet some did not. This leads room for interpretation of results as certain ethnicities are more at risk for developing depression than others. [63]

This study will ensure to account for sociodemographic variables to allow for subgroup analysis of data as needed.

To date, there is only one study that has been conducted to assess the prevalence of depression in PA students. This study consisted of one program and did not account for other potential variables including sociodemographic factors. Results of this study found that 34.95% of PA students expressed feelings of depression. [9] This study will help to obtain more data on the prevalence of depression among PA students while including a larger more representable sample size by including various PA programs from across the nation. The purpose of this study is to assess if the prevalence of depression among PA students is comparable to that of medical students.

Clinical Health Significance

Mental illness plagues 20% of the American population with 7.1% suffering from depression alone.[1 9] Mental illness has proven to be even more prominent in the medical profession with approximately 20% of medical students experiencing depression. [4] Thus far, the sole study conducted among physician assistant students showed that 34.95% of PA students screened positive for depression utilizing the PHQ-9. [40]

This study is of significant importance as it is critical to identify mental illness, particularly depression, in medical and PA students as studies have shown that physicians have higher suicide rates than the general population and also report significant career burnout. [39] Identifying the prevalence of depression in PA students may in turn reduce the burnout in the PA profession with 27% of PAs reporting leaving a job due to stress. [7]

Finally, identifying the prevalence of depression among PA students is crucial in order to compare it to that of medical students. Various studies have been conducted amongst medical students and research has shown that medical students have higher levels of psychological distress in comparison to their peers who had completed master degrees in other studies. [67] The education model for PAs is very similar to that of medical students. This study will identify the prevalence of depression among PA students and has the potential to lead to changes in the education system for both PA and medical students to help reduce overall stress and improve the prevalence of mental illness.

APPENDIX A: PHQ-9

Over the course of the last 2 weeks have you experienced any of the following symptoms?

Question	Not at all	Several days	More than half the days	Nearly every day
Little interest or pleasure in doing things?	0	1	2	3
Feeling down, depressed, or hopeless?	0	1	2	3
Trouble falling asleep or sleeping too much?	0	1	2	3
Feeling tired or have minimal energy?	0	1	2	3
Poor appetite or excessive eating?	0	1	2	3

Feeling bad about yourself or feeling that you are a failure?	0	1	2	3
Trouble concentrating while trying to complete a task?	0	1	2	3
Moving or speaking slowly or the opposite - feeling fidgety or restlessness?	0	1	2	3
Thoughts of hurting yourself or that you would be better off dead?	0	1	2	3

LIST OF JOURNAL ABBREVIATIONS

Am. J. Epidemiol.	American Journal of Epidemiology
Am. J. Psychiatry	The American Journal of Psychiatry
Annu. Rev. Clin. Psychol.	The Annual Review of Clinical Psychology
Arch. Gen. Psychiatry	The Archives of General Psychiatry
Asian J. Psychiatry	Asian Journal of Psychiatry
Br. J. Gen. Pract.	The British Journal of General Practice
Br. J. Psychiatry Suppl.	The British Journal of Psychiatry Supplement
Br. Med. J	The British Medical Journal
CAPMH	The International Association for Child and Adolescent Psychiatry and Allied Professions
Gen. Hosp. Psychiatry	General Hospital Psychiatry
Hum. Brain Mapp.	Human Brain Mapping
Hum. Psychopharmacol.	Human Psychopharmacology
Indian J. Psychiatry	The Indian Journal of Psychiatry
Int. J. Environ. Res. Public Health.	International Journal of Environmental Research and Public Health
Int J Prev Med.	The International Journal of Preventative Medicine
Int. J. Psychiatry Med.	The International Journal of Psychiatry in Medicine
J. Am. Acad. Physician Assist.	The Journal of the American Academy of Physician Assistants
J. Assoc. Am. Med. Coll.	The Journal of the Association of American Medical Colleges

J. Gen. Intern. Med.	The Journal of General Internal Medicine
J. Grad. Med. Educ.	The Journal of Graduate Medication Education
J. Health Psychol.	The Journal of Health Psychology
JACH	The Journal of American College Health
JAMA	The Journal of the American Medical Association
JCPSP	Journal of the College of Physicians and Surgeons Pakistan
JGSM	The Journal of Gender-Specific Medicine
JHP	The Journal of Health Psychology
JPAE	The Journal of Physician Assistant Education
Med. Educ.	Medical Education
Neuropsychiatr. Dis. Treat.	Neuropsychiatric Disease and Treatment
Postgrad. Med.	Postgraduate Medical Journal
Psychiatr. Serv.	Psychiatric Services
Singapore Med. J.	Singapore Medical Journal

REFERENCES

1. May 1, 2019. Survey: Americans becoming more open about mental health. https://www.apa.org. Accessed July 12, 2021. https://www.apa.org/news/press/releases/2019/05/mental-health-survey

2. Vahia VN. Diagnostic and statistical manual of mental disorders 5: A quick glance. *Indian J Psychiatry*. 2013;55(3):220-223. doi:10.4103/0019-5545.117131

3. Mojtabai R, Olfson M, Han B. National Trends in the Prevalence and Treatment of Depression in Adolescents and Young Adults. *Pediatrics*. 2016;138(6). doi:10.1542/peds.2016-1878

4. Rotenstein LS, Ramos MA, Torre M, et al. Prevalence of Depression, Depressive Symptoms, and Suicidal Ideation Among Medical Students: A Systematic Review and Meta-Analysis. *JAMA*. 2016;316(21):2214-2236. doi:10.1001/jama.2016.17324

5. Center C, Davis M, Detre T, et al. Confronting depression and suicide in physicians: a consensus statement. *JAMA*. 2003;289(23):3161-3166. doi:10.1001/jama.289.23.3161

6. Physician Assistants : Occupational Outlook Handbook: : U.S. Bureau of Labor Statistics. Accessed June 18, 2020. https://www.bls.gov/ooh/healthcare/physician-assistants.htm

7. B C, Tc M, N S, Vl G, Ac E. Burnout, Job Satisfaction, and Stress Levels of PAs. JAAPA : official journal of the American Academy of Physician Assistants. doi:10.1097/01.JAA.0000544305.38577.84

8. Brody DJ, Pratt LA, Hughes JP. Prevalence of Depression Among Adults Aged 20 and Over: United States, 2013-2016. *NCHS Data Brief*. 2018;(303):1-8.

9. NIMH » Major Depression. Accessed May 4, 2020. https://www-nimh-nih-gov.ezproxy.bu.edu/health/statistics/major-depression.shtml

10. Sullivan PF, Neale MC, Kendler KS. Genetic epidemiology of major depression: review and meta-analysis. *Am J Psychiatry*. 2000;157(10):1552-1562. doi:10.1176/appi.ajp.157.10.1552

11. Frank E, Dingle AD. Self-reported depression and suicide attempts among U.S. women physicians. *Am J Psychiatry*. 1999;156(12):1887-1894. doi:10.1176/ajp.156.12.1887

12. Firth-Cozens J. Individual and organizational predictors of depression in general practitioners. *Br J Gen Pract*. 1998;48(435):1647-1651.

13. Guille C, Speller H, Laff R, Epperson CN, Sen S. Utilization and Barriers to Mental Health Services Among Depressed Medical Interns: A Prospective Multisite Study. *J Grad Med Educ*. 2010;2(2):210-214. doi:10.4300/JGME-D-09-00086.1

14. Young EA. Sex differences and the HPA axis: implications for psychiatric disease. *J Gend-Specif Med JGSM Off J Partnersh Womens Health Columbia*. 1998;1(1):21-27.

15. Neumeister A, Nugent AC, Waldeck T, et al. Neural and behavioral responses to tryptophan depletion in unmedicated patients with remitted major depressive disorder and controls. *Arch Gen Psychiatry*. 2004;61(8):765-773. doi:10.1001/archpsyc.61.8.765

16. Goldberg JF, Burdick KE, Endick CJ. Preliminary randomized, double-blind, placebo-controlled trial of pramipexole added to mood stabilizers for treatment-resistant bipolar depression. *Am J Psychiatry*. 2004;161(3):564-566. doi:10.1176/appi.ajp.161.3.564

17. Fitzgerald PB, Laird AR, Maller J, Daskalakis ZJ. A meta-analytic study of changes in brain activation in depression. *Hum Brain Mapp*. 2008;29(6):683-695. doi:10.1002/hbm.20426

18. Hasler G, van der Veen JW, Tumonis T, Meyers N, Shen J, Drevets WC. Reduced prefrontal glutamate/glutamine and gamma-aminobutyric acid levels in major depression determined using proton magnetic resonance spectroscopy. *Arch Gen Psychiatry*. 2007;64(2):193-200. doi:10.1001/archpsyc.64.2.193

19. Germain A, Kupfer DJ. Circadian rhythm disturbances in depression. *Hum Psychopharmacol*. 2008;23(7):571-585. doi:10.1002/hup.964

20. Baumeister RF, Campbell JD, Krueger JI, Vohs KD. Does High Self-Esteem Cause Better Performance, Interpersonal Success, Happiness, or Healthier Lifestyles? *Psychological Science Public Interest J Am Psychol Soc*. 2003;4(1):1-44. doi:10.1111/1529-1006.01431

21. Henriksen IO, Ranøyen I, Indredavik MS, Stenseng F. The role of self-esteem in the development of psychiatric problems: a three-year prospective study in a clinical sample of adolescents. *Child Adolesc Psychiatry Ment Health*. 2017;11. doi:10.1186/s13034-017-0207-y

22. Cheong EV, Sinnott C, Dahly D, Kearney PM. Adverse childhood experiences (ACEs) and later-life depression: perceived social support as a potential protective factor. *BMJ Open*. 2017;7(9):e013228. doi:10.1136/bmjopen-2016-013228

23. Kendler KS, Aggen SH, Neale MC. Evidence for Multiple Genetic Factors Underlying DSM-IV Criteria for Major Depression. *JAMA Psychiatry*. 2013;70(6):599-607. doi:10.1001/jamapsychiatry.2013.751

24. Azeem R, Zubair UB, Jalil A, Kamal A, Nizami A, Minhas F. Prevalence of Suicide Ideation and its Relationship with Depression among Transgender Population. *J Coll Physicians Surg--Pak JCPSP*. 2019;29(4):349-352. doi:10.29271/jcpsp.2019.04.349

25. Sandfort TGM, Graaf R de, Bijl RV, Schnabel P. Same-Sex Sexual Behavior and Psychiatric Disorders: Findings From the Netherlands Mental Health Survey and Incidence Study (NEMESIS). *Arch Gen Psychiatry*. 2001;58(1):85-91. doi:10.1001/archpsyc.58.1.85

26. Wells KB, Golding JM, Burnam MA. Psychiatric disorder in a sample of the general population with and without chronic medical conditions. *Am J Psychiatry*. 1988;145(8):976-981. doi:10.1176/ajp.145.8.976

27. Fiske A, Wetherell JL, Gatz M. Depression in Older Adults. *Annu Rev Clin Psychol*. 2009;5:363-389. doi:10.1146/annurev.clinpsy.032408.153621

28. Kessler RC, Nelson CB, McGonagle KA, Liu J, Swartz M, Blazer DG. Comorbidity of DSM-III-R major depressive disorder in the general population: results from the US National Comorbidity Survey. *Br J Psychiatry Suppl*. 1996;(30):17-30.

29. Blaine B. Does depression cause obesity?: A meta-analysis of longitudinal studies of depression and weight control. *J Health Psychol*. 2008;13(8):1190-1197. doi:10.1177/1359105308095977

30. Ng CWM, How CH, Ng YP. Depression in primary care: assessing suicide risk. *Singapore Med J*. 2017;58(2):72-77. doi:10.11622/smedj.2017006

31. Fournier JC, DeRubeis RJ, Hollon SD, et al. Antidepressant drug effects and depression severity: a patient-level meta-analysis. *JAMA*. 2010;303(1):47-53. doi:10.1001/jama.2009.1943

32. March J, Silva S, Petrycki S, et al. Fluoxetine, cognitive-behavioral therapy, and their combination for adolescents with depression: Treatment for Adolescents With Depression Study (TADS) randomized controlled trial. *JAMA*. 2004;292(7):807-820. doi:10.1001/jama.292.7.807

33. Depression Treatment and Management | Anxiety and Depression Association of America, ADAA. Accessed May 8, 2020. https://adaa.org/understanding-anxiety/depression-treatment-management#

34. Khalid N, Atkins M, Tredget J, Giles M, Champney-Smith K, Kirov G. The effectiveness of electroconvulsive therapy in treatment-resistant depression: a naturalistic study. *J ECT*. 2008;24(2):141-145. doi:10.1097/YCT.0b013e318157ac58

35. History of the PA Profession and the American Academy of PAs. AAPA. Accessed July 13, 2021. https://www.aapa.org/about/history/

36. Luke S. Standards of Accreditation. ARC-PA. Accessed May 9, 2020. http://www.arc-pa.org/accreditation/standards-of-accreditation/

37. What to Expect in Medical School. Accessed June 22, 2020. https://students-residents.aamc.org/choosing-medical-career/article/what-expect-medical-school/

38. Understanding the Process. AAMC. Accessed July 13, 2021. https://students-residents.aamc.org/understanding-process/understanding-process

39. Orozco J, Furman J, Roman C, Guthrie J, Jackson C. Burnout prevalence in PA students. *J Am Acad Physician Assist*. 2016;29(10). doi:10.1097/01.JAA.0000490115.04561.27

40. Cocke KD, Klocko DJ, Kindratt TB. Screening for Undetected Depression in Physician Assistant Students. *J Physician Assist Educ Off J Physician Assist Educ Assoc*. 2019;30(2):118-121. doi:10.1097/JPA.0000000000000247

41. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9. *J Gen Intern Med*. 2001;16(9):606-613. doi:10.1046/j.1525-1497.2001.016009606.x

42. Martin A, Rief W, Klaiberg A, Braehler E. Validity of the Brief Patient Health Questionnaire Mood Scale (PHQ-9) in the general population. *Gen Hosp Psychiatry*. 2006;28(1):71-77. doi:10.1016/j.genhosppsych.2005.07.003

43. Schwenk TL, Davis L, Wimsatt LA. Depression, stigma, and suicidal ideation in medical students. *JAMA*. 2010;304(11):1181-1190. doi:10.1001/jama.2010.1300

44. James SL, Abate D, Abate KH, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*. 2018;392(10159):1789-1858. doi:10.1016/S0140-6736(18)32279-7

45. Schernhammer ES, Colditz GA. Suicide rates among physicians: a quantitative and gender assessment (meta-analysis). *Am J Psychiatry*. 2004;161(12):2295-2302. doi:10.1176/appi.ajp.161.12.2295

46. Beck AT, Beck RW. Screening depressed patients in family practice. A rapid technic. *Postgrad Med*. 1972;52(6):81-85. doi:10.1080/00325481.1972.11713319

47. Tjia J, Givens JL, Shea JA. Factors associated with undertreatment of medical student depression. *J Am Coll Health J ACH*. 2005;53(5):219-224. doi:10.3200/JACH.53.5.219-224

48. Levey RE. Sources of stress for residents and recommendations for programs to assist them. *Acad Med J Assoc Am Med Coll*. 2001;76(2):142-150. doi:10.1097/00001888-200102000-00010

49. Goebert D, Thompson D, Takeshita J, et al. Depressive symptoms in medical students and residents: a multischool study. *Acad Med J Assoc Am Med Coll*. 2009;84(2):236-241. doi:10.1097/ACM.0b013e31819391bb

50. Weissman MM, Sholomskas D, Pottenger M, Prusoff BA, Locke BZ. Assessing depressive symptoms in five psychiatric populations: a validation study. *Am J Epidemiol*. 1977;106(3):203-214. doi:10.1093/oxfordjournals.aje.a112455

51. Bailey RK, Mokonogho J, Kumar A. Racial and ethnic differences in depression: current perspectives. *Neuropsychiatr Dis Treat*. 2019;15:603-609. doi:10.2147/NDT.S128584

52. Schernhammer ES, Colditz GA. Suicide rates among physicians: a quantitative and gender assessment (meta-analysis). *Am J Psychiatry*. 2004;161(12):2295-2302. doi:10.1176/appi.ajp.161.12.2295

53. Dyrbye LN, Wittlin NM, Hardeman RR, et al. A Prognostic Index to Identify the Risk of Developing Depression Symptoms Among U.S. Medical Students Derived From a National, Four-Year Longitudinal Study. *Acad Med J Assoc Am Med Coll*. 2019;94(2):217-226. doi:10.1097/ACM.0000000000002437

54. Khalili R, Sirati Nir M, Ebadi A, Tavallai A, Habibi M. Validity and reliability of the Cohen 10-item Perceived Stress Scale in patients with chronic headache: Persian version. *Asian J Psychiatry*. 2017;26:136-140. doi:10.1016/j.ajp.2017.01.010

55. Seedhom AE, Kamel EG, Mohammed ES, Raouf NR. Predictors of Perceived Stress among Medical and Nonmedical College Students, Minia, Egypt. *Int J Prev Med*. 2019;10. doi:10.4103/ijpvm.IJPVM_6_18

56. Chow WS, Schmidtke J, Loerbroks A, Muth T, Angerer P. The Relationship between Personality Traits with Depressive Symptoms and Suicidal Ideation among Medical Students: A Cross-Sectional Study at One Medical School in Germany. *Int J Environ Res Public Health*. 2018;15(7). doi:10.3390/ijerph15071462

57. Lievens F, Coetsier P, De Fruyt F, De Maeseneer J. Medical students' personality characteristics and academic performance: A five-factor model perspective. *Med Educ*. 2002;36(11):1050-1056. doi:10.1046/j.1365-2923.2002.01328.x

58. Dunn LB, Iglewicz A, Moutier C. A conceptual model of medical student well-being: promoting resilience and preventing burnout. *Acad Psychiatry J Am Assoc Dir Psychiatr Resid Train Assoc Acad Psychiatry*. 2008;32(1):44-53. doi:10.1176/appi.ap.32.1.44

59. Thompson D, Goebert D, Takeshita J. A program for reducing depressive symptoms and suicidal ideation in medical students. *Acad Med J Assoc Am Med Coll*. 2010;85(10):1635-1639. doi:10.1097/ACM.0b013e3181f0b49c

60. Parikh RM, Eden DT, Price TR, Robinson RG. The sensitivity and specificity of the Center for Epidemiologic Studies Depression Scale in screening for post-stroke depression. *Int J Psychiatry Med*. 1988;18(2):169-181. doi:10.2190/bh75-euya-4fm1-j7qa

61. Spitzer RL, Kroenke K, Williams JB. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. *JAMA*. 1999;282(18):1737-1744. doi:10.1001/jama.282.18.1737

62. Chandavarkar U, Azzam A, Mathews CA. Anxiety symptoms and perceived performance in medical students. *Depress Anxiety*. 2007;24(2):103-111. doi:10.1002/da.20185

63. Subica AM, Aitaoto N, Link BG, Yamada AM, Henwood BF, Sullivan G. Mental Health Status, Need, and Unmet Need for Mental Health Services Among U.S. Pacific Islanders. *Psychiatr Serv*. 2019;70(7):578-585. doi:10.1176/appi.ps.201800455

64. Physician Assistant Education Association, Chitwood R, Yuen C. *By the Numbers: Program Report 34*. Physician Assistant Education Association; 2019. doi:10.17538/PR34.2019

65. The PHQ-9. Accessed July 13, 2021. https://www-ncbi-nlm-nih-gov.ezproxy.bu.edu/pmc/articles/PMC1495268/

66. Electronic Code of Federal Regulations (eCFR). Electronic Code of Federal Regulations (eCFR). Accessed July 13, 2021. https://www.ecfr.gov/

67. Brazeau CMLR, Shanafelt T, Durning SJ, et al. Distress among matriculating medical students relative to the general population. *Acad Med J Assoc Am Med Coll*. 2014;89(11):1520-1525. doi:10.1097/ACM.0000000000000482

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