

MENTAL HEALTH ASSESSMENT OF DENTAL STUDENTS
AND DENTAL RESIDENTS IN A MIDWESTERN DENTAL
SCHOOL: A PILOT STUDY

A THESIS IN
Oral and Craniofacial Sciences

Presented to the Faculty of the University
Of Missouri-Kansas City in partial fulfillment of
the requirements for the degree

MASTER OF SCIENCE

by
TAYLOR C. LITTLE

B.S., Murray State University, 2016
D.M.D., A.T. Still University Missouri School of Dentistry and Oral Health, 2021

Kansas City, Missouri
2023

MENTAL HEALTH ASSESSMENT OF DENTAL STUDENTS
AND DENTAL RESIDENTS IN A MIDWESTERN DENTAL
SCHOOL: A PILOT STUDY

Taylor Little, Candidate for the Master of Science Degree

University of Missouri-Kansas City, 2023

ABSTRACT

This study examined which demographic factors were associated with high levels of anxiety and depression in dental students and dental residents in a midwestern dental school. A twenty-four-item survey was distributed to 461 dental students and dental residents. The survey was divided into three domains including student and resident demographics, level of anxiety, and level of depression. Demographic factors were program of study, year of study, belonging to a high-risk group, marital status, parental status, physical activity, and social media usage. A high-risk group was defined as an individual who identified as African American, American Indian or Alaska Native, Asian, Hispanic or Latino, LGBTQ+, Native Hawaiian or Pacific Islander, or multiracial. The level of depression was measured utilizing the Patient Health Questionnaire 9 (PHQ-9), and level of anxiety was measured utilizing the General Anxiety Disorder 7 (GAD-7). To determine associations between demographic factors and levels of anxiety and depression Fisher's Exact or Chi-squared tests were used. Only 12 respondents were dental residents and were excluded from further analyses due to insufficient statistical power. Survey data revealed no statistically significant association

between level of anxiety or depression and year of study. Survey data revealed a statistically significant association of a low level of anxiety and greater than three days per week of physical activity. Additionally, survey data revealed a statistically significant association between a high level of depression and belonging to a high-risk group. Overall, results of this study suggest that some dental student demographics are associated with levels of anxiety and depression.

APPROVAL PAGE

The faculty listed below, appointed by the Dean of the School of Dentistry, have examined a thesis titled “Mental Health Assessment of Dental Students and Dental Residents in a Midwestern Dental School: A Pilot Study”, presented by Taylor Little, a candidate for the Master of Science Degree in Oral and Craniofacial Sciences, and hereby certify that in their opinion it is worthy of acceptance.

Supervisory Committee

Melanie Simmer-Beck, PhD, RDH, Committee Chair
Department of Dental Public Health and Behavioral Science

Mary P. Walker, D.D.S., PhD, Committee Co-Chair
Department of Oral & Craniofacial Sciences

JoAnna M. Scott, PhD.
Department of Research & Graduate Programs

Sarah L. Dallas, PhD.
Department of Oral & Craniofacial Sciences

CONTENTS

ABSTRACT.....	iii
TABLES	viii
INTRODUCTION	1
Mental Health in the United States	1
Mental Health Among Medical Healthcare Professions.....	5
Mental Health in the Dental Profession	6
Mental Health of Dental Students and Residents	7
Problem Statement.....	13
Hypotheses.....	13
METHODS	15
Survey Distribution and Data Collection.....	17
Experimental Design.....	18
Data Analysis	20
RESULTS	21
Demographics of Dental Students and Residents	21
Levels of Anxiety.....	23
Levels of Depression.....	25

DISCUSSION.....	27
Clinical Implications.....	31
Study Limitations.....	33
Future Investigations.....	33
CONCLUSIONS.....	35
LITERATURE CITED.....	36
APPENDIX.....	40
A. SURVEY.....	40
B. VERBAL RECRUITMENT CLASSROOM SCRIPT TO DENTAL STUDENTS.....	46
C. EMAIL RECRUITMENT SCRIPT TO RESIDENTS	48
D. FOLLOW-UP EMAIL SCRIPT TO STUDENTS	50
E. FOLLOW-UP EMAIL SCRIPT TO RESIDENTS	52
F. IRB APPROVAL LETTER.....	54
VITA.....	56

TABLES

Table	Page
1. Experimental Design: Independent and Dependent Variables	19
2. Summary of Demographics for Dental Students and Dental Residents.....	22
3. Relationship Between Levels of Anxiety with Demographic Factors.....	24
4. Relationship Between Levels of Depression with Demographic Factors.....	25

CHAPTER 1

INTRODUCTION

Mental Health in the United States

Recently, there has been an increase in awareness of mental health and mental illness in the United States (U.S.) (Mental Health America 2020; Centers for Disease Control and Prevention 2021; National Institute of Mental Health 2021). While the terms mental health and mental illness are often substituted for one another, it is important to note the differences. Mental illness is defined as a diagnosed medical condition that disrupts an individual's thoughts, feelings, mood, ability to relate to others, and daily functioning (Centers for Disease Control and Prevention 2021). Some common mental illnesses include depression, anxiety, attention-deficit/hyperactivity disorder, addictive behaviors, and bipolar disorder (Centers for Disease Control and Prevention 2021). On the other hand, mental health refers to someone's emotional, psychological, and social well-being (Centers for Disease Control and Prevention 2021). Mental health also affects the way someone thinks, feels, and acts, but can lack a formal mental illness diagnosis (Centers for Disease Control and Prevention 2021). Mental health can fluctuate and be episodic: with periods of a poor mental state followed by periods of a healthy mental state (National Institute of Mental Health 2021). Symptoms of poor mental health can vary from feeling sad, excessive worrying, extreme mood changes of highs and lows, inability to cope with stress, problems with alcohol and drug use, and suicidal ideation (Centers for Disease Control and Prevention 2021; National Institute of Mental Health 2021). The cause of poor mental health is multifactorial. Some of these factors

include a history of trauma or abuse, biological factors, chemical imbalances in the brain, lack of social support, and periods of high stress (Centers for Disease Control and Prevention 2021; National Institute of Mental Health 2021). The differences between mental illness and mental health may appear subtle, but it is important to become aware of the differences between the two.

Prevalence of mental illness has been relatively well documented, while mental health can be more difficult to quantify since it is based on an individual's perception and not a formal diagnosis (Mental Health America 2020; Centers for Disease Control and Prevention 2021; National Alliance on Mental Illness 2021). Mental illness can be diagnosed at each stage of life and can affect people of all ages, regardless of socioeconomic status, gender, or race, making mental illness one of the most common health conditions in the U.S. (National Institute of Mental Health 2021). According to the Centers for Disease Control and Prevention (CDC), nearly 50% of all people in the U.S. will be diagnosed with a mental illness at some point throughout their lifetime (2021). In any given year, one in five Americans will experience a mental illness (Centers for Disease Control and Prevention 2021; National Alliance on Mental Illness 2021). In 2020, 19% of adults in the United States experienced a mental illness, which is equivalent to over 47 million people (Mental Health America 2020). Mental illness does not affect all demographics equally. According to the National Alliance on Mental Illness (NAMI), there are several high-risk groups; non-Hispanic multiracial adults had the highest prevalence of mental illness at 32%, with non-Hispanic white adults second highest at 22%, followed by non-Hispanic American Indian adults at 19%, followed next by Hispanic or Latino adults at 18%, then African American

adults at 17%, and finally non-Hispanic Asian adults at 14%. By far, NAMI reports that the demographic group experiencing the highest prevalence of mental illness at all ages are those who identify as lesbian, gay, or bisexual at 44% (2021). Additionally, females are more commonly affected by mental illness than males (Mental Health America 2020; National Alliance on Mental Illness 2021). As discussed, the reported prevalence of mental illness in adults varies widely from 14% to 44% depending on race, gender identity, and sexual orientation. Prevalence of mental illness and poor mental health could potentially be higher than reported figures due to stigmatization of the topic.

Though mental illness is common, the topic is often stigmatized (Rossler 2016). The stigmatization surrounding those with mental illness is not a new phenomenon but has been occurring for hundreds of years (Rossler 2016). Only recently has it begun to be a more mainstream topic with an emphasis on destigmatizing mental illness (National Alliance on Mental Illness 2021). The negative stereotypes and stigmatization surrounding mental illness have become a barrier for many of those with mental illness and poor mental health to seek treatment (Rossler 2016). According to NAMI, in 2019 only 45% of adults with mental illness received treatment (2021). Additionally, mental health is often used interchangeably with mental illness and therefore also often stigmatized. With this negative perception of those who may be experiencing poor mental health, it can create the same hesitancy for those individuals to seek support. By destigmatizing mental illness and mental health, those affected may be encouraged to seek treatment and support, ultimately helping an individual reach a healthier mental state (National Alliance on Mental Illness 2021; National Institute of Mental Health 2021). Discussing mental health is extremely important not only due to the

condition's commonality but in the hopes of encouraging someone with poor mental health to seek support.

Several studies suggest that there are increasing numbers of people reporting stress, anxiety, and depression, which are linked to poor mental health (Collin et al. 2019; Heitzman 2020; Mental Health America 2020; Silverstein et al. 2020; Centers for Disease Control and Prevention 2021; Chi et al. 2021; National Alliance on Mental Illness 2021). Stress presents when the demands and pressures of an experience are perceived as excessive (Silverstein et al. 2020). This perception of stress varies by the individual experiencing the stress (Silverstein et al. 2020). While some stress may be beneficial and can encourage higher levels of performance, high amounts or prolonged periods of stress can be detrimental to mental and physical health (Silverstein et al. 2020). Anxiety is an abnormal and overwhelming sense of apprehension and fear (Terlizzi and Zablotsky 2019). This overwhelming feeling can often be accompanied by physical manifestations such as sweating, tension, and an increased heart rate (Terlizzi and Zablotsky 2019). Anxiety has been documented as the most prevalent mental illness, with an estimated 19% of American adults suffering from an anxiety disorder (National Alliance on Mental Illness 2021). Depression is a prolonged state of increased sadness, hopelessness, and unimportance (Terlizzi and Zablotsky 2019). It is not uncommon for a person who is diagnosed with depression to also suffer from anxiety (Lipson et al. 2015; National Institute of Mental Health 2021). Additionally, prolonged periods of stress can lead to an increase in levels of anxiety and depression (Lipson et al. 2015; National Institute of Mental Health 2021).

Globally, stress, anxiety, and depression are not only common mental illnesses but are interconnected and negatively affect a person psychologically and physically.

Mental Health Among Medical Healthcare Professions

As poor mental health is widespread among all Americans, the variable rates of poor mental health by occupation have been well documented. Certain occupations, such as those in the healthcare industry, consistently experience higher levels of poor mental health than the general population (Peterson et al. 2018; Reith 2018). The medical healthcare profession has consistently ranked in the top 20 professions at the highest risk for suicide (Peterson et al. 2018; Harvey et al. 2021). Estimates suggest that up to one in three physicians or physicians-in-training experience mental illness as compared to one in five in the general population (Harvey et al. 2021). High levels of poor mental health among treating physicians have been shown to lead to an increase in errors and poor patient outcomes (Harvey et al. 2021). The cause of higher rates of poor mental health in medical healthcare professionals has been well explored. Poor work-life balance, increased computerization of practice, long hours at work, and increases in bureaucratic tasks have all been consistently cited as negative factors impacting the mental wellness of medical healthcare professionals (Reith 2018; Harvey et al. 2021). The typical American works a 40-hour work week, while medical healthcare professionals are averaging 51 hours each week (Reith 2018). An increase in hours spent at work leads to less time at home and a poorer work-life balance. Increased usage of computerization in the form of electronic health or dental records was intended to streamline and increase efficiency in healthcare (Reith 2018). Unfortunately, many medical healthcare professionals report that the increase in computerization has led to less time spent with

patients and more time behind the screen (Reith 2018). Additional oversight from healthcare entities such as Medicare, Medicaid, and private insurances has resulted in physicians spending more time satisfying requirements for these programs (Reith 2018). Poor work-life balance, long hours at work, increased computerization of practice, and an increase in bureaucratic tasks have led to an increase in reported levels of burnout, stress, anxiety, and depression in medical healthcare professionals. Additionally, it is important to note that these stressors discussed above are irrespective of the coronavirus disease 2019 (COVID-19) pandemic. There has been a well-documented marked increase in reported levels of poor mental health among medical healthcare professionals since the start of COVID-19 (Heitzman 2020; Zhai and Du 2020). Because of the alarming rates of poor mental health among medical healthcare professionals, it is important to specifically investigate how dental healthcare professionals compare.

Mental Health in the Dental Profession

Similar to the overall pattern in medical healthcare professionals, dental clinicians also experience higher levels of poor mental health and stress than the general population (Rada 2004; American Dental Association 2017). According to the 2015 Dentist Well-being Survey conducted by the American Dental Association (ADA), 77% of all dentists reported a moderate or high level of stress at work (2017). According to the same survey, nearly 22% of dentists surveyed had a moderate level of depression, as compared to 7% in the general population (American Dental Association 2017; National Alliance on Mental Illness 2021). The same survey found that depression in the surveyed dentists was highly correlated with higher stress levels in the workplace (American Dental Association 2017). The source of the

increased stress has been traced to practice management issues, financial concerns, physical discomfort, and the personality types of the people who choose the dental profession (Rada 2004; American Dental Association 2017). Working in an environment with relatively higher levels of stress puts dental clinicians at an increased risk for experiencing symptoms of anxiety and depressive disorders (Rada 2004; American Dental Association 2017). Additionally, many dental clinicians display behaviors described as “perfectionism”. Though this trait is commonly observed in many quality dentists, it also predisposes someone for anxiety and depressive disorders (Rada 2004). These issues tend to develop early on in a dental professional’s career and even during dental education (Rada 2004; AlFaris et al. 2016).

Mental Health of Dental Students and Residents

Similar to the poor mental health trends seen in medical and dental healthcare professionals, previous studies report high levels of stress, anxiety, and depression in students while undergoing medical, nursing, veterinary, and dental education and training (AlFaris et al. 2016; Deeb et al. 2018; Knipe et al. 2018; Silverstein et al. 2020; Poma et al. 2021). There have been several studies suggesting that dental students may even experience higher levels of stress, anxiety, and depression than other healthcare professional students (AlFaris et al. 2016; Knipe et al. 2018). One study reported that out of healthcare professional students studying nursing, medicine, and dentistry, dental student respondents exhibited the highest rates of depression at 52% (AlFaris et al. 2016). Knipe and colleagues investigated the mental health of medical, veterinary, and dental students and found that the dental students surveyed experienced higher levels of anxiety and depression, and lower

overall wellbeing scores than their medical and veterinary counterparts (2018). These previous studies suggest alarming levels of poor mental health in dental students as compared to other healthcare professional students, highlighting the importance of further investigating the mental health of dental students.

Additional studies also call attention to high levels of poor mental health among dental students. The study by Chi et al. out of the University of Washington concluded that 22% of dental student respondents were experiencing a clinically significant amount of anxiety during their dental education (2021). Another study conducted with Californian dental students found that the prevalence of depression symptoms in respondents was 28% (Lerman et al. 2020). Additionally, a study out of Virginia found the prevalence of moderate to severe depression in the dental students surveyed to be at 10% (Deeb et al. 2018). These increased levels of poor mental health among dental students are not only alarming but is a topic that should continue to be explored. Gathering information on the prevalence of poor mental health among dental students is important, but it is also essential to recognize the contributing factors to the alarming rates of poor mental health in dental students.

The contributing factors to poor mental health in dental students are multifaceted. Stress factors affecting the mental health of dental students can be attributed to the highly competitive environment, performing clinical procedures that have the risk for potential harm if done incorrectly, interacting with patients, heavy workloads, fear of failing, lack of leisure time, high levels of financial debt, and strain on personal relationships (AlFaris et al. 2016; Collin et al. 2020). Prior to starting dental education, students were likely accustomed to consistently earning top scores and being at the top of their class. Now in dental training,

these students are surrounded by other students who were also at the top of their class before dental school, creating an innately competitive environment. On top of an innately competitive environment, heavy workloads, fear of failing, and clinical performance are all additional contributing factors affecting the stress levels of dental students (Harrison et al. 2016). One study found that 96% of respondents experienced mild to moderate levels of anxiety in the clinical setting (Malghani et al. 2021). Some common stressors for dental students in the clinical setting were getting infected by a patient, extracting the incorrect tooth, or making an incorrect diagnosis (Malghani et al. 2021). On top of academic and clinical stressors, dental students in the U.S. experience high levels of financial debt. According to the American Dental Education Association (ADEA), in 2020 the average dental student debt for graduating fourth-year students was \$304,824 (American Dental Education Association 2021). Additionally, the sweeping changes brought on due to the coronavirus disease 2019 (COVID-19) pandemic are an additional stressor for dental students (Heitzman 2020; Poma et al. 2021). High stress situations can lead to an increase in poor mental health and unhealthy behaviors, further underscoring the value of investigating stress, anxiety, and depression rates among dental students.

The rates and sources of stress, anxiety, and depression also have been documented to vary by year of study in dental education. A study done by Al Faris et al. concluded that dental students in their third year of education experience the highest levels of depression symptoms, followed by second year, first year, and finally fourth year. Another study found that depressive symptoms were highest during the first and third years of dental education (Lerman et al. 2020). Heavy workloads and fear of failing were more influential on stress

levels during the first and second years of dental education, while potentially harming a patient and high levels of financial debt were more influential stressors during the third and fourth years of study (AlFaris et al. 2016; Collin et al. 2019). Another study discussed that treating patients in the clinical setting during the third and fourth years of study was also a large source of anxiety in dental trainees (Malghani et al. 2021). In conclusion, dental students experience significant levels of stress, anxiety, and depression throughout their dental education which can vary by year of training due to dynamic stressors.

The social support and lifestyles of dental students also have an impact on their mental health. Social support has been defined as the psychological and material resources that are provided by family and friends during a time of need (Centers for Disease Control and Prevention 2021). One study reported that social support scores were significantly lower for first-year and single students (Harrison et al. 2016). The same study reported that students with children had a significantly lower score for perceived wellness than students without children (Harrison et al. 2016). Another study found that students who exercised less frequently were more likely to have major depressive symptoms (Lerman et al. 2020). The same study found that students identifying with minorities based on ethnicity, race, and gender identity were significantly more likely to experience major depressive symptoms, which is consistent with rates observed in the general population (Lerman et al. 2020). Furthermore, there have been numerous studies pointing to an association between increased screen time and higher levels of anxiety and depression in students (Fathima et al. 2019; West et al. 2021). One study reported that 20% of dental student respondents were experiencing depressive symptoms, 17% were experiencing anxiety, and 9% were

experiencing elevated levels of stress (Shailaja et al. 2020). These levels of stress, anxiety, and depression were directly associated with the amount of time dental students were spending on social media (Shailaja et al. 2020). These previous studies highlight that the personal lives of dental students can significantly impact their mental health, so it is important to continue to investigate how race, gender, marital status, physical health, parental status, and time spent on social media contribute to the mental health of dental trainees.

Another contributing factor to the mental health of dental students is the overall structure of dental education. A recent study of dental students in Saudi Arabia concluded that 40% of respondents experienced moderate or severe levels of depression when utilizing the Patient Health Questionnaire (PQH-9) (Almoammar et al. 2021). In contrast, a study conducted in the U.S. found that only 17% of dental student respondents were experiencing symptoms of depression (Chi et al. 2021). The differences in rates of depression between these two studies can potentially be attributed to the differences in the overall structure of dental education internationally. In the U.S. four years of dental education to achieve a Doctor of Dental Medicine (DMD), or Doctor of Dental Surgery (DDS) degree is typically completed after a four-year bachelor's degree. Furthermore, becoming a specialist entails additional years of training after achieving a DMD or DDS. Internationally, some countries allow students to start dental training directly out of high school in four to six-year programs to earn a Bachelor of Dental Surgery (BDS). Because of the difference in the delivery of dental education internationally, it is difficult to compare international studies on dental students' mental health with similar studies conducted in the U.S. Additionally, demographics, debt levels, and other stress factors are inherently different, also making

international studies difficult to compare with those conducted in the U.S. Though there have been studies conducted abroad on the mental health of dental students, for the purpose of this study, it is vital we focus mainly on studies conducted in the U.S.

While current studies have shown high levels of stress, anxiety, and depression in dental students, a lack of research exists exploring these same topics in advanced education dental residents in the U.S. There have been some international studies that highlight high levels of stress, anxiety, and depression among dental residents (Polychronopoulou and Divaris 2010; Madhan et al. 2012; Takarada et al. 2014). Because delivery of dental education differs widely internationally, it is difficult to directly associate international data with U.S. dental residents. Because higher overall levels of stress, anxiety, and depression exist for dental students in comparison to the general population, it can be anticipated that these levels will also be elevated for dental residents due to the high stress nature of advanced dental education. Dental residents typically have a substantial amount of clinical responsibilities in addition to education and research requirements (Silverstein et al. 2020). A recent study in California investigated stress levels in pediatric dental residents. This study surveyed pediatric dental residents across 76 pediatric dental residencies in the U.S. and concluded that pediatric dental residents experienced moderate stress levels, but that the stress levels did not vary by year of residency (Silverstein et al. 2020). Most recently, a survey was conducted at the University of Washington School of Dentistry investigating dental students' and dental residents' mental health and intention to leave their dental training programs during the COVID-19 pandemic (Chi et al. 2021). While this study found similar levels of anxiety and depression in dental students and residents as in previous

studies, the primary concern of this study was to investigate the intention to leave during the COVID-19 pandemic (Chi et al. 2021). There remains a lack of information on the prevalence of anxiety and depression in U.S. dental residents as compared to predoctoral dental student stress, anxiety, and depression levels. Additionally, there remains a lack of information on how race, physical activity, marital status, social media usage, and parental status contribute to the mental health of dental residents compared to dental students in the U.S.

Problem Statement

Despite the study by Chi et al. on the mental health and intention to leave during the COVID-19 pandemic, there have been no peer-reviewed studies explicitly reporting on the factors contributing to levels of anxiety or depression in advanced education dental residents in the U.S. irrespective of the COVID-19 pandemic (2021). Furthermore, there is an apparent lack of research comparing levels of anxiety or depression between students and residents in different years of dental education. Additionally, there is a lack of research investigating how demographic factors such as belonging to a high-risk group, physical activity, marital status, parental status, and social media usage correlate with levels of poor mental health in dental residents. This study aims to assess the levels of anxiety or depression in dental students and dental residents as well as the varying demographic factors such as year of study, belonging to a high-risk group, physical activity, marital status, parental status and social media usage.

Hypotheses

1. There will be a difference in the levels of anxiety or depression between dental students and residents based on year of study.

2. There will be a difference in the levels of anxiety or depression based on belonging to a high-risk group, physical activity, marital status, parental status, and social media usage in dental students and dental residents.

CHAPTER 2

METHODS

To investigate the levels of anxiety or depression in dental students and dental residents as well as demographic factors a twenty-four-item survey was constructed. The survey included questions aimed at gathering information on demographics such as belonging to a high-risk group, physical activity, marital status, parental status, and social media usage. Additionally, the survey adapted questions aimed at gathering self-reported levels of anxiety or depression utilizing two previously validated tools, the GAD-7 and the PHQ-9 (Kroenke et al. 2001; Spitzer et al. 2006; Lowe et al. 2008; Keum et al. 2018).

The survey was divided into three domains. The first domain collected information on dental student and dental resident demographics. The University of Missouri Kansas City (UMKC) School of Dentistry (SOD) is the only accredited public dental school in Missouri that offers a four-year DDS degree and multiple advanced education dental residency programs. The dental residency programs include orthodontics and dentofacial orthopedics, periodontics, endodontics, general dentistry, and oral and maxillofacial surgery. Information was first collected on the respondent's program and year of study. Additional items consisted of five questions aimed at gathering personal demographic factors. These questions gathered information regarding belonging to a high-risk group, marital status, parental status, physical activity, and time spent on social media. Specific information on ethnicity and race was not gathered because dental resident programs are small and recording ethnicity could have potentially identified a respondent. Instead, the respondents were asked if they identified with one or more of the following high-risk groups: African American, American Indian or Alaska

Native, Asian, Hispanic or Latino, LGBTQ+, Native Hawaiian or Pacific Islander, and/or two or more races. Respondents were asked about their personal social media usage based on a 2016 study conducted by Lin et. al. where respondents estimated their social media for personal use per day. This study measured time spent per day on social media from 0-30 minutes, 31-60 minutes, 61-120 minutes, and 121 minutes and above.

The second domain examined anxiety by adapting the generalized anxiety disorder 7 (GAD-7). The GAD-7 is a seven question self-report scale that has been previously validated to efficiently screen for levels of anxiety (Spitzer et al. 2006). The answers were scored with numeric values that were then summed into a composite score to assess the categorized level of the respondents' generalized anxiety (Spitzer et al. 2006). The categorized levels for the GAD-7 for generalized anxiety were 0-4 for none to minimal level, 5-9 for mild level, 10-14 for moderate level, and 15-21 for severe level. Respondents with a composite score of 10 or higher were considered to have a generalized anxiety disorder (Spitzer et al. 2006; Lowe et al. 2008).

The third domain evaluated stress and depression by adapting the Patient Health Questionnaire (PHQ-9) (Kroenke et al. 2001; Keum et al. 2018). The PHQ-9 is a nine question self-report scale that has been previously validated to efficiently screen for levels of depression (Kroenke et al. 2001). The answers were scored with numeric values that were then summed into a composite score to assess the categorized level of the respondents' depression (Kroenke et al. 2001). PHQ-9 categorized levels for depression severity were 0-4 for none to minimal level, 5-9 for mild level, 10-14 for moderate level, 15-19 for moderately severe level, and 20-27 for severe level (Kroenke et al. 2001). Respondents with composite

scores of 10 or higher were considered to have major depressive disorder (Kroenke et al. 2001).

During survey development, the Committee provided feedback regarding questions in the demographic domain to review clarity, necessity, and order. This feedback was utilized to revise the survey. Best practices were to not modify the questions in the second and third domains, because the tools were previously validated to reflect accurate levels of anxiety and depression in respondents. The only update to those domains was to modernize terminology in question twenty-one. Original terminology in item number twenty-one asked about trouble concentrating on reading the newspaper, this was updated to reflect more common ways respondents would be interacting with news media such as reading or watching television. After all modifications were made and approved by the Committee, the survey was finalized.

The final version of the survey was developed in REDCap (Research Electronic Data Capture) for distribution. Study data were collected and managed using REDCap electronic data capture tools hosted at the Center for Health Insights at UMKC. REDCap is a secure, web-based application designed to support data capture for research studies, providing 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources (Harris et al. 2009; Harris et al. 2019). The final version of the survey is included in Appendix A.

Survey Distribution and Data Collection

All members of the D1 class (109), D2 class (109), D3 class (105), and D4 class (109), orthodontics and dentofacial orthopedics (9), periodontics (4), endodontics (4), and

oral and maxillofacial surgery (12) were recruited for the study. The survey was administered via REDCap to each dental school class during designated class time. For the D1 class, this occurred during the Clinical Decision-Making course, for the D2 class, during the Patient Care III course, for the D3 class, during the Behavioral Science course, and for the D4 class, during the Treatment Planning course. The course director of each of the aforementioned courses had approved the use of class time for survey participation. The Committee Chair introduced and explained the survey to each respective class utilizing the Classroom Survey script, which is included in Appendix B. A link and/or QR code to the REDCap survey was also available on each respective course's Canvas site. Students were given approximately 10 minutes to complete the survey in class. Dental residents were contacted via email because there was not a class where all dental residents of every year meet at the same time. A copy of the email recruitment script for residents can be found in Appendix C. Both dental students and dental residents received a follow-up email one week later encouraging those who had not yet participated to complete the survey, the email scripts can be found in Appendices D and E, respectively.

Prior to survey distribution, the classroom script, email scripts, and survey were reviewed and approved by the UMKC Institutional Review Board (IRB). The approval letter from the IRB is included in Appendix F.

Experimental Design

This study was a cross-sectional, non-experimental design. There were one independent and two dependent variables for this study. The independent variable was the dental student and dental resident demographics, with eight specific demographic details

(program of study, year of study, belonging with a high-risk group, marital status, parental status, physical activity, and social media use). The dependent variables that were assessed were (1) level of generalized anxiety, and (2) level of depression. Associations between respondent demographics and levels of anxiety or depression were examined. The study design is outlined in Table 1.

TABLE 1
EXPERIMENTAL DESIGN: INDEPENDENT AND DEPENDENT VARIABLES

Independent Variables	Specific details of dental student and resident demographics	Dependent Variables
Student and resident demographics (Domain 1)	Program of study (Q1)	1. Level of generalized anxiety disorder [Domain 2: composite score (Q9-15)] 2. Level of depression [Domain 3: composite score (Q16-24)]
	Year of study (Q2)	
	Belonging with a high-risk group (Q4)	
	Marital status (Q5)	
	Parental status (Q6)	
	Physical activity (Q7)	
	Social media usage (Q8)	
Sample size (n) = number of students and residents responding to survey		

Data Analysis

Data collected from the survey was entered into a statistical software program¹. Composite scores were generated for the second and third domains of the survey to assess levels of anxiety or depression. The composite score for level of anxiety had a minimum possible score of 0 and a maximum possible score of 21. The composite score for level of depression had a minimum possible score of 0 and a maximum possible score of 27. Each composite score was further categorized as previously described.

Descriptive statistics were calculated for all variables of interest. Chi-square and Fisher's Exact tests were used to evaluate the associations between student and resident demographics and their categorized level of anxiety or depression. Significance for all testing was set at $\alpha = 0.05$.

¹SPSS Statistics for Windows, Version 27.0, IBM Corp. Armonk, NY 10504

CHAPTER 3

RESULTS

The survey was distributed to approximately 461 dental students and dental residents, of which 252 completed the survey. The number of completions leads to a total response rate of 54.6%. Nine of those responses were incomplete, so 243 respondents were used in the final statistical analyses.

Demographics of Dental Students and Residents

Table 2 illustrates the distribution between the levels of generalized anxiety and depression and demographics of the survey respondents. Most respondents to this survey were dental students in their first year of training (34.3%), did not belong to a high-risk group (72.9%), were single/never married (76.3%), did not have children (95.8%), were physically active for more than 3 days per week (58.5%), and used social media for 60 minutes or more per day (58.1%). Levels of anxiety for the respondents were approximately evenly distributed between the four levels of anxiety. Most respondents had none to minimal levels of depression (30.5%). Only 12 respondents were advanced education residents, summaries of their demographics are also included in Table 2. Due to the small sample size of advanced education residents, they were excluded from further analyses due to insufficient statistical power.

TABLE 2

SUMMARY OF DEMOGRAPHICS FOR DENTAL
STUDENTS AND RESIDENTS

	Dental Student N = 236 N (%)	Dental Resident N = 12 N (%)
Year of Study		
1 st	81 (34.3%)	3 (25.0%)
2 nd	60 (25.4%)	5 (41.7%)
3 rd	49 (20.8%)	4 (33.3%)
4 th	45 (19.1%)	0 (0%)
Missing	1 (0.4%)	0 (0%)
Belonging to a high-risk group		
Yes	64 (27.1%)	4 (33.3%)
No	172 (72.9%)	8 (66.7%)
Marital Status		
Single/Never Married	180 (76.3%)	4 (33.3%)
Married or Domestic Partnership	55 (23.3%)	8 (66.7%)
Widowed or divorced	1 (0.4%)	0 (0%)
Have Children		
Yes	9 (3.8%)	5 (41.7%)
No	226 (95.8%)	7 (58.3%)
Physical Activity (days/week)		
2 or fewer	98 (41.5%)	3 (25.0%)
3 or more	138 (58.5%)	9 (75.0%)
Social Media Usage (minutes/day)		
59 or fewer	98 (41.5%)	4 (33.3%)
60 or more	137 (58.1%)	8 (66.7%)
Missing	1 (0.4%)	
Level of Anxiety		
None to minimal (0-4)	58 (24.6%)	6 (50.0%)
Mild (5-9)	59 (25.0%)	4 (33.3%)
Moderate (10-15)	56 (23.7%)	2 (16.7%)
Severe (15-21)	60 (25.4%)	0 (0%)
Missing	3 (1.3%)	0 (0%)
Level of Depression		
None to minimal (0-4)	72 (30.5%)	6 (50.0%)
Mild (5-9)	66(28.0%)	3 (25.0%)
Moderate (10-14)	51 (21.6%)	2 (16.7%)
Moderately severe (15-19)	20 (8.5%)	0 (0%)
Severe (20-27)	16 (6.8%)	0 (0%)

Levels of Anxiety

Associations between binary GAD-7 scores (none/moderate (<10) vs moderate/severe (10+)) and dental student demographics were examined. Table 3 shows the associations between the binary levels of anxiety with demographic factors for dental students. There was a statistically significant relationship between physical activity and level of anxiety ($p=0.007$). Dental students who were physically active for 3 or more days per week had significantly lower levels of anxiety. There was no statistically significant association between level of anxiety and year of study (Hypothesis 1), belonging to a high-risk group, marital status, parental status, or social media usage (Hypotheses 2).

TABLE 3

RELATIONSHIP BETWEEN LEVELS OF ANXIETY
WITH DEMOGRAPHIC FACTORS

	Level of Anxiety		p-value*
	None/Mild (<10) N (Row %)	Moderate/Severe (10+) N (Row %)	
Year of Study (N = 233)			0.471
1 st	40 (50.0%)	40 (50.0%)	
2 nd	26 (43.3%)	34 (56.7%)	
3 rd	24 (50.0%)	24 (50.0%)	
4 th	26 (59.1%)	18 (40.9%)	
Belonging to a high-risk group (N = 233)			0.072
Yes	26 (40.6%)	38 (59.4%)	
No	91 (53.8%)	78 (46.2%)	
Marital Status (N = 233)			0.087‡
Single/Never Married	84 (47.2%)	94 (52.8%)	
Married or Domestic Partnership	33 (61.1%)	21 (38.9%)	
Widowed or divorced	0 (0%)	1 (100.00%)	
Have Children (N = 232)			0.999‡
Yes	5 (44.6%)	4 (44.4%)	
No	112 (50.2%)	111 (49.8)	
Physical Activity (days) (N = 233)			0.007
2 or fewer	39 (39.8%)	59 (60.2%)	
3 or more	78 (57.8%)	57 (42.2%)	
Social Media Usage (minutes) (N = 232)			0.771
59 or fewer	49 (51.6%)	46 (48.4%)	
60 or more	68 (49.6%)	69 (50.4%)	

*Calculated using a Chi-square or ‡Fisher's Exact test

Levels of Depression

Associations between binary PHQ-9 scores (none/mild (<10) vs moderate/severe (10+)) and dental student demographics were examined. Table 4 shows the associations between the binary levels of depression with demographic factors for dental students. There was a statistically significant relationship between belonging to a high-risk group and level of depression ($p=0.014$). Students belonging to a high-risk group had significantly higher levels of depression. There was no statistically significant association between level of depression and year of study (Hypothesis 1), marital status, parental status, physical activity, and social media usage (Hypothesis 2).

TABLE 4
 RELEATIONSHIP BETWEEN LEVELS OF DEPRESSION
 WITH DEMOGRAPHIC FACTORS

	Level of Depression		p- value*
	None/Mild (<10) N (Row %)	Moderate/Severe (10+) N (Row %)	
Year of Study (N = 224)			0.658
	1 st	46 (59.0%)	40 (40.0%)
	2 nd	35 (59.3%)	24 (46.7%)
	3 rd	28 (59.6%)	19 (40.0%)
	4 th	28 (70.0%)	12 (30.9%)
Belonging to a high-risk group (N = 225)			0.014
	Yes	30 (48.4%)	32 (51.6%)
	No	108 (66.3%)	55 (33.7%)
Marital Status (N = 225)			0.405‡
	Single/Never Married	103 (60.6%)	67 (39.4%)
	Married or Domestic Partnership	35 (64.8%)	19 (35.2%)
	Widowed or divorced	0 (0%)	1 (100.00%)
Have Children (N = 224)			0.999‡
	Yes	5 (62.5%)	3 (37.5%)
	No	133 (61.6%)	83 (38.4%)
Physical Activity (days) (N = 225)			0.365
	2 or fewer	55 (57.9%)	40 (42.1%)
	3 or more	83 (63.8%)	36.2 (36.2%)
Social Media Usage (minutes) (N = 225)			0.474
	59 or fewer	59 (64.1%)	33 (35.9%)
	60 or more	79 (59.4%)	54 (40.6%)

*Calculated using a Chi-square or ‡Fisher's Exact test

CHAPTER 4

DISCUSSION

This study explored the influence of demographics on mental wellness of dental students and dental residents at a midwestern dental school. The results showed that there was no difference in the levels of anxiety or depression based on year of training. Additionally, the results showed that more than 3 days a week of physical activity was associated with lower levels of anxiety, and belonging to a high-risk group was associated with higher levels of depression.

The National Alliance on Mental Illness reports that approximately one in five American adults suffer from an anxiety disorder (2021). The survey respondents in the current study found nearly half of respondents scored in moderate or severe levels of anxiety. It is important to note the marked increase in levels of anxiety in dental students as compared to the general adult U.S. population. Additionally, a recent study in Washington found that only 22% of dental students surveys were experiencing a clinically significant amount of anxiety during their education (Chi et al. 2021). The differences in the levels of anxiety between the general population could potentially be attributed to the innately stressful and competitive environment in dental education. Furthermore, the differences in the levels of anxiety between our survey respondents, and those in the Washington study could be explained by geographic and demographic differences of the respondents.

Similarly, to the levels of anxiety being higher in the dental student respondents than the general adult U.S. population, we see the same trend for levels of depression. The

reported prevalence of depression in the general population is 7% (National Alliance on Mental Illness 2021). The current study found that 36% of respondents were experiencing at least a moderate level of depression. Previous studies reported a wide range of rates of moderate or severe depression from 11% to 54% (AlFaris et al. 2016; Deeb et al. 2018; Lerman et al. 2020). It is important to note the trend of higher levels of depression in dental students than in the general population in both previous studies and the current study.

Results from the current survey revealed that physical activity and belonging to a high-risk group were the only demographic factors associated with levels of anxiety and depression. These findings reflect the findings of the Lerman study which found that dental students who exercised less frequently and who identified with minorities based on ethnicity, race, and gender identity were significantly more likely to experience major depressive symptoms (2020). We would also expect to see lower levels of anxiety in students who exercised more frequently because it is commonly accepted that exercise and meditation are effective in reduction of anxiety symptoms.

Though previous studies by Al Faris and Lerman had reported differences in levels of depression and anxiety based on years of training, this was not a significant finding in the current study (2016; 2020). This could be attributed to geographic and cultural differences in the survey respondents. It is important to note that the current study found the highest percentage of respondents scoring with high levels of both anxiety and depression were in their second year of training. This slightly higher percentage could be due to survey timing; the survey was distributed to students near mid-term exams.

There was no statistical significance found associated with marital or parental status with level of anxiety. The majority of survey respondents were single/never married and did not have any children living with them under the age of 18 years old. The levels of anxiety for single/never married respondents was approximately evenly distributed between high and low anxiety, while approximately two-thirds of married respondents scored in the low level of anxiety. One respondent reported themselves as widowed or divorced and scored high in anxiety. While the findings in the current study contrast with the findings in the Lerman study, more exploration into how social support and lifestyle correlate with levels of anxiety in dental students is needed.

Similarly, there was no statistical significance found associated with marital or parental status with level of depression. The levels of depression for single/never married and married respondents were about the same, with the majority of respondents scoring in the low level of depression. One respondent reported themselves as widowed or divorced and scored high in depression. While the findings in the current study contrast with the findings in the Lerman study, more exploration into how social support and lifestyle correlate with levels of depression in dental students is needed.

Social media usage was also not found as a significant demographic factor associated with levels of anxiety and depression in the current study. This contrasts with the Shailaja study which did find an association between levels of stress, anxiety, and depression and time spent on social media. The study by Shailaja was conducted at the height of COVID-19 to explore how the pandemic and information overload from excessive social media usage was contributing to stress, anxiety, and depression in dental students. The current study was

conducted after COVID-19 and was not considered a significant factor affecting the mental wellness of the respondents and could explain the reported differences.

Another potential reason there was no significant difference in level of anxiety by year of study, belonging to a high-risk group, marital status, parental status, and social media usage could be that the levels of anxiety are generally higher amongst all students. It would be difficult to see the effects of demographics on top of already high levels of anxiety. In contrast, the level of depression in the general population is much lower at 7% (National Institute of Mental Health 2021). This lower baseline for depression could make it easier to observe significant differences in level of depression based on various demographic factors. This could explain why survey respondents who belonged with a high-risk group were found to have significantly higher levels of depression but not significantly higher levels of anxiety. Overall, further exploration into how various demographic factors potentially affect levels of anxiety and depression in students undergoing dental education is needed.

A study conducted at the same midwestern dental school during COVID-19 found that 32% of dental students were experiencing high levels of anxiety (Cody et al. 2022). The current study found 49% of a similar cohort of students were experiencing high levels of anxiety. This could suggest that levels of anxiety have increased in dental students since COVID-19. Similar to the high level of anxiety found in dental students in the Cody study, high levels of depression in dental students were also observed (Cody et al. 2022). The Cody study found that 27% of student respondents were experiencing high levels of depression while the current study found 36% of respondents were experiencing a high level of depression. This also could suggest that levels of depression in the dental students surveyed

have increased since COVID-19. The differences between the current study and the Cody study could be explained because the current study did not include dental hygiene students; the previous study found that a higher number of hygiene students scored low in level of anxiety and depression as compared to their dental student counterparts. So, by excluding dental hygiene students from the current study this could have influenced the higher level of anxiety and depression found in dental students alone. Additionally, the survey was distributed in close proximity to midterm exams and could explain the spike in levels of both anxiety and depression. Further exploration into anxiety and depression levels in students undergoing dental education is needed post COVID-19.

Clinical Implications

Current survey responses and those from prior studies suggest that students enrolled in dental education experience significant amounts of anxiety and depression. Factors affecting the mental wellness of dental students and residents are multifaceted. Some previously researched factors include the highly competitive environment, performing clinical procedures that have the risk for potential harm if done incorrectly, interacting with patients, heavy workloads, fear of failing, lack of leisure time, high levels of financial debt, and strain on personal relationships (AlFaris et al. 2016; Collin et al. 2020). An additional stressor was the COVID-19 pandemic. One study showed that among dental health care professionals anxiety and depression rates peaked during November 2020 and December 2020, respectively (Eldridge et al. 2022). This same study found that anxiety and depression levels declined for dental professionals by May 2021 (Eldridge et al. 2022). The current study was distributed in the fall semester of 2022, many COVID-19 restrictions had been

lifted, so it can be assumed that COVID-19 was not a significant factor affecting the mental wellness of the dental students surveyed. This further supports the need for exploration into the factors affecting mental wellness in dental students since the current study suggested that anxiety and depression levels in dental students could have increased since a similar study was conducted during COVID-19 (Cody et al. 2022).

The current study reported anxiety and depression levels in dental students post COVID-19 as still being higher than the general U.S. adult population. The current study found that students who exercised more frequently had lower levels of anxiety. This information could be utilized to tailor wellness programs that promote physical activity. The current study also found that students belonging to high-risk groups were more likely to have higher levels of depression. This information is important so that wellness programs can target students who are more at risk for poor mental wellness. Furthermore, it is important to bring awareness to the increased levels of poor mental wellness in dental students so that wellness programs and mental health education can be improved upon within the dental education system. Increasing awareness of mental wellness within the dental education system can help to decrease the stigmatization surrounding mental illness and encourage those who are experiencing poor mental health to seek support (National Alliance on Mental Illness 2021). Improving these initiatives and overall awareness can improve mental wellness of students undergoing dental education which ultimately could lead to improved patient care and lower prevalence of poor mental wellness in the dental profession.

Study Limitations

A significant limitation of this study was the small sample size from advanced education residents. This could be due to the survey delivery method to the residents. Perhaps an in-person invitation to participate in the survey could have increased the response rate from residents. To get a better measure of mental wellness of dental residents, perhaps the survey should be distributed to multiple universities for an increased sample size.

Of the 243 respondents, 118 reported moderate or severe levels of anxiety, and 86 reported moderate, moderately severe, or severe levels of depression. This would infer that nearly half of the respondents have clinically significant levels of anxiety, and nearly 40% of respondents have clinically significant levels of depression. These levels are significantly higher than what is reported in the general population which is 19% and 7%, respectively. In part, this could be attributed response bias. Additionally, the survey was distributed in close proximity to midterm exams which could have contributed to the increased levels of both anxiety and depression. A more generic survey title and changing the timing of survey distribution might have controlled for this.

Future Investigations

The sample in this survey was current dental students and dental residents at a single public dental school in the Midwest, thus results cannot necessarily be generalizable to all dental student and resident populations. Future investigations could include multiple universities across the U.S. which could potentially reveal more generalizable results.

This study did not include gender identity. Previous studies have shown a difference in anxiety and depression rates between genders. Future studies should explore associations

between gender identity and levels of anxiety and depression so that curriculum and mental wellness programs can be more accurately tailored.

While this study did include a free-response option for respondents to leave comments, not many respondents took the opportunity to leave comments. Of the comments received, many of them mentioned feelings of professors and administrators at the dental school not listening to the students' concerns, heavy work loads, and a rigorous schedule which were contributing to their anxiety and depression. Future investigations could include a more robust examination of factors which could contribute to the levels of anxiety and depression that dental students are experiencing. This would allow for wellness programs to be more accurately tailored to the dental student needs.

CHAPTER 5

CONCLUSIONS

1. There was no significant difference in levels of anxiety or depression and the year of study.
2. There was a significant difference in levels of anxiety and physical activity. Dental students who were physically active for 3 or more days per week were more likely to have lower levels of anxiety.
3. There was a significant difference in levels of depression and belonging to a high-risk group. Dental students who belong to a high-risk group were more likely to have higher levels of depression.
4. There was no significant difference in levels of anxiety based on belonging to a high-risk group, marital status, parental status, and social media usage in dental students.
5. There was no significant difference in the levels of depression based on physical activity, marital status, parental status, and social media usage in dental students.

LITERATURE CITED

- AlFaris E, Irfan F, Qureshi R, Naeem N, Alshomrani A, Ponnampereuma G, et al. Health professions' students have an alarming prevalence of depressive symptoms: Exploration of the associated factors. *BMC Med Educ* 2016;16:279.
- Almoammar S, Alqarni KA, Alnazeh AA, Alshahrani RM, Sundram F, Alyami M, et al. Depression and suicidal ideation among dental students of southern Saudi Arabia: A cross-sectional study. *J Dent Educ* 2021. 10.1002/jdd.12763.
- American Dental Association. Dentist well-being survey report; 2017. Available from www.ebusiness.adaa.org/assets/docs/32944. Accessed October 21, 2021.
- American Dental Education Association. Educational debt. Available from https://www.adea.org/godental/money_matters/educational_debt.aspx. Accessed Nov 13, 2021.
- Centers for Disease Control and Prevention. Mental health. Available from <https://www.cdc.gov/mentalhealth/learn/index.htm>. Accessed October 20, 2021.
- Chi DL, Randall CL, Hill CM. Dental trainees' mental health and intention to leave their programs during the COVID-19 pandemic. *J Am Dent Assoc* 2021;152:526-34.
- Cody K, Scott JM, Simmer-Beck M. Examining the mental health of university students: A quantitative and qualitative approach to identifying prevalence, associations, stressors, and interventions. *J Am Coll Health* 2022. Doi: 10.1080/07448481.2022.2057192.
- Collin V, Toon M, O'Selmo E, Reynolds L, Whitehead P. A survey of stress, burnout and well-being in UK dentists. *Br Dent J* 2019;226:40-9.
- Collin V, O'Selmo E, Whitehead P. Stress, psychological distress, burnout and perfectionism in UK dental students. *Br Dent J* 2020;229:605-14.
- Deeb GR, Braun S, Carrico C, Kinser P, Laskin D, Golob Deeb J. Burnout, depression and suicidal ideation in dental and dental hygiene students. *Eur J Dent Educ* 2018;22:e70-e4. 10.1111/eje.12259.
- Eldridge LA, Estrich CG, Gurenlian JR, Battrell A, Lynch A, Vujicic M, et al. US dental health care workers' mental health during the COVID-19 pandemic. *J Am Dent Assoc* 2022;153:740-9.
- Fathima F, Vishnu Priya V, Gayathri R. Social media and anxiety - a survey. *Drug Invention Today* 2019;12:1841-4.

- Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (redcap)--a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377-81.
- Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: Building an international community of software platform partners. *J Biomed Inform* 2019;95:103208.
- Harrison PL, Shaddox LM, Garvan CW, Behar-Horenstein LS. Wellness among dental students: An institutional study. *Journal of Dental Education* 2016;80:1119-25.
- Harvey SB, Epstein RM, Glozier N, Petrie K, Strudwick J, Gayed A, et al. Mental illness and suicide among physicians. *The Lancet* 2021;398:920-30.
- Heitzman J. Impact of covid-19 pandemic on mental health. *Psychiatr Pol* 2020;54:187-98.
- Keum BT, Miller MJ, Inkelas KK. Testing the factor structure and measurement invariance of the PHQ-9 across racially diverse U.S. College students. *Psychol Assess* 2018;30:1096-106.
- Knipe D, Maughan C, Gilbert J, Dymock D, Moran P, Gunnell D. Mental health in medical, dentistry and veterinary students: Cross-sectional online survey. *BJPsych Open* 2018;4:441-6. 10.1192/bjo.2018.61.
- Kroenke K, Spitzer RL, Williams JBW. The phq-9: Validity of a brief depression severity measure. *Gen Intern Med* 2001;16:606-13.
- Lerman AR, Yamamoto KK, Taylor GW, Saeed SG. High depressive symptom prevalence in dental students associated with lifestyle and well-being characteristics. *J Dent Educ* 2020;84:771-80.
- Lipson SK, Gaddis SM, Heinze J, Beck K, Eisenberg D. Variations in student mental health and treatment utilization across us colleges and universities. *Journal of American College Health* 2015;63:388-96.
- Lowe B, Decker O, Muller S, Brahler E, Schellberg D, Herzog W, et al. Validation and standardization of the generalized anxiety disorder screener (gad 7) in the general population. *Med Care* 2008;46:266-74.
- Madhan B, Singh Rajpurohit A, Gayathri H. Mental health of postgraduate orthodontic students in india: A multi-institution survey. *Journal of Dental Education* 2012;76:200-9.

- Malghani PG, Abbasi LS, Majeed S, Saleem T. Level of anxiety in clinical settings and coping mechanisms used by dental undergraduate students to overcome it. *J Dent Educ* 2021;85:1749-55.
- Mental Health America. 2020 prevalence data. Available from <https://mhanational.org/issues/2020/mental-health-america-prevalence-data>. Accessed October 20, 2021.
- National Alliance on Mental Illness. Mental health by the numbers. Available from <https://www.nami.org/mhstats>. Accessed 11/6/2021.
- National Institute of Mental Health. Mental illness. Available from <https://www.nimh.nih.gov/health/statistics/mental-illness>. Accessed October 20, 2021.
- Peterson C, Stone DM, Marsh SM, Schumacher PK, Tiesman HM, LiKamWa McIntosh K, et al. Suicide rates by major occupational group - 17 states, 2012 and 2015. *MMWR Morb Mortal Wkly Rep* 2018;67:1253-60.
- Polychronopoulou A, Divaris K. A longitudinal study of greek dental students' perceived sources of stress. *Journal of Dental Education* 2010;84:524-30.
- Poma M, Al Amri F, Tawse-Smith A, Ma S. How are you coping with the covid-19 pandemic? Survey of undergraduate dental students' well-being during an unexpected global event. *Eur J Dent Educ* 2021;26.
- Rada RE, Johnson-Leong, C. Stress, burnout, and anxiety among dentists. *Journal of the American Dental Association* 2004;135:788-94.
- Reith TP. Burnout in united states healthcare professionals: A narrative review. *Cureus* 2018;10:e3681. 10.7759/cureus.3681.
- Rosler W. The stigma of mental disorders: A millennia-long history of social exclusion and prejudices. *EMBO Rep* 2016;17:1250-3.
- Shailaja B, Shetty V, Chaudhury S, Thyloth M. Exploring cyberchondria and its associations in dental students amid covid-19 infodemic. *Ind Psychiatry J* 2020;29:257-67.
- Silverstein ST, Tanbonliong T, Kritz-Silverstein D. Stress and coping strategies in pediatric dental residents. *J Dent Educ* 2020;84:1064-73.
- Spitzer RL, Kroenke K, Williams JBW, Lowe B. A brief measure for assessing generalized anxiety disorder. *Archives of Internal Medicine* 2006;166:1092-7.

Takarada T, Asada T, Sumi Y, Higuchi Y. Effect of rotation training system on the mental health status of postgraduate dental trainees at kyushu university hospital, fukuoka, japan. *Journal of Dental Education* 2014;78:243-9.

Terlizzi EP, Zablotsky B. Mental health treatment among adults: United states 2019. *NCHS Data Brief* 2019;380:1-8.

West S, Puszczynski R, Cohn T. Exploring recreational screen time and social anxiety in adolescents. *Pediatric Nursing* 2021;47:133-40.

Zhai Y, Du X. Addressing collegiate mental health amid covid-19 pandemic. *Psychiatry Res* 2020;288:113003.

APPENDIX A

SURVEY

MENTAL HEALTH ASSESSMENT OF DENTAL STUDENTS AND RESIDENTS

Page 1

Thank you for your participation in this survey.

SECTION 1: Program and Personal Characteristics

1. Please select your program of study at UMKC SOD:

- Doctor of Dental Surgery (DDS)
 Advanced Education Dental Resident

Please select your year of study in your respective program:

- 1st year
 2nd year
 3rd year
 4th year

-
4. Do you belong to one or more of the groups listed below (Yes or No):

African American

American Indian or Alaska Native

Asian

Hispanic or Latino

LGBTQ+

Native Hawaiian or Pacific Islander

Multiracial

- Yes
 No

What is your marital status?

- Single/Never Married
 Married or Domestic Partnership
 Widowed or Divorced

Do you have any children (≤ 18 years of age) living with you?

- Yes
 No

How many days per week are you physically active for at least 30 minutes outside of work, for example: walking, running, lifting weights, cycling, etc.?

- 0 days
 1-2 days
 3-4 days
 5+ days

How much time do you use social media per day for personal use (Facebook, Instagram, TikTok, Reddit, Twitter, Snapchat, YouTube, etc.)?

- 0-30 minutes
- 30-60 minutes
- 60-120 minutes
- 120+ minutes

SECTION 2**9. Over the last two (2) weeks, how often have you been bothered by the following:**

	Not at all	Several days	More than half the days	Nearly every day
Feeling nervous, anxious or on edge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not being able to stop or control worrying	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Worrying too much about different things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trouble relaxing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being so restless that it is hard to sit still	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Becoming easily annoyed or irritable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling afraid as if something awful might happen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

SECTION 3**10. Over the last two (2) weeks, how often have you been bothered by any of the following:**

	Not at all	Several days	More than half the days	Nearly every day
Little interest or pleasure in doing things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling down, depressed, or hopeless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trouble falling or staying asleep, or sleeping too much	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling tired or having little energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Poor appetite or overeating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling bad about yourself - or that you are a failure or have let yourself or your family down	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trouble concentrating on things, such as reading or watching television	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Moving or speaking so slowly that other people could have noticed? Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thoughts that you would be better off dead or of hurting yourself in some way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

-
11. If you have any comments you would like to share, please use the free response text box below:

If you are feeling like hurting yourself, there are some resources available to help listed below:

The national suicide prevention hotline is 1-800-273-8255 UMKC Roo's for Mental Health also offers services including free counseling at the Counseling Center:
Phone Number: 816-235-5614
Website: <https://info.umkc.edu/roosformentalhealth/> UMKC School of Dentistry offers free independent student support services. If you are interested, contact Barrett Price. Meetings are confidential.
Phone Number: 816-235-2172
E-mail: bsptgf@umkc.edu

APPENDIX B

VERBAL RECRUITMENT CLASSROOM SCRIPT TO DENTAL STUDENTS

The purpose of this research study is to better understand the well-being of students enrolled in UMKC's dental and dental resident programs.

On behalf of Dr. Taylor Little, a candidate for the Oral and Craniofacial Sciences Masters and a resident in the Orthodontics and Dentofacial Orthopedics department here at UMKC, we are asking all dental students and dental residents currently enrolled at UMKC to complete a short survey regarding their demographics and their current mental wellness. Results will help determine how to expand wellness interventions, programming, and resources at UMKC School of Dentistry to support our students and residents.

The survey will take approximately 5 minutes to complete. Your participation is entirely voluntary; you may skip any questions that you do not want to answer or choose to stop participating at any time. There are no risks or benefits to participating in this study and it will not have any influence on your grade in any class or your rights as a student.

Your responses will be completely anonymous. Please be assured, there is no way for the research team to identify you or your responses to the survey. All surveys will be collected via REDCap. You may access the survey by clicking on the link on this courses Canvas site or by scanning the QR code projected here. Your assistance is greatly appreciated.

Do you have any questions about the research study?

If you have any additional questions later, please contact Dr. Taylor Little at telittle@umkc.edu or Dr. Melanie Simmer-Beck at simmbereckm@umkc.edu. If you have questions or concerns about your rights as a research participant, you can call UMKC Research Compliance at 816-235-5927.

<https://redcap.link/szgzg4gj>



APPENDIX C

EMAIL RECRUITMENT SCRIPT TO RESIDENTS

Hello, my name is Dr. Taylor Little. I am a candidate for the Oral and Craniofacial Sciences Masters and a resident in the Orthodontics and Dentofacial Orthopedics department here at UMKC. We are conducting a research study to better understand the well-being of students and residents enrolled in UMKC's dental student and dental resident programs. We would like to assess your demographics and your level of anxiety and depression. Results will help determine how to expand wellness interventions, programming, and resources at UMKC School of Dentistry to support our students and residents.

The survey will take approximately 5 minutes to complete. Your participation is entirely voluntary; you may skip any questions that you do not want to answer or choose to stop participating at any time. There are no risks or benefits to participating in this study and it will not have any influence on your grade in any class or your rights as a resident.

Your responses will be completely anonymous. Please be assured, there is no way for the research team to identify you or your responses to the survey. All surveys will be collected via REDCap. Your assistance is greatly appreciated.

Do you have any questions about the research study? If so, please contact Dr. Taylor Little at tlittle@umkc.edu or Dr. Melanie Simmer-Beck at simberbeckm@umkc.edu. If you have questions or concerns about your rights as a research participant, you can call UMKC Research Compliance at 816-235-5927.

If you choose to participate, the survey should take about 5 minutes. The link is below.

<https://redcap.link/szgzg4gj>



APPENDIX D

FOLLOW-UP EMAIL SCRIPT TO STUDENTS

Dear Dental Students,

Thank you for taking time to complete our survey to better understand your demographics and your well-being. We have gained valuable insight and are using this information to determine how to expand wellness interventions, programming, and resources at UMKC School of Dentistry.

For those of you who have not yet completed the survey, we invite you to do so. **It is really important for ALL students to have a voice.** The survey will take about 5 minutes. All responses will be completely anonymous. Please be assured, there is no way for the research team to identify you or your responses to the survey. The deadline to complete the survey has been extended to November 11th.

If you want to participate, you may open the survey in your web browser by clicking the following link:

<https://redcap.link/szg4gj>



Do you have any questions? If so, please contact Dr. Taylor Little at tlittle@umkc.edu or Dr. Melanie Simmer-Beck at simberbeckm@umkc.edu. We are happy to answer questions through e-mail or schedule an individual or group Zoom meeting.

Thank you,

Dr. Simmer-Beck and Dr. Little

APPENDIX E

FOLLOW-UP EMAIL SCRIPT TO RESIDENTS

Dear Dental Residents,

Thank you for taking time to complete our survey to better understand your demographics and your well-being. We have gained valuable insight and are using this information to determine how to expand wellness interventions, programming, and resources at UMKC School of Dentistry.

For those of you who have not yet completed the survey, we invite you to do so. **It is really important for ALL residents to have a voice.** The survey will take about 5 minutes. All responses will be completely anonymous. Please be assured, there is no way for the research team to identify you or your responses to the survey. The deadline to complete the survey has been extended to November 11th.

If you want to participate, you may open the survey in your web browser by clicking the following link:

<https://redcap.link/szgzg4gj>



Do you have any questions? If so, please contact Dr. Taylor Little at tlittle@umkc.edu or Dr. Melanie Simmer-Beck at simberbeckm@umkc.edu. We are happy to answer questions through e-mail or schedule an individual or group Zoom meeting.

Thank you,

Dr. Simmer-Beck and Dr. Little

APPENDIX F

IRB APPROVAL LETTER



Institutional Review Board
University of Missouri-Kansas City

5319 Rockhill Road
Kansas City, MO 64110
816-235-5927
umkcirb@umkc.edu

July 19, 2022

Principal Investigator: Melanie Lea Simmer-Beck
Department: Dent Public Health & Behav Sci

Your IRB Application to project entitled "MENTAL HEALTH ASSESSMENT OF DENTAL STUDENTS AND DENTAL RESIDENTS IN A MIDWESTERN DENTAL SCHOOL: A PILOT STUDY Little/Simmer-Beck" was reviewed and determined to qualify for IRB exemption according to the terms and conditions described below:

IRB Project Number	2092349
IRB Review Number	380249
Initial Application Approval Date	July 19, 2022
IRB Expiration Date	N/A Revised Common Rule
Level of Review	Exempt
Project Status	Active - Exempt
Exempt Categories	45 CFR 46.104(d)(2)
Risk Level	Minimal Risk

Approved Documents

- little_research_recruitment_scripts_2092349_07-13-22.docx
- little_research_survey_instrument_2092349_07-13-22.docx

The principal investigator (PI) is responsible for all aspects and conduct of this study. The PI must comply with the following conditions of the determination:

1. No subjects may be involved in any study procedure prior to the determination date.
2. Changes that may affect the exempt determination must be submitted for confirmation prior to implementation utilizing the Exempt Amendment Form.
3. The Annual Exempt Form must be submitted 30 days prior to the determination anniversary date to keep the study active or to close it.
4. Maintain all research records for a period of seven years from the project completion date.

If you are offering subject payments and would like more information about research participant payments, please click here to view the UM system Policy on Research Subject Payments: https://www.umsystem.edu/oei/sharedservices/apss/nonpo_vouchers/research_subject_payments

If you have any questions, please contact the IRB at 816-235-5927 or umkcirb@umkc.edu.

Thank you,
UMKC Institutional Review Board

VITA

NAME: Taylor Little

DATE AND PLACE OF BIRTH: January 29th, 1994; St. Louis, MO

EDUCATION:

5/2012	Diploma	Parkway South High School Manchester, MO
05/2016	B.S. Biology	Murray State University Murray, KY
05/2021	D.M.D.	A. T. Still University Missouri School of Dentistry & Oral Health Kirksville, MO
12/2023 In Process	M.S. Oral & Craniofacial Sciences	University of Missouri-Kansas City School of Dentistry Kansas City, MO
12/2023 In Process	Orthodontics & Dentofacial Orthopedics	University of Missouri-Kansas City School of Dentistry Kansas City, MO

PROFESSIONAL ORGANIZATIONS:

2017-Present American Dental Association
2017-Present Missouri Dental Association
2021-Present American Association of Orthodontists

HONORS:

2016 Sigma Xi Outstanding Student Research Award
2020 American Student Dental Association District 8 Delegate of the Year
2021 American Student Dental Association Award of Excellence
2021 Missouri School of Dentistry & Oral Health Outstanding Student Ambassador
2021 Hu Friedy Golden Scaler Award
2021 Omicron Kappa Upsilon Inductee