

PSYCHOLOGICAL AND PHYSIOLOGICAL CORRELATES OF
BURNOUT IN POSTGRADUATE DENTAL RESIDENCY TRAINING: A
RETROSPECTIVE STUDY

by

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CERTIFICATE OF APPROVAL


MASTER'S THESIS

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ABSTRACT

PSYCHOLOGICAL AND PHYSIOLOGICAL CORRELATES OF BURNOUT IN POSTGRADUATE DENTAL RESIDENCY TRAINING: A RETROSPECTIVE STUDY

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Background. High levels of stress and burnout have been well documented in medical residencies, dental students, and among practicing dentists. However, there is little research on the prevalence of burnout among dental residents at the post-graduate level. The purpose of this study was to determine the prevalence of burnout among naval postgraduate dental residents and explore potential mediating mechanisms associated with burnout severity. **Aims.** This study has three aims. 1) Determine the relationships among burnout and anxiety, depression, fatigue, and poor sleep quality. 2) Explore the potential buffering effects of diet, exercise, social support, and resting vagal tone on burnout. 3) Explore any potential gender differences on burnout and other study measures.

Materials and Methods: Study participants were residents attending the Naval Postgraduate Dental School (n=21). All study participants completed self-report measures assessing burnout, anxiety, depression, fatigue, sleep quality, physical activity, diet, and social support. In addition, participants completed a physiological assessment to determine resting autonomic activity and reactivity to a cognitive challenge.

Results: Participants were grouped on burnout severity score (no=9, moderate=8, yes=4). Burnout group severity was significantly related to symptoms of anxiety and depression, poor sleep quality, and high fatigue. Exercise, diet, social support, and high resting vagal tone had no significant relationship to burnout group. No significant differences were detected between men and women on burnout group, anxiety, depression, sleep quality, or fatigue.

Conclusion: These results suggest that burnout is a reality for some students. However others report minimal impact of residency on psychological distress and physical functioning. Future studies should explore potential mediating variables that may better predict burnout severity. This may lead to improved management of distress over the course of residency training for residents at higher risk for experiencing burnout.

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Chapter 1: Review of the Literature

Residency training is among the most difficult of educational programs. The impact of long term and short term challenges on the resident's psychological well-being and risk for developing burnout has been well documented in medical residency training. During the 1970's and 1980's, medical educators attempted to examine the quality of the personal and professional lives of residents. Several small nonrandomized studies found a higher incidence of depression, anger, and hostility in residents than in the general population. (Collier, 2002) Additionally, studies have shown that medical residency training programs have both long and short term detrimental effects on emotional health, sleep quality and quantity, physical health, fatigue, and social relationships. 78% of medical residents experienced at least 1 episode of burnout during training (Collier, 2002). A survey of general surgery residents found that 28% reported weekly feelings of emotional exhaustion, 32% noted a personal and professional balance that was "very poor" or "not great," and 1 in 7 considered leaving their residency at least once a week. (Shapiro, 2017.)

While there is an awareness for the risk for burnout among medical residency programs, little research has studied dental postgraduate residency programs. Dental residency programs display similar mental, emotional, and physical challenges to medical residency programs (Divaris, 2012). Divaris et al found high rates of burnout among a sample of Greek dental postgraduate students. He also found that substantial proportions

of dental students demonstrated signs of psychologic morbidity during their residency training.

The concept of burnout is of particular concern for medical professionals. Maslach et al defined burnout as a syndrome involving chronic fatigue, emotional exhaustion, and fatigue at the very idea of work. Burnout has been assumed to result from chronic occupational stress. Aspects of burnout have been linked to a negative impact on resident's well-being, as well as reduced performance and decreased patient satisfaction. If unaddressed, burnout can result in a decrease in personal achievement in which the clinician doubts his or her abilities and capacity for success (Shapiro, 2017.)

The aim of this study was to explore the prevalence of burnout among naval postgraduate dental residents and explore the relationship between both psychologic and physiologic factors that could potentially serve as protective factors, lowering an individual's risk for developing burnout. This pilot study is innovative due to the fact that the population is under-studied and considered a high risk for developing burnout. Additionally, no previous studies utilized physiologic markers of perceived stress and burnout.

Physiologic stress responses, which are designed to produce stress adaptation and maintain homeostasis (allostasis), are mediated through output of hormones via the hypothalamic-pituitary-adrenal (HPA) axis, the autonomic nervous system (ANS), and interaction with mediators of immune and metabolic systems.(Teixeira, 2015.) While normally protective, these stress response mechanisms can be severely damaging when dysregulated and fail to cease after termination of stressor exposure. (Teixeira, 2015.) Individual stress sensitivity and reactivity is thus important in the etiology and

maintenance of pathologies for which excessive stress impact is a risk factor including cardiovascular, metabolic and immunological diseases as well as stress-related psychopathologies such as depression, anxiety, substance abuse and personality disorders (Teixeira, 2015.). An autonomic imbalance occurs when a person can't regulate emotional or physical stressors. Individuals experiencing chronic emotional or physical stress have a hyperactive sympathetic nervous system. The parasympathetic nervous system, which serves as an inhibitory system for the flight or fight response, loses its ability to regulate the sympathetic system, resulting in autonomic imbalance. Autonomic imbalance and decreased parasympathetic tone in particular may be the final common pathway linking negative affective states and dispositions to numerous diseases and conditions as well as increased morbidity and mortality, and it may be implicated in psychopathological conditions (Teixeira, 2015.)

This network of structures can be indexed by heart rate variability (HRV) and vagal tone (RMSSD) (Teixeira, 2015.). Vagal tone is also commonly measured in order to evaluate a patient's autonomic balance. Vagal tone has been reported to reflect the general level of parasympathetic activity (Grossman, 2004). Vagal tone is typically considered in the context of heart function, but also has utility in assessing emotional regulation and other processes that alter, or are altered by changes and modification of the parasympathetic activity (Grossman, 2004).

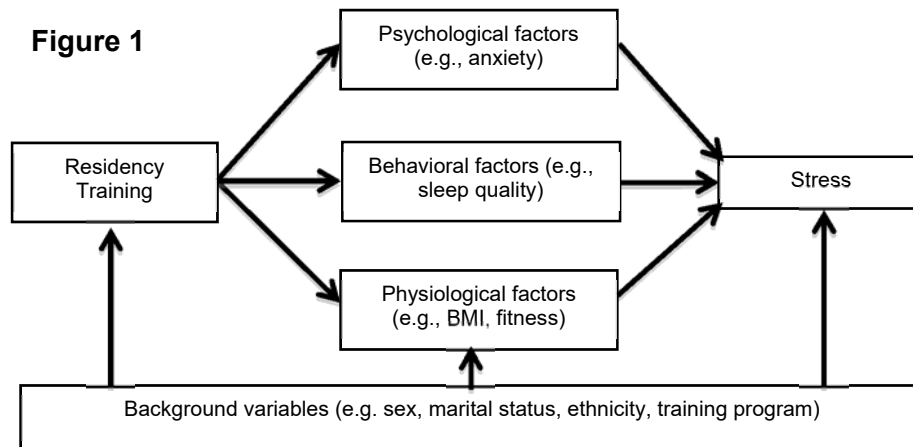
Therefore, due to the complex nature of the stress response and the interaction of both physiologic and psychologic factors on the manifestation of stress, it is critical to include a physiologic measure to assess resident's perceived stress and risk for burnout. Moreover, by identifying those individuals who display autonomic resilience, we may be

able to discover if these individuals display lower risk for burnout and potentially determine if there are protective mechanisms in place that allow these individuals to be resilient and fare better in rigorous academic environments.

This study improves upon previous studies since previous studies have not explored potential mediating variables that may reduce a resident's risk for developing burnout. We looked at the following factors: sleep, social support, diet, physical activity, and nutrition and predicted that these self-care measures would lower a resident's risk for developing burnout.

Lastly, no research has evaluated gender differences on perceived stress and the risk for burnout in postgraduate dental residency. In an article by Shapiro assessing the prevalence of the use of shame in OMS residency training and the relationship of shame and resident burnout, he found that gender is an important risk factor for burnout. Although the study found no gender predilection for burnout, 100% of female respondents who were exposed to just a single shame event had decreased self-esteem ($P < .0001$) and were significantly more likely to experience isolation ($P < .001$) and depression ($P = .037$) (Shapiro, 2017). The findings of this study highlight the specific emotional challenges women face in residency and suggest that gender could potentially be a risk factor for developing burnout in postgraduate dental residents.

This study has three aims: 1) Determine the relationships among burnout and anxiety, depression, fatigue, and poor sleep quality. 2) Explore the potential buffering effects of diet, exercise, social support, and resting vagal tone on burnout. 3) Explore any potential gender differences on burnout and other study measures.



Chapter II: Materials and Methods

Participants: 21 first or second year residents attending Naval Postgraduate Dental School for two or more consecutive academic years starting in June of 2017 volunteered for the study. The Naval Postgraduate Dental School (NPDS) is the US Military's premier postgraduate dental training institution and has been in operation for 94 years now. The school has five residency programs that are either two or three years in duration and includes endodontics, periodontics, prosthodontics, oral and maxillofacial pathology, orofacial pain, and comprehensive dentistry. NPDS typically has about 20 new residents each year and the academic year runs from July-June. Residents are active duty military dentists; the majority are Navy dentists, with the occasional Army or Air Force dentists as necessitated by service needs. All residents were individually asked if they were interested in participating in this study. If a resident was interested in

participating in the study, they then signed an informed consent obtained according to the IRB/HIPAA guidelines.

Inclusion Criteria: Age ≥ 18 . All residents enrolled in NPDS were eligible to participate in this study.

Exclusion Criteria: Pregnant or breast-feeding women, or those residents who decided they do not wish to participate in the study.

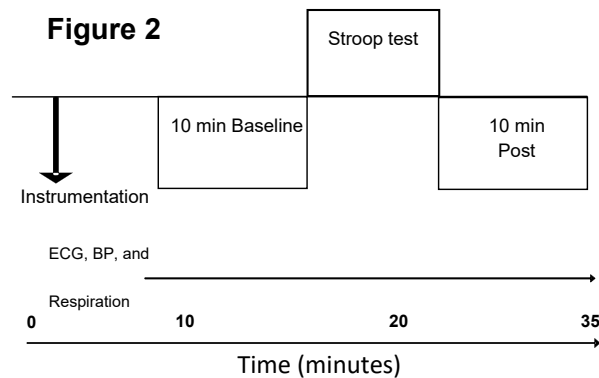
Study procedures: Written informed consent was obtained from eligible and interested residents after the start of the academic year in accordance with IRB/HIPAA guidelines. After consent, all participants were scheduled for a baseline study assessment. All study participants completed study self-report measures and completed a brief physiologic assessment. Details of each self-report measure are described below and the self-report measures are listed in table 1.

Physiological Assessment

All study participants completed an identical brief physiologic stress assessment. This minimally invasive assessment recorded ECG, continuous blood pressure, and respiration rate. The assessment began by having the participant rest quietly for ten minutes in a recliner in a quiet room (Dr. Schmidt's office building 2, third floor, room 3260). During this baseline recording, the participant rested comfortably and minimized physical movement. To elicit a standardized cardiovascular response, the participant completed the Stroop Color Word test (described below). This test was then followed by ten minutes of post-challenge physiological recording where the participant was

instructed to rest quietly in the recliner while the cardiovascular recovery curve was monitored. The physiological assessment took approximately 35 minutes.

Cardiovascular activity was recorded using a 3-lead electrocardiogram (Biopac ECG100C) placed in the Lead II configuration and sampled at 1000hz. Continuous blood pressure will be recorded on a beat-to-beat basis by photoplethysmography (Biopac NIBP 100D). Respiration rate will be recorded using strain-gauge belts to assess thoracic and abdominal distention during inspiration (Biopac RSP100C).



Self-Report Assessments

Demographics and Health History Questionnaire: All participants completed a brief demographics and health history questionnaire after study enrollment. Information recorded here includes ethnicity, race, marital status, smoking and alcohol use as well as questions about medical and surgical history, current medications, and current use of non-prescription supplements.

Generalized Anxiety Disorder (GAD-7): The GAD-7 is a 7-item measure used to assess presence of symptoms of generalized anxiety over the previous two weeks. The GAD-7

is a widely used assessment instrument and has demonstrated good psychometric properties in clinical and research applications (Spitzer, RL., et al).

Patient Health Questionnaire-9 (PHQ-9): The PHQ-9 is a 9-item measure of the presence and severity of depressive symptoms over the previous two weeks. Test-retest reliability, internal consistency, and convergent validity have been established (Kroenke, K. et al)

Perceived Stress Scale (PSS): The PSS is a 10-item measure used to assess perceived stress over the previous month. The PSS is the most frequently used measure of perceptions of stress and has been translated into many languages. The scale has acceptable psychometric properties. (Roberti, JW, et al).

The Burnout Measure, Short Version (BM-SV): The BM-SV is a 10 item measure of burnout at work. The items are scored on a 1-7 Likert scale ranging from “never” to always. The BMSV has good psychometrics and is commonly used assessment tool in work stress and burnout research applications (Malach-Pines, A.)

Fatigue Symptom Inventory (FSI): The FSI is a 14-item measure used to assess the severity, frequency, and daily pattern of fatigue as well as its perceived interference with quality of life over the previous week. The FSI has been used in many research and clinical applications and has demonstrated good psychometrics (Donovan KA, et al)

Insomnia Severity Index (ISI): The ISI is a brief instrument that assesses the severity of both nighttime and daytime components of insomnia. It has been validated for use as a screening tool to detect sleep disturbances in research and clinical settings (Bastien, CH.)

Paffenbarger Physical Activity Scale (PPAS): The PPAS is a 4-item measure of perceived physical activity. The measure has several open and closed-ended items that ask the participant to estimate their usual levels of daily physical activity, frequency, and exertion. Participants also list any sports or recreational activities. The PPAS has good psychometrics and is a commonly used measure in exercise research studies. (Simpson, K.)

Diet History Questionnaire: The Diet History Questionnaire is used by the National Institute of Health to evaluate their patient's diet. We modified the questionnaire to include questions about water, caffeine, and alcohol intake in order to better evaluate our patient population. The Questionnaire is validated by the National Institute of Health.

Duke-Social Support Questionnaire (DUKE-SSQ). The DUKE-SSQ is an eight-item widely used social support questionnaire. The scale ranges from "much less than I would like to" to "as much as I would like." The DUKE-SSQ yields a total score and alpha has ranged from 0.86 to 0.88.

Stroop Color Word Test: The Stroop Color Word test is a well-validated measure that assesses ability to selectively attend to the color of a word while filtering out its meaning. The interference of the word meaning when naming the color is called the Stroop effect. Theoretically, recent interpretations of the Stroop effect are based on the parallel distributed processing model of Cohen et al. The parallel distributed processing model sees capacity limitations as system-resource limits and views the Stroop effect as a decision process gathering evidence by the parallel processing of multiple sources of relevant and irrelevant information, which determines the length of processing time

needed to respond to the Stroop words (Cohen, JD). This classic cognitive challenge paradigm is an effective yet non-invasive way to elicit sympathetic arousal and has been used in many studies over the past several decades.

Table 1: Self-Report Measures
Demographics and Health History
Depression (PHQ-9)
Anxiety (GAD-7)
Perceived Stress Scale (PSS)
Burnout Measure – Short Version (BM-SV)
Fatigue Symptom Inventory (FSI)
Insomnia Severity Index (ISI)
Paffenbarger Physical Activity Scale (PPAS)
Diet History Questionnaire
Duke Social Support Questionnaire (DUKE-SSQ)
Physiological Assessment (Stroop Test)

Statistical Analyses:

Confidentiality was maintained on all materials through the use of participant ID numbers. Data were analyzed using the SPSS 24.0 statistical package (SPSS, Inc.). The first step in data analyses was to compute descriptive statistics including mean, and standard deviations of all demographic, physiological, and self-report data. Any outlying scores were compared to the original data to ensure there were no data entry errors. The alpha level for all analyses was set at $p < 0.05$. Hypotheses one was evaluated using the

Pearson Correlation which is the measure of the linear correlation between two variables to evaluate the relationship between burnout, anxiety, depression, fatigue, and poor sleep quality. Hypothesis two was evaluated using the Sobel test which is a method of testing the significance of a mediation effect. Hypothesis three was evaluated using a repeated measures analysis of variance (ANOVA) strategy comparing males and females on the heart rate variability index of RMSSD across the different periods of the physiological assessment (baseline, stressor, recovery).

Chapter III: Results

The Prevalence of Burnout among the 21 subjects was first evaluated. 4 Subjects were found to exhibit high burnout according to the self-report measure, 8 subjects exhibited moderate burnout, and 9 subjects exhibited mild burnout (Table 2)

Table 2: Prevalence of Burnout Among Subjects

Burnout	Number of Subjects
Severe	4
Moderate	8
Mild	9
Total Sample Size	21

Table 3 shows the average scores for all residents according to anxiety, depression, burnout, sleep quality, and interference from fatigue. Anxiety score is

indicative of mild anxiety based on norms for this measure. Scoring between 5-9 on this measure falls into the mild category for anxiety. Depression score is in the normal range, again based on norms for this measure. Sleep quality score: scoring in the range 8-14 indicates mild to moderate sleep disturbance. FSI score suggests moderate symptoms of fatigue based on norms for this measure

Table 3: Variable Averages for the Sample

Measure	Mean	Standard Deviation
Anxiety	5.48	3.7
Depression	4.48	3.7
Burnout	26.81	11.4
Sleep Quality	8.43	4.7
Interference from Fatigue	21.67	14.4

Aim 1 Results:

Our first aim sought to determine the relationships among burnout, anxiety, depression, fatigue, and poor sleep quality. Our study found that burnout was significantly correlated to anxiety, depression, burnout, sleep quality and interference from fatigue using the Pearson correlation ($p < .01^{**}$). Burnout was most strongly correlated to anxiety (Table 4).

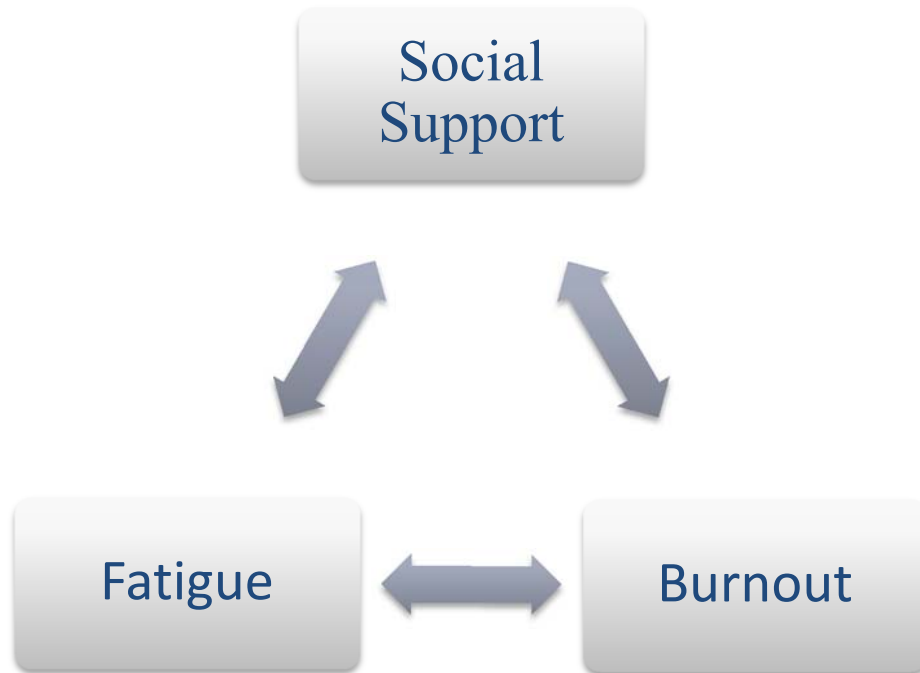
Table 4: Pearson Correlation of Burnout

Measure	Anxiety	Depression	Sleep Quality	Interference from Fatigue
Burnout	.767**	.760**	.557**	.731**

Aim 2 Results:

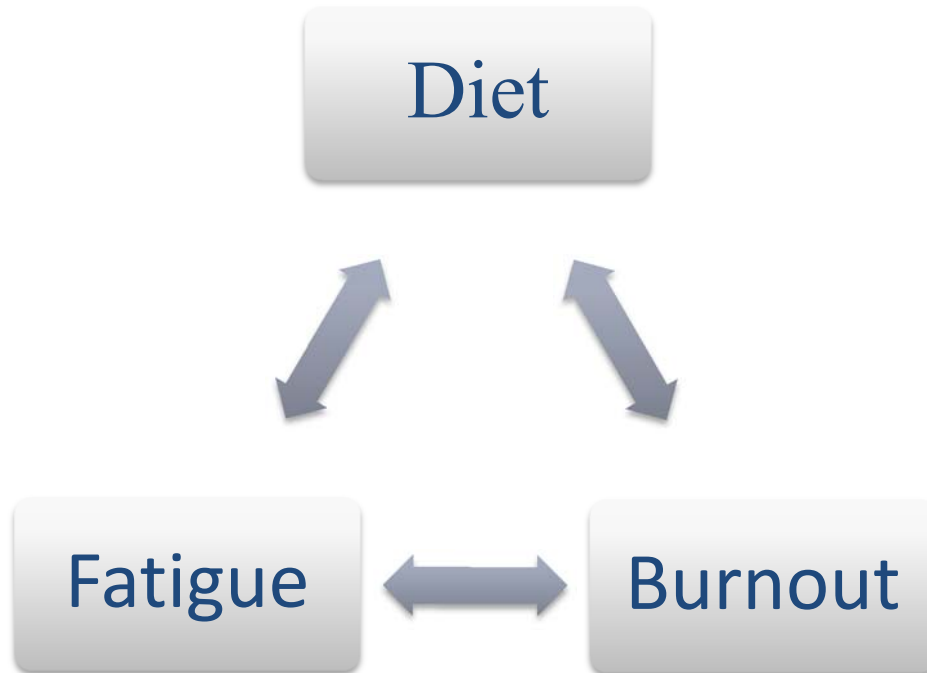
Our second aim was to explore possible buffering effects of social support and diet on the relationship between fatigue and burnout. We used a Sobel test, which is a statistical test for assessing mediational relationships (Baron and Kenny, 1986). We know that fatigue and burnout are highly correlated in our study. When we tested to see if social support mediated this relationship, we did not find any change (Figure 3).

Figure 3: Exploring Buffering Effects of Social Support on Burnout using the Sobel test



When we entered Diet into the model (Figure 4), again we did not find any mediational influence on the association between fatigue and burnout.

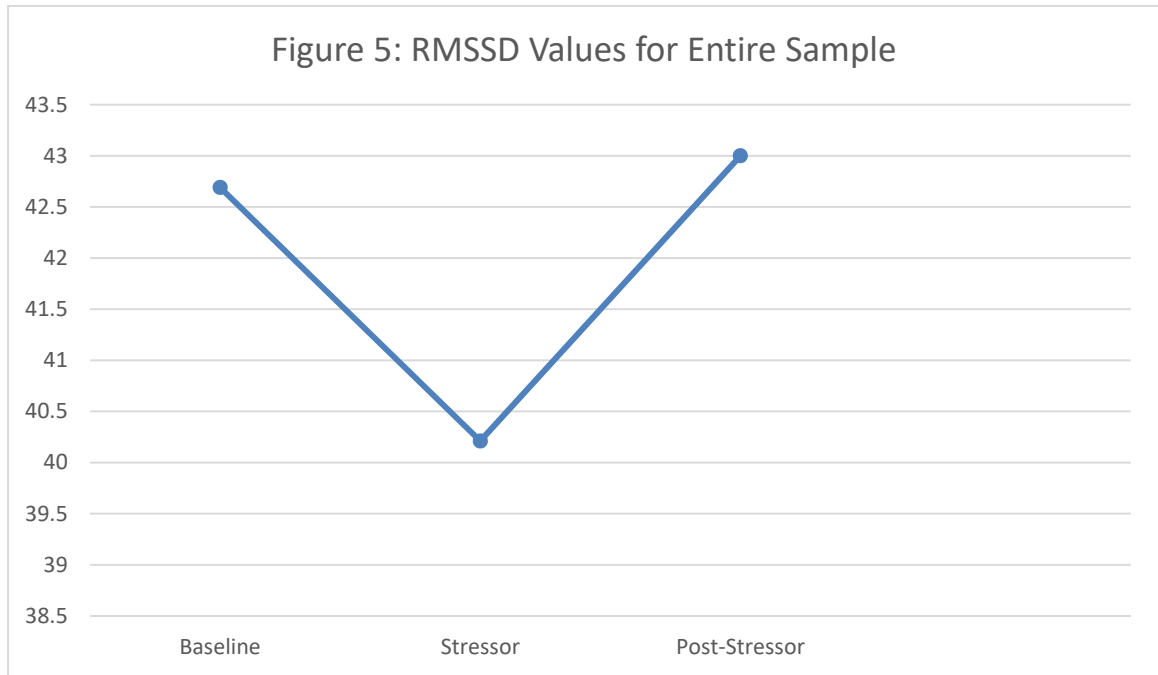
Figure 4: Exploring Potential Buffering Effects of Diet on Burnout



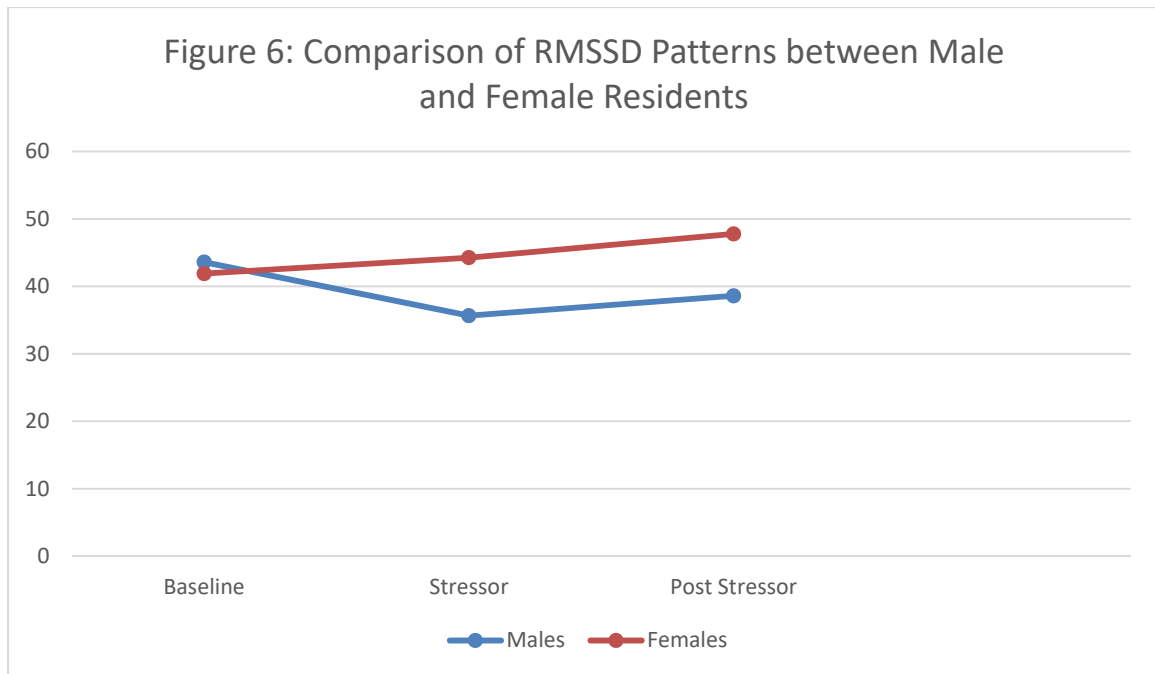
Aim 3 Results

For our third aim, we sought to explore any potential gender differences on burnout and the other study variables we evaluated. We had approximately a 50-50 split between male and female subjects. For all of the psychological assessments, there was no difference found between men and women. Although not significantly different, women on average exhibited higher values for anxiety, depression, poor sleep quality, fatigue, and burnout than men. We also sought to evaluate vagal tone among male and female residents but first looked at the breakdown of vagal tone for the entire sample. Figure 5 shows the entire sample's averages for vagal tone as represented by Root Mean Square of the Successive Differences in normal-to-normal heart beats (RMSSD) for the duration of the physiologic assessment. At the baseline the mean RMSSD value score was 42.69. When they were subjected to the Stroop test the mean RMSSD value dropped down to 40.21 which is what we would expect since the Stroop test is a Cognitive

Stressor. The mean post stressor RMSSD value was 43.46 which is what we would expect. So as a whole our participants showed the anticipated pattern of vagal response and recovery from stress measured via RMSSD.



When we compared men vs women, while the mean RMSSD value was not significantly different, it was interesting to compare the pattern of the vagal response between men and women (Figure 6). While men displayed the anticipated pattern of the stress response as we saw earlier when examining the total sample size, women actually became more relaxed during the stress test and even more so after the stress test. This could suggest they anticipated the test and may have had some anxiety towards doing the assessment prior to baseline.



Chapter IV: Discussion

The purpose of this study was to explore the prevalence of burnout among naval postgraduate dental residents. This study shows that burnout is a reality for many residents at Naval Postgraduate Dental School and the prevalence is similar to medical residency programs. Naval Postgraduate Dental School residents on average display mild anxiety, mild to moderate sleep disturbance, and moderate fatigue when compared to the general population. These findings add to the knowledge base of stress and burnout in the dental education field and provide new information about this area of postgraduate dental education that has been less studied. The significance of these findings demonstrate that Naval Postgraduate Dental Residents are a high risk population for developing burnout which we know can lead to a negative impact on resident’s well-being, as well as reduced performance and decreased patient satisfaction (Shapiro, 2017). It may also lead to an increase risk for resident drop out which would negatively impact the Dental Corps ability to fill specialty billets.

Our first aim of this study was to determine the relationships among burnout and anxiety, depression, fatigue, and poor sleep quality. Our study found that burnout was significantly correlated to anxiety, depression, burnout, sleep quality and interference from fatigue. Burnout was most strongly correlated to anxiety. The correlation between these variables has not been studied previously in post-graduate dental or medical students. Future studies should explore the relationships between these variables further to explore potential predictors of burnout. Further, it is possible that residents displaying high initial scores of anxiety and depression and/or exhibit high fatigue and poor sleep patterns at the start of their programs may be more likely to experience burnout. This line of research would help educators identify high risk residents at the inception of residency and potentially allow educators the opportunity to intervene and implement prevention programs to reduce the prevalence of burnout in their programs.

The second aim addresses a novel question that hasn't been studied in previous research in dental or medical residents. We sought to explore if there were buffering variables that could reduce burnout scores. This would be an important finding since residency programs could utilize the information to educate their residents and potentially help prevent burnout from occurring or reduce burnout prevalence, improving resident experience and educational success. We selected social support and diet as potential buffering variables that could affect the relationship between fatigue and burnout. Diet was not associated with burnout. All subjects reported a healthy diet on the self-report measure. This finding could be attributed to the fact that this a military residency and there is a requirement to maintain physical standards. It also could be attributed to the

fact that the survey was a subjective assessment. Future studies could use other methods to more objectively evaluate residents' diets. We also found that social support did not buffer resident burnout levels. Again we used a self-report measure and all subjects subjectively believed they had good social support. With such a narrow margin to compare variation between samples we could not fully examine the influence of this measure on burnout levels. These buffering variables should be continued to be studied. With a larger sample size and with more variation in levels of social support and diet between subjects we may find that it carries a significant influence on burnout levels.

The third aim explores potential gender differences on burnout. The influence of gender on burnout in medical and dental residency programs has not been extensively studied. Although not significant, we did report that women had higher scores overall for anxiety, depression, burnout, fatigue, and sleep quality. With a larger sample size this could be significant. We also sought to evaluate the difference in physiologic stress between genders by examining resident vagal tone which is a measure of an individual's autonomic balance. Previous studies have only relied on self-report assessments. No studies have included an evaluation of autonomic resilience. We chose to measure Vagal tone (RMSSD) as a measure of autonomic resilience. We first compared the breakdown of the entire sample and saw that residents on average displayed the anticipated pattern, with the entire sample presenting with a stress response during the stressor. When we compared men vs women, however, while the mean RMSSD value was not significantly different, men displayed the anticipated pattern of the stress response while women actually became more relaxed during the stress test and even more so after the stress test. This could suggest they anticipated the test and may have had some anxiety towards

doing the assessment prior to baseline. Another possible explanation is that the test served as a distraction from the day to day stressors they were subjected to and over the course of the assessment became more relaxed. Psychological and physiologic differences among gender should continue to be explored with a larger sample size in order to determine if gender is truly an important risk factor for burnout in postgraduate dental residency programs.

Limitations

The results of this study should be viewed within the limitations of the data. We did not receive IRB approval until October 2017. Our goal was to get a true baseline assessment of all our variables which ideally would have been at the start of the school year in June before residents were subjected to any stressors. Another limitation was our small subject size and the fact that there was little variation among subjects. All subjects subjectively believed they had a good diet, had good social support and exercised regularly. There was not enough range among residents in terms of the buffering variables we tested to truly test the impact of these factors on burnout levels. Having more objective psychologic assessments could also reveal more accurate evaluations of fatigue, sleep quality, diet, and social support and the correlation to burnout.

Chapter V: Conclusion

In conclusion, the results suggest that burnout is a reality for many postgraduate dental residents. Burnout can lead to a decrease in personal achievement, self-doubt, and even increase the risk for drop out. This study sheds light on the prevalence of burnout in Naval Postgraduate Dental Residents, an understudied population, but merely scratches

the surface of our understanding of the problem of postgraduates' emotional well-being and risk for developing burnout. Future studies should evaluate a larger sample size and continue to explore potential mediating variables that may better predict burnout severity. Identification and provision of support to vulnerable individuals early during their training are likely to be the most promising strategy for improving their emotional and professional well-being (Divaris, 2012).

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