

PREDICTORS OF STRESS, BURNOUT, AND WELL-BEING IN POSTGRADUATE
DENTAL RESIDENCY TRAINING: A PROSPECTIVE STUDY

by

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CERTIFICATE OF APPROVAL

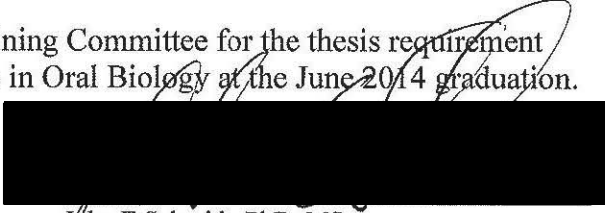
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ABSTRACT

PREDICTORS OF STRESS, BURNOUT AND WELL-BEING IN POSTGRADUATE DENTAL RESIDENCY TRAINING: A PROSPECTIVE STUDY

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Introduction: Postgraduate training is challenging and stressful. Several studies have shown that medical residencies have short and long-term effects on emotional health, physical functioning, and social relationships in residents. Most of these studies have also looked at the relationship between stress and burnout through self-report measures at one time point. However there has been no study exploring presence and change in stress and burnout in graduate dental residency training. In addition, previous research has not explored the impact of residency training on autonomic balance. Aims: The purpose of this study was to determine if stress and burnout among Naval Postgraduate Dental School (NPDS) residents increased during a three-month period. Secondary aims included 1) exploring potential buffering effects of self-care activities such as diet and exercise on stress and burnout and, 2) exploring the association among stress and burnout with autonomic balance. Methods: Study participants were residents attending the NPDS (n=21). All study participants completed two identical self-report and physiological assessments three months apart. Assessments included psychological, physical, social

functioning, and self-care activities. Results: No change was found in perceived stress or autonomic balance between the two time points ($p's > .05$). Level of reported burnout changed significantly with more residents reporting significant burnout ($p < 0.05$). Neither Time 2 burnout nor perceived stress were significantly associated with diet or exercise at time 1 or Time 2 ($p's < 0.05$). Time 2 burnout was significantly correlated with social support ($p < 0.05$). There was a statistically significant decrease in exercise level ($p < 0.05$).

Conclusions: It is evident that dental residency becomes more stressful over time. There may also be a seasonal impact here. Future studies should focus on possible ways to maintain low level of stress and burnout among residents utilizing more self-care practices.

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INTRODUCTION

High levels of stress and burnout have been documented in medical residencies, dental students, and among practicing dentists¹⁻⁴. However, there is a paucity of information available on stress and burnout among dental residents in post-graduate training programs⁵. The challenges, short term and long term impact of medical residency training has been an area of intense study since the late 1980's³. At that time, residency programs began to improve identification and management of 'burnout' among medical residents. Medical residency training has been shown in several studies to have both short and long-term detrimental impact on emotional health, sleep quantity and quality, physical health, fatigue, and social relationships^{3,7,9}.

Many medical residency programs have made significant improvements in the areas of addressing residency stress and burnout through the adoption of self-care awareness programs, stress management programs, and careful monitoring of resident mental and physical health¹¹. However, the awareness and application of these techniques is nearly non-existent in post-graduate dental residency training programs. Dental residency can be just as mentally, emotionally, and physically challenging as medical residency^{2,5,12}. Several studies have found strong evidence of significant stress and burnout in post-graduate dental residents via self-report measures^{2,5,12}. However, no studies in medical or dental residency have assessed physiological stress using heart rate, blood pressure or other biomarkers. Furthermore, it is rare for a dental residency program to monitor levels of stress and/or burnout using self-report measures or biomarkers. The present study is highly innovative, not only because of the understudied population that is known to be at high risk for stress and burnout, but also because it proposes a much broader and more comprehensive approach to assessing perceived and physiological stress.

This study had three aims:

Aim 1: To measure changes in stress and burnout among (NPDS) residents during a 3-month period.

Aim 2: To explore potential buffering effects of self-care activities such as diet and exercise on stress and burnout over a 3-month period.

Aim 3: To explore association among stress and burnout with physiological reactivity (autonomic balance).

Materials and Methods

Participants. All Naval Postgraduate Dental Students enrolled in a two year or longer consecutive academic program starting in 2017 were eligible for this study. The majority of residents are Navy dentists, with the occasional Army, Air Force, or Coast Guard dentists as necessitated by service needs. All residents were asked individually if they are interested in participating in this study. If the resident was interested, informed consent was obtained according to IRB/HIPAA guidelines. Participants completed a physiological assessment to determine resting autonomic activity and reactivity to a cognitive challenge. Two assessments were completed, one at base line and one at three-month mark.

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

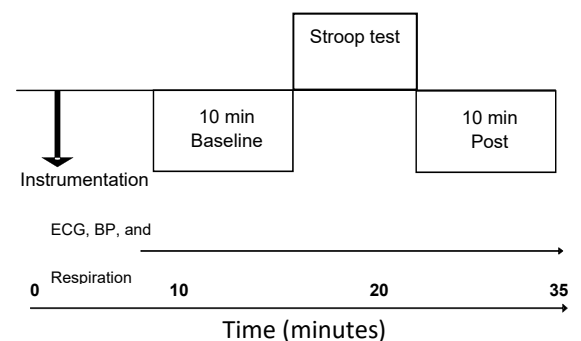
Exclusion criteria. Pregnant or breast-feeding women. If a participant withdrew from residency while enrolled in the study, she or he was released from further study participation.

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, 21 participants participated at the baseline assessment. A second set of physiologic and psychological assessment (identical to the one performed at baseline) was done 3 months later. Number of participants at the second assessment was 18 (3 were unable to complete the second assessment due to scheduling conflicts). Participants completed self-report measures and a physiological assessment. Details of the physiologic assessment and each self-report measure are described below.

Physiological Assessment

All study participants completed an identical brief physiological stress assessment. These minimally invasive assessments recorded ECG, continuous blood pressure, and respiration rate and began by having the participant rest for 10 minutes in a recliner in a quiet room (Dr. Schmidt's office, Building 2, 3rd Deck, Room 3260). During this baseline recording, the participant was instructed to rest comfortably and to minimize any physical movements. Next, to



elicit a standardized cardiovascular response, the participant completed the Stroop Color Word test (described below). This was then followed by ten minutes of post-challenge physiological recording where the participant was instructed to again 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 was recorded on a beat-to-beat basis by photoplethysmography (Biopac NIBP100D).

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-7¹⁸ 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 applications¹⁸.

Patient Health Questionnaire-9 (PHQ-9). The PHQ-9¹⁹ 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 established¹⁹.

Perceived Stress Scale (PSS). The PSS²⁰ 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 properties²¹.

The Burnout Measure, Short Version (BM-SV). The BM-SV²² 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 BM-SV has good psychometrics and is a commonly used assessment tool in work stress and burnout research applications^{23,24}.

Fatigue Symptom Inventory (FSI). The FSI²⁵ 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 applications²⁶ and has demonstrated good psychometrics²⁷.

Insomnia Severity Index (ISI). The ISI²⁸ 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^{28,29}.

Paffenbarger Physical Activity Scale (PPAS). The PPAS³⁰ 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 studies³¹.

Nutrition and Diet Assessment. All participants will complete a seven-item assessment of diet and nutrition. This measure will be keyed to diet and nutrition choices over the previous week and will include items on intake of fruit and vegetable, water, caffeine, alcohol, as well as an item on perceived quality of diet.

DUKE-Social Support Questionnaire (DUKE-SSQ). The DUKE-SSQ³² is an eight-item widely used social support questionnaire. The scale ranges from “much less than I would like” 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 Test³³ 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.³⁴. 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 words³⁵. 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.

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 $p < 0.05$.

Results

The data show an inverse correlation between decrease in exercise days per week with an increase in total burnout score between the two assessments. ($p = 0.015$) (Figure 1).

In order to compare the burnout levels, the residents were grouped into low, moderate, and high levels of burnout, based on score from the Burnout Measure. Burnout group did change significantly between the two time points with a significant increase in residents falling into the High Burnout range shown here in

RED from 3 residents at baseline to 7 residents at time 1 falling into this category. ($p < 0.05$) (Figure 2)

Comparison of anxiety level showed that those with moderate and high burnout (shown in figure 3 in yellow and red) exhibited significant increase in anxiety between the two assessments. ($p = 0.001$) (Figure 3)

Comparison of depression level revealed that those with high burnout shown here in red exhibited an increase in depression, the possibility that this increase was due to seasonal affect should be considered. ($p = 0.022$) (Figure 4)

Evaluation of fatigue level revealed that there was a significant difference in Interference from Fatigue among the burnout groups at both assessments. ($p = 0.015$) (Figure 5)

Vagal response was used to evaluate the autonomic resilience. The participants were about the same at baseline at both assessments. However, vagal response at Time 1 was much more reactive showing a stronger stress response than at Baseline. Furthermore, participants at Time 1 never fully recovered to their resting vagal tone during the post-stress recording period. ($p = 0.03$) (Figure 6).

DISCUSSION:

The current study had three aims

Aim 1: To measure changes in stress and burnout among (NPDS) residents during a 3-month period.

Aim 2: To explore potential buffering effects of self-care activities such as diet and exercise on stress and burnout over a 3-month period.

Aim 3: To explore association among stress and burnout with physiological reactivity (autonomic balance)

As to the first aim, the level of burnout increased significantly over the 3-month period with more residents reporting significant burnout. As residencies progress, the workload increases. This gradual yet consistent overload causes burnout in the residents. The level of anxiety and depression among residents also increased in the 3-month period. It is important to note that the second assessment was performed in January and there is a possibility of seasonal affective disorder causing an increase in the depression level.

As to aim 2, exercise was shown to have an inverse association with burnout which suggests that such self-care activities can have a positive buffering effect on burnout among residents.

As to aim 3, when vagal responses were compared between baseline and 3-month follow-up, it was evident that during re-assessment, residents exhibited a much higher response to stressors and they never fully recovered back to

baseline. Therefore, it is crucial to have preventive measure in place to prevent residents from reaching high burnout level.

The current study had multiple limitations:

- 1- The study didn't start collecting data till Oct 2017 which means the residents were three months into program, therefore a true baseline was never established.
- 2- Different residencies have different schedules therefore combining all residencies together can have a masking effect on true level of burnout and stress at different times

It is evident that dental residency becomes more stressful over time which leads to higher burnout. Future studies should focus on possible ways to maintain low level of stress and burnout among residents utilizing more self-care practices.

Furthermore, physiologic assessment of stress using salivary cortisol as a biomarker should be considered.

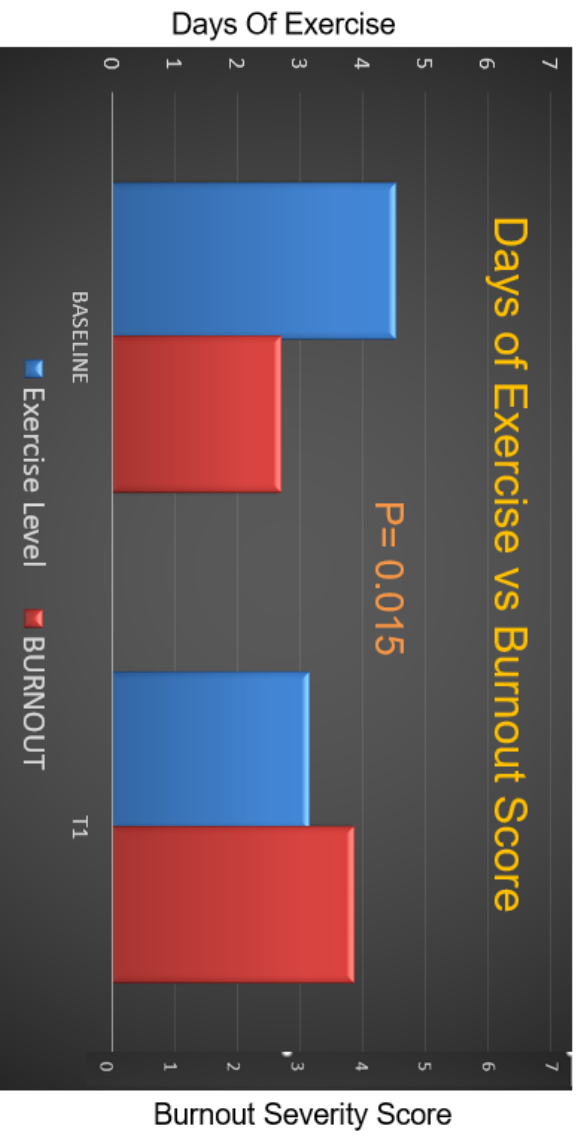
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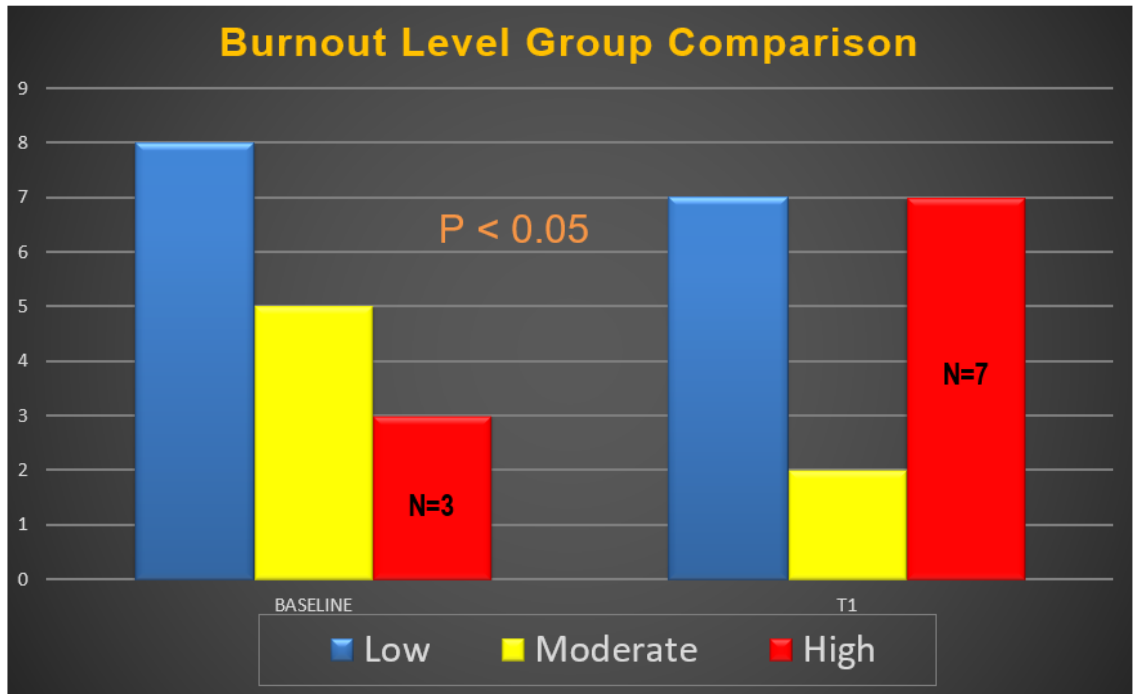
Figures:

FIGURE 1



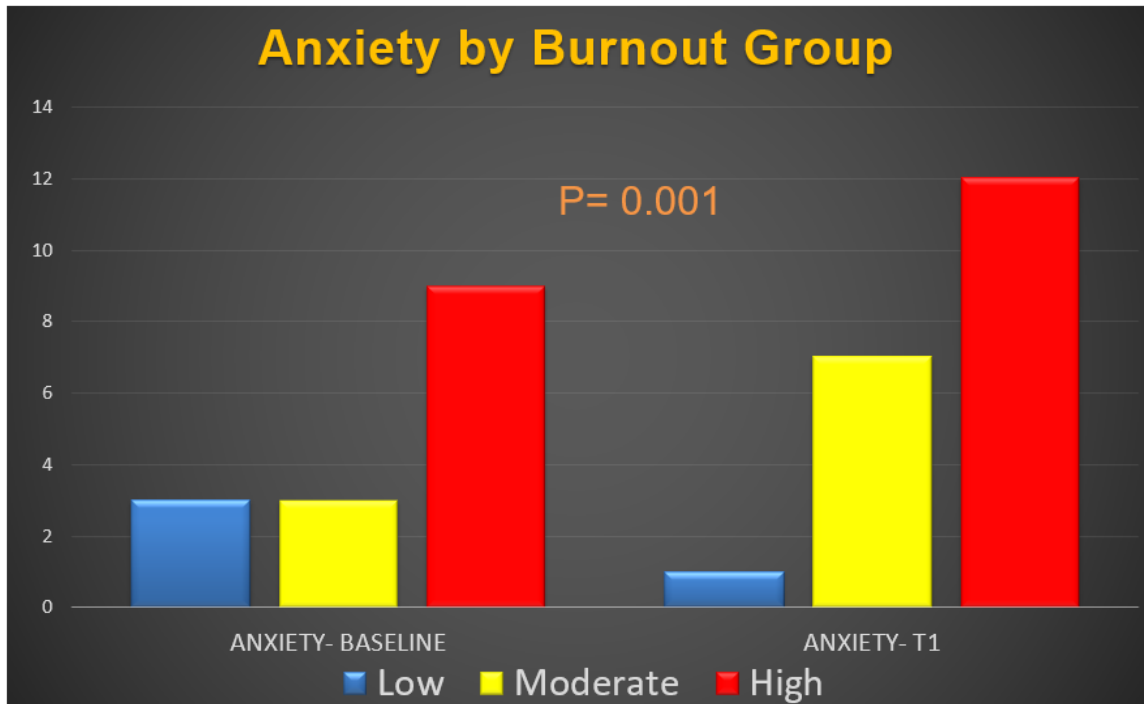
This graph compares exercise days per week to total burnout score and the burnout measure between the two assessments. On the left axis is exercise days per week and shown in blue. On the right axis is total burnout score and shown in red. The baseline assessment is on the left and the T1 assessment is on the right.

Figure 2:



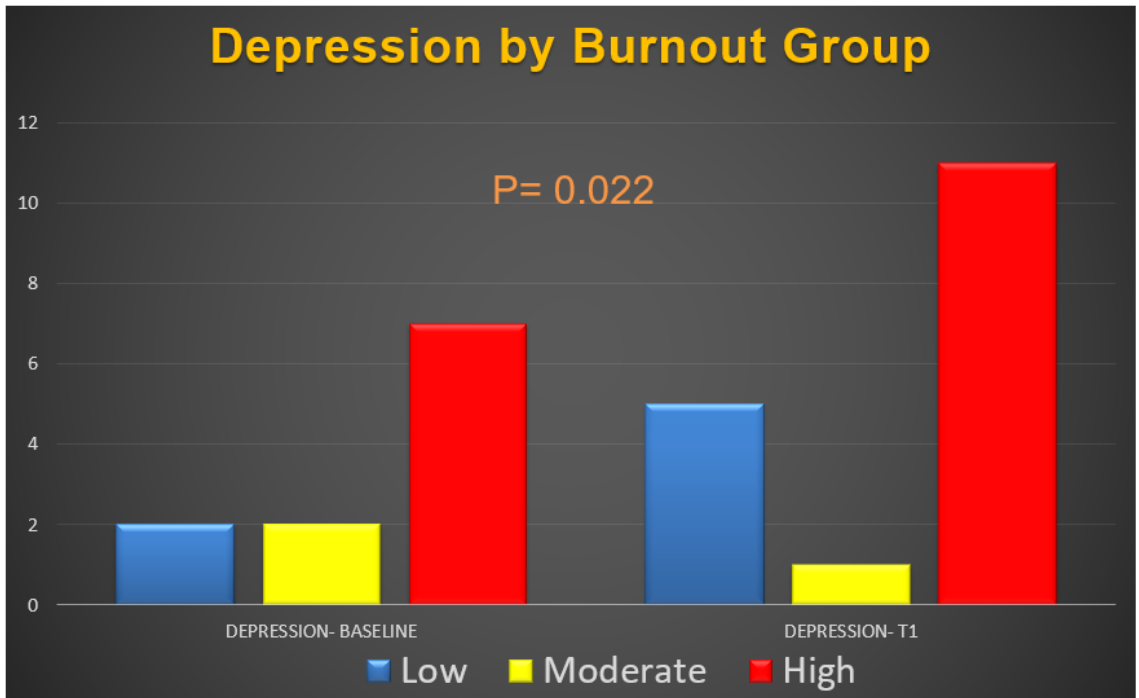
Burnout group did change significantly between the two time points with a significant increase in residents falling into the High Burnout range shown here in RED from 3 residents at baseline to 7 residents at time 1 falling into this category

Figure 3



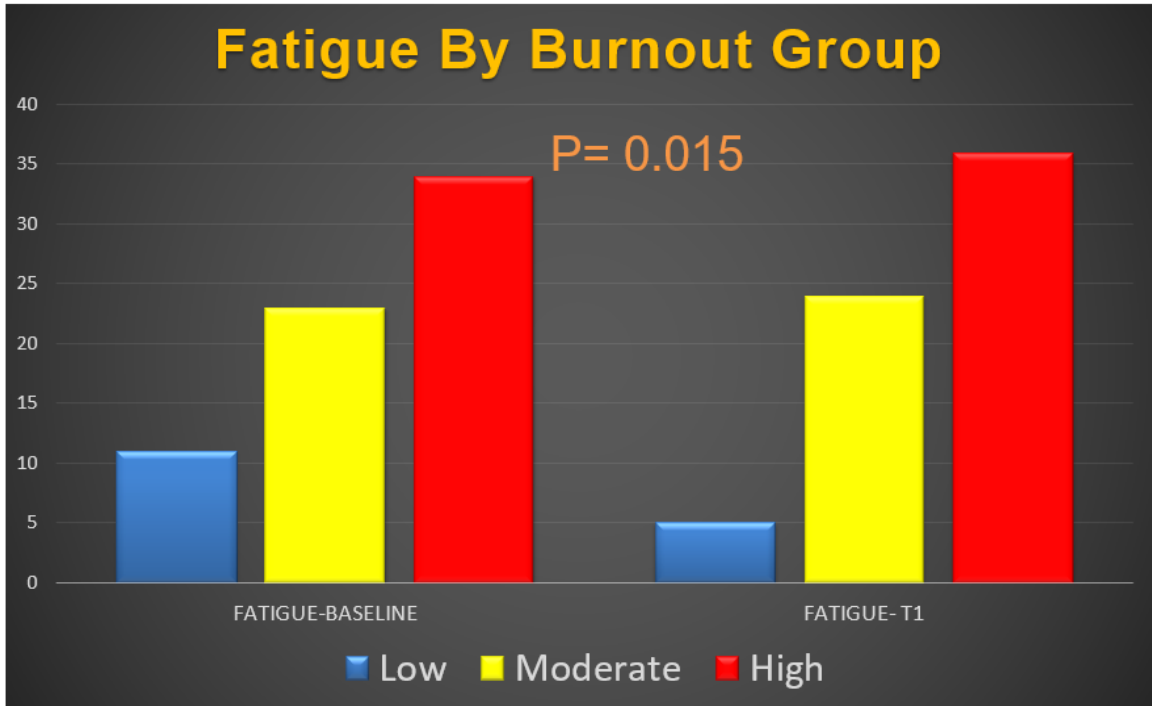
Those with moderate and high burnout shown here in yellow and red exhibited significant increase in anxiety between the two assessments.

Figure 4



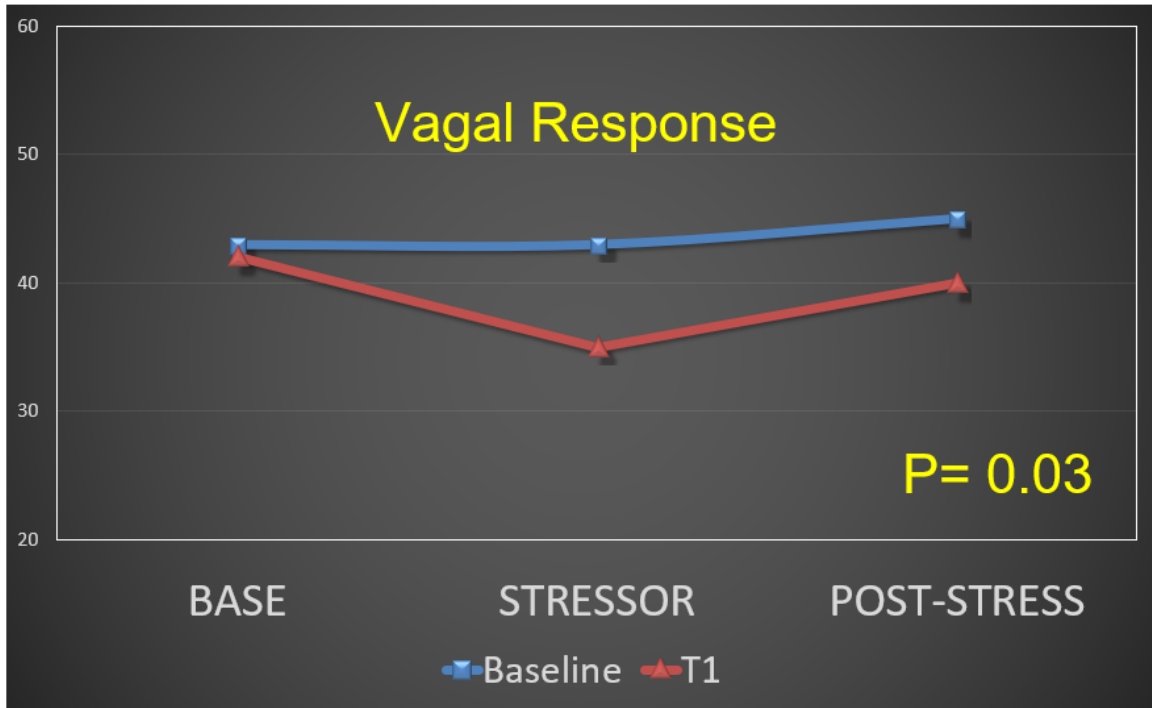
Those with high burnout shown here in red exhibited an increase in depression, the possibility that this increase was due to seasonal affect should be considered

FIGURE 5:



There was a significant difference in Interference from Fatigue among the burnout groups at both assessments.

FIGURE 6:



This graph shows the Vagal Response to the Cognitive Stressor. Vagal response is on the Y axis and study period is on the X axis. Participants started with a 10 minute baseline, followed by the Stroop Test which took 5 minutes. This was followed by a 10 minute post-stress recording period.