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Medical Students' Test Anxiety As They Face the USMLE Step 1 Exam

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by

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Abstract

Medical Students' Test Anxiety As They Face the USMLE Step 1 Exam

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Test anxiety is a well-researched topic in educational literature. However, despite knowing the high prevalence amongst learners and negative consequences of test anxiety, this body of research has not had much effect on medical education. Medical students face high rates of burnout compared to their peers, sometimes attributed to the high-stakes career defining board examinations, called the United States Medical Licensing Exams (USMLE), they must take. Of these exams, the USMLE Step 1 exam is considered the most important in applications to residencies. In this paper, the factors that lead to high levels of anxiety surrounding the Step 1 exam and the educational literature on test anxiety is analyzed. The limited literature on test anxiety in medical students is discussed, and recommendations grounded in educational research are made on how to identify and alleviate such anxiety.

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Chapter 1: Introduction

Medical students face many challenges during their four years of training. They face high rates of burnout with long hours of studying and taking care of patients in hospitals and clinics. Beyond patient care, medical students must undergo a number of examinations, of which the most important are arguably the United States Medical Licensing Examinations (USMLE) (“United States Medical Licensing Examination ®,” 2020). Of these, the test that currently plays the most important role in applications for residency training is the USMLE Step 1, as the score on this exam is the most highly considered selection factor by programs across the nation and can help determine what specialty a student may enter (Gauer & Jackson, 2017; “Results of the 2016 NRMP Program Director Survey,” 2016).

As students begin their medical school education, the importance of the Step 1 exam is often emphasized early on, and, as students typically take the exam only after two years of training have passed, they experience long-term ruminations about the test. Anxiety surrounding doing well on the exam can be (and feel) self-defeating for these students as it affects their study habits and performance, along with their wellbeing. It can also distract them from the true reason for which they entered medical school: to take care of patients. It then seems imperative to explore how to understand and minimize such anxiety, but the literature specific to the medical education context seems limited.

In the educational research literature, test anxiety is a well-studied construct that has been developed over nearly 70 years of research. It can be defined broadly as “intrusive anxiety-related behaviors and cognitions elicited by testing stimuli in academic settings” (Szafranski, Barrera, & Norton, 2012). How best to define and measure test

anxiety, its effects, and prevalence have all been explored in great depth. However, in the medical student population, there seems to exist a gap in connecting this knowledge, despite the high pressures around testing and likely prevalence of test anxiety amongst these trainees. It is the purpose of this report to explore the breadth of literature that exists on test anxiety and identify areas of application to medical education in the context of national board examinations, specifically Step 1.

In this paper, the basic information about the Step 1 exam and factors that lead to its emphasis and the surrounding anxiety it often elicits will be explored. With this background knowledge, the literature on test anxiety will be discussed. This will start with theoretical background and development, including the phases of the study-test cycle that test anxiety can affect beyond the day of the exam itself. Test anxiety's relationship with performance and wellbeing will be discussed along with its prevalence. In addition, the literature on test anxiety specifically for medical students will be examined, with a focused lens around Step 1 and how such test anxiety is affecting this population. Finally, the last chapter will consider how to move forward in identifying and alleviating debilitating test anxiety in medical students.

Chapter 2: USMLE Step 1

In order to attend medical school in the United States, students must work diligently, both in the classroom and outside in extracurricular activities throughout their high school and college years. Students must successfully finish high school, encountering a myriad of course-level and high-stakes exams, and then enter college, which itself requires either taking the SAT or ACT exam. Then, as they approach the end of their college career, applying to medical school requires taking the Medical College Admission Test (MCAT). Thus, medical students are no stranger to rigorous exams to pursue their career goals and, more often than not, have experienced good success in terms of grades and test scores. However, as they progress in their academic career, the pool of their peers gets smaller and more competitive, and the stakes get higher. Beyond medical school, students will apply and interview for residency programs. Programs and specialties range in their competitiveness, but overall, trainees must spend three to seven years after medical school as a resident physician where they work under the guidance of an attending physician before they can become an independently practicing doctor. In order to get the residency program or specialty of their choice, medical students must apply and interview in a manner not dissimilar to the undergraduate and medical school application process. Thus, it is not surprising that medical education comes with its own set of exams.

Medical students take numerous tests in a variety of forms, from institutional objective structured clinical examinations (OSCEs) with standardized patients to multiple-choice national board examinations. There is a high level of importance placed on all exams but none more so than on the United States Medical Licensing Exams (USMLE). As implied in the name, these sets of exams are nationally recognized and

required by all those with an M.D. degree in order to practice medicine in the United States (“United States Medical Licensing Examination ®,” 2020). Of these national board exams, the USMLE Step 1 exam, most often referred to simply as *Step 1*, is the first. Step 1 is an eight-hour exam with up to 280 multiple choice questions, covering a broad array of basic science and general principles related to medicine, spanning 18 major areas. It is typically taken at the end of the first two years of medical school (“United States Medical Licensing Examination | Step 1,” 2020). A score is assigned to the test results, with a maximum of 300. The current minimum score required to pass is 194.

Step 1 is also arguably the most important exam of a medical student’s time during preparation to becoming a physician. There are numerous factors that play into why Step 1 is considered so important. Firstly, as stated earlier, a passing score is required for medical licensure in order to practice as an MD-degreed doctor. However, if a student fails, there is an opportunity to repeat the exam. Students can take Step 1 up to six times, with a maximum of three times within a 12-month period. This may seem forgiving, but students who fail Step 1 on their first attempt have a lower chance of graduating medical school when compared to their peers. Whereas 99.5% of medical students who pass Step 1 on their first attempt graduate, only 90% of students who fail Step 1 initially successfully progress through completion of their medical education (Andriole & Jeffe, 2012). Of those who failed initially, only 67% succeed in passing on repeat testing (“United States Medical Licensing Examination | Performance Data,” 2018). These students are also twice as likely not to earn board certification when compared to their peers who passed on their first attempt (McDougle et al., 2013).

It is also important to remember that the endgame of medical education is not at the medical school level and that simply graduating medical school will not grant them

the ability to serve patients as a doctor. Step 1 is also important when it comes to the application process for residency programs, similar to the MCAT in medical school applications and SAT/ACT scores in undergraduate school applications. In one study, of roughly 1,200 residency program directors surveyed, nearly a third of them said they would “never” consider a student who failed Step 1 on their first try, and roughly half said they would “seldom” consider such a student. Thus, if students do not pass on their first attempt, they find themselves facing closed doors on much of their potential future. This also varies by specialty, with the “nevers” being as low as 3% in Family Medicine programs compared to up to 80% in Plastic Surgery programs (“Results of the 2016 NRMP Program Director Survey,” 2016). Thus, certain career paths are more likely closed down when a medical school student does not pass the Step 1 exam on the first attempt, and such students will find their options restricted so as not to allow them access to a more competitive specialty.

However, we must remember that this exam is not simply a pass/fail test, but one that comes with a numeric score out of 300. USMLE exam scores, especially Step 1 scores, have been shown to play a large role in what residency programs and specialties a student can pursue (Gauer & Jackson, 2017). The Step 1 score is the most frequently cited factor that residency program directors use in their consideration of applicants for an interview and one of the top five factors when deciding to match a student to their program (“Results of the 2016 NRMP Program Director Survey,” 2016). Additionally, a medical student’s probability of matching to the specialty of choice increases significantly with an increasing score on Step 1 (“Charting Outcomes in the Match for U.S. Allopathic Seniors,” 2016). Clearly, the performance on this exam is important. However, unlike previous standardized exams that play a strong role in an application, once a student passes Step 1 (with a score equal to or greater than 194), the board exam

cannot be retaken to improve the numeric score. It is then no wonder that students feel highly anxious about this exam that plays a heavy role in their future career goals.

There are two major reasons to be concerned with the levels of anxiety around an examination that plays a pivotal role in a student's future career. One is with how having high levels of anxiety about the exam can affect the Step 1 score itself. Does anxiety affect a student's ability to study and perform on the day of the test? If such an effect exists, the reliability of the Step 1 test accurately to assess and convey a student's mastery of the broad material is compromised. The other major area of concern is how such anxiety can affect the well-being of students. It is then important first to explore the concept of test anxiety in educational literature and subsequently how it has been explored specifically in the context of medical students.

Chapter 3: Test Anxiety

OVERVIEW OF THEORETICAL DEVELOPMENT

Test anxiety is a well-studied construct that has evolved over time in its definition. Test anxiety can be defined broadly as “intrusive anxiety-related behaviors and cognitions elicited by testing stimuli in academic settings” (Szafranski, Barrera, & Norton, 2012). In early years, test anxiety was seen as more of a physiological autonomic response, and consideration of the individual’s phenomenological experience of the emotional state was ignored. This is clearly seen in a study showing a physiological response recorded in medical students who developed glycosuria, sugar in the urine, after an exam (Folin, Denis, & Smillie, 1914). As stress increases levels of the hormone cortisol, blood glucose levels increase and can lead to glycosuria, thus showing that the test triggered a physiological stress response. More formally and rigorously, since the early 1950s, test anxiety has come to be recognized as a complex construct that has undergone a number of theoretical shifts over the decades (Lowe, 2018). Test anxiety became a subject of study with the work of Mandler and Sarason (1952), when they developed a theory that anxiety during testing situations acts as an important contributor to testing outcomes. Through the work of Liebert and Morris (1967), the foundation of test anxiety has been described as two distinct factors: “worry” and “emotionality.” The emotionality component, also referred to as *physiological arousal*, consists of physiological reactions and affective changes to testing situations. This includes common experiences with which many are familiar, such as nervousness, elevated heart rate, and increased sweating. These responses are all related to a heightened sympathetic response in the body. Perhaps because the response is so common, research shows low to no

relationship between emotionality and achievement (Bandalos, Yates, & Thorndike-Christ, 1995; Morris & Liebert, 1969).

Although emotionality captures the autonomic changes of the body, worry, a more cognitive aspect of test anxiety, consists of the negative thoughts that are related to testing environments (Morris, Davis, & Hutchings, 1981). Examples of cognitive test anxiety include thoughts of failing an exam, imaginings of consequences of test scores, or ruminations of being unprepared. With increasing worry, performance on intellectual tasks was seen to suffer (Green, Angoff, & Encandela, 2016; Morris & Liebert, 1969). Other research has demonstrated that it is the cognitive component of test anxiety that most heavily contributes to the observed decreases in performance that have been observed in highly test-anxious students (Mowbray, 2012). It has been suggested that the reason that the cognitive component of test anxiety has a negative effect on test performance is that these negative thoughts about performance are task-irrelevant and function to distract important cognitive resources away from the actual task at hand, leading to decreased ability to focus on the actual test and perform to the best of one's ability (Spielberger & Vagg, 1995). This includes negative impacts on working memory and attentional control (Zeidner, 2007). Thus, more recently, research and theories have emphasized the multidimensional nature of test anxiety beyond the dichotomous split of physiological and cognitive aspects. This has been further expanded in a model presented by Friedman and Bendas-Jacob (1997) who included tenseness (physiological) and social derogation (concerns that negativity will come from important peers/figures if performance is suboptimal). From their model, a brief version was developed (B-FTAS) that allowed for efficiency and broader screening potential, such as administration to high school students across multiple school districts (von der Embse, Kilgus, Segool, & Putwain, 2013).

More recently, in 2017, the Test Anxiety Measure for College Students (TAM-C) was developed as another multidimensional measure of test anxiety, but specifically for undergraduate students (Lowe, 2018). It uses six components: cognitive interference, physiological hyperarousal, social concerns, task-irrelevant behaviors, worry, and facilitating anxiety. The facilitating anxiety corresponds closely with the concept of the Yerkes-Dodson Law, which is explained further in a later section describing the relationship between test anxiety and performance. TAM-C has also been utilized to compare the prevalence of test anxiety in students in Canada and the United States (Lowe, 2019).

PHASES OF TEST ANXIETY

Much research has been conducted on the existence of test anxiety and the correlation it has with student performance. However, a reasonable question to ask is whether test anxiety is limited to the testing period itself, or whether it extends to the period before when a person would be preparing for a test, or after the test, when the person should be engaged in other important tasks but is experiencing anxiety while waiting for test results. In classic views and approaches to test anxiety, research has been dominated by exploration of cognitive interference during testing conditions, exploring interrupting thoughts and retrieval barriers. For example, anxiety blocking refers to a situation when a learner is in a testing situation, and despite having mastered the material before the test, the learner's ability to retrieve learned information is limited by anxiety. However, more progressively, research has looked at different phases of testing and learning, recognizing that testing does not happen in isolation and that anxiety surrounding a test can arise at different phases of learning. The "Learning-Testing Cycle"

includes three main phases: the preparation phase, the test itself, and reflection phase (Cassady, 2004).

Preparation Phase

Test anxiety can be present during test preparation, stemming from certain beliefs that affect behaviors that can interfere with learning. Those with high test anxiety perceive an upcoming exam as a threat, a “potential harm to the student’s academic standing, self-esteem, or peer status” (Cassady, 2010, p. 15). This is heightened in students with low self-efficacy and low perceived autonomy to control the outcome, a phenomenon that can easily arise when learning academically complex material (Everson, Tobias, Hartman, & Gourgey, 1993). A test like the USMLE Step 1 that has broad topics and connections needing to be mastered is just such a situation. Students higher in test anxiety have also been shown to worry more about their performance in the context of their peers (Cassady, Mohammed, & Mathieu, 2004) and can see tests as threats to self-concept. In the preparation phase, it can then be seen that students with test anxiety are more focused on what motivation theorists refer to as *performance goals* rather than *mastery goals* (Dweck & Leggett, 1988; Pintrich, 2000).

Given the orientation of test anxious students’ beliefs during the preparation phase, it is then not surprising that they may adopt maladaptive responses fueled by their test anxiety. Firstly, test anxiety has been shown to consume working memory space (Cassady, 2004; Ikeda, Iwanaga, & Seiwa, 1996), such that even if they use the same strategies and devote the same time to studying than a less anxious student may use, the end result of learning will be less adequate. Additionally, given the perceived threat, test anxious students have been shown to use task-avoidant strategies, such as procrastination more so than their peers (Wolters, 2003). They also may use more passive learning

techniques, such as surface-level note taking, to avoid delving into the material that makes them confront the stressors that remind them of the perceived threat.

In sum, one conclusion to be derived from this literature is that a hyper-focus on how students feel on the day of their tests may not be enough to help them cope and control their anxiety. Test-anxious students show the effect of their anxiety even as they prepare for the feared test. Thus, targeting changes in test anxiety and outcomes of students cannot focus only on how to reduce anxiety while taking the test but must be initiated from the time the test is introduced and begins to loom large in the lives of students.

Performance Phase

The traditional research on test anxiety has focused on the effect of anxiety during testing itself. I will refer the reader to the sections explored above for information about the debilitating effects of anxiety while taking a test.

Reflection Phase

It is also important to look at the reflection phase of test anxiety. Students with high test anxiety have been shown to attribute their successes on exams to externalized factors, such as “getting lucky” or having an easy exam. At the same time, these same students are more likely to attribute any failure to internal attributes than their less-anxious peers (Bandalos et al., 1995). These attributions lead to a sense of helplessness and lack of autonomy in testing situations. To protect their self-worth based on their reflection of the exam, students may adopt what psychologists have called *self-handicapping* as part of their performance avoidance motivation, procrastinating in their studying in other areas of their studies and blaming poor performance on their own test

anxiety. Even though the reflection phase of test anxiety has distinct features, it is important to note that the reflection phase can often bleed into the preparation phase, as tests are usually not taken in isolation, but as part of a course or a continuous program of study, and students will often have to start preparing for the next test soon after they have completed one.

RELATIONSHIP BETWEEN TEST ANXIETY AND PERFORMANCE

Tests of all kinds are designed ideally to measure how much a student has learned and how well she/he has mastered a subject. However, there are often controllable and uncontrollable factors that can affect a student's true score, seen as both positive or negative deflection in measured outcomes. For example, a multiple-choice question with poor alternative choices could lead a student to choose the correct response by guessing despite not understanding the content behind the question. This would result in a falsely elevated test score that does not reflect the person's knowledge. By contrast, a student who has had poor sleep the night before may have low concentration on test day and score lower than reflects her/his mastery of the material.

The question remains, and with mixed results in the literature, how test anxiety and its individual components may affect performance outside of how much a student has mastered the material. As far back as 1908, this relationship has been explored and was eventually summarized as the Yerkes-Dodson Law. This law is often demonstrated by a bell-shaped curve. With increasing physiological or mental arousal, performance increases. However, there is a "peak" that is reached in performance, beyond which as arousal is even further heightened, performance declines from the peak. This relationship has been confirmed in research (Anderson, 1990; Duffy, 1957).

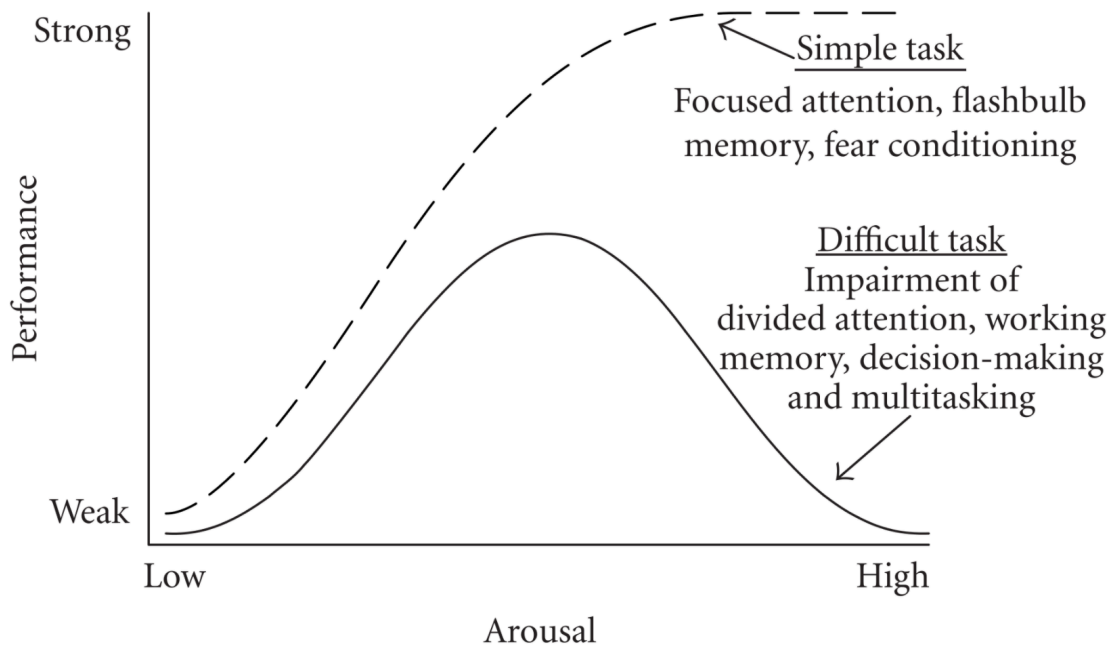


Figure 1: Yerkes-Dodson curve based on original data from Yerkes Dodson 1908 (Diamond, Campbell, Park, Halonen, & Zoladz, 2007)

In this relationship, the idea is that some arousal, associated with increasing attention and interest, leads to improved performance, whereas too much arousal, more associated with anxiety, can lead to a decline in performance. Such a relationship complicates measurement and correlation studies of test anxiety and performance, as some measures may not capture a difference in where the “peak” lies for a particular student. As mentioned above, although the emotionality factor of test anxiety has shown poor correlation with performance, increasing worry has been shown to have a negative correlation with performance on intellectual tasks (Morris & Liebert, 1969). Other research has demonstrated that it is the cognitive component of test anxiety that most heavily contributes to the observed decreases in performance that have been seen in highly test-anxious students (Mowbray, 2012). Aligned with these prior studies, a more

recently developed measure for test anxiety amongst college students that had six factors demonstrated a mild negative correlation with “cognitive interference,” aligned with the traditional “worry” (Lowe, 2018). In addition, there was a mild positive correlation with “facilitating anxiety,” aligning with the arousal upward slope in the Yerkes-Dodson law. However, the other four sub-scales, including physiological arousal (which aligns with “emotionality”) were not statistically significant in their correlation with performance (Lowe, 2018).

PREVALENCE

Across education at all levels, test anxiety is a fairly common experience. It has been estimated that 25-40% of all students in the United States suffer from some significant degree of test anxiety (Gibson, 2014). Test anxiety has been shown to have negative consequences on student performance from primary education (Hill & Wigfield, 1984) to medical students studying for board exams (Green et al., 2016). Although test performance is an important consideration, especially for the medical student population on their USMLE Step 1 exam, perhaps the focus should not be solely on how test anxiety affects scores. The negative effects of test anxiety have been shown not to be limited to test performance. Students report negative impacts to their physical and emotional well-being (Encandela, Gibson, Angoff, Leydon, & Green, 2014). Test anxiety also reduces the validity of exams due to the negative error it introduces that is unrelated to a student’s actual ability and knowledge (Zeidner, 2007).

Thus, we should consider how high levels of test anxiety can affect the mental health and wellness of students, how it can pull students away from learning (as seen in the test preparation and reflection phases of the learning-testing cycle), and how the very exams that cause anxiety become inaccurate representations of ability. It would seem

important to work to understand test anxiety better as a construct and to try to minimize its impact on students at all levels.

Chapter 4: Step 1 and Test Anxiety in Medical Education

Although many studies have been conducted on test anxiety in the settings of elementary, secondary, and college education, there is more limited research in the environment of medical education. I reviewed both the medical education and educational psychology literature for information on test anxiety, focusing on how it relates to medical students and the USMLE board exams, including Step 1 and Step 2 CK. In order to find relevant studies, I searched the following databases: PUBMED, MEDLINE, ERIC, and PSYCHINFO, searching for any article that included “USMLE,” “Medical Licensing Exam,” “Step 1,” or “Step 2 CK” AND “test anxiety” or “exam anxiety” in all fields. This search yielded only six results with only three papers relevant to the current topic. The next step involved bibliographic branching, a process by which all references in the identified articles from the previous search were checked. Finally, the search was expanded to include general medical education outside the context of USMLE board exams. This resulted in a total of only 9 studies relevant to my topic of test anxiety in medical students.

The prevalence of test anxiety in the medical student population is not dissimilar from that found in the general student population in the United States, ranging from 10%-28% (Green et al., 2016; Saravanan, Kingston, & Gin, 2014; Tektaş, Paulsen, & Sel, 2013). Test anxiety similarly affects performance in the context of medical school with increased levels being modestly associated with lower Step 1 scores (Green et al., 2016). The effects of test anxiety are not limited to performance alone, and studies have explored the effect of test anxiety on medical students’ wellbeing and mental health.

In one study of over 900 German medical students, those with significant test anxiety were at increased risk of substance use, including tobacco smoking, stimulant

use, and benzodiazepine use (Tektaş et al., 2013). In Malaysia, medical students with test anxiety were shown also to have increased psychological distress and amotivation (Saravanan et al., 2014). In the United States, a study linked test anxiety in medical school to negative effects on both emotional and physical well-being, as well as cognitive functioning (Encandela et al., 2014). This is especially concerning given how vulnerable the medical profession is to burnout, a long-term stress response marked by emotional exhaustion and depersonalization. Although students who enter medical school start with lower rates of burnout and depression compared to their college graduate peers, this trend becomes reversed by the time medical students reach their second year, which is also around the time that students start taking the Step 1 exam (Dyrbye et al., 2014). Alarming, nearly half of all medical students experience some degree of burnout during their education, and burnout has been associated with increased suicidality (Dyrbye et al., 2008). If test anxiety contributes to feelings of burnout in any form, identifying and reducing such a contributor should be a priority.

What has been done in order to combat test anxiety in this population seems fairly limited. The perception by students is often that educators within medical school programs are not sympathetic to those struggling with test anxiety (Tektaş et al., 2013). Students often feel they are left to their own devices in what strategies to use to study for the board exams (Encandela et al., 2014), leading them to use a wide variety of methods that are sometimes ineffective. However, two studies have tested the effectiveness of therapeutic approaches to minimizing test anxiety in both the preparatory and performance phase. One study took 72 medical trainees who had failed at least one professional exam, including the Step 1 (Powell, 2004). The trainees were recognized to have debilitating test anxiety that limited their preparation and/or performance and subsequently given behavioral therapy. As a promising result, a significantly higher

percentage of these students passed compared to the national average for repeat test takers. A more recent study had medical students take a course that instructed them in both study strategies and relaxation techniques, which resulted in reduced test anxiety. However, there was no effect on performance on Step 1 (Green et al., 2016).

There are multiple factors that could affect the differing results of these two studies, especially when it comes to the effect of the intervention on test performance. The students in the Powell (2004) study underwent a more therapy-based approach, with an outlined ideal study timeline with periodic face-to-face discussions of difficulties and strategy use. The students in the Green et al. (2015) study were involved in a short-term lecture-based course, 6 hours per day for 6 days. The threshold for what was considered “high” or “debilitating” test anxiety was also not consistent across these two studies. The two studies took students at different stages, as the students in the Powell exam had already failed a high-stakes exam whereas the students in the Green et al. study were involved prior to their first time taking Step 1. Despite these differences, it is important to note that both studies showed decreases in test anxiety and improvements in confidence and mental health.

It is evident that despite the many years of enduring testing throughout their education, medical students are still at a high risk of experiencing test anxiety. Although the number of studies that have looked at medical students specifically is limited, what has been shown is that such test anxiety can affect not only the performance, but the physical and mental well-being of such students. Identifying students with debilitating test anxiety and treating them can prove beneficial to both testing outcomes and health and may play a role in helping reduce the stressors that lead to burnout.

Chapter 5: Next Steps

Test anxiety remains highly prevalent in students at all stages of learning, and this includes even the high-performing college students who make it into medical school (Green et al., 2016; Saravanan et al., 2014; Tektaş et al., 2013). Although the construct of test anxiety has received much attention from educational researchers, studies involving medical students who face high-stakes board examinations have been few. The importance of the USMLE board exams is emphasized early in medical education, and students prone to test anxiety experience worry much earlier than when concentrated study time begins. These students feel as if the education system is unsympathetic towards their struggles and feel left to their own devices in preparation for such exams (Encandela et al., 2014). It is important to consider identifying students with moderate to high levels of test anxiety early on so they may receive support that can minimize the effect of debilitating test anxiety on performance and mental health.

We should first consider utilizing a measure that is geared more towards the stressors that are specific to medical education, such as the effects such exams have on residency and career potential. A preliminary measure is included, highlighting such key components and is modeled after the TAM-C (Lowe, 2018), including subscales for worry, social concerns, and cognitive interference (Appendix A). For students with high test anxiety, it will be important not to target only the cognitive effects during the performance phase, but to identify difficulties experienced during students' preparation and reflection phases. Thus, worry items have been further subdivided to encapsulate which phases a student may be most strongly affected. Validity and reliability of the proposed measure would, of course, have to be assessed. In addition, further studies would need to be completed to establish which therapeutic approach would be most

beneficial. However, the first step would seem to include identifying which students are at high risk of test anxiety.

In order to find solutions for improving motivation, performance, and wellbeing surrounding USMLE Step 1 in the future, it may be important to consider test anxiety not just in isolation, but also in the context of other emotions that surround academics. Students have been shown to experience a diverse array of emotions in relation to academic settings, and such emotions are related to achievement and motivation (Pekrun, Goetz, Titz, & Perry, 2002). It may prove beneficial to view medical students and their surrounding emotions with high-stakes exam more holistically. The framework offered by Pekrun and colleagues for achievement emotions is based on three dimensions: *object focus*, or whether an emotion pertains to the activity or the outcome; *valence*, or the positivity or negativity of an emotion; and *activation*, whether the emotion activates or deactivates learning (Pekrun, Frenzel, Goetz, & Perry, 2007). Generally, in this context, anxiety is thought of as a prospective outcome-focused, negative, activating emotion.

Table 1: A Three-Dimensional Taxonomy of Achievement Emotions (Pekrun & Perry, 2014)

Object Focus	Positive ^a		Negative ^b	
	Activating	Deactivating	Activating	Deactivating
Activity	<i>Enjoyment</i>	<i>Relaxation</i>	<i>Anger</i> <i>Frustration</i>	<i>Boredom</i>
Outcome/ Prospective	<i>Hope</i> <i>Joy^c</i>	<i>Relief^c</i>	<i>Anxiety</i>	<i>Hopelessness</i>
Outcome/ Retrospective	<i>Joy</i> <i>Pride</i> <i>Gratitude</i>	<i>Contentment</i> <i>Relief</i>	<i>Shame</i> <i>Anger</i>	<i>Sadness</i> <i>Disappointment</i>

^a pleasant emotions; ^b unpleasant emotions; ^c anticipatory joy/relief

With this framework of achievement emotions, Pekrun and Perry's (2014) control-value theory of achievement emotions states that control appraisals and value

appraisals of achievement activities and outcomes are the most proximal determinants of these emotions.

Future work may prove beneficial in delving into achievement emotions more broadly, not simply focusing on anxiety.

UPDATE ON USMLE STEP 1

While I was working on this report, the USMLE has adopted a pass/fail model for Step 1 to be implemented in the next two years (“United States Medical Licensing Examination | Change to pass/fail score reporting for Step 1,” 2020). How this will affect residency applications and students’ perceptions of the exam are yet to be seen. However, there is a valid concern that the anxiety and importance placed on Step 1 will instead be passed down to USMLE Step 2 CK (“United States Medical Licensing Examination | Step 2 CK (Clinical Knowledge),” 2020), a longer, similarly formatted multiple-choice examination, focused more on clinical knowledge rather than basic science information. Students will also continue to be graded on standardized examinations on “shelf exams” during their rotations within hospital clinical rotations. Despite the change in Step 1’s grading system, it is important to keep in mind that certification and testing does not end with Step 1. Students will continue to be evaluated on their performance on other high-stakes exams. Therefore, my examination of the literature on test anxiety as it applies to medical students remains relevant, and understanding how test anxiety can be detrimental to the performance and mental health of medical students seems an important concern for those charged with designing the curriculum and educating the next generation of medical students.

Appendix A: Test Anxiety in Medical Education Scale

Please use the following 5-point scale from extremely/always true to not at all/never true to rate how true each statement is for you.

5	4	3	2	1
Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree

Preparation Phase Items

The night before an exam, I get concerned that I did not study sufficiently.

The stress of the exam prevents me from studying effectively.

I procrastinate studying for bigger exams in medical school.

I avoid topics that are difficult for me when I study.

Performance Phase Worry Items

I am calm going into important exams in medical school. (reverse-scored)

I worry that a test will negatively affect my medical career during the exam.

I get nervous starting an important exam in medical school.

Reflection Post-Test Items

I continue to worry about my performance even after an important test is over.

If I do well on an important exam, I feel like I got lucky.

I cannot discuss test questions with peers after an important exam because it causes me to worry.

Social Concerns Items

If I do poorly on an important test, I think I will disappoint my loved ones.

I worry how others will perceive my performance in medical school exams.

I don't think about how a poor exam score will affect my relationships. (reverse-scored)

I worry that my peers will look down on me if I do poorly on a test.

I worry that my mentors will be disappointed if I don't perform as expected on important exams.

Cognitive Interference Items

I have a hard time paying attention when I take a test.

Negative thoughts of how I'm doing on a test interrupt me as I'm taking it.

I have intruding thoughts that distract me from my exams.

I think about how my future will be affected during important exams.

I can think through clinical questions better when it is not on an important exam.

I can focus well while I take an important test. (reverse-scored)

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