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## Effectiveness of a mental skills curriculum to reduce novices' stress



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### ABSTRACT

**Background:** Stress has been shown to negatively impact surgical performance, and surgical novices are particularly susceptible to its effects. Mental skills are psychological strategies designed to enhance performance and reduce the impact of stress to consistently facilitate the ideal mental conditions that enable performers to perform their best. Mental skills have been used routinely in other high-stress domains (e.g., with Navy SEALs, military pilots, elite athletes, and so forth) to facilitate optimal performance in challenging situations. We have developed a novel mental skills curriculum (MSC) to aid surgical trainees in optimizing their performance under stressful conditions. The purpose of this study was to determine the effectiveness of this MSC in reducing novices' stress.

**Methods:** The MSC was implemented with a convenience sample of surgical novices over 8 wk. Two stress tests were administered before and after completion of the MSC to assess its effectiveness in reducing trainee stress. The Trier Social Stress Test (TSST) is a validated method of measuring participants' stress responses; it was implemented by giving participants 10 min to prepare for an impromptu presentation and 5 min to present it in front of a medical education expert who would be assessing them. The O'Connor Tweezer Dexterity Test (OTDT) is a test of fine motor dexterity; participants competed against each other in small groups who would complete the test the fastest. Such competition has been shown to cause acute stress in performers. To assess stress, heart rate (HR), perceived stress (STAI-6), and perceived workload (NASA-TLX) were completed during all testing sessions.

**Results:** Nine novices (age  $23 \pm 7$  y, 55% women) completed the MSC. HR increased significantly from resting to performance during the TSST and from early during competition (at 2 min and 30 s of elapsed time) to immediately after completing the task. However, participants perceived less stress during and immediately after the TSST and OTDT tests ( $P < 0.05$ ) after completion of the MSC. In addition, they reported significantly less workload during the second OTDT administration ( $P < 0.05$ ) and showed a trend toward faster completion of this test.

This study was presented at the annual meeting of the Annual Academic Surgical Congress meeting in Jacksonville, Florida, on February 2, 2016.

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**Conclusions:** The novel MSC was effective at reducing surgical novices' perceived stress and workload during two comprehensive stress tests. Although not statistically significant, participant's enhanced performance during the OTDT is encouraging. This curriculum may be valuable to help inexperienced learners reduce stress in a variety of situations related to learning and performing surgical skills. Additional research using a larger sample size is currently underway to validate the effectiveness of this curriculum.

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## Introduction

Stress, the result of cognitive demands exceeding one's ability to manage those demands, has been identified as one of the most significant barriers to successful surgical performance.<sup>1–</sup>

<sup>5</sup> The innate difficulties of surgery; the constantly evolving surgical techniques, procedures, and technology, the need to perform amidst almost constant distractions, and the necessity of communicating effectively with the surgical team, among others, have the potential to create overwhelming stress that can potentially lead to errors and jeopardize patient safety. Indeed, stress has been shown to impede surgeons' fine motor coordination and dexterity, decision-making ability, concentration, ability to effectively communicate with the surgical team, and emotional state.<sup>4</sup>

In a recent survey conducted at our institution, 40% of responding surgeons (i.e., attendings and residents) indicated that they had witnessed an intraoperative complication due to surgeon stress.<sup>5</sup> In addition, 82% of the respondents reported that formal stress management training would be beneficial for surgeons. Thus, it is evident that surgeons are desiring formal training on how to best combat the deleterious effects of stress to maintain effective clinical performance. However, surgical novices may be of even greater need of this type of training due to their inexperience in the operating room, resulting in a lack of effective stress-coping strategies and heightened stress.<sup>1</sup>

Mental skills, or psychological tools and strategies designed to enable performers to regularly achieve their ideal mental state for optimal performance, may be effective at helping surgical novices manage stress effectively.<sup>6</sup> Indeed, Arora *et al.*<sup>7</sup> implemented a mental imagery intervention after surgical novices' virtual reality simulation training and found that a group that received mental imagery training reported significantly less stress than controls who had not received mental imagery training (measured subjectively with the State-Trait Anxiety Inventory [STAI] and objectively with heart rate [HR] and cortisol levels) during their performance of virtual reality laparoscopic cholecystectomies. Moreover, the authors found a significant negative correlation between stress and imagery use. These findings suggest that imagery is an effective strategy to reduce surgical novices' stress during simulated surgical performance. Beyond the effects of mental imagery, there may be additional performance enhancement benefits that can be gleaned from mental skills training. Consisting of energy and attention management techniques, refocusing strategies, and goal setting, among others, these techniques have been implemented with high efficacy in other high-stress domains such as elite athletes,<sup>8</sup> U.S. Navy SEALs,<sup>9</sup> military pilots,<sup>10</sup> and police special forces.<sup>11</sup> However,

outside of mental imagery, there have been limited attempts to implement these skills within surgery. The purpose of this study was to test the effectiveness of a novel, robust mental skills curriculum (MSC) at reducing surgical novices' stress.

## Methods

A novel MSC was developed by a diverse research team consisting of a surgeon educator with expertise in minimally invasive surgery and simulation-based research, a PhD educator with expertise in instructional design, and a performance psychologist with expertise in mental skills training. Through adaptation and subsequent implementation of David Kern's (2009) model, the curriculum was developed to include a needs assessment, identification of goals and objectives, identification of the appropriate instructional methodology, and selection of best methods of assessment of curriculum-based outcomes.<sup>12</sup> The developed curriculum consisted of eight modules, which were implemented in the following order: introduction to mental skills, goal setting, energy management (relaxation and "psyching-up"), attention management, mental imagery, refocusing strategies, and performance routines (see [Table](#)).<sup>13</sup>

To test the effectiveness of the curriculum, a convenience sample of surgical novices (premedical college and medical students) were enrolled in an institutional review board–approved pilot study. The enrolled participants were trained during weekly, 45-min sessions offering a multimodal education experience including video education modules, written workbook exercises, and an interactive discussion with a mental skills trainer about how to optimally integrate skills from the MSC to enhance performance and reduce stress.

### Assessments of stress

To assess the effectiveness of our MSC, we administered two stress-inducing tests (Trier Social Stress Test [TSST] and O'Connor Tweezer Dexterity Test [OTDT]) before (pre-MSC test) and after (post-MSC test) its implementation and recorded the stress of our participants using objective (HR) and subjective (STAI) methods.

### Trier social stress test

The TSST is a validated method of assessing stress in a variety of populations.<sup>14</sup> Over the past 20 years, the TSST has been implemented frequently in laboratory settings to increase participants' stress response (i.e., activation of the hypothalamic–pituitary–adrenal stress axis leading to up to three-fold

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