

Clinical Science

# Implementation results of a novel comprehensive mental skills curriculum during simulator training



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## KEYWORDS:

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Stress management;  
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Performance enhancement

## Abstract

**BACKGROUND:** Mental skills training refers to the implementation of cognitive performance-enhancing strategies to promote optimal performance. We aimed to develop a surgery-specific mental skills curriculum (MSC) and obtain initial evidence of efficacy.

**METHODS:** The developed MSC consisted of 8 proven performance-enhancing modules. Its efficacy was assessed during laparoscopic simulator-based practice by novices using validated instruments of mental skills, workload, and stress, in addition to a skill transfer test to a porcine model. A paired *t* test was used to analyze the data.

**RESULTS:** Nine surgical novices completed the curriculum. Compared with baseline assessment, participants improved significantly their laparoscopic performance and mental skills after completion of the MSC. All participants completed the task in the porcine model without an appreciable change in their perceived stress. During the skill transfer test, 8 participants were observed using mental skills taught in the MSC.

**CONCLUSIONS:** A surgery-specific simulator-based MSC was developed, and its efficacy in improving mental skills and surgical performance was supported during a surgical skill transfer test. © 2016 Elsevier Inc. All rights reserved.

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Working as a surgeon requires not only extensive medical knowledge, critical thinking skills, and fine motor control, but also endurance and stamina, both physical and psychological. Surgeons must be able to maintain attention, make split-second decisions, and retain fine motor control throughout the entirety of a surgical procedure, sometimes lasting several hours. In addition to operating, surgeons must also effectively lead and communicate with their operating room team. The complexities, implications, and risks associated with operations create a generally stressful environment.<sup>1,2</sup> Furthermore, advances in surgery continue to increase the demands on surgeons. For example, laparoscopic surgery is notably more difficult and stressful than traditional open surgery.<sup>3</sup> Increased intraoperative stress may jeopardize patient safety by negatively affecting surgeons' coordination, emotional state, concentration, and decision-making ability.<sup>4</sup> Novice surgeons, compared to expert surgeons, are more likely to experience the negative effects of stress according to objective (eg, heart rate variability and heart rate) and subjective (eg, self-report) measures of stress.<sup>1</sup> In novice laparoscopic surgeons, stress has been shown to negatively impact economy of motion, amount of time taken, and errors made.<sup>5</sup>

Results from a survey of 72 surgeons from Carolinas Medical Center showed that "complex or rarely performed cases" were perceived as the most stressful intraoperative factors, whereas "personal life distractions" and "multitasking requirements" as the least stressful. In general, trainees perceived greater amounts of stress during surgery than attending physicians. Importantly, nearly 40% of respondents indicated that they had witnessed an intraoperative complication due to stress and 82% felt that stress management training would be beneficial.<sup>6</sup> Similar findings have been reported internationally.<sup>4</sup>

Mental skills are trainable mental abilities that support successful learning and performance,<sup>7</sup> with the aim of consistently reaching the user's upper range of ability. In sport psychology, mental skills have been widely successful in helping athletes consistently perform at high levels.<sup>8</sup> Furthermore, mental skills interventions have been shown to improve performance with US Navy SEALs,<sup>9</sup> military pilots,<sup>10</sup> police special forces,<sup>11</sup> and elite athletes.<sup>12</sup> Not only are mental skills curricula designed to decrease the effects of stress, but they can also help with mental imagery (practice or rehearsal), arousal regulation skills, attention management skills, goal setting, and performance-enhancing preperformance routines.<sup>13-17</sup>

Research has shown that mental skills optimization can also benefit surgical performance and stress reduction in the operating room.<sup>18,19</sup> Mental imagery has been demonstrated to enhance surgeons' performance, skill acquisition,<sup>20,21</sup> knowledge,<sup>22</sup> and confidence.<sup>22</sup> Arousal regulation skills have also been effective at reducing surgeons' psychological and physiological stress.<sup>18,19</sup> Interviews with expert surgeons conducted at our institution indicate that they regularly use mental skills to enhance their performances and

reduce levels of stress (unpublished data). Therefore, we hypothesize that the implementation of a mental skills curriculum (MSC) will aid in the reduction of perceived stress and workload and improve surgical performance.

The objective of this study was to develop a surgery-specific MSC to be implemented during simulation training and obtain initial evidence of efficacy in improving performance. We specifically aimed to demonstrate improvements in mental skills and laparoscopic performance after training.

## Methods

A novel MSC was developed by an interdisciplinary team consisting of a surgeon educator with expertise in laparoscopic surgery and simulation-based research, a performance psychologist with expertise in mental skills training, and a PhD educator with expertise in instructional design. Through adaptation of David Kern's (2009) model, the curriculum was devised to include a needs assessment, development of goals and instructional objectives based on this assessment, identification and development of instructional methods, and development of assessment and evaluation methods for the measurement of curriculum outcomes.<sup>23</sup> The developed curriculum consisted of 8 modules: introduction to mental skills, mental imagery, goal setting, energy management (relaxation), attention management, refocusing strategies, and performance routines (see [Table 1](#)). The modules for this curriculum were chosen based on empirical work on the implementation of comprehensive mental skills curricula implemented in the military, sport, individual mental skill interventions implemented with surgeons, and the expertise of the collaborating performance psychologist with 35 years of consulting experience in mental skills training of high performers in many disciplines, including medicine.

In an institutional review board-approved study, a convenience sample of surgical novices ( $n = 9$ ) including premedical college and medical students, were enrolled to study the effectiveness of the MSC. We aimed to include 10 participants and initially recruited 15, but because the study ran over the summer, 4 of them could not finish as they had to leave the city, and 2 were unable to finish due to previous commitments. Participants were volunteers and gave informed consent before their participation. After a baseline assessment of laparoscopic and mental performance, participants completed the MSC and trained using laparoscopic simulators over the course of an 8-week period. Their performance was again evaluated after curriculum completion and compared to baseline. In addition, a transfer test using a porcine model was performed to assess the effectiveness of training.

## Baseline assessment

Baseline assessment consisted of a questionnaire completed by all participants, which included demographic

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