Emotional Intelligence and Stress in Medical Students Performing Surgical Tasks

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Abstract

Purpose
Poor stress management skills can compromise performance in the operating room, particularly in inexperienced trainees. Little is known about individual differences in managing stress. This study aimed to explore the relationship between trait emotional intelligence (EI) and objective and subjective measures of stress in medical students faced with unfamiliar surgical tasks.

Method
Seventeen medical undergraduates completed an unfamiliar laparoscopic task on a simulator during January to April 2008. Subjective stress before, during (retrospectively), and after the task was measured using the self-report State-Trait Anxiety Inventory. Objective stress was measured using continuous heart rate (HR) monitoring. Participants also completed the Trait Emotional Intelligence Questionnaire short form (TEIQue-SF). The authors computed scores for global trait EI and the TEIQue-SF four factors and carried out descriptive and correlational analyses.

Results
The highest levels of subjective stress were reported during the task and correlated positively with trait EI as well as with the trait EI factors of well-being and emotionality. Objective stress (mean HR) during the task was positively related to the sociability factor of trait EI. Higher trait EI scores were also associated with better after-task recovery from stress experienced during the task.

Conclusions
Students with higher trait EI are more likely to experience stress during unfamiliar surgical scenarios but are also more likely to recover better compared with their lower-trait-EI peers. Trait EI has implications for the design of effective stress management training tailored to individual needs and potential applications to surgical trainee selection and development.

Surgical education and training are inherently stressful, and the ability to cope effectively with this stress is a critical facet of surgical competence.[1,2] Although chronic stress has been well studied,[3–5] less attention has been paid to acute stress. *Acute stress*—defined as the physical, mental, or emotional response to a perceived increase in demand for motor, cognitive, or other performance[6]—is a particular problem in the operating room (OR) where the demands or *stressors* are numerous, ranging from technical complications and equipment failures to distractions and interruptions.[7,8] A recent systematic review on the impact of stress on performance concluded that stress can impair both psychomotor and teamwork skills in novice surgeons, which has obvious implications for patient safety and surgical education.[9] Evidence suggests that stress is present across health care specialties[10] and that it can also compromise learning.[11] The latter is a key concern in the current climate of reduced trainee working hours where the training potential of every educational encounter must be maximized.

Although research has shown that there is significant variability in individuals' responses to stress and that these responses are affected by their cognitive appraisal of the stressful situation,[12] little is known about the factors that account for these individual differences. Thus, it may be that certain personality traits put individuals at greater risk of experiencing stress during surgical challenges or, conversely, confer them with an ability to better cope with stress.[13,14] Furthermore, the relationship between personality traits and stress may have important implications for surgical training because it may allow educators to identify individuals who are likely to require additional training, increased supervision, or specific instruction in stress management skills. This is important because stress management skills are often confined to the "hidden curriculum" rather than explicitly taught.[7]

In the psychology literature, emotional intelligence (EI) has recently emerged as a personality characteristic that affects the perception of emotional and stressful situations. Early conceptualizations of EI referred to it as an ability, much like cognitive ability, reflecting efficacy of affective information processing[15]; hence, the usage of the term *intelligence*. After this framework faced significant challenges to produce scientifically robust assessment measures of the construct,[16] EI was conceptualized as a personality trait—in other words, not a form of intelligence.[17] Within this "trait EI"

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Acad Med. 2011;86:1311–1317.
First published online August 24, 2011
doi: 10.1097/ACM.0b013e31822bd7aa

framework, EI captures personality facets and dispositions related to emotions. It refers to a constellation of emotional self-perceptions and essentially concerns people's self-perceptions of their emotional abilities.[17]

A robustly validated instrument that assesses trait EI via subjective self-report is the Trait Emotional Intelligence Questionnaire (TEIQue).[18] Using this tool, studies have shown trait EI to correlate with other personality traits[19] and, importantly for our study, with how people cope with stress: Individuals with higher trait EI scores display greater self-efficacy in coping with stress and are more likely than those with lower trait EI scores to view potentially stressful tasks as challenges rather than as threats.[20–22] Specifically within medicine, our recent systematic review revealed that EI is related to a number of the core competencies that modern medical curricula seek to deliver, including empathy, communication/interpersonal skills, and the ability to cope with stress effectively.[23]

To the best of our knowledge, no study to date has directly investigated the relationship between EI and stress within the context of surgery, despite surgery's inherently stressful nature. The aim of this study was to explore the relationship between trait EI and stress in medical undergraduates performing an unfamiliar surgical task. We intended students' lack of familiarity with the task to elicit stress. Given that inexperience makes one particularly vulnerable to stress,[9] we anticipated that any underlying relationship between trait EI and stress would be likely to be revealed in the context of such a task.

Method

Participants

We recruited undergraduate medical students in their fourth year of the six-year curriculum at a central London university medical school using convenience sampling based on their availability during the study period (January to April 2008). Inclusion criteria required having no previous laparoscopic experience, either in simulation or in a real OR. In an e-mail that we sent to the entire year group, we encouraged all students who met the inclusion criteria to self-report their experience and availability for the purpose of this study to the study coordinator (P.S.). From the potentially suitable 60 students who agreed to participate, we selected 18 using a random, computer-generated list.

We used medical students as a proxy for surgical trainees to ensure that participants were true surgical novices who had never had any previous opportunity to perform the surgical procedure; the resultant unfamiliarity would thus provide the intended level of stress. We also ensured that no participant had any history of psychological or physiological illness that could affect his or her heart rate (HR). (The study coordinator elicited such information from the participants at the time of their recruitment.) We informed all participants that their scores would be kept strictly confidential and would not be used for any formative or summative assessment purpose.

Informed consent was obtained from the 18 participants, and ethical approval was granted by the St. Mary's Hospital local ethics committee. (This study was part of a larger research program[24]; we have not reported data and analyses related to trait EI elsewhere.)

Measures

Trait emotional intelligence: TEIQue short form. We assessed trait EI using a paper version of the validated TEIQue short form (TEIQue-SF).[18] The TEIQue-SF consists of 30 self-report items (available at http://www.psychometriclab.com), which are answered on a seven-point Likert scale (1 = completely disagree to 7 = completely agree). Item ratings are summed to derive an index of global trait EI, which can range from a minimum of 30 to a maximum of 210 (or from 1 to 7, if items are rescaled). In addition to the global score, the TEIQue-SF yields scores on four trait EI factors:

- *Emotionality* covers empathy, emotional perception, emotional expression, and relationships (example item: "Expressing my emotions with words is not a problem for me").
- *Sociability* covers assertiveness, emotional management, and social awareness (example item: "I would describe myself as a good negotiator").
- *Self-control* covers impulsiveness, emotion control, and stress management (example item: "On the whole, I am able to deal with stress").
- *Well-being* covers optimism, self-esteem, and happiness (example item: "On the whole, I am pleased with my life").

The TEIQue-SF has been widely used across a variety of populations, countries, and task domains, with high reliability (typical Cronbach alphas >0.80) and extensive validation evidence.[25,26] The TEIQue-SF took participants five to eight minutes to complete in this study.

Subjective stress: State-Trait Anxiety Inventory. We used a paper version of the validated short form of Spielberger's State-Trait Anxiety Inventory (STAI) to measure subjective level of stress.[27] This six-item questionnaire captures cognitive, emotional, and physical responses to stress. (Anxiety is a stress response—hence, our use of an anxiety measure.) It has been validated for use in surgical settings in previous studies.[7,28] Participants rated each of the six items on a four-point scale (1 = not at all to 4 = very much), resulting in a minimum score of 6 and a maximum score of 24. Higher scores indicate greater levels of stress. This short form of the STAI took participants two minutes to complete at each of three administrations during the study.

Objective stress: HR. It is important to assess stress objectively as well as subjectively, particularly because participants may lack the insight to self-report it accurately.[9,28] For this reason, we incorporated HR to measure objective levels of stress. HR was captured by a Polar s710i HR monitor (Polar Electro, London, UK) in the form of a simple chest strap worn by the participants throughout the task. Participants also wore a sports watch that picked up the signals from the HR monitor and collected the data wirelessly. This provided a continuous measure of HR throughout the procedure from which we extracted the mean and maximum HR.

Procedure

The study coordinator administered and collected all measures and tested each participant individually on the Minimally Invasive Surgical Trainer–Virtual Reality simulator (MIST-VR, Mentice, Goteburg, Sweden). The MIST-VR is one of the most extensively validated virtual reality surgical simulators, having demonstrated adequate face, content, and construct validity for training and assessing surgical skill.[29] We chose it to provide the surgical context for this study because it is a very effective tool that mirrors the psychomotor tasks of laparoscopic surgery.

On arrival to the surgical simulator laboratory, each participant provided informed consent, and the study coordinator explained the study procedure to him or her. The participant then completed the TEIQue-SF.

Before carrying out the surgical task, the participant went through a familiarization or orientation phase with the MIST-VR. The study coordinator explained the simulator, and the participant was able to spend 10 to 15 minutes becoming familiar with the controls. This was necessary because all participants were complete surgical novices who had never used the simulator before the study. It was important that they be able to complete the task and that we could rule out the possibility that findings would be due to their lack of familiarity with the equipment rather than to the nature of the surgical task itself.

On completion of the familiarization phase, the study coordinator asked the participant to wear the HR monitor and complete the STAI so as to capture the student's subjective stress before the surgical task. The participant then performed a laparoscopic task on the MIST-VR. The task consisted of holding a virtual sphere steady with an instrument in one hand while using a diathermy tool held in the opposite hand to correctly cauterize virtual boxes—without touching the sphere—as the boxes appeared and moved around the sphere. Once a box had been correctly cauterized, it would disappear, and a new box would appear at another point around the sphere. If a box was touched incorrectly, or if the sphere was touched accidently, the box would not disappear until the correct procedure had been performed. In this study, a total of five boxes appeared around the sphere, and all had to be safely cauterized before the task was completed. We chose this laparoscopic task because the students' unfamiliarity and inexperience with it would act as the stressor for the study. Task completion took approximately 20 minutes.

After the participant performed the task, the study coordinator asked him or her to complete two further STAI questionnaires: one to capture how stressed the student felt "during" the task (retrospective assessment) and one to capture how the student felt "right now" (at the end of the task). The study coordinator then gave each participant informal feedback on his or her performance and highlighted opportunities for stress management training (in the form of available courses) should the student wish to pursue them.

Statistical analyses

All analyses were carried out using SPSS version 17.0 (SPSS Inc., Chicago, Illinois). We computed descriptive statistics (mean, median, standard deviation) for the TEIQue-SF and STAI scores. We estimated the reliability of these scales using Cronbach alpha internal consistency coefficients. Alphas of 0.70 or higher are typically acceptable for research purposes.[30] We also computed mean and maximum HR scores.

To explore the relationship between trait EI and stress, we carried out correlational analyses (Spearman rho correlation coefficients). In addition, we subtracted participants' after-task STAI scores from their before-task and during-task STAI scores. This simple algebraic manipulation generates what we term "stress variation indices" (SVIs). Because we assessed stress before, during, and after the stress-inducing (for the novice operators) surgical task, these indices are useful in showing how stress levels changed over the course of our study. We computed two SVIs for each participant: one to capture changes in stress levels before versus after the task and one to capture differences in stress levels during versus after the task. Because we subtracted stress levels measured both before and during the task from stress levels measured after the task, the SVIs practically demonstrate participants' subjective recovery from stress (i.e., reduction in their stress levels) as they completed the task. SVIs should be interpreted as follows:

- *A positive SVI* indicates that stress levels were lower after than before or during the task.
- *A negative SVI* indicates that stress levels were higher after than before or during the task.
- *An SVI of zero* indicates that stress levels were constant throughout the study.

We tested SVIs against a value of zero (0) using one-sample t tests to determine

Table 1

Descriptive Statistics for Trait Emotional Intelligence and Stress Measures Among Medical Students Completing an Unfamiliar Simulated Surgical Task, 2008*

Measure	Mean	Median	Standard deviation	Cronbach α
TEIQue-SF (trait EI)				
TEIQue-SF global score	159.18	159	13.35	0.77
Well-being factor	34.62	35	3.16	0.51
Self-control factor	29.21	30	4.66	0.55
Emotionality factor	40.82	41	5.60	0.58
Sociability factor	32.12	33	4.37	0.74
STAI (subjective stress)				
STAI before task	9.18	9	3.00	0.83
STAI during task	10.65	10	2.37	0.60
STAI after task	8.41	8	2.24	0.73
SVI before/after task	0.76	0	2.61	N/A
SVI during/after task	2.24	2	2.11	N/A
HR (objective stress)				
Mean HR	77.29	78	9.56	N/A
Maximum HR	109.18	110	13.97	N/A

* Indices based on N = 16–17 (one STAI form was missing). EI indicates emotional intelligence; HR, heart rate; STAI, State-Trait Anxiety Inventory (short form)[27]; SVI, stress variation index; TEIQue-SF, Trait Emotional Intelligence Questionnaire short form (www.psychometriclab.com).

whether participants' stress levels changed significantly during the study. This is a data analytic procedure that has previously been used in the study of participants' reactions to emotional stimulation in psychological research[31] as well as in the study of nontechnical skills in surgery.[32] We also carried out correlational analyses between SVIs and trait EI. An alpha level of 0.05 was taken to indicate statistical significance for all statistical tests.

Results

Of the 18 students that we selected to participate, 17 (11 men and 6 women) completed all parts of the study. One participant failed to complete the TEIQue-SF measure and was thus excluded from the study; another participant failed to complete one STAI form, and thus some analyses are based on data from 16 participants. The mean age of participants was 21.33 years (SD = 1.14 years), and all were interested in pursuing surgical training.

Descriptive statistics for all measures are displayed in Table 1. The STAI was reliable in capturing stress levels before and after the task, but it was less reliable in retrospectively capturing during-task stress levels. Analysis of the SVI before/after the task did not reveal significant differences ($t(16) = 1.21$, $P = .245$). This suggests that subjective stress levels were comparable before and after the task. In contrast, participants were significantly more stressed during the task than either before or after completing it, with subjective stress levels decreasing after task completion as evidenced by the positive value of the SVI during/after the task ($t(16) = 4.37$, $P < .001$). The fact that participants' stress levels were highest during the task suggests that the procedure exerted pressure on the students as anticipated. Global trait EI scores were reliable, although the four factor scores were less so, as has been previously demonstrated.[18]

Table 2 summarizes the intercorrelations between trait EI and the stress indicators (subjective and objective). Analyses across the stress indicators revealed positive intercorrelations between mean HR and maximum HR as well as positive intercorrelations between STAI before/after the task and during/after the task.

Table 2

Spearman ρ Correlation Coefficients Between Trait Emotional Intelligence and Stress Indices Among Medical Students Performing an Unfamiliar Simulated Surgical Task, 2008*

	TEIQue-SF											
	Global score	Well-being	Self-control	Emotionality	Sociability	Mean HR	Max HR	STAI before task	STAI during task	STAI after task	SVI before/after task	SVI during/after task
Objective stress												
Mean HR	0.23	−0.19	0.01	0.00	0.53†	1						
Maximum HR	0.11	−0.19	0.05	−0.15	0.36	0.89‡	1					
Subjective stress												
STAI before task	0.02	0.06	0.44	0.13	−0.38	−0.14	−0.02	1				
STAI during task	0.61†	0.58†	0.40	0.49§	0.20	0.10	0.08	0.38	1			
STAI after task	−0.09	0.19	0.10	−0.06	−0.23	−0.19	−0.09	0.51†	0.57†	1		
SVI before/after task	−0.09	−0.25	0.37	0.04	−0.36	−0.04	0.06	0.72¶	−0.09	−0.18	1	
SVI during/after task	0.60†	0.38	0.17	0.46	0.30	0.29	0.20	−0.18	0.44	−0.42	0.04	1

* Correlations based on N = 16–17 (one STAI form was missing). HR indicates heart rate; STAI, State-Trait Anxiety Inventory (6-item short form[27]); SVI, stress variation index; TEIQue-SF, Trait Emotional Intelligence Questionnaire short form (www.psychometriclab.com).
† $P < .05$.
‡ $P < .001$.
§ $P = .053$.
¶ $P < .01$.

These patterns suggest that participants who tended to be more stressed before and during the task also tended to be more stressed when they had finished, thus confirming that there were important individual differences in how participants experienced the task.

Global trait EI scores and the emotionality and well-being factor scores, as assessed by the TEIQue-SF, correlated positively with STAI scores during the task. In addition, sociability factor scores correlated positively with mean HR while the surgical task was being carried out. These findings indicate that higher trait EI was associated with higher levels of stress experienced by the participants as they carried out the simulated laparoscopic task.

Global trait EI scores also correlated positively with the during/after task SVI, indicating that higher trait EI was associated with more pronounced recovery to before-task stress levels once the task was completed. This pattern is depicted graphically in Figure 1.

Discussion

Managing stressful situations is vital to maintaining optimal performance in surgery; however, little research has focused on the factors affecting individual differences in the ability to cope with stress. In this study, we found that medical students with higher trait EI experienced more stress during the execution of an unfamiliar surgical task than did their peers with lower trait EI. This pattern was evident in consistent positive correlations between global trait EI (and some of its factors) and indices of stress. In addition, however, we found that students with higher trait EI recovered faster from their stressful simulated surgical experience than did their lower-trait-El peers (as evidenced in the analyses of the SVIs).

The first key finding of this study concerning the positive relationship of trait EI with anxiety during the task confirms that high-trait-EI individuals show increased sensitivity to affective stimuli in the environment (including stressors). This echoes previous relevant findings, from studies using laboratory-based mood induction procedures[33,34] and negotiation tasks,[34] showing that high trait EI scores are not always associated with desirable outcomes. However, this study also contradicts other previous findings where a mild-to-moderate negative relationship between trait EI and stress has been observed in psychological laboratory studies.[35]

The second key finding of this study concerns the positive relationship of trait EI with the SVI during/after the surgical task. This result also echoes previous findings outside surgery showing that higher-trait-EI individuals tend to recover faster than their lower-trait-EI peers after exposure to stressful stimuli.[33,34] Conceptually, this pattern is consistent with recent views of EI as a dynamic feature of human interaction rather than as a static property of an individual.[36] The interplay between higher levels of stress while carrying out an unfamiliar task but better recovery afterward provides evidence of such a potentially dynamic nature of EI. Further research should elaborate on this view.

Our findings ought to be qualified by a number of limitations. First, replications with larger sample sizes would increase confidence in our conclusions (although the size of the correlations that we observed with this sample does suggest reasonably large effect sizes). Second, given the specificity of surgical tasks, it is difficult to extrapolate the current findings to other tasks and, importantly, to live surgery. Studies that combine robust and theoretically driven EI assessment with real-time observation in the OR are required to determine the applicability of these findings to more experienced surgeons involved in real procedures. Replication with inexperienced but practicing surgeons would also help determine whether the stress they experience is similar to that experienced by the medical students, allowing the latter group to be used as a proxy. Third, from a psychometric perspective, the trait EI factors used in this study were not as reliable as they might be, and we echo the recommendation of Cooper and Petrides[26] that the full form of the TEIQue be used when factor- and facet-level measurement are desired in addition to a global score. The main issue is practicality, as the full form of the tool is considerably longer.

Regarding implications of these findings, this study shows that individuals cope

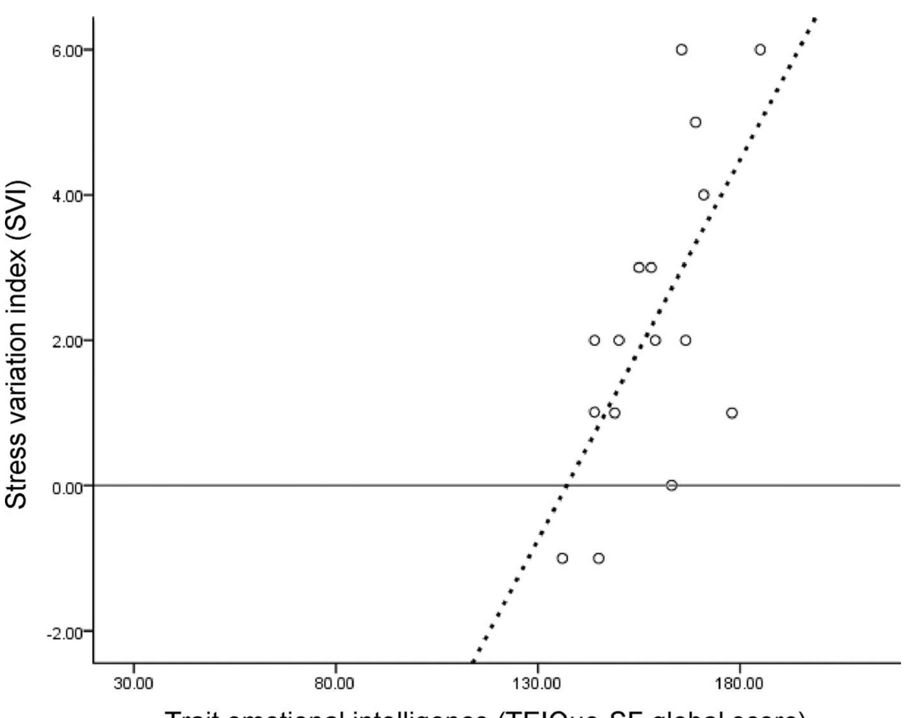

Figure 1 Scatterplot of the positive correlation between trait emotional intelligence (TEIQue-SF global score) and recovery from surgical-task-related stress (SVI) among 16 to 17 surgical novices (UK medical students in the fourth year of a six-year curriculum) who performed an unfamiliar simulated laparoscopic procedure. SVI is the stress variation index, calculated as the State Trait Anxiety Inventory (STAI; six-item short form[27]) after-task score minus the STAI during-task score; TEIQue-SF is the score on the short form of the Trait Emotional Intelligence Questionnaire (available at www.psychometriclab.com).

differently with stress and that, therefore, their training needs with regard to managing stressors are also likely to differ. Identifying those who are most likely to experience stress and tailoring interventions to better equip them with the skills they need to cope[37,38] (e.g., optimizing their trait EI levels through training[39]) could reduce the likelihood of patient safety being compromised by adverse effects of stress.[21] In addition, if trait EI does indeed influence stress management in surgery, it could potentially be used as a criterion to inform the selection and development of medical applicants and trainees.[40]

Taken together, our findings suggest that a view that "EI is good for you" is not supported by evidence.[41] Instead, mounting evidence shows that higher trait EI can have both adaptive and maladaptive consequences, at times putting the individual at risk of experiencing more stress than a peer with lower trait EI. Further investigation is required to explore whether high trait EI is to the benefit or detriment of the individual in terms of surgical performance or potential. It is important to remember, in light of the fact that acute stress may actually be conducive to human performance,[42] that any relationship between stress levels and performance may well be complex and not necessarily negative.

Finally, it is worth noting that current studies in surgery and medical education have assessed EI only descriptively or via instruments of low psychometric quality.[23] With the consistent application of tools that have demonstrably superior psychometric qualities (e.g., TEIQue-SF or TEIQue full form), research on EI in health care could proceed fruitfully to the investigation of the links between personal characteristics, like trait EI, and clinical performance.

Conclusion

This study provides evidence for a positive relationship between trait EI and the experience of, and recovery from, stress among medical undergraduates engaged in unfamiliar surgical procedures. What is particularly important for future research to determine is the extent to which the effects of trait EI and stress have a bearing on actual clinical performance. From a training and policy perspective, our results have potential application to the selection of surgical trainees and to the development as well as the design of stress management training programs tailored to the needs of individual physicians and trainees.

Funding/Support: This research was supported in part by the United Kingdom's Economic and Social Research Council Centre for Economic Learning and Social Evolution (Sevdalis). Drs. Arora, Russ, and Sevdalis are affiliated with the Imperial Centre for Patient Safety and Service Quality, which is funded by the United Kingdom's National Institute for Health Research (NIHR). Dr. Aggarwal is funded by a Clinician Scientist Award from the NIHR, Department of Health, UK.

Other disclosures: None.

Ethical approval: The study was approved by the St. Mary's Hospital local ethics committee as part of a larger project investigating stress in surgical practice.

Previous presentations: The findings reported here were presented at the Behavioural Science Applied to Surgery International Workshop; September 13–14, 2010; Amsterdam, the Netherlands.

References

1 Flin R, O'Connor P, Crichton M. Safety at the Shard End: A Guide to Non-Technical Skills. Surrey, England: Ashgate; 2008.
2 Shapiro SL, Shapiro DE, Schwartz ER. Stress management in medical education: A review of the literature. Acad Med. 2000;75:748–759. http://journals.lww.com/academicmedicine/Fulltext/2000/07000/Stress_Management_in_Medical_Education__A_Review.23.aspx. Accessed June 21, 2011.
3 Dyrbye LN, Thomas MR, Shanafelt TD. Medical student distress: Causes, consequences, and proposed solutions. Mayo Clin Proc. 2005;80:1613–1622.
4 Bunch WH, Dvonch VM, Storr CL, Baldwin DC Jr, Hughes PH. The stresses of the surgical residency. J Surg Res. 1992;53:268–271.
5 Zelem JD. Facing the daily grind: How surgeons might cope with burnout. Bull Am Coll Surg. 2007;92:24–26.
6 Lazarus RS. The psychology of stress and coping. Issues Ment Health Nurs. 1985;7:399–418.
7 Arora S, Hull L, Sevdalis N, et al. Factors compromising safety: Stressful events in the operating room. Am J Surg. 2010;199:60–65.
8 Sevdalis N, Forrest D, Undre S, Darzi A, Vincent CA. Annoyances, disruptions, and interruptions in surgery: The Disruptions in Surgery Index (DiSI). World J Surg. 2008;32: 1643–1650.
9 Arora S, Sevdalis N, Nestel D, Woloshynowych M, Darzi A, Kneebone R. The impact of stress on surgical performance: A systematic review of the literature. Surgery. 2009;147:318–330.
10 LeBlanc VR. The effects of acute stress on performance: Implications for health professions education. Acad Med. 2009;84(10 suppl):S25–S33. http://journals.lww.com/academicmedicine/Fulltext/2009/10001/The_Effects_of_Acute_Stress_on_Performance_.8.aspx. Accessed June 21, 2011.
11 Prabhu A, Smith W, Yurko Y, Acker C, Stefanidis D. Increased stress levels may explain the incomplete transfer of simulator-acquired skill to the operating room. Surgery. 2010;147:640–645.
12 Harvey A, Nathens AB, Bandiera G, LeBlanc VR. Threat and challenge: Cognitive appraisal and stress responses in simulated trauma resuscitations. Med Educ. 2010;44:587–594.
13 Hassan I, Weyers P, Maschuw K, et al. Negative stress-coping strategies among novices in surgery correlate with poor virtual laparoscopic performance. Br J Surg. 2006;93:1554–1559.
14 Schuetz M, Gockel I, Beardi J, et al. Three different types of surgeon-specific stress reaction identified by laparoscopic simulation in a virtual scenario. Surg Endosc. 2008;22:1263–1267.
15 Mayer JD, Caruso DR, Salovey P. Emotional intelligence meets traditional standards for an intelligence. Intelligence. 1999;27:267–298.
16 Petrides KV. Trait emotional intelligence theory. Ind Organ Psychol. 2010;3:136–139.
17 Petrides KV, Pita R, Kokkinaki F. The location of trait emotional intelligence in personality factor space. Br J Psychol. 2007; 98:273–289.
18 Petrides KV, Furnham A. The role of trait emotional intelligence in a gender-specific model of organizational variables. J Appl Soc Psychol. 2006;36:552–569.
19 Petrides KV, Vernon PA, Schermer JA, Ligthart L, Boomsma DI, Veselka L. Relationships between trait emotional intelligence and the Big Five in the Netherlands. Pers Individ Dif. 2010; 48:906–910.
20 Mikolajczak M, Luminet O, Menil C. Predicting resistance to stress: Incremental validity of trait emotional intelligence over alexithymia and optimism. Psicothema. 2006;18:79–88.
21 Mikolajczak M, Luminet O. Trait emotional intelligence and the cognitive appraisal of stressful events: An exploratory study. Pers Individ Dif. 2008;44:1445–1453.
22 Mikolajczak M, Luminet O, Roy E, Verstrynge V. An exploration of the moderating effect of trait emotional intelligence on memory and attention in neutral and stressful conditions. Br J Psychol. 2009;100:699–715.
23 Arora S, Ashrafian H, Davis R, Athanasiou T, Darzi A, Sevdalis N. Emotional intelligence in medicine: A systematic review through the context of the ACGME competencies. Med Educ. 2010;44:749–764.
24 Arora S, Sevdalis N, Aggarwal R, Sirimanna P, Darzi A, Kneebone R. Stress impairs psychomotor performance in novice laparoscopic surgeons. Surg Endosc. 2010;24: 2588–2593.
25 Biggart L, Corr P, O'Brien M, Cooper N. Trait emotional intelligence and work–family conflict in fathers. Pers Individ Dif. 2010;48: 911–916.
26 Cooper AJ, Petrides KV. A psychometric analysis of the Trait Emotional Intelligence Questionnaire–Short Form (TeiQue-SF) using item response theory. J Pers Assess. 2010;92:449–457.
27 Marteau TM, Bekker H. The development of a six-item short-form of the state scale

of the Spielberger State-Trait Anxiety Inventory (STAI). Br J Clin Psychol. 1992; 31:301–306.

28 Arora S, Tierney T, Sevdalis N, et al. The Imperial Stress Assessment Tool (ISAT): A feasible, reliable and valid approach to measuring stress in the operating room. World J Surg. 2010;34:1756–1763.

29 Maithel S, Sierra R, Korndorffer J, et al. Construct and face validity of MIST-VR, Endotower, and CELTS—Are we ready for skills assessment using simulators? Surg Endosc. 2006;20:104–112.

30 Dukes KA. Cronbach's alpha. In: Encyclopedia of Biostatistics. 2nd ed. http://www.mrw.interscience.wiley.com/emrw/9780470011812/eob/article/b2a13018/current/html. Accessed June 21, 2011.

31 Sevdalis N, Harvey N. Biased forecasting of post-decisional affect. Psychol Sci. 2007;18: 678–681.

32 Sevdalis N, Lyons M, Healey AN, Undre S, Darzi A, Vincent CA. Observational teamwork assessment for surgery: Construct validation with expert vs. novice raters. Ann Surg. 2009;249:1047–1051.

33 Petrides KV, Furnham A. Trait emotional intelligence: Behavioural validation in two studies of emotion recognition and reactivity to mood induction. Eur J Pers. 2003;17:39–57.

34 Sevdalis N, Petrides KV, Harvey N. Trait emotional intelligence and decision-related emotions. Pers Individ Dif. 2007;42:1347–1358.

35 Mikolajczak M, Petrides KV, Luminet O, Coumans N. An experimental investigation of the moderating effects of trait emotional intelligence on laboratory-induced stress. Int J Clin Health Psychol. 2009;9:455–477.

36 Lewis NJ, Rees CE, Hudson JN, Bleakley A. Emotional intelligence in medical education: Measuring the unmeasurable? Adv Health Sci Educ Theory Pract. 2005;10:339–355.

37 Levey RE. Sources of stress for residents and recommendations for programs to assist them. Acad Med. 2001;76:142–150. http://journals.lww.com/academicmedicine/Fulltext/2001/02000/Sources_of_Stress_for_Residents_and.10.aspx. Accessed June 21, 2011.

38 Rathbun J. Helping medical students develop lifelong strategies to cope with stress. Acad Med. 1995;70:955–956. http://journals.lww.com/academicmedicine/Abstract/1995/11000/Helping_medical_students_develop_lifelong.7.aspx. Accessed June 21, 2011.

39 Nelis D, Quoidbach J, Mikolajczak M, Hansenne M. Increasing emotional intelligence: (How) is it possible? Pers Individ Dif. 2009;47:36–41.

40 Carr SE. Emotional intelligence in medical students: Does it correlate with selection measures? Med Educ. 2009;43:1069–1077.

41 Petrides KV, Sevdalis N. Emotional intelligence and nursing: Comment on Smith, Profetto-McGrath, and Cummings (2009). Int J Nurs Stud. 2010;47:526–528.

42 Klein G. The effects of acute stress on decision making. In: Driskell JE, Salas E, eds. Stress and Human Performance. Mahwah, NJ: Erlbaum; 1996.

Teaching and Learning Moments

July First

On my first morning of internship, I arrived early, took signout from the doctor who had just finished his own internship, and went to round on my patients. At the door of the first room, I met a cardiologist coming out. I introduced myself and explained that it was my first day of internship, that I was on call, and that this woman was my patient. "Is there anything special you want me to do or look out for?" I asked. He looked at me for a moment, then turned and looked back at the patient, back to me, then back to the patient. He gave one more look at the middle-aged woman lying in the cardiac intensive care unit with the *whoosh-thump* sound of an intraaortic balloon pump cycling every second or so in the background, permeated with beeping and blinking machines, and turned to me, "If this woman dies, it's not your fault."

Terrified, I nodded and listened to his instructions about how to titrate her pressors in the hope, likely vain, that the balloon pump could be removed without instigating her death immediately. She had ischemic cardiomyopathy and was not a transplant candidate because of a recent cancer, which could recur as soon as she started immunosuppressives. She was going to die soon; the only question was when, where, and how. The cardiologist didn't want me to feel guilty when the inevitable occurred. It was a true act of mercy, although it didn't feel that way as I wondered if I had entered *Alice in Wonderland* or a horror movie.

I am an attending now. On July 1 of last year, my service received a very marginally stable patient in transfer from the ICU. The head of the hospital's rapid response team, the floor's charge nurse, and I, as the attending, sat down together to plan her management. We wanted to protect the patient from decompensating further and to orchestrate the management if she did, so the young nurses and the brand new intern knew what to do, the patient would be as safe as we could make her, and to protect the junior staff from a potentially traumatic event. I wrote out in detail precisely which vital sign abnormalities might occur, a differential diagnosis for each, the tests I would order and the empiric therapy I would consider. My instructions also included a few things not to do because of known—but perhaps easy to overlook in a crisis—conditions that the patient already had.

As I took the elevator up to see the new intern, I thought of my old teacher. I had specific instructions to convey, but I also wanted to be half as kind as he had been to me. When I entered the resident on-call office, phones were ringing, pagers were beeping, there were papers everywhere, and the interns and residents were trying mightily to contain the chaos. The intern I was looking for was at the center of it, with her notebook in hand and carefully marked and highlighted signouts in three colors. I explained about my patient and gave her my plan. She looked terrified but gulped and tried to focus on the specifics as I spoke. I looked at her when we were done; in the few minutes that we had talked, she had received four pager calls that she had to return, so I let her go. On my way to the elevator, I didn't quite think I had done my mentor justice. I went back and looked at her. As she turned to me, I said, "If something bad happens to her tonight, do what I said to do, but there is probably nothing you can do to stop it."

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