the effects of fatigue. The da Vinci Skills Simulator (dVSS) was introduced to fatigued and nonfatigued residents to assess novel robotic skills acquisition. It was hypothesized that fatigue would not affect proficiency on the dVSS.

**METHODS:** Fifteen general surgery residents were randomized into 2 groups: pre- and post-call. Each group was presented 5 tasks on the dVSS that varied in complexity and difficulty. Participants were given two 1-hour sessions to achieve an MScoreTM in the 90th percentile for each task. Participants completed the Epworth Sleepiness Scale (ESS). Metrics were compared between pre- and post-call groups and between fatigued (ESS>10) and nonfatigued (ESS<10) residents. Fisher’s exact test and *t*-test were used. Significance was set at p<0.05.

**RESULTS:** A statistically significant difference was found between the pre- and post-call reported sleep hours (p=0.036), but not in sleep interruptions or caffeine intake (Table). Total time, number of attempts, and high score were compared between the 2 groups. There were no statistically significant differences between the pre- and post-call groups or between the fatigued/nonfatigued groups.

**CONCLUSIONS:** Despite a significant difference (p=0.036) in reported sleep hours, there were no significant differences in total time, number of attempts, or high score between the pre- and post-call groups. Additionally, there was no significant difference between fatigued/nonfatigued groups. In conclusion, fatigue does not significantly affect proficiency on novel robotic surgical skills acquisition in general surgery residents.

**Can Teenage Novel Users Perform as Well as General Surgery Residents upon Initial Exposure to a Robotic Surgical System Simulator?**

Akshat J Mehta, Tristan E Senkowski, Weston Robison, John Allen, MD, Christopher K Senkowski, MD, FACS

Mercer University School of Medicine, Savannah, GA

**INTRODUCTION:** New techniques in minimally invasive and robotic surgical platforms require staged curricula to ensure proficiency. Scant literature exists as to how much simulation should play a role in training those who have skills in advanced surgical technology. The abilities of novel users may help discriminate if surgically experienced users should start at a higher simulation level or if the tasks are too rudimentary. It is recommended that residency training programs include exposure to robotic technology. This study’s purpose was to explore general surgery residents’ ability to gain proficiency on the da Vinci Skills Simulator (dVSS) as compared with novel users. The hypothesis was that surgery residents will have increased proficiency in skills acquisition as compared with novel users.

**METHODS:** Six general surgery residents were compared with 6 teenagers using metrics measured by the dVSS. Participants were given two 1-hour sessions to achieve an MScoreTM in the 90th percentile on each of the 5 simulations. MScoreTM software compiles a variety of metrics including total time, number of attempts, and high score. Statistical analysis was run using *t*-test. Significance was set at p<0.05.

**RESULTS:** Total time, attempts, and high score were compared between the 2 groups. The general surgery residents took significantly less total time to complete peg board 1 (p=0.043) (Table). No significant difference was evident between the 2 groups in the other 4 simulations across the same MScoreTM metrics.

**Table. Novel User vs Residents**

<table>
<thead>
<tr>
<th>Simulation task</th>
<th>Teen total time (n=6), min, mean ± SD</th>
<th>Resident total time (n=6), min, mean ± SD</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peg board 1</td>
<td>547.18±111.83</td>
<td>207.17±97.51</td>
<td>0.045</td>
</tr>
<tr>
<td>Ring walk 1</td>
<td>184.83±85.09</td>
<td>161.83±59.74</td>
<td>0.601</td>
</tr>
<tr>
<td>Energy dissection 1</td>
<td>790.67±949.46</td>
<td>1,247.33±1,381.44</td>
<td>0.52</td>
</tr>
<tr>
<td>Match board 1</td>
<td>2,166.33±1,775.16</td>
<td>1,306±567.71</td>
<td>0.301</td>
</tr>
<tr>
<td>Needle targeting</td>
<td>514.8±286.22</td>
<td>573.6±514.44</td>
<td>0.829</td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** Our findings indicate that previous medical knowledge or surgical experience does not significantly affect one’s ability to acquire new skills on the dVSS.

**Cognitive Mechanisms of Workload-Related Performance Decline in Surgical Residents**

Hemel Modi, Daniel R Leff, PhD, FRCS(Gener Surg) MS(Hons), Harisimrat Singh, PhD, Guang-Zhong Yang, Ana W Darzi, MB BCH, FACS(Hons)

Imperial College, London, UK

**INTRODUCTION:** Stressors in the operating room can increase surgeons’ cognitive workload and degrade their technical performance. The neural mechanisms that signal increased cognitive burden in surgeons are unclear; however, the prefrontal cortex (PFC) is implicated due to its involvement in attention and concentration. We hypothesized that, under time pressure, junior residents are less able to engage the PFC and maintain performance than more senior residents.

**METHODS:** Twenty-eight surgical residents (15 PGY1-2, 8 PGY3-4, 5 PGY5) performed a laparoscopic suturing task under 2 conditions: “self-paced,” in which residents were permitted to take as long as required to tie each knot; and “time pressure,” in which a maximum of 2 minutes were allowed. Subjective workload was quantified using the Surgical Task Load Index. An optical topography system, which measures changes in cortical...
haemodynamic parameters was used to infer PFC activation responses. Technical skill was assessed using task progression scores, error scores, leak volumes, and knot tensile strengths.

RESULTS: Among PGY1-2 and PGY3-4 residents, time pressure led to greater subjective workload, diminished PFC activation, and significant deterioration in performance. In contrast, no such change in subjective workload was observed among PGY5 residents, who demonstrated sustained PFC activation and less performance deterioration under time pressure.

CONCLUSIONS: Senior residents are better able to cope with intraoperative cognitive demands and stabilize their performance under pressure, perhaps due to enhanced PFC recruitment and task engagement. Future work will seek to develop cognitive training strategies that will maintain task engagement among junior residents, allowing them to improve performance under pressure.

Delineating Optimal Surgical Performance in Laparoscopic Donor Nephrectomy among Transplant Surgery Fellows: A Learning Curve Analysis
Oscar K Serrano, MD, Ananta Bangdiwala, David Vock, PhD, Varvara A Kirchner, MD, Danielle Berglund, Ty B Dunn, MD, FACS, Erik Finger, MD, PhD, Timothy L Pruett, MD, FACS, Arthur J Matas, MD, FACS, Raja Kandaswamy, MBBS, FACS
University of Minnesota, Minneapolis, MN

INTRODUCTION: Laparoscopic donor nephrectomy (LDN) requires a high degree of surgical competence and skill. United Network for Organ Sharing recommends that fellowship-trained surgeons participate in 15 LDNs to be considered proficient.

METHODS: A retrospective, single center case analysis was performed of all LDN between January 2000 and December 2014 to construct a learning curve model. Measures of surgical performance included operating time (ORT), estimated blood loss (EBL), and the presence of a complication. Case complexity was defined by clinical metrics from donors with BMI > 30 kg/m², previous abdominal operations, renal vasculature multiplicity, and those in whom a right nephrectomy was performed. Outcomes and case complexity were compared between junior transplant surgery fellows (jrTSF) and senior transplant surgery fellows (srTSF).

RESULTS: Our study included 1,145 LDN procedures (929 performed by jrTSF; 216 by srTSF). The proportions of adverse surgical events were higher for jrTSF than for srTSF: high EBL, 51% vs 40% (p = 0.03); complication, 5% vs 4% (p = 0.66); high ORT, 60% vs 44% (p = 0.002). Incidence of high-risk donor characteristics did not differ during the training period. Based on the risk-adjusted nonparametric analysis of the learning curves, a trend of improving operating room time can be observed after 18 LDN procedures, intraoperative complications after 24 LDN procedures, and EBL after 24 LDN procedures. The comprehensive learning curve model for transplant surgery fellows demonstrates a decreasing trend in adverse surgical events after 19 procedures.

CONCLUSIONS: In the current era, in which fundamental laparoscopy skills are mandated during residency training, transplant surgery fellows seem to achieve improved rates of adverse surgical outcomes during LDN after 19 cases.

Effects of Incorporating the Extended Focused Assessment with Sonography for Trauma Training into the Third Year Medical Student Surgical Clerkship
Cassandra C Krause, Reed F Krause, Nephtali R Gomez, MD, Vi A Dinh, MD
Loma Linda University, Loma Linda, CA

INTRODUCTION: Studies have shown the benefit of integrating ultrasound education into undergraduate medical curricula. However, few studies assess the benefit of integrating ultrasound into the third year surgery clerkship. This study sought to assess the feasibility and effectiveness of extended focused assessment with sonography for trauma (eFAST) exam training during the third year surgery clerkship.

METHODS: This was a prospective cohort study using participants as self-controls. We integrated eFAST training into the required 10-week third year surgery clerkship curriculum. Training included a 15-minute video lecture followed by 50-minute hands-on training. Participants were required to log 3 eFAST exams on patients in the emergency department. Participants were assessed at the start and completion of the clerkship through a 5-point Likert scale survey, 22-question quiz, and an objective structured clinical exam (OSCE). The survey assessed confidence in performing the eFAST exam. The quiz assessed pathology interpretation of the eFAST exam. The 6-minute, 18-item eFAST OSCE assessed ability to acquire windows and identify structures and quality of images.

RESULTS: Ninety-two students were assessed. The survey showed a mean confidence improvement from 2.8 ± 1.1 to 3.6 ± 0.9, p < 0.01. Average quiz grade improved from 50% ± 16% to 65% ± 15%, p < 0.01. The average OSCE score improved from 46% ± 27% to 81% ± 18%, p < 0.01. The percentage of participants able to complete the eFAST scan within 6 minutes improved from 17% ± 38% to 81% ± 39%, p < 0.01.

CONCLUSIONS: Our study shows that a brief training and completion of eFAST exams throughout the clerkship improves students’ confidence, knowledge, and speed in the eFAST exam.

Endovascular Training Using a Simulation-Based Curriculum Is More Cost-Effective than Conventional Training in the Hybrid Angiosuite
Heidi Maertens, Frank Vermassen, MD, PhD, Rajesh Aggarwal, MBBS, PhD, FRCS, FRCS, FACS, Isabelle Van Herzele, Lieven Annemans
Ghent University Hospital, Ghent, Belgium, McGill University, Montreal, QC

INTRODUCTION: Because postgraduate endovascular training lacks curricular support, clinical skills are acquired in real patients