

## **Women in Academic Surgery: Why is the playing field still not equal?**

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**Background:** Over the last decade, the number of women in surgery has steadily increased and women now make up nearly half of those entering the surgical workforce. Despite this, women are not well represented in academic surgery positions, particularly in leadership roles. The purpose of this study was to explore career satisfaction and advancement for women in academic surgery.

**Methods:** A 48-item email survey with questions regarding career satisfaction, mentorship, research productivity, family life and discrimination, was sent to Canadian female academic surgeons.

**Results:** 37% (78/212) of eligible surgeons from 6 sub-specialties responded. Participants rated their career satisfaction as 8.6/10 (median 9, mode 10). The majority (79%) identified at least one mentor and 89% of mentors were men. Despite this, 54% of participants wished they had better mentorship. The most common university rank was assistant professor (47%), and 50% had never received an academic promotion. The hours worked ranged from 40-100/ week, with the largest group (28%) working 51-60 hours. Most participants averaged 5-6 days in the operating room per month. Research productivity was highest in their first 5 years of practice. When asked about discrimination, 18% felt discriminated against in medical school, 36% in residency, 12% in fellowship, and 41% as a staff surgeon. The most common source of discrimination was cited as gender (56%), with age (9%) and race (5%) less common. 57% of participants felt that their gender posed a challenge in their work as surgeons. Participants felt the three best aspects of being a surgeon were: operating, patient interaction and diversity of duties. The three worst aspects included loss of personal time, impact on personal relationships and overall time commitment. Surgeons suggested more flexible work hours, reduced workload and more equitable colleague relationships as important changes that could influence more women to enter the field of surgery.

**Conclusion:** There remain ongoing challenges for many women in academic surgery. The most prevalent issues highlighted in this survey include lack of gender equality, appropriate mentorship, and accommodations for surgeons with families. Continued advancement of women in academic surgery is dependent on addressing these concerns.

## **A novel longitudinal basic surgical skills curriculum with a supplemental home-video assessment program**

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**Objective:** To evaluate a longitudinal basic skills curriculum supplemented by home-video assessments and to determine if peers can serve as valid evaluators of performance.

**Background:** Surgical skill development is typically dependent on feedback from faculty, who have limited availability. Incorporation of home-video assessments allows for more flexibility for faculty participation. Peer feedback may also avoid these constraints, but may not be as reliable.

**Methods:** Twenty-four surgical interns completed a 12-week basic surgical skills curriculum consisting of 6 sessions and 4 home-video assignments each with 4 to 8 tasks focused on knot tying and suturing. Skills were assessed at baseline, during, and at the conclusion of the curriculum by three experts on a scale from 1-10. For the home video assessments, interns were randomized into two groups; either giving/receiving feedback to/from peers (n=12), or receiving feedback from faculty (n=12). Faculty concurrently rated videos from the peer feedback group for comparison purposes only. The two groups were compared on performance using a repeated measures ANOVA. Faculty and peer scores were compared on paired t-test; number of comments were compared using a Wilcoxon-matched pairs test, and comments were characterized as global/specific and positive/negative.

**Results:** There was significant improvement at each time period for both groups. Performances for both groups on the home-video assessments were significantly better than at the final assessment. The peer feedback group did perform better at the final assessment than those receiving faculty feedback by 0.6 points ( $p=.04$ ). Regarding feedback, peer raters gave higher global scores compared to faculty for all assignments ( $p<.01$ ). However, when using a checklist, there was no significant difference between scores ( $p>.05$  for all 4 assignments). Faculty raters tended to give more specific feedback comments compared to peer raters.

**Conclusions:** This skills curriculum improves interns' basic surgical skills. The greatest improvements were in a stress home-video environment. Decline seen in a test-setting suggests that skills have not yet reached automaticity, but may be closer in the peer feedback group. Peers may serve as reliable raters with the use of checklists, but the discordance in global scores and less specific comments warrant further consideration.

## **Top tips for Telementoring surgery: a North American expert consensus report and implementation checklist**

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**Introduction:** Telementoring can be defined as the method where an experienced surgeon guides a less experienced surgeon who is operating at a distance, through the use of audio-visual technology. Although not a novel concept, there has been limited uptake in this technique despite rapid advances in telecommunications over the past few years. The aim of this study was to determine an expert opinion regarding surgical telementoring and develop a checklist that could potentially address and prevent the known pitfalls that hinder the implementation of this under-utilized technique.

**Methods and Procedures:** Four surgeons known to have extensive experience in telementoring surgery were targeted via electronic mail for interview. All interviews were audio recorded and transcribed. Themes were determined and summarized into a consensus report.

**Results:** A researcher trained in interview techniques carried out semi-structured telephone interviews with 2 Canadian and 2 US surgeons at a time of mutual convenience over a two weeks period. The interviews lasted an average of 29 minutes (range 21.14-43.42 minutes). Key themes isolated from the interview transcriptions included training relationship, patient information, team involvement, medico-legal, safety and technological considerations. A 20 point telementoring implementation checklist, to be completed before any scheduling any cases by the mentor and mentee, was developed and then refined by the experts. Specific items within the themes on the list include "training language determined", "ground rules regarding training established", "patient aware and consents to telementoring", "clear documentation of responsible surgeon", "equipment checks", "telestration/telepointing available", "technology back up available", "OR team familiar with equipment", "business plan in place for mentor payment".

**Conclusions:** Certain key points regarding surgical telementoring have been defined by experts. If addressed prior to commencing training, these could potentially increase the uptake and feasibility of telementoring. Future work will involve the implementation checklist to be piloted to determine the impact of these tips.

## **Correlations among facets of emotional intelligence in a surgical cohort**

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**Background:** There has been an increased focus on emotional intelligence in relation to communications and human interactions in the professional setting. Trait Emotional Intelligence Questionnaire (TEIQue, Thomas International, Inc.) is a method of measuring emotional intelligence incorporating four factors with two focusing on intrapersonal (well-being and self-control) and two on interpersonal (emotionality and sociability) attributes. The four factors are further divided into 15 facets ranging from happiness to adaptability. The purpose of this study was to determine the degree of correlation among these 15 facets based on the results from employees of a general surgical department.

**Methods:** The TEIQue was administered prospectively to a cohort of surgical residents and attending physicians, physician assistants, nurse practitioners, nurses, administrative assistants, and research staff in a surgical department. There were 71 participants in total. Data analysis consisted of the Pearson's  $r$  to obtain correlation strength ( $r$ -value) among the facets.

**Results:** A comparison of the four factors demonstrated low to moderate correlation ( $r=0.30$  to  $0.60$ ). Within each of the four factors, the correlation among its three to four facets was extremely high ( $r=0.72$  to  $0.92$ ). All correlations among facets belonging to different factors were direct and in the low to moderate range ( $r=0.3-0.69$ ). The greatest such correlation was seen between social awareness and emotional perception ( $r=0.69$ ), both of which belong to the interpersonal factors. The facet with the largest number of correlations was adaptability; there were correlations with five other facets including happiness, optimism, stress management, emotion expression and relationship. Emotion regulation was the facet with no other correlation.

**Discussion:** The results from this surgical cohort show a high correlation among facets belonging to the same factors. In addition, there appears to be an interaction between social awareness and emotional perception, which are categorized under the interpersonal factors. The relationship of adaptability and other facets of emotional intelligence warrants further study. Future research will focus on similar examinations involving a larger and more variable cohort.

## **A Decade of Duty Hour Standards: Increasing Pass Rate Trends on the American Board of Plastic Surgery Written Examination**

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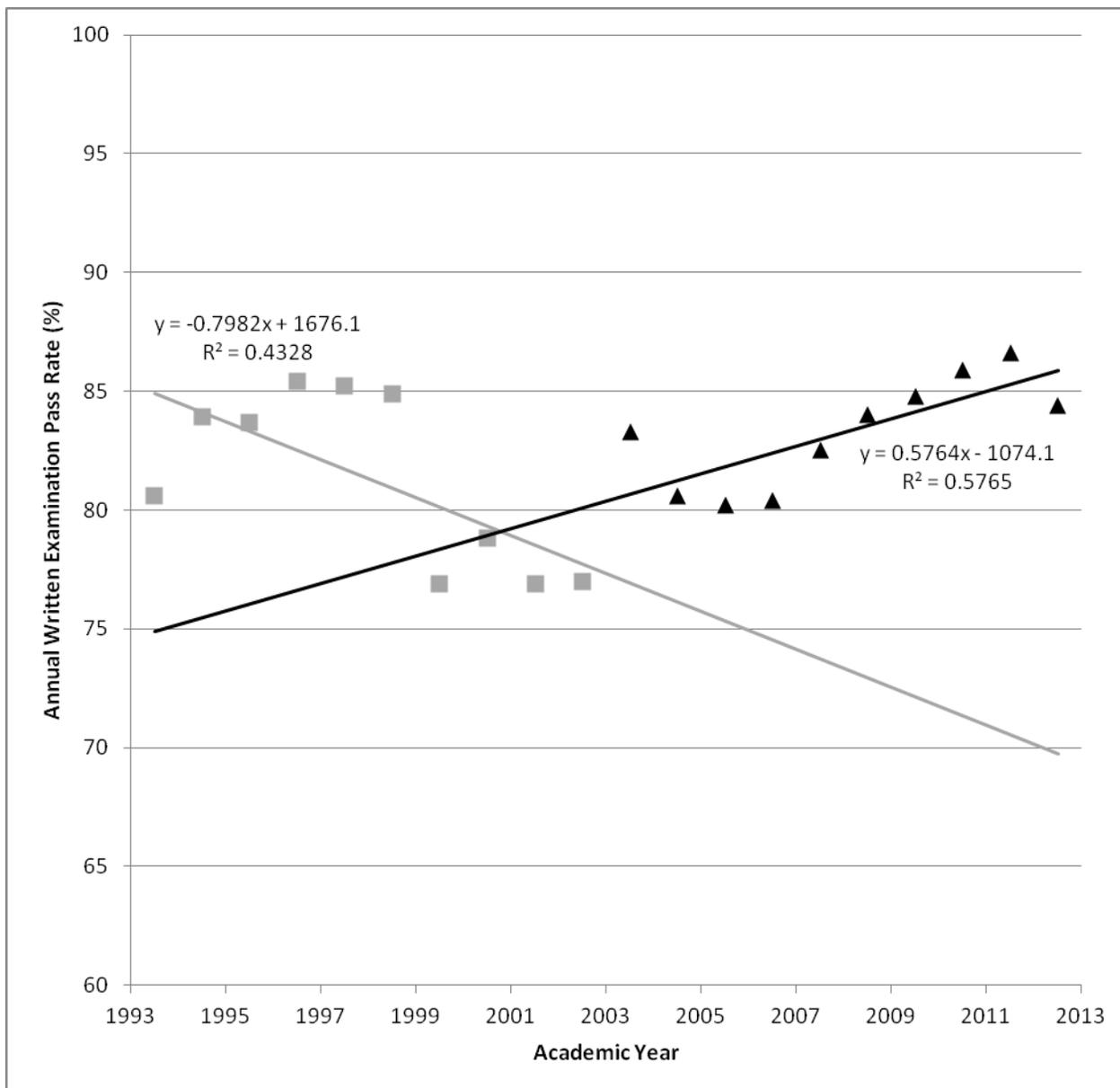
**Introduction:** It was believed that the Accreditation Council for Graduate Medical Education (ACGME) duty hour standards initiated in 2003 would improve resident education. The purpose of this study was to evaluate the educational outcomes on the American Board of Plastic Surgery Written and Oral Examinations. The hypothesis is that pass rates on these examinations have increased since 2003.

**Methods:** In this retrospective study from 1994-2013, outcomes on the Written and Oral Examinations were obtained from the American Board of Plastic Surgery. To evaluate pass rate trends, simple linear regression was performed using the academic year as the independent variable and the pass rate as the dependent variable. Segmented linear regression was also performed surrounding 2003. Statistics were performed using an  $\alpha = 0.05$ .

**Results:** The overall pass rate on the Written Examination was 4,113/4,992 (82.4%) with a median annual pass rate of 83.5% (Interquartile Range [80.3% - 84.8%]). The overall pass rate on the Oral Examination was 4,009/4,910 (81.6%) with a median annual pass rate of 81.4% (Interquartile Range [79.5% - 82.6%]). Simple linear regression showed an increasing pass rate since 2003 on the Written Examination ( $p = 0.01$ ), with no changes on the Oral Examination ( $p = 0.46$ ). Segmented linear regression on the Written Examination showed a decreasing trend before 2003 ( $p = 0.04$ ) with an upward deflection in slope surrounding 2003 ( $p < 0.001$ ). There were no significant 20-year trends for the Written or Oral Examinations (both  $p > 0.05$ ).

**Conclusions:** There are clearly increasing pass rate trends on the Written Examination surrounding the institution of the ACGME duty hour standards. Additionally, segmented linear regression is an invaluable test in evaluating examination outcomes surrounding this change in residency training. These findings help support duty hour restrictions, and may suggest that plastic surgery examinees have changes in study habits.

Figure 1: Segmented linear regression on the American Board of Plastic Surgery Written Examination pass rates surrounding 2003



## **A Night Float Week in a Surgical Clerkship Improves Student Team Cohesion**

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**Introduction:** Resident duty hour restrictions have resulted in numerous schedule changes in surgical training. Night float teams are common, but student clerkship call schedules often follow a traditional, intermittent model. This discrepancy may result in less valuable overnight clinical experiences and a feeling of disconnect between students and the resident care teams. The comparative educational value of a student night float model remains unclear. We hypothesize that night float rotations in the third year surgical clerkship improve student learning as well as student perceptions of team cohesion.

**Methods:** Medical students at our institution are traditionally on call with the trauma/emergency general surgery service (EGS) once per week. A night float system was implemented halfway through the 2013/14 academic year such that, for the second half of the year, each medical student completed one week of night float with EGS. We prospectively studied the impact of this scheduling intervention on team cohesion, using the Perceived Cohesion Scale, rated 1-7, and academic performance, using the Surgery Shelf exam scores. Pre- and post- intervention scores were compared with Student's t-test

**Results:** We surveyed 70 medical students, 37 traditional call students and 33 night float students, with 64 respondents (91% response rate). Student perception of team cohesion increased significantly, with no perceived loss of educational benefit (table). Shelf exam scores of the pre-intervention group were compared to the post-intervention group, and the average score for night float students was significantly higher than traditional call students (75.4 vs 69.4,  $p < 0.05$ ).

**Conclusion:** A week long night float experience for medical students significantly improves their perception of team cohesion and is associated with higher shelf exam scores. Overall medical student educational value may be improved with the addition of a dedicated period of night float during the surgical clerkship.

	<b>Pre-intervention</b>	<b>Post-intervention</b>	<b>Significance</b>
<b><i>I feel that I belong to this group</i></b>	<b>4.81</b>	<b>5.66</b>	<b>p=0.021</b>
<b><i>I am happy to be part of this group</i></b>	<b>5.47</b>	<b>6.13</b>	<b>p=0.049</b>
<b><i>I see myself as part of this group</i></b>	<b>4.69</b>	<b>5.66</b>	<b>p=0.008</b>
<b><i>This group is one of the best anywhere</i></b>	<b>4.48</b>	<b>5.47</b>	<b>p=0.012</b>
<b><i>I feel that I am a member of this group</i></b>	<b>4.69</b>	<b>5.53</b>	<b>p=0.040</b>
<b><i>I am content to be a part of this group</i></b>	<b>4.91</b>	<b>5.88</b>	<b>p=0.005</b>
<b><i>I participated in useful educational opportunities while on call</i></b>	<b>5.97</b>	<b>6.22</b>	<b>p=0.483</b>
<b><i>I regretted missing other clinical opportunities because of call</i></b>	<b>2.97</b>	<b>2.75</b>	<b>p=0.219</b>

## **A Tube Thoracostomy Simulator can Effectively be Incorporated into a Medical Student Skills Lab.**

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**Background:** Tube thoracostomy (TT) is a fundamental, and potentially lifesaving, skill for physicians. Standardized training is lacking and many students complete a surgical clerkship without performing a TT. As part of our continuing effort to incorporate technical skill simulation into medical student education, a porcine TT model was designed and implemented for 3rd year medical students. We hypothesized that this low cost, high fidelity TT simulator could be implemented into a student surgical skills curriculum with a high degree of student acceptance and satisfaction.

**Materials and Methods:** A TT simulator was designed using a fresh porcine thorax. Iterative testing with expert and trainee surgeons was used to confirm content validity. The model was implemented as part of a 3rd year skills curriculum. All students starting their clerkships completed the skills lab and were surveyed to determine how comfortable they felt placing a TT as well as their perceptions of the workshop. Surveys were administered using a 5 point Likert scale and free text answers were analyzed.

**Results:** In two years, 256 medical students completed the simulation and 88% responded to the immediate post-simulation survey. Students gave the simulation an average score of 4.6 on a 5 point Likert scale. Students responded positively in the qualitative response section with 17 of 18 comments reflecting positive sentiments. Students responded positively to realistic simulation model, stating, "using actual ribbed meat...was a great model" and the "chest tube [simulation] was an excellent model."

**Conclusions:** A low cost, high fidelity TT simulator can be incorporated into a medical student surgical skills curriculum with a high degree of student satisfaction. Ongoing efforts to incorporate technical skills training early in medical education are feasible and should be continued.

## **Aligning Institutional Priorities: Engaging Housestaff in Quality Improvement and Safety Initiatives to Fulfill CLER Guidelines and Meaningful Use**

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**Problem:** The Accreditation Council for Graduate Medical Education Clinical Learning Environment Review guidelines require sponsoring institutions to engage housestaff in improving systems of care and patient outcomes. Concurrently, academic institutions need active housestaff participation and buy-in to meet additional incentives such as electronic health record (EHR) Meaningful Use.

**Approach:** The University of Washington Housestaff Quality and Safety Council (HQSC) was created to partner resident and fellow trainees with institutional leadership to achieve both educational and quality improvement goals. The primary objective of the HQSC inaugural project was to create and implement an EHR problem list manager (PLM) tool to improve the use and functionality of the inpatient problem list. Pre- and post-intervention surveys concerning attitudes toward the inpatient problem list were used to develop the PLM and inform content for an online module designed to educate housestaff about the inpatient problem list and PLM.

**Outcomes:** Partnerships were created between housestaff, information technology and administrative leadership. Housestaff survey response rate was 47% (486/1039) across 44 programs. Comparing surveys before and after the intervention showed significantly increased self-reported routine updating of the problem list ( $p=0.002$ ) and comfort with the problem list ( $p=0.05$ ). However, housestaff concerns about problem list accuracy and usefulness persisted. Next steps This innovative program serves as a model for successful engagement of housestaff in institutional quality and safety initiatives. Housestaff and institutional partnerships will continue to be utilized for additional PLM improvements and problem list training. Future work will include re-assessing utilization and accuracy of the PLM.

## **An Early Surgical Training Module for Compartment Pressure Measurement**

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**Introduction:** Compartment pressure measurement (CPM) requires knowledge of disease state and technical proficiency for accurate diagnosis of compartment syndrome (CS). The efficacy of simulated CPM teaching models to junior surgical residents is unknown. We test a novel simulated teaching module's ability to educate junior residents in CPM and assessment of CS.

**Methods:** 22 PGY1 & PGY2 surgical residents received a 1 hour didactic and 1 hour practical teaching module on the clinical assessment and performance of CPM for CS using the Stryker® Intra-Compartmental Pressure Monitor and Sawbones® Compartment Syndrome Model. Participants' proficiency was measured with a validated 10-question pre-test and 10-question post-test multiple-choice exam following the didactic teaching session structured by a PGY5 surgical resident. Two board certified general surgeons with specialization in acute care surgery then administered a 10-point practical competency examination for CPM and CS clinical assessment. Participants were assessed for CS knowledge retained at 1 month by survey.

**Results:** One-way within subjects ANOVA indicated significant difference between pre-, post-, and retention test scores [F (2,49)=9.24, p<0.01]. Participants showed significant improvement in written test performance after module completion, with mean pre- and post-test scores of 6.1/10 and 7.9/10, respectively (p<0.01). Students successfully demonstrated practical skill ability with average CPM practical performance scores of 8.5/10 for preparation components, 9.0/10 for performance components, and 8.5/10 for management components, which did not statistically differ by one-way within subjects ANOVA [F (2,57)=0.46, p=0.63]. Skills test scores were not statistically different between evaluators (p=0.83). Preliminary retention test scores (mean 8.2/10) were not significantly different from post-test scores (mean 7.9/10), indicating that knowledge was retained (p=0.1879).

**Conclusion:** This teaching module demonstrates a simulated mechanism for the efficient education of junior surgical residents in CPM technique and clinical assessment of CS. This educational approach may have widespread applicability across surgical training programs.

## **Assessing the quality of the surgery clerkship: Results of the 2013 Canadian Graduation Questionnaire**

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**Purpose:** The purpose of this study was to compare student's perceptions of their Surgery clerkship (SR) to the national Canadian average and across 3 distributed teaching sites, and to determine how these perceptions correlate with standardized examination performance.

**Methods:** All undergraduate 3rd year surgery clerkship trainees from a single graduating medical school class were prospectively queried at the completion of their surgical training rotation using the Canadian Graduate Questionnaire. Overall quality of the rotation, teaching and supervision, and patient workload were quantitatively evaluated with a 5-point Likert scale. Qualitative responses were generated using open-ended prompts to probe for perceived strengths and weaknesses of the surgical clinical training rotation. Examination performance data was collated from the surgery component of the Medical Council of Canada Qualifying Examination Part I (MCCQE) and stratified by training site.

**Results:** 144 (58%) of the 2013 graduating class responded. Of the three provincial teaching sites, response rates were 47%, 47%, and 61%. Overall, 81% of the respondents rated the SR as good or better. Comparatively, these ratings were lower than Emergency Medicine (97%), Internal Medicine (90%), Family Practice (88%), and Psychiatry (88%), but similar to Obstetrics (81%) and higher than Pediatrics (71%). Strengths of the surgical rotation identified from qualitative analysis for distributed sites included increased opportunities for "hands-on" learning, and ample exposure to the operating room. Perceived weaknesses included insufficient supervision by preceptors and staff, and inappropriate levels of responsibility. Interestingly, the campus with the poorest quantitative and qualitative educational experience ratings in the CGQ demonstrated statistically significant better performance on the MCCQE Part I surgical component than its higher rated local cohorts ( $p < 0.05$ ).

**Conclusion:** The SR continues to lag behind other clerkship rotations in student evaluated quantitative and qualitative measures of educational quality. Distributed surgical clinical education programs can be an effective strategy for providing a broad surgical exposure to increasing numbers of medical students, but standardization of student educational experiences remains a significant challenge. Despite voiced concerns, there was no correlation in this cohort between teaching perception and examination performance.

## **Coronary artery anastomosis simulation in a medical student population: A cost-effective and reproducible model that promotes interest in surgical careers**

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**Introduction:** We aimed to assess the economical and logistical feasibility of implementing a coronary artery anastomosis simulation model in a population of surgically inexperienced medical students and to evaluate how students' interest in surgery as a career changed after their participation.

**Methods:** A low-fidelity coronary anastomosis simulation task station was developed, utilizing key components of low-fidelity models used in prior studies, with a renewed focus on cost-effectiveness, reproducibility, and ease of assembly. The model was used for proctored student training as well as independent practice in our institutional simulation lab. Students were recruited into this IRB approved study and randomized to one of two groups: "supervised training only" (TO), or "unsupervised self-practice" (TP). The TO group only practiced under the supervision of attending cardiac surgeons, while the TP could also practice unsupervised. Digital recordings of anastomoses were rated by attending cardiothoracic surgeons using a verified assessment tool. A survey documenting interest in surgery was completed before and after participation, and the Chi-squared test was used to compare levels of interest between the TP and TO groups in addition to those completing and withdrawing from the simulation.

**Results:** From January-September 2014, 57 students completed 312 simulated anastomoses. Fixed costs to initiate the study were \$1,094.30 to accommodate proctored groups of up to 10 students, including digital recording capability. Students completed an average of  $(5 \pm 1.89)$  anastomoses (range 1-10). Cost per anastomosis was \$4.30. At baseline, 60.4% of students were interested in pursuing a career in surgery, 25% were interested in pursuing a career in a non-surgical field, and 14.6% were undecided. After participation (84% survey response), there was increased interest in surgery in students who completed training (n=28) compared to students that withdrew (n=20) ( $p=0.045$ ). However, no statistical difference between TO (n=26) and TP (n=22) groups ( $p=0.753$ ) was identified.

**Conclusion:** Using an inexpensive and reproducible model for coronary anastomosis, medical students demonstrated increased interest in a career in surgery. More than supervision, the presence of a model itself stimulated trainee interest, implying that a host of high-quality, low-cost models could be implemented across medical specialties with reasonable effort and cost.

## **Developing an effective surgical skills simulation program for surgical residents in a resource-constrained setting**

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**Background:** It is estimated that 11% of the global burden of disease is surgical. The greatest burden of surgically-treatable diseases falls on people in resource-constrained settings. As resource-constrained countries address a shortage of surgeons by increasing the number of trainees, a major barrier is the lack of surgical educators and clinical opportunities. This is an opportunity for surgical simulation to narrow the training gap. We developed a model for a surgical simulation program in a resource-constrained setting.

**Methods:** This program consisted of 1) faculty development, 2) curriculum development, and 3) curriculum implementation. Building on an existing relationship between two training institutions, a formal agreement was developed creating an international simulation fellowship. This 3-week intensive training program has a specific curriculum including observation, mentoring, and practice in surgical simulation. A measurable outcome was defined as development of training curricula applicable in both training environments. This was followed by implementation of a surgical skills course in the resource-constrained country.

**Results:** At completion of the fellowship, the faculty had developed 8 written training curricula with formal performance metrics: Instrument Identification, Knot-Tying, Suturing, Laparotomy, Intestinal Anastomosis, Colostomy, Basic Laparoscopy, and Basic Chest Procedures. These were then used as the basis of a surgical skills course held in the resource-constrained environment. Low-cost alternatives to commercially purchased simulation models were constructed locally. Each session included local faculty assisted by experienced educators from the established program. Thirty-four incoming surgical residents were enrolled and successfully completed the course. Two of these curricula have since been introduced as new offerings at the established simulation center, including use of the low-cost materials that were felt to be superior to commercial models. Planning is underway for the next fellowship and training courses.

**Discussion:** Our experience confirms that this model is effective in establishing a surgical simulation program in a resource-constrained training program. Key lessons learned are the importance of relationship building between institutions, a focus on faculty development and support, and the importance of formal deliverable outcomes. Curricula and materials developed in and for a resource-constrained environment can be brought back and used to enhance surgical education in more established programs.

## **Development of a Clinical Breast Exam (CBE) Web-Based Module**

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**Introduction:** The Clinical Breast Exam (CBE) seeks to evaluate breast related concerns and detect palpable breast abnormalities. Multiple studies indicate that health care professionals believe they need more training in CBE. The goal of this project was to provide an easily accessible, concise resource on CBE for students to demonstrate proper techniques and improve confidence.

**Methods:** Two educational products were developed including an eleven-minute video depicting components of the CBE and a video segment-embedded PowerPoint module with additional written explanations and pictures of the CBE including breast anatomy. On-line viewing of both products was required by the clerkship. A student survey was created using a five point Likert scale (1=not helpful/confident, 5=exceptionally helpful/confident) to assess the educational value and impact of both products.

**Results:** A total of 121 students rotated on the clerkship and completed the survey over eight months. All students completed the breast objective structured clinical exam (OSCE) with 26% reporting the opportunity to perform a CBE during the clerkship. Of all resources available on the CBE during the clerkship, the video and PowerPoint received the highest mean scores of 4.2 and 4.0, respectively, while reading the surgical textbook received the lowest (3.2). Eighty seven percent of students recommended that future students utilize both the video and PowerPoint resources. Confidence in performing a CBE for any clinical encounter prior to and after viewing these resources improved from a mean rating of 2.6 to 3.5. When asked if the information learned from these resources was helpful to the student during the clerkship, the mean rating was 3.0. On multivariable analysis, the breast exam video was a statistically significant predictor of feeling prepared for the breast station OSCE ( $p=0.001$ ).

**Conclusions:** The development of online education products demonstrating the CBE has been well received by the surgery clerkship students. Overall, the majority of the students utilized one or both resources and found them helpful. Specifically, students reported increased confidence in the CBE after viewing the resources and felt an improved sense of preparedness for their breast station OSCE. These educational tools can serve as a valuable resource for our learners.

## Development of a Virtual Airway Skill Trainer (VAST): An Initial Task Analysis of the Open Cricothyroidotomy

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Background: The consequences of an unexpectedly difficult airway include failed intubation with resultant brain injury or death. The necessary maneuver when endotracheal intubation fails is an emergency surgical airway, usually a cricothyroidotomy (CCT). Despite the life-saving role of this procedure, only one percent of all critical airways require CCT, limiting trainee experience. Concurrently, CCT incurs a high complication rate, varying from 6% to 40%. Proficiency in CCT thus requires training supplemental to clinical experience, to equip practitioners with the skills to safely manage these high-stakes situations.

The long term goal of this project is to develop a Virtual Airway Skill Trainer (VAST) that provides visual and haptic feedback for authentic performance of the cricothyroidotomy.

Methodology : Procedural steps outlined in the American College of Surgeons (ACS) *Advance Trauma Life Support (ATLS)* training provided the framework for analysis. An expert panel reviewed the literature and determined the key components of a CCT to replicate a variety of straightforward, as well as difficult, anatomic conditions, including variations in body mass index, neck length and width, landmark prominence, and neck extension. These anatomical parameters were coupled with analysis of the procedural steps of CCT, including specifics of angle, force, and time, to develop performance metrics, which will be evaluated against benchmarks for proficiency. Videotapes of experts performing and narrating cricothyroidotomy on human cadavers were also reviewed.

Results: Initial tasks and preliminary scoring attributes are shown in Table 1.

Learning objectives mapping of current CCT tasks								
		1. Identify key landmarks for performing CCT	2. Perform correct	3. Enter membrane	4. Dilate with finger or	5. Insert 6.0mm ET tube, confirm	6. Secure ETT without dislodgement	7. Perform entire procedure within 1
1	Determine CCT is necessary	X						X
2	Palpate the thyroid cartilage and move down to the space between thyroid and cricoid cartilage	X						X
3	Perform incision with #10, #11 or #15 blade scalpel		X					X
4	Create a 4-5cm mid-line vertical or a horizontal incision through the skin and carry down to the cricothyroid membrane.		X	X				X
5	<ul style="list-style-type: none"> <li>Make <u>horizontal</u> incision at lower aspect of membrane (avoids vessels at top of membrane)</li> <li>Immediately place finger or clamp through incision into airway to hold position open</li> </ul>		X	X				X
6	Use finger, Kelly clamp or tracheal dilator to dilate the cricothyroidotomy			X	X			X
7	Insert the airway in to the trachea.					X		X
8	Advance the ETT far enough to ensure the cuff is within the trachea, then inflate cuff					X	X	X
9	Inflate the cuff with air					X	X	X
10	Confirm tube placement by (1) auscultating breath sounds, and (2) confirming airway position by CO2 detector					X	X	X
11	Secure the tube with sutures to the						X	X

	neck.								
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**CCT = Cricothyroidotomy; ETT = Endotracheal; CO2 = Carbon dioxide**

Conclusion: The initial task analysis is completed and the metrics identified will be used to perform validity experiments. In the next phase of development, motion and force metrics will be obtained with gloves embedded with pressure sensors.

## **Evaluation of NBME Shelf Examination Scores after Implementation of a Novel Tablet Application**

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**Abstract Introduction:** Traditional education outside of the clinical arena consists of didactics and book learning, although newer technologic resources are becoming readily available. Little information exists on the use and efficacy of resources such as smartphone or tablet applications. The primary aim of this study was to develop and assess a novel tablet application based on adult learning theory.

**Methods:** A tablet application (App) was developed to deliver two general surgery questions to third year medical students every weekday during their surgery clerkship daily for eight weeks. A tablet was made available to all students during the eight week rotation, but use was not required. To foster an adult learning environment and actively engage the learner, a notification alarm and a reminder icon were employed by the App. The application provided immediate feedback to the user, informing of them of correct answers and providing the opportunity for online discussion. App usage data was compared to National Board of Medical Examiners (NBME) surgery shelf examination scores. Data was collected over a ten month period.

**Results:** Overall, 72 out of 107 (67%) students responded to at least one question providing evidence of active engagement. Fifty percent of the users answered more than 84% of the questions, while 36% responded to 100% of questions. There was no difference seen on the NBME score between users and non-users ( $p=0.77$ ). In addition, merely attempting more questions was associated with a decrease in NBME score (0.47 decrease per question attempted). Answering questions correctly, however, was associated with a statistically significantly higher NBME score. For each question answered correctly, a 0.76 increase in NBME score was seen.

**Conclusion:** Applications can provide the opportunity for students to actively engage with content and promote active learning. Importantly, this experience provided the opportunity for students to experience self-direct learning and voluntarily engage with content. While there was no significant difference between users and non-users, a result seen in many other educational technology endeavors, individuals who answered questions correctly were more likely to perform better on the NBME shelf examination.

## **International Surgical Rotations Provide a Qualitatively Unique Clinical Experience for General Surgery Residents**

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**Background:** Resident interest in international surgery continues to increase, while the educational value of these rotations remains unclear. Little data exists to describe resident operative experiences in international rotations, though anecdotal data suggest a very different case mix from US surgical rotations. We hypothesized that international surgery rotations provide an educational experience unique from even the most comparable US training environment – a dedicated rural surgery year.

**Methods:** We compared a US rural rotation with two international surgical electives, comparing the international operative logs from 5 residents from 2 different institutions to 5 residents participating in a dedicated rural surgery year. We additionally distributed a free text survey to residents rotating internationally that focused on the qualitative educational experience. These responses were analyzed using grounded theory with constant comparison. Dichotomous data were compared using X2 tests.

**Results:** As expected, residents on international rotations demonstrated a strong interest in global surgery and comments focused on 8 themes as well as multiple subthemes. International participants highlighted knowledge gained regarding “resources” and “healthcare systems” as two of the most consistent themes of their experience – highlighting the unique decision making of resource limited environments. Similarly, residents who rotated internationally highlighted the value of the cultural exchange, the strong operative experience and the importance of this rotation in their overall training. Despite qualitative comments highlighting the uniqueness of the operative experience, when normalized by week, operative volume and diversity was not significantly different between rural and international training sites,  $p > 0.05$  for all ACGME categories.

**Conclusion:** International rotations for general surgical residents provide a numerically similar but qualitatively distinct training opportunity for general surgery residents. Residents found these experiences personally and professionally meaningful, thought provoking and educationally unique despite similar overall case numbers to a rural rotation. When developing and implementing international rotations, evaluation metrics should focus on the qualitative as well as quantitative aspects of the resident experience.

## **Investigation of training for students who is weak in maneuver of laparoscopic surgery - Laborer of the off-the-job training**

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**Background:** On-the-job and the Off-the-job training are put in practice as complementary training for endoscopic operation maneuver training for both residents and medical students. There is certain number of medical students whose technical progress is not seen after training. The aim of this study was to investigate the method to find students who are bad at laparoscopic surgery, and to investigate the effect of special training for young residents and students.

**Materials and Methods:** Six Specialists in laparoscopic surgery, 10 residents and 30 medical students (fifth grade in Tokushima Univ.) were participated. Four tasks (rubber band ligation, beads movement, beads delivery, gauze excision) were practiced and each required time was measured. The resident group and the student group measured required time after an exercise again for one week, and person who are bad at laparoscopic maneuver are decided by time exceeded in tasks more than two from before exercise.

As special training for person who are bad at laparoscopic maneuver, 2 training were performed; one was contacting the tip of the bar with the forceps which trainer shows optionally for eye-hand coordination, and the other was method commentary of laparoscopic cholecystectomy (Lap-C), and experience of Lap-C with Lap Mentor II.

**Results:** It was inversely correlated with the years of experience at required time of 4 tasks; rubber band ligation: 10.7sec: 17.1: 41.0 (experts : residents : students), beads movement: 80sec: 90.1: 121.2, beads delivery: 106sec: 117.8: 143.4, gauze excision: 114.7sec: 126.8: 143.4. After one week training, required time of tasks in both resident group and student group were shortened, but among student group, 7 students showed time excision at least one task, and 5 students showed bad at laparoscopic maneuver whereas resident group showed none. After special training, 7 students who showed bad at laparoscopic maneuver showed shortening of required time in all tasks.

**Conclusions:** Laborer of the Off-the-job training can find the student who is weak in laparoscopic maneuver, and the training of eye hand coordination and understanding of maneuver by virtual operation will improve laparoscopic maneuver effectively.

## **Medical Student Learning Styles are Unbalanced and At Odds with Current Medical Education Curricula.**

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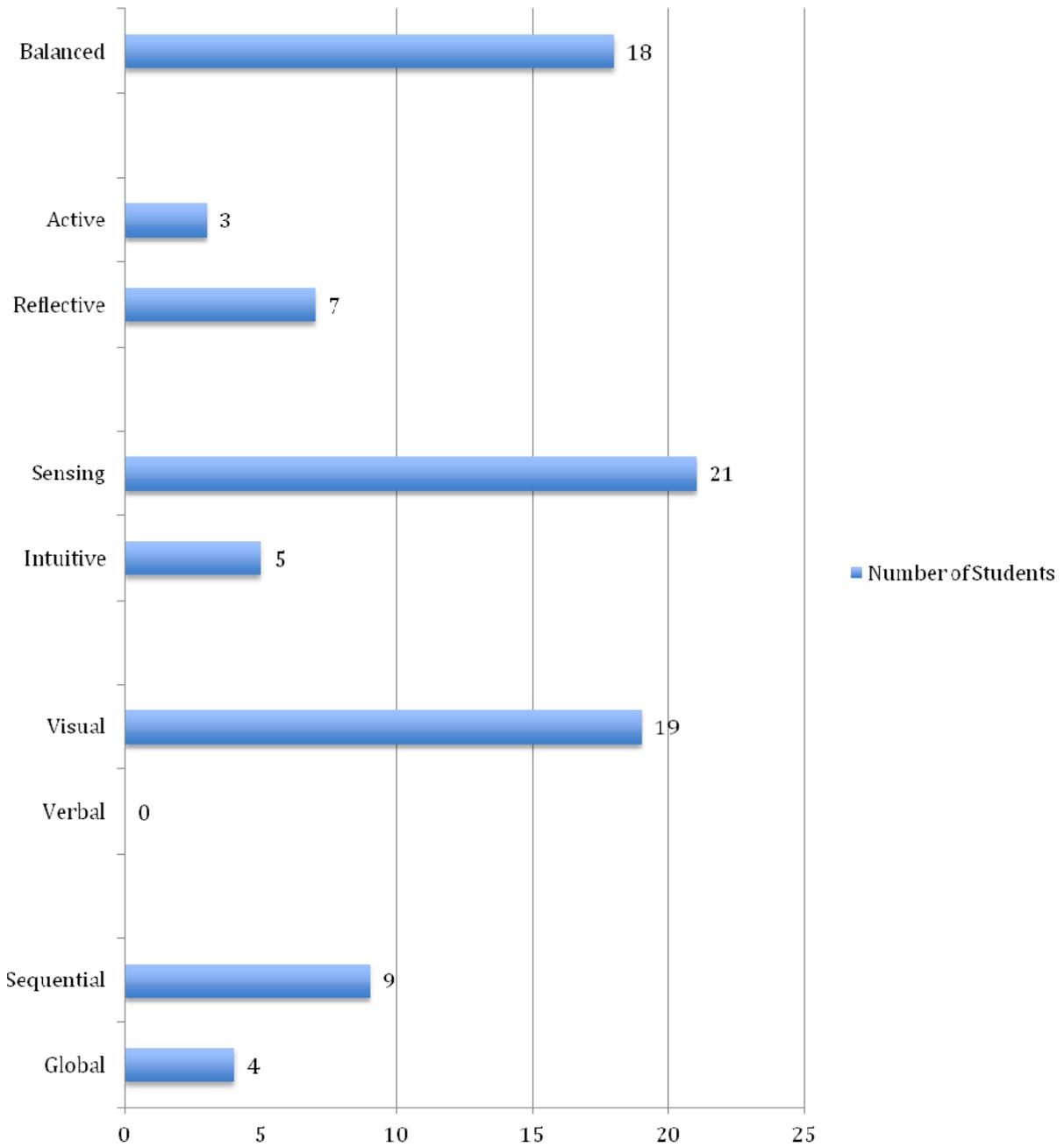
**Objective:** The success of current medical student curricula is predicated on two assumptions: 1) all students learn the same way and 2) most medical students are verbal learners and will excel in a lecture-based environment. We hypothesize that medical students learning styles are both diverse unbalanced. The aim of our study is to quantify medical student learning styles using the Index of Learning Styles (ILS): a tool developed and validated for the purpose of identifying learning strengths in individual students.

**Methods:** First year medical students (n=65) participated in the study. The ILS questionnaire consists of 44 questions used to identify a students learning style in four learning categories: active/reflective, sensing/intuitive, visual/verbal and sequential/global. Students scoring between one and seven points, on an 11 point scale, for all tested learning types will be considered a "balanced learner" for the purpose of this study.

**Results:** Three students were identified as active learners, while seven were identified as reflective learners. Five students were identified as intuitive learners, while 21 identified themselves as a sensing learning style. There were no verbal learners compared to 19 visual learners. Four students learned globally, while nine were considered to be sequential learners. Eighteen students (27.7%) were determined to be balanced learners in all four categories.

**Conclusion:** We found that medical students indeed do not all learn in the same manner and that only 27.7% of students were considered a balanced learner. Our study identified most popular learning styles to be reflective, intuitive, visual and sequential. This means students prefer to learn by thinking things out, working alone, are considered to be abstract thinkers, and prefer pictures and diagrams to lectures. This is in stark contrast to how current medical education curricula are set up. Further studies to determine the academic impact of these learning styles are needed.

## Number of Students (n=65)



## **Methods in Evaluation of Acquisition of Clinical Skills in a General Surgery Residency**

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**Objective.** As part of the evaluation of resident learning of basic surgical skills including central venous access and tube thoracostomy, a Verification of Proficiency (VOP) assessment tool created by the American College of Surgeons (ACS) and the Association of Program Directors in Surgery (APDS) was adopted by the Department of Surgery at Penn State Hershey Medical Center in its training laboratory for first-year surgical residents (PGY1) using direct faculty observation. Our current study deviated from this practice by having senior residents (PGY4), rather than attending surgeons, test the PGY1 residents' proficiency in basic surgical skills. The goal of this study was to train senior surgical residents to evaluate junior residents, as well to assess correlation between senior resident and faculty evaluations of proficiency.

**Materials and Methods.** PGY1 residents were tested for proficiency in central venous access and tube thoracostomy using plastic and animal models, respectively. Completion of 21 separate tasks was required for successful central venous access; 15 tasks were required for tube thoracostomy. An overall grade of fail was assigned if one or more tasks was omitted or incorrectly performed. Testing sessions were assessed live by a PGY4 surgery resident using a standardized VOP evaluation listing each task. The testing sessions were concurrently video-taped and saved. The taped sessions were shown to an attending surgeon who independently verified the PGY1's surgical skills using the same standardized VOP evaluation. Using the attending grade as the gold standard, sensitivity of the PGY4's evaluations was calculated.

**Results.** Twenty-four PGY1 residents underwent testing. PGY4 residents passed 15 PGY1s in central venous access; the attending surgeons passed 9 PGY1s ( $S_n=0.78$ ). For tube thoracostomy, the PGY4 residents passed 18 PGY1s; the attending surgeons passed 13 PGY1s ( $S_n=0.85$ ). For both central venous access and tube thoracostomy, PGY4s were over 80% sensitive for each individual task.

**Conclusion.** Senior surgical residents can assess junior residents' basic surgical skills with high sensitivity. By engaging senior residents rather than attending surgeons for VOPs, attending surgeons could better utilize their time teaching and mentoring junior residents, rather than simply evaluating them.

## **Mobile Platform for Assessing Emergency Trauma Surgical Skill Performance.**

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Background: Surgical resident's operative trauma experience has decreased from 60-35 cases 1999-2012. A mobile platform would be useful for residency programs to evaluate competence in trauma skills. We tested the hypothesis that remote review of video clips discriminated pre from post training performance in vascular control no differently than co-located performance evaluation.

Methods: Performance of surgical skills were evaluated by two co-located trained experts during three video-recorded vascular exposure procedures (Brachial artery [BA], Axillary Artery [AA] and Femoral Artery [FA]) performed on fresh cadavers by ten 3<sup>rd</sup> - 5<sup>th</sup> year surgical residents before and within 2 weeks of Advanced Surgical Skills for Exposure in Trauma (ASSET) training. Metrics included landmarks, specific steps and techniques, expert discriminators and global performance ratings common to 10 experts. The performance metrics were previously validated for BA, AA and FA with inter rater reliability (ICC) analysis showing ICC 0.7- 0.98 among 5 raters. In this study, Pre/Post training video clips of 10 residents for each procedure were randomly ordered for blinded analysis by 2 trained evaluators and compared to same-procedures simultaneously assessed by co-located evaluations. Co-located and video evaluations were compared with Pearson Correlation and Linear Mixed Models.

Results: Evaluation metrics showed no floor or ceiling effects. Expert discriminators (skin incision, logical sequence, anatomic knowledge etc), procedural steps (correct structure identification) and global ratings (1= poor-5=excellent) of anatomy were no different among co-located and video evaluators for BA, AA, FA. Differences in other global ratings of skills, readiness and overall grade (%) were variable between video and co-located evaluations (Table).

Discussion: Remotely situated video review, had agreement in objective pre/post training performance with co-located evaluators, but not in more subjective assessments. Video focused on the surgeon's hands could account for these differences. Video recordings of cadaveric vascular exposure, with remote evaluations of objective metrics assesses residents vascular exposure competence.

		Landmarks (%)	Technical Points (%)	Expert Discrimination (%)	Procedural (%)	Global Anatomy	Global Tech Skill	Global Readiness	Grade (%)
		mean ± SD	mean ± SD	mean ± SD	mean ± SD	mean ± SD	mean ± SD	mean ± SD	mean ± SD
Axillary	Pre	86 ± 6	57 ± 3	55 ± 5	38 ± 5	2 ± 0.2	3 ± 0.2	2.2 ± 0.2	65 ± 2.3
	Post	46 ± 6	73 ± 3.5	75 ± 5	85 ± 5	3.5 ± 0.2	3.5 ± 0.2	3.7 ± 0.3	81 ± 2.4
	Post training Delta	40 ***	16 ***	20 ***	47***	1.4***	1 ***	1.5***	16 ***
	Co-located vs. Video (p value)	0.8	0.02*	0.59	0.1	0.09	0.02*	0.3	0.1
Brachial	Pre	60 ± 6	62 ± 3	61 ± 5	62 ± 5	2.4 ± 0.2	2.8 ± 0.2	2.5 ± 0.2	69 ± 3
	Post	66 ± 6	68 ± 3	65 ± 5	79 ± 6	3.1 ± 0.2	3.1 ± 0.2	3.0 ± 0.2	75 ± 3
	Post training Delta	7	7	5	18 ***	0.8 ***	0.3	0.5 *	5.5 *
	Co-located vs. Video (p value)	0.75	0.02*	0.02*	0.46	0.15	0.27	0.1	0.1
Femoral	Pre	70 ± 3.9	56 ± 3.6	37 ± 5	44 ± 6.3	2.5 ± 0.2	2.4 ± 0.2	2.2 ± 0.2	66 ± 2.3
	Post	85 ± 3.9	70 ± 3.6	70 ± 5	87 ± 6.3	3.5 ± 0.2	3.2 ± 0.2	3.4 ± 0.2	79 ± 2.3
	Post training Delta	14 *	14 ***	33 ***	44.5 ***	1 ***	0.9 ***	1.2 ***	13 ***
	Co-located vs. Video (p value)	0.004 ***	0.04 *	0.5	0.7	0.2	0.07	0.04 *	0.004 ***

α=0.05. Significance is demarcated as: \*\*\* p<0.0001; \*\* p<0.001; \* p<0.05

**Table: Shows mean ± standard deviation(SD) of metrics across top X axis. Along the Y axis are shown Axillary, Brachial and Femoral artery vascular exposure and control procedures performed by 10 surgical residents with the Pre Post training differences and whether the evaluators used video or were co-located. Expert, and Procedural evaluations and Anatomy Global Ratings were not different between video and co-located evaluators.**

## Needs of a Surgical Sub-Internship Elective: Optimizing Surgical Education for the M4 Year

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**Purpose:** Formal curriculum for the fourth-year of medical education (M4) remains school-specific and highly variable. A national, standardized curriculum for a M4 surgery subinternship has yet to be devised. The goal of this project is to identify the current characteristics of surgical sub-internship rotations offered by medical schools and to explore the opinions of clerkship directors on important curricular elements for surgical sub-internships.

**Methods:** An itemized survey of surgery clerkship directors at LCME-accredited medical schools was distributed under an exempt, IRB-approved study. Participants were queried as to current and/or potential curricular elements essential to a standardized, surgical sub-internship course.

**Results:** Thirty-seven responses (21.6%) were received. Routine length of instruction for current M4 electives in surgery was 4 weeks (91.8%). Summary of current, curricular elements formally taught and assessed is depicted in Table. Instruction was greatest for the curricular elements of clinical care and medical knowledge. Summative student assessment was comprised of faculty evaluation (91.7%), resident evaluation(66.7%), procedural competence(25%), and knowledge-based examination(16.7%); with few incorporating objective structured clinical examination (11.1%), oral examination(8.3%), nursing evaluation(5.6%), or patient evaluation(0%). Of the ACGME-defined competencies, formal instruction occurred in patient care(56.8%), medical knowledge(13.5%), practice-based learning(5.4%), interpersonal and communication skills(10.8%), professionalism(40.5%) and system-based practice(37.8%).

Eighty-nine percent of clerkship directors noted interest in the development and implementation of common curricular elements within a standardized, sub-internship elective. Curricula of greatest interest for development, implementation, and assessment as part of a surgery, sub-internship were medical knowledge(75.7%), clinical skills(73.0%), technical skills(54.1%), clinical problem solving(48.6%), and inter-professional education and/or simulation(45.9%).

**Conclusions:** Current sub-internship electives in surgery are void of standardized curriculum and utilize little formalized instruction or assessment as part of their curriculum. A minority of courses offer formal instruction within the ACGME competency framework. There is significant interest among clerkship directors to formalize a national curriculum for surgical subinternship rotations.

**Table: Current Curricular Elements Taught and Assessed in Surgery Sub-Internship Electives**

Curriculum Element	Element Taught (%)	Element Assessed (%)
Patient Assessments	31.2	6.2
Care Handoff	40.6	3.1
Medical Knowledge	15.6	12.5
Procedural Skills	21.8	9.3
Interprofessional Communication	12.5	3.1
Order writing	50	6.2
Clinical Documentation	78.1	15.6
Literature evaluation	25	6.2

## PROFESSIONALISM AMONG SURGICAL RESIDENTS: DOCUMENTING THE ADVANTAGES OF A PROFESSIONALISM CURRICULUM

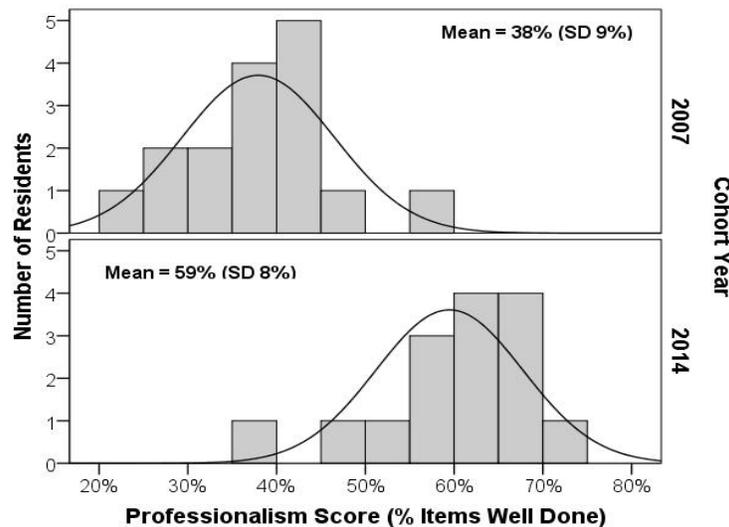
Mark S. Hochberg, M.D., Russell S. Berman, M.D., William Tsai, M.A., Ivelisse Vazquez, B.A., Mrudula Naidu, M.S., Sandra R. Zabar, M.D., H. Leon Pachter, M.D., Department of Surgery, New York University School of Medicine, New York, NY

**BACKGROUND:** Professionalism education is a vital component of surgical training. This research attempts to determine if an annual six session interactive professionalism curriculum can effectively change the professionalism environment among surgical residents.

**METHODS:** To study professionalism skills of residents, a six station Objective Structured Clinical Examination (OSCE) was developed to focus on specific resident challenges: delivering the bad news of an unexpected death, explaining a health proxy, explaining a medical error, effective patient handoff, identifying an impaired resident colleague, and the correct use of an interpreter. Identical OSCE scenarios were administered to two cohorts of surgical residents, in 2007 and again in 2014. Surgical residents were rated by standardized patients according to a strict task checklist of professionalism criteria.

**RESULTS:** An ANOVA was conducted with overall professionalism score (% well done) as the dependent variable and cohort (2007 vs. 2014) and resident year (R1 vs R2) as factors. The cohort main effect was significant ( $F=49.01$ ,  $p<.001$ ) with 2007 residents ( $n=16$ ) receiving a mean score of 38% of professionalism items "well done" (SD 9%) and 2014 residents ( $n=15$ ) an average of 59% "well done" ( $n=16$ ). While R2 residents performed slightly better than R1 residents (R2 mean = 51%, SD 13% vs R1 mean = 46%, SD 14%) this difference was not significant ( $F=1.96$ ,  $p=.173$ ). The histogram below graphically presents the results.

**CONCLUSIONS:** Professionalism education and its emphasis in surgical training have markedly improved surgical resident professionalism from 2007 to 2014. The level of understanding, awareness and practice of professionalism has improved to a statistically significant degree over the seven years. This documented improvement in OSCE performance reflects the value of a professionalism curriculum and the heightened understanding of these skills for the patients we seek to serve.



## **Sustaining Increased Entry of Medical Students into Surgical Careers: A Student-Led Approach**

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**Purpose:** The number of medical students entering into general surgery residency programs fell by nearly 50% through the 1980s to the early 2000's, with an accompanying decline in the general surgeon workforce. After the Columbia University College of Physicians and Surgeons (P&S) experienced a decline in student entry into general surgery far below the national average, the faculty developed a surgical interest group in 2002 – the Allen O. Whipple Surgical Society. The Society engaged preclinical students in the field of surgery through suturing and laparoscopic courses, shadowing and mentorship, and opportunities to assist transplant teams on procurements. Several years later, these faculty-led programs became entirely run and organized by preclinical students. After a significant increase in surgical matriculation was reported in our 2006 follow-up publication, we investigated whether this increase continues to be sustained under student leadership.

**Methods:** Columbia's residency match lists from 2006-2014 were reviewed for the number of students who matriculated into general surgery and affiliated, or once affiliated programs including vascular surgery, plastic surgery, and thoracic surgery. These results were compared for trends with data from the National Residency Match Program for all U.S. senior students of corresponding years. A Cochran-Mantel-Haenszel (CMH) test was performed to analyze differences in proportions of surgical entry between the two samples over 2006-2014.

**Results:** After the establishment of the Allen O. Whipple Surgical Society, entrance into general surgery residency programs tripled from the early 2000's rates to over 12% of 2006 P&S graduates. Eight years later, our data continues to illustrate a sustained effect, with an average of over 8% of students entering into general surgery residency programs, significantly higher than the NRMP's average ( $p < 0.025$ ).

**Conclusions:** P&S developed a set of preclinical programs in 2002 to stimulate interest in surgical careers through mentoring and hands-on experiences. These initiatives were met with tremendous success and, now under leadership of preclinical students, have resulted in a significant sustained increase in students entering general surgery programs.

## **Systems Based Practice Blogs: an Effective and Easy Tool for Milestone Assessment**

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**Purpose:** As part of a longitudinal systems based practice (SBP) curriculum, residents participated in an SBP blog during their PGY2 year. The objective was to allow residents to apply concepts learned in their PGY1 curriculum and to assess achievement level of ACGME Milestone SBP2, Improvement of Care.

**Methods:** PGY2 residents were assigned to lead a monthly on-line discussion (blog). The leader was asked to identify an SBP problem encountered in their clinical environment. They were tasked with posting the problem, attaching a pertinent article from the literature, and posing two discussion questions. All PGY2 residents were then responsible to participate in the blog. Evaluation was performed by analyzing blog transcripts. A rubric documented the number of posts per resident and each post was evaluated to determine if it exemplified specific milestone levels. Qualitative analysis of discussions was performed to identify themes.

**Results:** A total of six blogs, each representing one discussion led by a different resident, were evaluated. All residents participated as a leader and demonstrated achievement of Milestone SBP2 Level 1 and 2 by identifying: a problem; how care is provided in our system; system factors contributing to the problem; and system failures. Most follow-up posts confirmed Level 2 achievement with meaningful discussions regarding system failures. Five of six discussions (and all six residents) included suggestions about how to create system change (Level 3) but none described reporting failures or participating in system solutions (Levels 3 and 4). Themes from preliminary qualitative analysis suggest that junior residents consider system contributions to patient care problems. Work-arounds were frequent while reporting or acting to implement system solutions was not seen.

**Key Lessons/Conclusions:** Resident blogs were successfully used to assess junior residents' ability to apply concepts learned in a PGY1 SBP curriculum and to document achievement of Milestone SBP2 Levels 1, 2 and part of Level 3. While our PGY2 residents did not demonstrate full achievement of Milestone Level 3 or 4, their performance is on par with expectations for our longitudinal SBP curriculum. Qualitative analysis supports the need to engage residents in reporting and solving system problems to improve patient care.

## **Teaching Across the Continuum: Variation in Rankings and Valued Teaching Components between Surgery Residents and Medical Students**

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**Background/Purpose:** Surgical faculty often teach medical students (MS) and residents (R) within the same environment. However, MS and R may require different teaching methods. The aim of this study is to identify the teaching components valued by these two sets of learners and investigate the etiology in discrepancies in faculty evaluations between these groups.

**Methods:** Teaching evaluations of 84 surgical faculty completed by MS and R from 2011-2014 were analyzed using a mixed-methods approach to identify predictors of teaching competence. From a subset of 43 faculty who all received yearly evaluations, top/bottom educators in MS evaluations were identified and traced to their corresponding rankings within R evaluations. Content analysis was used to evaluate comments and identify themes associated with substantial differences in faculty rankings.

**Results:** For MS, questions pertaining to instructor feedback, engagement of students and availability were factors that correlated with overall ranking. There were no specific areas within resident evaluations due to the lack of variation in responses to different questions. There was a lack of correlation between top and bottom quartiles of educators evaluated by MS and R. The top quartile of educators in the MS group was spread out among the R rankings, with several educators ranked in the bottom quartile by R. Similar patterns were observed in the reverse direction for faculty rated in the top quartile by R. Faculty that were highly ranked by R and lowly by MS were described by R as providing optimum supervision and autonomy and clear explanations of intra-operative decision making, but appear intimidating to MS and lack preoperative/postoperative teaching. Faculty that were highly ranked by MS and lowly by R were associated with providing clear MS lectures, being approachable, and displaying compassion; however, they displayed poor ability to delegate and lacked trust in R to include them in intra-operative decision making and surgical procedures.

**Conclusions:** Residents and medical students value faculty using different criteria, with residents more focused on operative teaching and autonomy, whereas medical students focused on approachability. Using one group to define the best teachers or teaching methods is insufficient as learners' value different optimal attributes.

## The July effect: The impact of a 2-week intensive skills-based “boot camp” for incoming first year surgical residents

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**Background:** The era of reduced work hours and increased focus on patient safety has led to a shift in surgical education practices. Simulation has become an important component of resident education, as a method of ensuring exposure to important technical skills and basic principles in a safe, low-stress environment. The transition from medical student to junior resident is a particularly important time to ensure that these skills have been achieved. Typical distributed models of skill training fail to provide practice opportunities during the critical July transition point. This study presents the results of a novel massed model 2-week intensive skills course for all first year surgical residents in a major academic centre.

**Methods:** Fifty-five first year surgical residents, representing all specialties, participated in a 2-week training program prior to assuming any clinical duties. The program consisted of short didactic lectures followed by faculty run training sessions. Residents worked through facilitator guided low and high fidelity simulators focusing on basic surgical skills. Feedback was provided throughout. A 9-station objective structured assessment of technical skills (OSATS) type examination was administered as both a pre- and post-test. Expert evaluators scored trainees using both a checklist and global rating scale (GRS). Wilcoxon Signed-rank non-parametric test was used to assess for significant effect of intervention with a p value <0.05.

**Results:** Post-test checklist scores were significantly higher for all test stations compared to pre-test scores. Post-test GRS scores were significantly higher in 5 of 7 test stations that included GRS as an element of evaluation (see Table 1). An aggregate of all stations showed an overall significant increase in checklist and GRS scores from pre-test to post-test.

**Conclusion:** This study highlights the ability of a large-scale massed training program to significantly improve the technical skill of first year surgical residents prior to entering clinical practice.

Table 1: OSATS test station checklist and global rating scale scores.

Station	Pre-Test Checklist (%)	Pre-Test GRS (%)	Post-Test Checklist (%)	Post-Test GRS (%)
Instrument Identification	65 +/- 27	n/a	100 +/- 4*	n/a
Gowning and Gloving	89 +/- 28	80 +/- 20	100 +/- 0*	100 +/- 0*
Prepping and Draping	71 +/- 17	44 +/- 44	100 +/- 6*	100 +/- 4*
Chest Tube Insertion	70 +/- 30	60 +/- 20	100 +/- 10*	67 +/- 17
Suturing of Skin Laceration	91 +/- 18	77 +/- 20	100 +/- 18*	87 +/- 10*
Skin Lesion Excision	82 +/- 29	77 +/- 30	88 +/- 18*	77 +/- 17
Foley Catheter Insertion	73 +/- 27	68 +/- 20	100 +/- 0*	100 +/- 4*
Two-Hand Knot Tying	64 +/- 46	45 +/- 40	100 +/- 0*	95 +/- 20*
Surgical Timeout Protocol	70 +/- 30	n/a	100 +/- 0*	n/a

Aggregate Score

74 +/- 14

65 +/- 13

96 +/- 3\*

81 +/- 6\*

Scores represented by median +/- IQR; \* indicates a significant improvement where  $p < 0.05$ .

## **The Relationship Of Motivation To Performance In Medical Trainees**

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**Introduction:** Learner motivation is a key contributor to knowledge and skill acquisition across educational environments, and it is evident that not just the amount, but the quality of learner motivation influences learning strategies used and performance achieved, particularly for complex tasks. Work hour restrictions, patient safety concerns, and rapidly advancing knowledge and technical skill requirements are increasingly shifting the focus towards self-directed and lifelong learning skills for surgical residents, particularly through independent study and simulation. However, evidence suggests that such training modalities are grossly underutilized. To maximize the benefits of training tools that require a high degree of learner self-regulation, we must first understand how to maximize trainee engagement. In this climate, an understanding of the interplay between types of learner motivators and their influence on performance is required. The objective of this systematic review is to determine the effect of the quality of learner motivation on performance in medical trainees.

**Methods:** Prospective, peer-reviewed studies from all dates that reported medical student and/or resident motivation for the acquisition of knowledge or technical skills in relationship to performance were eligible for inclusion in this review. The study was conducted according to PRISMA guidelines for systematic reviews. Study heterogeneity precluded pooling the data, but summarizable trends were reported.

**Results:** The initial search returned 2476 unique titles of which 13 were included in the final synthesis. In total, 3199 participants were enrolled across all studies (range: 15-849; mean: 231). Eight studies found a significant positive relationship between quality of motivation and performance, and no study found a negative relationship. Self-efficacy, high task value, and intrinsic motivation consistently correlated positively with performance, while test anxiety, performance goal orientation, and extrinsic motivation correlated negatively.

**Conclusion:** There is a paucity of literature examining the role of motivation in relation to performance outcomes for surgical trainees. However, the available data indicate that quality of motivation can significantly impact performance. As the surgical education climate continues to change, understanding the role of learner motivation in achieving desirable performance outcomes will be crucial in designing curricula that engage surgical learners.

## **The Use of Models and Feedback to Facilitate Self-Regulated Learning in Medical Students Completing a Surgical Simulation Task**

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Surgical simulation research traditionally emphasizes acquisition of surgical skills or the ability to carry out specific procedures. The present study extends this research by examining how simulation impacts medical students' attitudes, motivation, and beliefs about learning. Although this type of research is common within educational setting, to date, these issues have not been explored within surgical education. Three questions guided our study 1) How does the presence of a coping model impact medical students' knowledge acquisition, self-efficacy, and self-regulation as compared to a mastery model? 2) How does the presence of process feedback about medical students' performance on a surgical simulation task impact knowledge acquisition, self-efficacy, and self-regulation as compared to medical students who get no direct feedback? 3) How do medical students' experiences with surgical simulation influence their experiences within a surgical clerkship? We employed an explanatory sequential mixed-methods design. In this type of study, the researchers begin by conducting a quantitative study. The researchers then supplement those results with qualitative data in the form of targeted interviews and observations. The purpose of the qualitative data is to better understand the context under which the quantitative data was collected. Our sample included all third year medical students who complete the surgical clerkship during two rotations (n=60). For the quantitative portion of the study our independent variables included modeling (coping, mastery) and feedback (present vs. absent). Our dependent variables included a pre-experimental a laparoscopic peg transfer task the approximates the skills being taught in the simulation center, self-efficacy for completing the task, self-efficacy for self-regulation, a student satisfaction survey, intrinsic interest, post-test measures of students' knowledge and skills for completing the task, and an interview protocol designed to elicit information about how the students' experiences with the simulation tasks impacted their perceptions of surgery and the surgical clerkship. Preliminary results suggest the presence of coping models and feedback have significant individual and additive effects on medical student's knowledge, self-efficacy, and self-regulation as compared to students who do not receive modeling or feedback. Qualitative results suggest modeling and feedback help medical students reflect on their own learning and builds confidence.