ABSTRACT #1
Mini Talk Session I
1:10pm-1:15pm

HEMI-DIAPHRAGM PARALYSIS AND DIAPHRAGM PLICATION AFTER LUNG TRANSPLANT

Ilitch Diaz-Gutierrez, MD; Stefan Elde, MD; Stephen J. Huddleston, MD PhD; Kathleen Kane, BS; Andrew Shaffer, MD; Matthew Soule, MD; Sara Shumway, MD; Marshall Hertz, MD; Rafael S Andrade, MD; Rosemary Kelly, MD.
University of Minnesota

Background
Phrenic nerve dysfunction following lung transplant is associated with significant morbidity. The impact of diaphragm plication on these patients is unknown.

Objective
We describe a single center experience with diaphragm plication after lung transplant.

Methods
A retrospective review was performed on 456 consecutive patients who underwent lung transplant at our institution from May 2005 to September 2017. A prospectively collected research database was queried to identify patients with diaphragm paralysis and those who underwent diaphragm plication were analyzed separately. Pulmonary function testing was performed on all patients preoperatively and postoperatively as per transplant protocol.

Results
The incidence of hemi-diaphragm paralysis was 3.7% (n=17) and 8 of these patients underwent diaphragm plication. The diagnosis was made preoperatively with a sniff test in 6 and intraoperatively in 2 patients. Diaphragm plication was performed concomitantly with lung transplant in 87.5% and postoperatively via laparoscopy in 12.5%. There was no difference between groups in terms of prolonged mechanical ventilation (>5 days), reintubation rates or length of stay. There were no deaths in either group at 30-days and no difference in 1-year survival.

Conclusion
Diaphragm plication is safe and may be performed concomitantly with lung transplant.

ABSTRACT #2
Mini Talk Session I
1:15pm-1:20pm

ANATOMIC EVALUATION OF RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA (REBOA) CATHETER DEPLOYMENT FOR POSTPARTUM HEMORRHAGE MANAGEMENT

Ada Breitenbucher, Zachary D. Miller, Kris Waring, Alicia Zhang, Eliza Pelrine, Jillian Johnson, Mitchell Butterbaugh, Victor Vakayil, Peter Kernahan, Michael Bateman, James Harmon Jr
University of Minnesota

Background
REBOA is primarily used in the management of abdominopelvic and lower extremity trauma and ruptured abdominal aortic aneurysms. An emerging use of the REBOA catheter is as an alternative to intrauterine arterial embolization or ligation for management of postpartum hemorrhage. REBOA catheters are deployed in aortic Zones I or III. Zone I is defined as the left subclavian artery to celiac trunk. Zone II is defined as the celiac trunk to the most caudal renal artery and should be avoided for catheter deployment. Zone III is defined as the most caudal renal artery to the aortic bifurcation. Catheter placement in Zone III caudal to the inferior mesenteric artery (IMA) and gonadal arteries may reduce ischemic complications. Readily available data regarding the distances of the distal aorta and its branches is limited. These data would inform the clinicians using this catheter.

Objective
We aim to evaluate anatomic variation in vessel length from the femoral artery puncture site to Zone III of the aorta to deploy the REBOA catheter for postpartum hemorrhage. Fixed-distance recommendations for deployment distance are limited due to patient size variation. We sought to create a simple height-based formula to calculate REBOA catheter deployment distance for Zone III.

Methods
The study was approved by the Anatomy Bequest at the University of Minnesota. Height, weight, and age were obtained from records of 23 female whole-body donors. After anatomic dissection, vessel lengths were measured from the right femoral artery puncture site. All measurements were obtained by three independent observers, and the results were averaged. CT images of an additional whole-body donor were obtained, and a 3D reconstruction of the vasculature was created.

Results
The average donor age was greater than 74.7 years (SD 13.6; ages over 90 are reported as 90 for privacy); average height was 162.9 cm (SD 5.8); average weight was 132.0 lbs (SD 28.6). The average distance from the femoral artery puncture site to the aortic bifurcation was 18.7 cm (SD 1.7), and the average distance from the femoral artery puncture site to the IMA was 23.1 cm (SD 1.9). A proposed equation of D=(H/10)+6, where D=deployment distance and H=height in cm, had 100% Zone III landing, and 65% (15 of 23) were caudal to the IMA.

Conclusion
Although there is marked anatomic variation in vessel lengths, a simple height-based equation may help reduce complications in patients undergoing REBOA catheter placement in Zone III. Due to variability in surface markings in the gravid state, patient height was used to create the equation. This study was limited by the population (predominantly elderly and Caucasian). Endovascular measurement was not possible due to the preservation process. Future studies will evaluate radiographic measurements and surface landmarks.

ABSTRACT #3
Mini Talk Session I
1:20pm-1:25pm

KNOT TYING: TRANSFORMING NOVICE TO PROFICIENT PERFORMANCE IN LESS THAN 60 MINUTES. CAN IT BE DONE?

Mohamed S. Baloul, MBBS; Yazan N. AlJamal, MBBS; Humza Y. Saleem, MD; Nicholas Prabhakar, BA; David Farley, MD
Mayo Clinic

Background
Learners normally pass through different developmental stages (novice, competency, proficiency, expertise, mastery); as they become more skilled they depend less on abstract principles and more on concrete experience [Daley B., 1999]. Our proficient general surgery PGY-2s and PGY-3s tie secure one-handed knots in 17.5 and 12.5 seconds (mean), respectively.

Objective
Determine how long it takes novice learners to reach proficiency in a one-handed knot tying task.

Methods
Undergraduate students were invited to a 1-hour surgical skills session. Students were taught, assessed, practiced, and reassessed on how to tie one-handed square knots on a balloon filled with fake blood. Students were allowed to do as many repetitions as they wanted. Feedback was freely offered, and assessment was voluntary. Knots were assessed based on time to complete three square throws and whether there was presence of leakage.

Results
A total of 31 students participated in the event. Learners collectively attempted the task 250 times (mean= 20.6; range: 7 - 108). Three one-handed knots were completed on average in 29.3 (±19.2) seconds by students on their 1st assessment. 50% of all balloons leaked on inspection. Students assessed on the 9th task (n=8) had a mean final time of 15 (±5.7) seconds (Figure 1). Leak rates dropped to 25%, 9%, and 0% by assessments 3, 7, and 11, respectively.

Conclusion
While half of all undergraduate students' knots leaked, over 25% of learners that practiced one handed knots and were assessed at least nine separate times in 60 minutes became proficient. Future efforts to speed the process of moving learners from novice to proficiency with knot tying will utilize online education, practicing at home, sequential learning, and the pressure of chronometry.

ABSTRACT #4
Mini Talk Session I
1:25pm-1:30pm

STERNOCLAVICULAR JOINT INFECTIONS: A CASE SERIES

Bergman, Zachary MD. Diaz-Gutierrez, Ilitch, MD. Rao, Madhuri, MD. Andrade, Rafael, MD.
University of Minnesota

Background
Sternoclavicular joint infections (SCJI) are a rare disease associated with a high rate of complications including osteomyelitis, abscess formation, mediastinitis and empyema. Patients with SCJI are almost universally immunocompromised with conditions such as Diabetes Mellitus, Cirrhosis, malignancy, or intravenous drug use. Management of SCJI often mandates resection of the sternoclavicular joint and prolonged course of antibiotics. Surgery is particularly challenging given the lack of substantial overlying tissue and the proximity to major vascular structures, nerves and the thoracic duct.

Objective
Evaluate a single institution's experience with management of sternoclavicular joint infections.

Methods
An IRB waiver was obtained for this retrospective review of patients with sternoclavicular joint infections managed between January 2017 and February 2018. The patient's charts were reviewed to analyze age, gender, presentation, radiologic studies, management and outcome.

Results
There were 3 patients (2 women and 1 man) diagnosed with sternoclavicular joint infections based on clinical presentation and chest computed tomography. The mean age was 63 years-old (60-69). Comorbidities included uncontrolled diabetes mellitus in 2 of the patients and recent chemoradiation in one. All patients were managed operatively with incision and drainage and resection of the SCJ. The surgical defect was managed with negative pressure wound dressings. Complications included bacteremia in 2 of the patients. Wound cultures revealed gram positive cocci (Streptococcus anginosus, Streptococcus pyogenes, and methicillin-sensitive Staphylococcus aureus). The mean length of hospital stay was 11.3 days (8-15). The patients were all discharged on a 6-week course of intravenous antibiotics. Two-month follow-up showed no evidence of recurrence and complete wound healing.

Conclusion
Sternoclavicular joint infection is a rare condition that requires prompt intervention with incision and drainage, resection of the SCJ, and prolonged intravenous antibiotics.

ABSTRACT #5
Surgical Potpourri I
1:30pm-1:40pm

SURGICAL MYECTOMY VS. ALCOHOL ABLATION FOR SEPTAL REDUCTION IN PATIENTS WITH OBSTRUCTIVE HYPERTROPHIC CARDIOMYOPATHY - EARLY AND LATE OUTCOMES IN A PROPENSITY SCORE MATCHED COHORT

Anita Nguyen, MBBS, Hartzell V. Schaff, MD, Dustin Hang, MD, Rick A. Nishimura, MD, Jeffrey B. Geske, MD, Joseph A. Dearani, MD, Brian D. Lahr, MS, Steve R. Ommen, MD
Mayo Clinic

Background
In pt with hypertrophic cardiomyopathy (HCM), obstruction of the left ventricular outflow tract (LVOT) can be relieved by surgical septal myectomy or alcohol septal ablation (ASA). Whilst septal myectomy outcomes have been established, there remains uncertainty regarding long-term results of ASA.

Objective
This study aims to compare the short- and long-term outcomes of septal myectomy and ASA in a propensity score matched cohort.

Methods
Between December 1998 and September 2016, 1,274 pt underwent isolated septal myectomy and 211 pt had ASA at our institution. We used propensity scoring to match these pt, and adjusted for potential confounders, including age, sex, New York Heart Association (NYHA) class, chronic lung disease, hypertension, and LVOT gradient. Following 2:1 matching, our study cohort included 334 septal myectomy pt and 167 ASA pt. Our primary endpoint was overall mortality, and secondary endpoints included freedom from reintervention, early and late postoperative LVOT gradients, and symptomatic status.

Results
The median age of myectomy pt was 65 (58, 71) yr, and median age of ASA pt was 64 (56, 73) yr (p=0.9). All pt had dyspnea at presentation, and median NYHA was 3 (3, 3) in both groups (p=0.6). The median resting/provoked LVOT gradient in myectomy pt was 85 (70, 104) mmHg, and 88 (67, 105) mmHg in ablation pt (p=0.8).

There were no differences in survival between surgical septal myectomy pt and ASA pt (risk of death for ASA vs. myectomy, HR=1.2, 95% CI=0.5-2.7, p=0.7). During follow-up, 0.3% of pt having septal myectomy had reintervention for LVOT obstruction compared to 12.6% of ASA pt (HR=33.3, 95% CI=4.4-250.6, p

Conclusion
Septal myectomy and ASA are important modalities to relieve LVOT obstruction in symptomatic HCM pt refractory to medication. Survival in pt undergoing myectomy or ASA is similar, but freedom from reintervention, early and late reduction of LVOT gradient, and early symptomatic improvement are markedly superior in pt undergoing septal myectomy.

ABSTRACT #6
Surgical Potpourri I
1:40pm-1:50pm

OUTCOMES OF LAPAROSCOPIC CAPD CATHETER PLACEMENT: A HUMBLING SINGLE-SURGEON EXPERIENCE

Nicholas Prabhakar, Yazan AlJamal MBBS, Humza Saleem MD, Mohamed Baloul MBBS, David Farley MD
Mayo Clinic

Background
While Continuous Abdominal Peritoneal Dialysis (CAPD) catheter placement is typically a straightforward surgical procedure, it is frequently performed on chronically ill patients with end-stage renal disease (ESRD). Surgical techniques and post-operative outcomes vary greatly in the medical literature.

Objective
Report our experience using a minimally invasive technique in placing CAPD catheters and offer our early and late surgical outcomes for these ESRD patients.

Methods
An IRB-approved, retrospective review (2017-2018) of every patient that underwent a minimal invasive PD Cath placement at Mayo Clinic, MN performed by one surgeon. Analysis focused on specific patient outcomes, early (30 days) complications, and conservative management versus reoperation.

Results
A total of 21 patients with ESRD (ASA I: 0, II: 0, III: 15, IV: 6) underwent 27 total (includes replacement surgeries) laparoscopic PD Cath placements. Mean patient age was 56.7 years, 62% were male, and mean BMI was 29.2 (range: 18.96-39.57). Mean operative time was 62 minutes, and seven patients were hospitalized overnight (33%). The rate of early- and late-complications was 11% (n=3) and 33% (n=9) respectively. Reoperation rate was 33% (n=9; 1 early vs. 8 late). CAPD catheters malfunctioned in 7 patients (1 early vs 6 late) and all underwent reoperation. CAPD catheter infections occurred in 5 patients: two required reoperation; three were treated successfully with oral antibiotics. Only 10 of the 27 operations (37%) were free from early or late complications (mean follow-up=162 days).

Conclusion
Although the 27 CAPD catheter placements in patients with ESRD were technically easy to accomplish, the long term outcomes (functionality, free of infection) were disappointing. Fibrinous build up causing catheter dysfunction and avoiding catheter infections remains a work in progress.

ABSTRACT #7
Surgical Potpourri I
1:50pm-2:00pm

A DECADE OF EXPERIENCE WITH LAPAROSCOPIC VENTRAL HERNIA REPAIRS

Sarah Lund, Dr. David Farley
Mayo Clinic School of Medicine

Background
Laparoscopic ventral hernia repair (LVHR) has become the mainstay of treatment for abdominal hernias. Few studies have evaluated surgical outcomes for patients undergoing LVHR in long-term follow-up.

Objective
The primary goal of this review was to investigate long-term outcomes of LVHR.

Methods
A retrospective review of a large tertiary medical center's experience with LVHR was undertaken. We collected data on consecutive patients who underwent LVHR between 2002-2005.

Results
Sixty-three patients (F: 26, M: 37; mean age = 63 years [range: 32 – 80] and mean BMI 32.6) underwent LVHR at our institution. Recurrent hernias made up 41% of repairs. Mean operative time was 164 minutes (range: 50 – 439). Mean hospital stay was 3.7 days (range: 0 – 22). Short term (ileus, pneumonia, complication of concurrent procedure, adrenal insufficiency, small bowel obstruction) and long-term (hernia recurrence, mesh infection, small bowel obstruction, seroma) complications occurred in 19% and 44% of patients respectively. With a mean follow-up of 149 months (range: 114 – 179), recurrent hernias were noted in 15 patients (23%). Seroma formation occurred in 14 patients (22%). Small bowel obstruction occurred in 10 patients (16%). Five patients developed a mesh infection (8%). The use of PTFE mesh, longer operative time, and having a larger hernia defect were risk factors for mesh infection. Four patients underwent reoperation for mesh infection, with mesh removed in all four operations. Operating on recurrent hernias was a risk factor for future hernia recurrence. Differing methods of fixation and obesity were not risk factors for long-term complications.

Conclusion
Long-term outcomes for patients undergoing LVHR is fraught with complications (44%) and a considerable risk of hernia recurrence (23%).

ABSTRACT #8
Surgical Potpourri I
2:00pm-2:10pm

POST-DISCHARGE OPIOID PRESCRIBING PATTERNS AND RISK FACTORS IN PATIENTS WITHOUT COMPLICATIONS

Jeffrey S. Scow, MD, Nicholas M Tomhave, Jenna K Lovely, RPh, PharmD, BCPS, Grant M Spears, BS, Marianne Huebner, PhD, David W Larson, MD, MBA
Mayo Clinic

Background
Few studies have examined the amount and indications for opioids prescribed in the post-discharge period.

Objective
The primary aim of this study was to evaluate the need for post-discharge opioids in patients undergoing colorectal operations and experiencing no surgical complications. The secondary aim was to examine the accuracy of the Opioid Risk Tool (ORT) to predict the need for additional opioid prescriptions. Our hypotheses were that few patients would require post-discharge opioids and that the ORT would predict patients requiring post-discharge opioids.

Methods
All patients undergoing elective colorectal surgery between January 2012 and December 2014 that did not experience NSQIP complications within 30 days or receive an opioid prescription in the 2 weeks prior to operation were reviewed. ORT score was calculated for all patients. Patients requiring post-discharge opioids within one year were compared to those not receiving additional opioids after discharge.

Results
There were 367 patients that met inclusion criteria and 56 (15%) received post-discharge opioids. Opioid use in the year prior to surgery was the only significant risk factor to receive post-discharge opioids. Opioids were prescribed for three distinct reasons by three groups of prescribers. The ORT did not accurately predict need for post-discharge opioids.

Conclusion
Even among patients without complications, 15% received post-discharge opioid prescriptions. Previous opioid use within the year prior to surgery was a major risk factor for additional prescriptions. The timing and prescriber's specialty are impacted by the indication for post-discharge opioids. The ORT did not predict which patients would receive post-discharge opioids.

ABSTRACT #9
Surgical Potpourri I
2:10pm-2:20pm

COST-EFFECTIVENESS EVALUATION OF LAPAROSCOPIC VERSUS ROBOTIC MINIMALLY-INVASIVE COLECTOMY

Vlad V. Simianu, MD MPH; Wolfgang B. Gaertner, MD; Karen Kuntz, ScD; Mary R. Kwaan, MD, MPH; Ann C. Lowry, MD; Robert D. Madoff, MD; Christine J. Jensen, MD MPH
University of Minnesota

Background
The use of robotic-assisted minimally-invasive colon surgery is increasing. Robotic technology is more expensive, and whether robotic colectomy is cost-effective remains to be determined.

Objective
Conduct a cost-effectiveness evaluation of open, laparoscopic, and robotic colectomy.

Methods
We constructed a decision-analytic model to evaluate the one-year costs and quality-adjusted time between robotic, laparoscopic, and open colectomy. Inputs into the model were derived from available literature for costs, quality of life(QOL), and outcomes. Results are presented as incremental cost-effectiveness ratios(ICERs), defined as incremental costs per quality-adjusted life year(QALY) gained. We performed one-way and multi-way sensitivity analyses to test the robustness of our results to clinically reasonable variations.

Results
Open colectomy was more costly with lower QOL than robotic and laparoscopic approaches. In the societal perspective, robotic colectomy costs $745 more per case than laparoscopy and resulted in an ICER of $2,322,715/QALY because of minimal differences in QOL. In the healthcare sector perspective, robotics cost $1339 more per case with an ICER of $4,174,849/QALY. In a probabilistic sensitivity analysis, the cost-effective approach was laparoscopic in 54.8% of cases, robotic in 38.8%, and open in 6.4%(Figure). Cases in which robotic colectomy was cost-effective had higher postoperative QOL by 0.012, lower length of stay(LOS) by 2.0 days, and return to work 4 days sooner compared to laparoscopy.

Conclusion
Laparoscopic and robotic colectomy are both more cost effective than open resection. Situations in which the robotics may be more cost effective than laparoscopy are driven by improved postoperative QOL and LOS. With increased use of robotic technology in colorectal surgery, there is a burden to demonstrate these benefits.

ABSTRACT #10
Surgical Potpourri I
2:20pm-2:30pm

NON-INTUBATED THORACIC SURGERY A.K.A AWAKE V.A.T.S.

Benjamin Zhang, MD, Rafael Andrade, MD, and Madhuri Rao, MD
University of Minnesota Department of Surgery

Background
Historically general anesthesia and thoracic surgery have had a close relationship. With early general anesthesia in the form of chloroform or ether inhalation, there was an issue of pneumothorax that occurred with chest surgery. Advancements in mechanical ventilation including single lung ventilation have improved techniques in thoracic surgery, but general anesthesia has its own associated morbidities and mortalities.

Objective
Nonintubated thoracic surgery has been demonstrated more recently in some institutions. We demonstrate our experience with thoracoscopic procedures in performed under regional anesthetic techniques, with our without conscious sedation, in spontaneously breathing patients is a feasible alternative to general anesthesia

Methods
We report indication and short term outcomes. Our patients underwent thoracoscopic procedures for non-anatomic peripheral wedge resections or for pleurodesis. Patients were seen in the pre-op anesthesia clinic with discussion of an airway plan, pain management plan with either local or regional anesthesia, and discussion of their pulmonary comorbidities. Patients with significant cardiac comorbidities or a known difficult airway were excluded.

Results
We performed eight non-intubated thoracoscopic procedures. Four of the patients had pre-existing interstitial lung disease. Three of the surgeries were done for metastatectomies and one for pleurodesis. The procedures were done through a uniportal incision in 6 of the 8 cases and through two port sites in the other two. We had 0 conversions to general anesthesia. Operative times have ranged from 35-70 minutes. Four of the 8 patients discharged on post-operative day 0 with the others discharging on days 1,2, and 4(2).

Conclusion
Non-intubated thoracoscopic surgery is a feasible to thoracic surgery under general anesthesia. More work is required in developing a standardized protocol as well as progression to more complex cases.

ABSTRACT #11
Mini Talk Session II
3:30pm-3:35pm

MAKING EPAS A 59 MINUTE OBJECTIVE MEASURE FOR SURGICAL TRAINEES – A PILOT STUDY

Yazan AlJamal MBBS, Stephanie Heller MD, David Farley MD
Mayo Clinic

Background
Accurately confirming surgical trainees have met the requirements of entrusted professional activities (EPAs) will require rigorous staff input.

Objective
Given our staff reluctantly offer voluminous resident feedback, we rely heavily on objective, OSCE-type measures and pondered whether such simulation-driven evaluations might prove useful to the ABS pilot effort on EPA analysis.

Methods
Our surgical trainees participate biannually in a 59 minute simulation-based assessment which covers surgical technique, knowledge and critical thinking in a host of domains. All stations were timed, videotaped, and checklists developed for objective analysis. The content and difficulty of the stations differed between the PGY levels. Performance at each station was assessed based upon 1 to 5 Likert Scale (1=poor to 5=stellar). Only those domains relevant to 4 of the 5 ABS pilot projects (inguinal hernia repair, appendectomy, cholecystectomy, and trauma resuscitation) were tabulated for this study.

Results
16 PGY-2s, 8 PGY-3s, 10 PGY-4s and 10 PGY-5s surgical residents completed the sim-based assessment. Performance within and between PGY levels was variable. The mean (SD) EPA scores for all PGY levels are listed in Table 1. PGY 5s outperformed other PGY classes in all 4 EPAs (p

Conclusion
Analysis gleaned from a 59 minute OSCE in a simulated setting offers objective data that appears to have construct validity related to resident performance. Refining our Surgical X-Games to cater to the specific EPA scoring system may better allow objective analysis of when trainees cross the threshold from "can do with some help" to "can do autonomously".

ABSTRACT #12
Mini Talk Session II
3:35pm-3:40pm

PRACTICE TIME WITHIN A SIM CENTER ENHANCES SURGICAL INTERN PERFORMANCE

Jessica Pakonen, Rebecca Martin, Yazan AlJamal, M.B.B.S., David Farley, M.D.
Mayo Clinic

Background
Simulation (SIM) has proven to be a useful tool in providing objective assessment; some evidence exists that practicing within a SIM center helps transfer knowledge and skill to the OR, intensive care unit, ER, etc.

Objective
We looked to clarify whether practicing specifically within a SIM center correlates with perceived competence, actual competence, and offering lessor physical and mental demands on basic surgical tasks.

Methods
As a part of our Mayo Surgical Olympics, one 7-minute station assessed surgical interns' right, left and two handed open knot tying. Interns throw 10 knots (each) using their right, left and two hands. Time is recorded for each skill. Interns completed a pre-survey on their hours of practice time in the OR, SIM or home, perceived competence (predicting how long they will take to tie knots), and perceived level of mental and physical demand with the skills required.

Results
Twenty men and 11 women (n=31) completed the open knot tying station. Practice time within the SIM center correlated with predicted scores on left- and right-handed knots (p=0.002, p=0.01) and actual scores on left- and two-handed knots (p

Conclusion
Interns with greater practice time in the SIM lab indicated higher predicted scores for knot tying and performed better at knot tying. Mental and physical demands were less for interns predicting they would excel in open knot tying. While numerous factors lead to tying knots quickly, the benefits of deliberate practice within the SIM center appears to increase knot tying speed along with decreasing mental and physical stress.

ABSTRACT #13
Mini Talk Session II
3:40pm-3:45pm

LOW COST INANIMATE MODELS ARE USEFUL IN ASSESSING OPEN AND LAPAROSCOPIC SKILLS OF GS RESIDENTS

Yazan AlJamal MBBS, Humza Saleem MD, Nicholas Prabhakar, Mohamed Baloul MBBS, David Farley MD
Mayo Clinic

Background
Surgical residents prefer to spend most of their training time doing operations on real patients. Little has been written about training and assessing senior surgical residents on low cost models for both open and laparoscopic surgery. While our simulation education efforts have concentrated on surgical interns, we do assess senior level residents biannually in our simulation center. The cost and educational utility of such an effort to assess open and laparoscopic skills has not been delineated.

Objective
To use low cost inanimate model to objectively assess General Surgery residents'

Methods
Surgical residents biannually participate in a 59 minute OSCE (Surgical X-Games) consisting of 6 stations. Several stations involve open surgery low-cost task trainers (constructed from felt, yarn, cardboard, etc.) and laparoscopic task trainers (laparoscope, monitor, graspers, plastic box containing felt and cloth made to look like abdominal organs). Skills assessed were open inguinal hernia repair, small bowel anastomosis, and portal vein injury management, laparoscopic abdominal exploration and enterotomy closure. Performance analysis utilized an objective checklist, and residents provided feedback (Likert Scale 1= negative through 5=positive) regarding the utility of the exercises.

Results
Forty-four GS residents (16 PGY-2s, 8 PGY-3, 10 PGY-4s and 10 PGY-5s) completed the assessment. Performance within and between PGY levels was variable, but PGY 5 trainees outperformed PGY-2s, 3s, and 4s (p

Conclusion
Low cost inanimate models facilitated assessment of surgical residents' open and laparoscopic surgical skills. Residents felt the models were useful and realistic, and staff found them inexpensive, easy to set up, and durable. We will plan to look for new ways to use this low cost option in our surgical curriculum and specifically find a lap enterotomy closure model that is not so taxing on PGY-5s.

ABSTRACT #14
Surgical Potpourri II
4:15pm-4:25pm

EARLY PALLIATIVE CARE IN CRITICALLY ILL PATIENTS WITH FATAL DISEASE IS ASSOCIATED WITH DECREASED LENGTH OF STAY

Mark J. Stice, BA; Quinn J. Mallery, BS; Mariya E. Skube, MD; Tatiana A. Ditta, MS; Greg J. Beilman, MD.
University of Minnesota

Background
The care of patients in the intensive care unit (ICU) requires significant resources, especially at the end of life, with sepsis being the major diagnosis in most ICU admissions. Disposition delays, including floor bed availability and end of life decision-making are major causes of prolonged ICU stay. We sought to evaluate the effects of early palliative care (PC) discussions on length of stay (LOS) with the hypothesis that early PC consultation is associated with decreased LOS in patients who die in the ICU or hospice.

Objective
Assess early PC intervention's role in reducing LOS in ICU patients with fatal disease.

Methods
We identified adult patients in 5 ICUs on mechanical ventilation >96 hours during the year 2016 who succumbed to their disease. To collect demographic data we used Crimson (The Advisory Board Co, Washington, DC), a relational quality improvement database. We compiled two patient groups: those with ICU LOS >10 days over system average, and those with ICU LOS less than system average. The system average was determined by averaging the LOS for patients with the same MS-DRG, mortality risk, and illness severity over the previous 27 months in our 6 hospital healthcare system. Additional retrospective chart review was conducted to assess primary admitting diagnosis, chronic health conditions, and PC intervention practices. Chi-squared and Welch's t-test were used to compare groups. Bonferroni correction method was applied as appropriate to account for multiple comparisons.

Results
There were no significant differences in age, sex, existing chronic illnesses, or illness severity between groups (Table 1). Sepsis was the most common diagnosis in both groups. PC consultation rates were not significantly different between excess LOS and below system groups (70% vs 50%, p=0.53), however, patients with an excess LOS received PC consult significantly later in their hospital course (27.4 vs 10.9 days, p=0.016). In subgroup analysis of septic patients, the excess LOS group also had significantly later PC consults (32.6 vs 6.8 days, p=0.012). A strong correlation is observed between initial PC consult day and LOS across all patients in the whole sample and septic subgroup (Figure 1). A small subset of patients (n=8), equally distributed between excess LOS and below system groups, had early PC consult followed by a prolonged interval prior to their disposition. Most patients had social factors such as young age, unexpected illness, or language barriers contributing to their prolonged intervals.

Conclusion
In patients who died in the ICU, a strong correlation between PC consult interval and LOS was observed with early PC intervention associated with a significantly shorter LOS. Social factors can prolong disposition intervals, and proactive mortality risk counseling could reduce disposition delays. Our study suggests that early PC intervention may decrease unnecessary resource utilization in ICU patients, including those with sepsis as a major diagnosis.

ABSTRACT #15
Surgical Potpourri II
4:25pm-4:35pm

A COMPREHENSIVE REVIEW OF MANAGEMENT OPTIONS IN PEDIATRIC RECTAL PROLAPSE

Z Morrison, M LaPlant, D Saltzman
Marshfield Medical Center

Background
Rectal prolapse continues to be a significant issue for both children and adults. It is apparent that there is no universally preferred method to surgically treat rectal prolapse given that over 100 operative procedures have been reported in the literature to treat this condition.

Objective
We sought to characterize the most common procedures used to treat rectal prolapse in children and determine their corresponding success rates.

Methods
To better categorize and prioritize management strategies of pediatric rectal prolapse, we conducted a review of the literature. We searched Medline, PubMed, and Scopus for the terms "rectal prolapse" and "children." Primary source publications reporting on management strategies of pediatric rectal prolapse and satisfying our exclusion criteria were analyzed for patient demographics, intervention strategy, efficacy, and post-operative outcomes. Procedures were categorized by anatomic approach and surgical method, and complications were quantified.

Results
Sixty-one studies from 21 countries documenting 2,136 patients were analyzed. Sclerotherapy was the most common method used to treat rectal prolapse with an overall first injection success rate of 89.2% and a recurrence rate of 10.3%. These studies utilized three main sclerosing agents: ethyl alcohol, phenol 5%, and hypertonic saline. Ethyl alcohol seems to be the optimal sclerosing agent due to low a complication rate, high efficacy, ready availability, and low cost. Over 20 operative procedures could be categorized into abdominal or perineal approaches and included rectopexy, bowel resection, mucosal plication, and anal suture cerclage. The most common operative procedure was laparoscopic rectopexy (with mesh or suture), with a success rate of 91.1%. Post-operative complications from all procedures were typically minimal; constipation and wound infection were most commonly cited.

Conclusion
Despite a multitude of often complex options for the treatment of rectal prolapse in children, the most straightforward approaches of sclerotherapy and laparoscopic rectopexy are the most commonly used strategies found by our literature review, with initial success rates of approximately 90% each.

ABSTRACT #16
Surgical Potpourri II
4:35pm-4:45pm

SALINE OR ANTISEPTIC SOLUTION? A SYSTEMATIC REVIEW OF WOUND CHARACTERISTICS, CLINICAL USES, AND WOUND HEALING OUTCOMES IN NEGATIVE PRESSURE WOUND THERAPY WITH INSTILLATION

Jeremie D. Oliver, BS, BA1; David V. Ivanov, BS1; Varsha S. Salunkhe, BS2; Arif Chaudhry, MD3; Krishna Vyas, MD, PhD, MHS3 ORIGINATING INSTITUTIONS: 1Mayo Clinic School of Medicine, Rochester, MN, USA; 2Samuel Merritt University, California School of Podi
Mayo Clinic School of Medicine

Background
Negative-pressure wound therapy (NPWT) is a tool frequently utilized to assist in preparing complex wounds for delayed closure. Unlike conventional wound care dressing, NPWT creates a tightly-sealed environment with continuous or cycles of negative pressure to promote cell migration, increase growth factors, and remove of pro-inflammatory cytokines and debris. However, there are several shortcomings of NPWT alone in at-risk, complex wounds.
Topical instillation therapy in addition to NPWT (NPWTi) has been reported to increase efficacy of wound therapy, adjunctively controlling bacterial growth and further propagating granulation at the wound bed. NPWTi augments traditional negative-pressure systems with the added function of a timed, volumetric topical wound solution release that remains in the bed for a programmed period of time. Slow irrigation with instillation solution (IS) allows for mechanical debridement in a closed environment while keeping the wound site at an optimal moisture level. Depending on the amount of bioburden and risk for infection, a surgeon may select topical antibiotic or antiseptic solutions in lieu of normal saline.

Objective
The objective of this study was to perform the first systematic review of all published literature on negative-pressure wound therapy with topical instillation (NPWTi) with combined outcomes examining saline and non-saline (antiseptic) solutions, as well as the heterogeneous settings, indications, and wound characteristics to better elucidate the clinical uses and outcomes of negative pressure wound therapy with topical instillation in the treatment of complex wounds.

Methods
A comprehensive literature search of the MEDLINE, PubMed, Embase, Scopus, Cochrane and Google Scholar databases was conducted (with institutional medical librarian assistance) for studies published through December of 2017 with search terms related to negative-pressure wound therapy with instillation and filtered for relevance to postoperative outcomes in wound healing. Wound characteristics, type of solution, and various vacuum and instillation settings were also collected. Outcome measures included hospital length of stay, time to final surgical procedure, average duration of wound therapy, and proportion of closed wounds at final follow-up.

Results
A total of 11 articles were selected and reviewed based on the authors' study criteria from 89 identified. All selected articles reported outcomes data on negative-pressure wound therapy with instillation using either saline or antiseptic solution. Four studies used exclusively saline, five used exclusively non-saline solution, and two studies had cohorts using saline or non-saline fluid Data was compiled for 270 patients receiving saline instillation and 155 patients receiving antiseptic solution instillation. The following weighted means were calculated for selected outcomes: the saline fluid combined length of stay was 18.1 days, while the non-saline combined length of stay was 12.8 days; the saline fluid time from placement of NPWTi to final surgical procedure was 9.8 days, while the non-saline time from placement of NPWTi to final surgical procedure was 9.2 days; the saline fluid combined closure rate was 94.8%, and the non-saline fluid combined closure rate was 90.4%.

Conclusion
This investigation serves as a preliminary framework to understand the impact of instillation approaches (saline vs antiseptic) in complex wound management when evaluating healing outcomes, as well as present the heterogeneous clinical picture of the uses of NPWTi.

ABSTRACT #17
Surgical Potpourri II
4:45pm-4:55pm

COMPARING INCIDENCE AND RECURRENCE RATES OF PRIMARY URETHRAL CANCER

Elias Saba, B.S., Bradley Stish, M.D.
Mayo Clinic School of Medicine

Background
Primary urethral cancer is rare, comprising less than 1% of all diagnosed malignancies. Due to the disease's rarity, prospective studies to define best clinical practices are lacking. Many of the published retrospective studies include patient cases extending as far back as the 1950s, and may not accurately reflect patient outcomes achieved with modern treatment. We sought to report the clinical presentations and treatment outcomes for a cohort of patients with primary urethral cancer treated at a single institution between 1991 and 2016.

Objective
We sought to report the clinical presentations and treatment outcomes for a cohort of patients with primary urethral cancer treated at a single institution between 1991 and 2016.

Methods
Patients eligible for this study were those with primary invasive urethral carcinoma diagnosed and treated between 1991-2016 at the Mayo Clinic. Patients were excluded from the study if they had in-situ disease, distant metastases at diagnosis, concurrent unrelated malignancies, or less than one year of follow-up available. Cancer staging was recorded according to AJCC 7th edition cancer staging guidelines. All treatments were administered at the discretion of the treating physicians. Sites of first recurrence were recorded and stratified as either local, regional, or distant. Survival and recurrence times were assessed from the date of diagnosis. Freedom from recurrence and survival estimates were calculated with JMP software using the Kaplan-Meier method. Associations of patient and treatment characteristics with outcomes were assessed with a Log-Rank test.

Results
A total of 37 eligible patients were included in the final analysis of which 20(54%) were male . Median age at diagnosis was 59 (range 34-79). Stage at diagnosis was: I (n=7, 19%), II (n=9, 24%), III (n=14, 38%), and IV (n=7, 19%) with 5 patients (14%) presenting with lymph node involvement. Histologically, cases included squamous cell carcinoma (40.5%), transitional cell carcinoma (40.5%), and adenocarcinoma (18.9%). Treatment modalities included surgery alone (59.5%) radiotherapy alone (18.9%), and combined surgery plus radiotherapy treatment (21.6%). Chemotherapy was given to 18 of the 37 patients as a component of their primary treatment. Any recurrence was documented in 16 patients (43.2%) with first recurrence most commonly being local (n=8), followed by distant (n=5) and regional (n=3). Five year local/regional recurrence free survival (LRRFS) and overall survival (OS) for the group were 58.5% and 63.7%, respectively. Patients with adenocarcinoma had a significantly worse LRRFS at 5 years compared to other histologies (33.3% vs. 63.8%, p=0.04). OS at 5 years was as follows: I=83.3%, II=54.7%, III=69.8%, IV=42.8% (p>0.05). LRRFS and OS did not differ based on patient, gender, or treatment received.

Conclusion
This retrospective study provided important data regarding the outcomes of patients with primary urethral cancer treated in the modern era. While the size of this cohort limits statistical power to detect subtle differences, treatment outcomes were similar regardless of treatment modality. Patients with adenocarcinoma histology and increasing disease stage appear to have worse outcomes and may benefit from more aggressive treatments. As primary urethral cancer comprises a particularly rare condition, further investigation involving a larger study population is required to ensure development of optimal evidence-based treatment guidelines.

ABSTRACT #18
Surgical Potpourri II
4:55pm-5:05pm

MEDICAL STUDENT PERCEPTIONS OF 24-HOUR CALL

Steven J Skube, Archana Ramaswamy, Jeffrey G Chipman, Robert D Acton
University of Minnesota

Background
Twenty-four-hour call has been a fundamental experience for medical students during their clinical rotations. Most specialties have withdrawn their 24-hour call requirement in favor of a night-float system for required medical student rotations. General surgery clerkships are often the only courses that medical students are required to participate in 24-hour call.

Objective
The aim of this study was to assess the perceptions and utility of 24-hour call for medical students during their surgery clerkship.

Methods
Medical students completing their required surgical clerkship over two periods (n=72) at our institution were surveyed during the first week of clerkship and after the completion of the clerkship regarding their perceptions and experience with 24-hour call.

Results
Response rate for the pre-clerkship survey was 75% (n=54) and 63% (n=45) for the post-clerkship survey. The mean age of respondents was 26 years, and the majority of students were in their third year of medical school (96%). Most (62%) of the students responding to the survey had between 2-10 call shifts over an 8-week period. Overall, less than half of the students thought the 24-hour call requirement should remain for the required surgical clerkship (45% pre-clerkship and 42% post-clerkship). After completing the clerkship, students interested in surgery more often agreed the 24-hour call requirement should remain (73% versus 27%, $p = 0.003$). Students rotating at a Level I Trauma Center were also more likely to agree the call requirement should remain (63% versus 31%, $p = 0.04$). Figure 1 compares perceptions of 24-hour medical student surgical call before and after completing the surgery clerkship. Medical students generally had less concerns (mental health, fatigue, mistakes, grade performance) related to 24-hour call after completion of the clerkship. Concerns about the effect of 24-hour call on study schedule remained high in both pre- and post-clerkship groups.

Conclusion
Students interested in a career in surgery and students rotating at Level 1 Trauma Centers more often recommended continuation of the 24-hour call schedule, indicating increased utility for these groups. Negative perceptions of 24-hour call decreased after experiencing 24-hour call and finishing the required surgery clerkship.

ABSTRACT #19
Surgical Potpourri II
5:05pm-5:15pm

VIDEO TRAINING WORKS FOR ATHLETES, DOES IT WORK FOR SURGEONS?

Nicholas Prabhakar, Yazan AlJamal MBBS, Humza Saleem MD, Mohamed Baloul MBBS, David Farley MD
Mayon Clinic

Background
Video analysis of performance and quick assessment of pattern recognition has become common place in major sports, and we believe that this idea can be transferred to medical training. We have utilized surgical videos in a variety of settings (teaching modules, surgical pearls, Twitter feeds, etc.) in our surgical training program. We developed an efficient assessment tool in the form of an 8-minute video clip. We aimed to determine if the scored interaction with this video tool differentiates novices from experts.

Objective
We aimed to determine if the scored interaction with this video tool differentiates novices from experts.

Methods
We created four distinct, muted eight-minute videos comprised of 13-15 video snippets tailored in difficulty to the PGY2-5 levels; some of the 30 second videos used were identical between the PGY video tests. Scores were based on the amount of surgical facts relevant to the videos that the participants communicated within the allotted time. Novice and expert groups verbalized all 4 complete videos; PGY2s through PGY5s verbalized only their distinct PGY video as a part of a Surgical X-Games competition.

Results
5 interns, 4 PGY2s, 8 PGY3s, 6 PGY4s, 5 PGY5s and 3 general surgeons participated. Table (1A) shows the mean and range for each group. Interns scored the lowest compared to the senior residents, who scored in the middle, followed by the experts who scored the highest ($p<0.05$). Table (1B) shows the specific videos that we found differentiated between experts and the surgical residents.

Conclusion
Eight-minute compiled videos, covering a dozen or more operative snippets allow experienced surgeons to verbalize more facts than novice or early learners. Further research and educational efforts to assess and teach with surgical videos may facilitate pre-emptive learning to lead to similar success of our major sports team in their quest for world championships.

ABSTRACT #20
Surgical Potpourri III
8:00am-8:10am

MICROSURGERY TRAINING IMPACT ON MICROSURGERY TRAINEES' MUSCULOSKELETAL SYMPTOMS AND WORKLOAD

Amro Abdelrahman MBBS; Bethany Lowndes PhD, MPH; Anita Mohan MBBS, MRCS; William Anding, Jordyn Koenig, Valerie Lemaine MD, MPH; Shelley Noland MD; Karim Bakri MD; Steven Moran MD; Samir Mardini MD; Susan Hallbeck PhD, PE, CPE.
Mayo Clinic

Background
Microsurgery has positively impacted patient outcomes and satisfaction. However, the effect of performing microsurgery on microsurgeons' musculoskeletal health and workload has yet to be studied. Performance-limiting musculoskeletal injuries and illnesses could impact patients' access to microsurgery. Thus, exposures to postural risk factors during standard and advanced microsurgery training were studied.

Objective
The objective of this study was to evaluate microsurgery impact on microsurgery trainees' musculoskeletal symptoms and workload.

Methods
During a randomized controlled trial comparing surgical trainees' performance for standard or advanced microsurgery training in a microsurgery skills laboratory, microsurgery trainee body-part discomfort and workload was assessed by two measures: body-part discomfort questionnaire and National Aeronautics and Space Administration task load index questionnaire (NASA-TLX). Participants completed pre-training familiarization and testing, then were randomized to the standard or advanced group. Each session, participants completed two femoral artery anastomoses (cutting the artery until the last knot). The advanced group participants completed the first session through a narrow cylinder and the second session though a higher cylinder with the rat tilted 22o from horizontal. Participants in the standard group had no restriction to the anastomoses site. Participants completed a post-training test. A body-part discomfort questionnaire was completed before and after each session which was focused on severity (none, slight, or substantial) of pain, stiffness, or numbness in several body areas and technical problems (mental fatigue, trouble concentrating, irritability and tremor). After each session, participant completed the NASA-TLX with 6 subscales (0-20 scale). Chi-square, t-tests and one way ANOVA were performed, as appropriate, with $\alpha = 0.05$.

Results
11 participants (standard=6, advanced=5) completed 44 microsurgery sessions. Demographics and microsurgery experience did not differ significantly between two groups. NASA-TLX subscales did not differ between the two groups ($p>0.05$) except for the frustration in the first training session (standard=5.7±4.7, Advanced=11±2.1, $p=0.045$). After each session, neck stiffness worsened significantly ($p=0.04$ and 0.01, respectively) and mental fatigue and tremor increased significantly from the pre-session assessments (both p

Conclusion
Microsurgery Trainees reported a high rate of arm and neck stiffness, mental fatigue, tremor and workload after microsurgery. In both standard and advanced training, trainee workload may exceed a sustainable threshold. Musculoskeletal symptoms and workload may impact microsurgeon health and performance; thus, ergonomic improvement of the microsurgery layout is necessary.

ABSTRACT #21
Surgical Potpourri III
8:10am-8:20am

PATTERNS AND DETERMINANTS OF POSTOPERATIVE OUTCOMES IN MITRAL VALVE REPAIRS

Parvathi Balachandran, Monali Mohan, Brian D. Lahr, Joseph A. Dearani, Richard C. Daly, Simon Maltais, Sorin V. Pislaru, Hartzell V. Schaff
Mayo Clinic

Background
Chronic mitral regurgitation (MR) leads to a prolonged state of volume overload of the left atrium leading to its enlargement. Left atrial enlargement is associated with many risk factors for mortality in the general population. In chronic MR, LA size is proportionate to the regurgitant volume, which is a marker of the burden of MR. Thus, LA size is a quantifiable measurement of the severity and chronicity of the valve disease and, in turn, influences outcomes after mitral valve repair. Echocardiography is the most common method used to assess LA size, but reliable measurement of LA size can be problematic. It is crucial to standardize methods for quantification of LA size and correlate reference ranges to severity of MR and operative outcomes. The knowledge gaps in standardized LA size measurements are also reflected in clinical assessment of LA size reduction, known as LA reverse remodeling that occurs after surgical repair of mitral valve.

Objective
To assess the preoperative factors determining left atrial reverse remodeling after mitral valve repair for degenerative disease.

Methods
We reviewed records of 836 patients who underwent mitral valve repair for degenerative disease from 2007 through 2015. We obtained left atrial end-systolic 2D volume index (LAVI) from echocardiograms taken pre and postoperatively to analyze reverse remodeling of the left atrium (LA) in these patients. We performed multivariable regression analysis to determine the baseline effects of LAVI, age, sex, body mass index (BMI), atrial fibrillation (AF), hypertension, pulmonary artery systolic pressure, and left ventricular end-systolic and diastolic dimensions on postoperative LA reverse remodeling (modeled separately for immediate and one-year postoperative remodeling). We also analyzed the association of preoperative LAVI with early postoperative AF and with long-term mortality using logistic and Cox regression, respectively.

Results
The largest decrease in LA volume occurred in the immediate postoperative period (mean change in LAVI -13.96 mL/m2, CI -12.87 to -15.06, p

Conclusion
In patients with degenerative MR who have MV repair, preoperative LAVI was associated with the extent of LA reverse remodeling, and risk of early postoperative AF and late mortality. The major portion of reverse remodeling occurs within the first month after operation and is greatest in younger patients and those in sinus rhythm preoperatively.

ABSTRACT #22
Surgical Potpourri III
8:20a-8:30am

EMERGENCY SURGERY FOR INTESTINAL PERFORATION SECONDARY TO LYMPHOMA: 30-DAY POST-OPERATIVE OUTCOMES AND 1-YEAR SURVIVAL

Miguel A. Gomez Ibarra, M.D., Cornelius A. Thiels, D.O., Pamela E. Skaran, Juliane Bingener, M.D.
Mayo Clinic

Background
Gastrointestinal perforation is a potential complication for lymphoma patients. Many of these patients are immunocompromised, therefore operative management can be challenging.

Objective
Our aim is to review 30-day outcomes and one-year survival after emergent surgery for intestinal perforation in the setting of lymphoma.

Methods
Single institutional retrospective review was done to identify patients with a diagnosis of lymphoma who underwent a non-elective surgery to treat an intestinal perforation from January 2006 to August 2017. Patient characteristics, immunosuppression history, operative details, pathology reports, hospital course, and laboratory data were obtained by chart review. Thirty-day complications rates were defined using Clavien-Dindo (CD), 1-year survival and Cox-model data were obtained.

Results
Over 10-years, 51 patients with a diagnosis of lymphoma presented with intestinal perforation, of which 30 (59%) were men. Mean age was 61±15 years and 15 patients (29%) had a previous organ transplant. Mean ASA score was 3±0.6. Twenty six (51%) had prior chemotherapy and 19 (37%) were on immunosuppressive therapy due to other causes. Pre-operative mean leukocytes count was 11.5±8.5x109/L and mean neutrophils 9.6±7.9x109/L. Surgical approach included 9 (18%) laparoscopic converted to open and 42 (82%) open cases. Mean OR time 143±75 minutes, mean estimated blood loss (EBL) 293±435 mL. Non-Hodgkin lymphoma was found in 40 patients (78%), Hodgkin lymphoma in 2 (4%), and post-transplant lymphoproliferative disorder (PTLD) in 9 (18%). Locations of perforation were small bowel in 35 (69%) patients and large bowel in 16 (31%) patients. Mean length of stay was 17±16 days. Major morbidity (CD grade 3 or 4) occurred in 28 patients (55%) with infectious and cardiovascular complications being the most common. Nine (18%) died within 30-days due to infection, multiorgan failure, end-stage refractory T-cell lymphoma, or respiratory failure. One year survival was 55% (n=26). In univariate analysis; age (Hazard Ratio: 1.03 (95% CI 1.00-1.06) and ASA score (HR: 2.13, 95% CI 1.19-3.54) were significantly associated with post-operative 1-year mortality. Gender, leukocytes, neutrophils, organ transplant, OR time, EBL, chemotherapy, and immunosuppressants had no association with mortality.

Conclusion
Perforation in lymphoma patients carries an 18% mortality, 55% serious morbidity in the post-operative period with 55% 1-year survival. While these numbers are high, additional risk stratification may identify which patients may benefit from emergency surgery.

ABSTRACT #23
Surgical Potpourri III
8:30am-8:40am

UNICENTRIC CASTLEMAN'S DISEASE OF THE ABDOMEN AND PELVIS: A GENERAL SURGEON'S PERSPECTIVE

Najiha Farooqi MD, Elena Frye Naharro, Atusa Fathali, Keaton Joppru, Salman Ikramuddin, Greta Berger, Muhammad Maaz MD, Victor Vakayil MBBS, MS, James V Harmon MD, Ph.D., FACS, Nivedita Arora MBBS
University of Minnesota

Background
Castleman's disease is an uncommon lymphoproliferative disorder which manifests in either a unicentric or multicentric pattern. Multicentric Castleman's disease (MCD) is a systemic process not amenable to surgical treatment other than lymph node biopsy for diagnosis. In unicentric Castleman's disease (UCD), surgical excision is curative. We reviewed our experience with UCD of the abdominopelvic region, which typically presents with symptoms of pain or obstruction, or is identified incidentally on imaging studies. There are two histologic subtypes of Castleman's disease: the hyaline vascular (HV) variant and the plasmacytoid (PC) variant. Castleman's disease has been closely associated with both HIV and HHV8.

Objective
To review our experience with this rare tumor and to identify features of abdomino-pelvic UCD in patients who may present to general surgeons.

Methods
A 20 year, retrospective, single-center review of all patients who underwent surgery for abdominopelvic UCD was performed at our academic medical center. We reviewed patient clinical records, pathology reports, operative reports, laboratory studies, and imaging studies. Three to five years of patient follow-up was available on all patients except one patient who was lost to follow-up.

Results
Over the 20 year period 28 patients were identified with Castleman's disease. Nineteen patients presented with unicentric disease and nine presented with multicentric disease. The focus of this report are the nine patients who underwent surgery for abdominopelvic UCD. The mean age of these nine patients was 48 years, ranging from 28-75 years. Six patients were female and three were male. Three patients presented with abdominal pain and one presented with back pain, the other five patients were identified with an incidental mass on CT imaging. A pre-op percutaneous needle biopsy was performed for two patients. The disease presented as intra-abdominal in 5 patients, retroperitoneal in 2 patients, and pelvic in 2 patients. No extranodal organ involvement was observed in any patient. Tumor size ranged from 1.5 cm to 10 cm. The pathologic subtype was confirmed in seven patients; the HV variant was identified in four patients and the PC variant in three patients. The only surgical complication following open abdominal resection was a seroma. At three year follow-up eight patients were found to be disease free (DF) and at five year follow-up seven patients were DF. Two patients who underwent viral testing were negative for HIV and HHV8.

Conclusion
Abdominopelvic UCD is an uncommon tumor which may present with abdominal pain or be identified as an incidental finding. In contrast, MCD is a distinct disease with systemic clinical manifestations. However, the role of surgery in MCD is primarily diagnostic while surgical resection is considered curative in UCD.

ABSTRACT #24
Surgical Potpourri III
8:40am-8:50am

QUANTIFYING SHORT-TERM MORBIDITY FOLLOWING TOTAL PANCREATECCTOMY AND AUTO-ISLET TRANSPLANTATION; A NATIONAL SURGICAL OUTCOMES REVIEW.

Victor R. Vakayil MBBS, MS, Keaton Joppru, Barite Gutama, Melena D. Bellin MD, Gregory J. Beilman MD, James V Harmon MD, Ph.D., FACS
University of Minnesota

Background
Total pancreatectomy with auto-islet transplantation (TPIAT) is a surgical option for patients with severe chronic and recurrent pancreatitis. The University of Minnesota (UMN) is a pioneer in the field, performing the first TPIAT in 1977. The UMN remains the largest TPIAT center in the world with over 650 TPIAT procedures completed to date. The complication rates for TPIAT at the UMN were last reported in 2015. National data on postoperative complication rates and patient outcomes are limited and vary widely.

Objective
We sought to quantify short-term mortality and morbidity rates following TPIAT using a national surgical outcomes database and to identify independent pre-operative predictors of post-surgical infectious complications (PSIC).

Methods
American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) was designed to improve the quality of patient care. We reviewed the ACS NSQIP database from 2005-2015 to identify all patients who underwent a TPIAT. Patients with malignant disease were excluded from the analysis. Patient demographics, pre-operative co-morbidities, laboratory variables, post-operative 30-day mortality, and overall morbidity outcomes were evaluated. PSIC was defined as composite categorical outcome that included superficial, deep and organ space infections, pneumonias, urinary tract infections and post-operative sepsis and shock. Univariate analysis followed by multivariate logistic regression was performed to identify independent predictors of PSIC.

Results
A total of 384 patients met our inclusion criteria, with a mean age of 41.7 ± 12.7; predominantly female (70.3%) and Caucasian (81.3%). Mortality rate at 30 days was 0.8%(N=3) with an overall morbidity rate of 36.2%(N=139). PSIC rate was 28.9%(N=111) whereas superficial and deep surgical site infections rates were 6.5%(N=25) and 2.3%(N=9) respectively. Organ space infections, pneumonias, UTI's, sepsis and septic shock rates were 9.1%(N=35), 8.5%(N=33), 5.2%(N=20), 11.5%(N=45%), 1.8%(N=7%), respectively. Post-operative bleeding requiring blood transfusion was present in 27.1% (N=104) of patients. On the univariate analysis, emergency surgery status, increased surgical wound classification, ASA scores ≥2, decreased pre-operative sodium, increased alkaline phosphatase levels and increased intraoperative time was associated with an increased PSIC rate. On the multivariate model, increased operative time was independently associated with an increased risk of developing a PSIC (OR: 1.02, 95% CI 1.01- 1.04, Hosmer-Lemeshow P= 0.7).

Conclusion
TPIAT is a surgical option for patients with chronic and recurrent pancreatitis associated with low 30-day mortality but significant postoperative morbidity. Post-operative bleeding, sepsis and organ space infection contribute significantly to postoperative morbidity. Increased operative time was independently associated with the risk of PSIC. The UMN is searching for innovative ways to decrease operative times and improve patient outcomes.

ABSTRACT #25
Surgical Potpourri III
8:50am-9:00am

BIONOTE E NOSE TECHNOLOGY MAY REDUCE FALSE POSITIVE IN LUNG CANCER SCREENING PROGRAMMES

Raffaele Roccoa, Raffaele Antonelli Incalzib, Giorgio Pennazzac, Marco Santonicoc, Claudio Pedoneb,
Mayo Clinic

Background
The 20% reduction in lung cancer-specific mortality reported by the investigators of the National Lung Screening Trial has sparked renewed interest for the use of low-dose computed tomography (LDCT) in the screening of populations at high risk for developing lung cancer. Despite this, hindrances such as radiation exposure, economic costs, and the occurrence of false-positive results leading to unnecessary invasive diagnostic procedures and the reported over-diagnosis of slow-growing (indolent) tumors do exist. It has been postulated that the assessment of volatile organic compounds (VOCs) in the exhaled breath can be used as a diagnostic tool for lung cancer so as to reduce false positives resulting from LDCT screening.

Objective
Breath composition may be suggestive of different conditions. E-nose technology has been used to profile volatile organic compounds (VOCs) pattern in the breath of patients compared with that of healthy individuals. BIOsensor-based multisensorial system for mimicking NOse, Tongue and Eyes (BIONOTE) technology differs from Cyranose® based on a set of separate transduction features. On the basis of our previously published experience, we investigated the discriminating ability of BIONOTE in a high-risk population enrolled in a
lung cancer screening program.

Methods
One hundred individuals were selected for BIONOTE based on the attribution to the high-risk category (i.e. age, smoking status, chronic obstructive pulmonary disease status) of the University Campus Bio-Medico lung screening programme. We used a measure chain consisting of (i) a device named Pneumopipe (EU patent: EP2641537 (A1):2013-09-25) able to catch exhaled breath by an
individual normally breathing into it and collect the exhalate onto an adsorbing cartridge; (ii) an apparatus for thermal desorption of the cartridge into the sensors chamber and (iii) a gas sensor array which is part of a sensorial platform named BIONOTE for the VOCs mixture
analysis. Partial least square (PLS) has been used to build up the model, with Leave-One-Out cross-validation criterion. Each breath fingerprint
analysis costs €10.

Results
The overall sensitivity and specificity were 86 and 95%, respectively, delineating a substantial difference between patients and healthy individuals.

Conclusion
Our preliminary data show that BIONOTE technology may be used to reduce false-positive rates resulting from lung cancer screening with low-dose computed tomography in a cost-effective fashion. The model will be tested on a larger number of patients to confirm the reliability of these results.

ABSTRACT #26
CoC Paper Competition

IMPACT OF PATIENT'S PRIMARY LANGUAGE ON STAGE OF CANCER AT DIAGNOSIS

Mariya E. Skube, Bruce Alexander, Greg J. Beilman, Todd M. Tuttle
University of Minnesota

Background
Patients with limited English proficiency have been identified to have worse health outcomes and care utilization patterns compared to their English-speaking counterparts. Cancer screening rates have also been shown to be lower in non-English-speaking patients. Previous studies have demonstrated that demographic characteristics such as race and socioeconomic characteristics can lead to delayed cancer diagnosis however the influence of preferred language has not been well studied.

Objective
The objective of this study was to investigate if a patient's primary language impacts the stage of cancer at the time of diagnosis.

Methods
A retrospective review of the Minnesota Cancer Surveillance System's database was conducted with incorporation of language data from an integrated health system's data repository. Adult patients with cancer of the breast, colon and rectum, female genital system, male genital system, or respiratory system were included, and cancer stage at the time of diagnosis was grouped as early (stages 0-2) or advanced (stages 3-4). Stage comparisons were made using chi square test of independence between English and non-English language (NEL) patients, and a multiple logistic regression model was created to assess other potential predictor variables of cancer stage.

Results
From a cohort of 13,245 cancer patients spanning the years 1991-2017, 311 (2.3%) were NEL. Thirty-one unique non-English languages were represented with the most common languages being Spanish (n=60), Russian (n=44), and Vietnamese (n=37). Thirty-six percent of NEL individuals were diagnosed at an advanced stage compared to 25.8% of English speakers (p

Conclusion
NEL patients are at risk of being diagnosed with cancer at a more advanced stage compared to English speakers, which can impact disease prognosis. The NEL population warrants unique attention when it comes to cancer detection initiatives, and further study is warranted to delineate associated and contributing factors.

ABSTRACT #27
CoC Paper Competition

GENERATION OF A VALIDATED PSC-DERIVED CHOLANGIOCARCINOMA PDX MODEL AND CELL LINE

Matthew C Hernandez MD, Jennifer L Leiting MD, Steven Bronk, Lin Yang Phd, Tommy Ivanics MD, John R Bergquist MD, Rondell Graham MBBS, Stephen Murphy PhD, George Vasmatzis PhD, Gregory Gores MD, Mark J Truty MD MSc
Mayo Clinic Rochester

Background Cholangiocarcinoma (CCA) represents a rare but difficult to diagnose tumor with few treatment options. There is significant biologic heterogeneity and its origin (intrahepatic, hilar, or distal) is associated with several clinical, molecular, and prognostic factors. Primary sclerosing cholangitis (PSC) is an idiopathic cholangiopathy characterized by cholestasis, chronic inflammation, and progressive fibrosis of the biliary tree. This milieu can result in the transformation of normal cholangiocytes into CCA. Few CCA cell lines exist that are derived from patients with PSC, therein limiting our understanding of effective anti-tumor therapies. Patient-derived xenografts (PDX) allow for amplification of primary patient tissue in immunodeficient mice. PDX models have been shown to correlate highly with patient oncology phenotype and subsequent clinical outcomes.

Objective In order to further understand the biology of PSC related CCA and estimate the value of modern or novel therapeutics, we aimed to establish and verify a CCA PDX model and subsequently generate a corresponding cell line derived from a patient with PSC associated cholangiocarcinoma.

Methods With informed consent and institutional approval, an operative liver biopsy specimen from a 36 year old male with PSC was engrafted into immunodeficient mice, passed into multiple generations and subsequent PDX derived tissue was digested and seeded onto a 2D cell culture flask within complete media. PDX metrics were calculated (individual, overall and generational engraftment efficiency (IPEE, OPEE, GEE)) as well as time to tumor formation and harvest (TTF, TTH). The cell line was propagated (>50 passages) and a stable cell line was named PAX 42. Authentication of patient, PDX, and the cell line was performed using immunohistochemistry (CK7, 19, EPCAM), immunoblot with comparison to known cholangiocarcinoma cell lines (HUCCT-1) for (CK7/19, EPCAM, α-SMA, HNF4α), 2D/3D cell culture systems, anchorage-independent growth, next generation matepair DNA/RNA sequencing, and generation of cell based ortho/heterotopic indirect xenografts.

Results The PDX tumor successfully grew in multiple generations. The PDX metrics are seen in Figure. Notably, as a biopsy derived xenograft, the tumor demonstrated high engraftment in both initial implantations as well as in subsequent generations. Further, the PDX model accurately recapitulated patient histomorphologic features. PDX tissue was subsequently digested and immortalized as a cell line. Immunoblot revealed strong bands for cytokeratins 9 and 19 as well as HNF 4alpha, Figure. There was no expression of smooth muscle actin which confirmed the lack of fibroblast growth. Immunohistochemistry (CK 7, 19,) demonstrated similarity between the patient, original PDX model, cell line, and indirect heterotopic as well as orthotopic (liver) PDX model. Soft agar assay demonstrated anchorage independent cellular growth as well as in hanging drop cell culture systems, Figure. Compared to HuCCT-1, a well-established cholangiocarcinoma cell line, there were similar cellular growth rates at 48 hours.

Conclusion We have generated and validated a PDX model derived from a patient with PSC associated CCA. This model was similar to the patient and has been propagated into several generations with subsequent amplification of patient tissue. We also have generated a stable and contemporary cell line derived from PDX tissue. Cell growth and CCA markers were similar to the well validated Hucct-1 CCA cell line. Heterotopic and orthotopic (liver) engraftment of the cell line further demonstrated similarity to the patient and original PDX which is a sine qua non for cell line validation. The combination of a new PDX and corresponding cell line demonstrates translational importance to understanding oncologic mechanisms as well as therapeutic sensitivities PSC associated CCA. It recapitulates histopathologic and molecular characteristics specific to CCA, demonstrates reliable growth in 2D, 3D, and PDX formats, and displays unique functional sensitivities to modern and targeted therapies. The PAX 42 cell line will continue to support ongoing research assessing the biologic function of CCA in order to determine additional actionable therapeutic targets.

ABSTRACT #28
CoC Paper Competition

NEOADJUVANT CHEMOTHERAPY FOR BORDERLINE AND RESECTABLE PANCREATIC ADENOCARCINOMA: SINGLE AGENT GEMCITABINE MAY NOT BE INFERIOR TO MULTI-AGENT CHEMOTHERAPY

Scott Kizy, Ariella M Altman, Schelomo Marmor, Jane Hui, Todd Tuttle, Jason Denbo, Eric H Jensen
University of Minnesota

Background
Neoadjuvant chemoradiation for borderline resectable (BR) and resectable (RES) pancreas cancer has become widely utilized.

Objective
We determined the outcomes for patients who receive neoadjuvant chemotherapy alone for borderline and resectable pancreas cancers.

Methods
Using our institution's pancreas cancer registry, we identified patients who received neoadjuvant chemotherapy for RES and BR pancreas cancer between 2010 and 2017. RES cancers had no radiographic evidence of vascular involvement nor distant metastases. BR was defined per NCCN guidelines. Patients were excluded if they received chemoradiation, or were lost to follow-up. Patients received either Gemcitabine alone or multi-agent chemotherapy (Gemcitabine and Abraxane, or 5FU/Oxaliplatin/leucovorin/irinotecan (FOLFIRINOX)) and analyzed in an intention-to-treat analysis.

Results
We identified 73 patients with RES and BR pancreas cancer who received neoadjuvant chemotherapy. There were no differences in baseline characteristics between groups (Table 1). 50.7% received single agent Gemcitabine and 49.3% received multi-agent chemotherapy (Gemcitabine/Abraxane (27.4%) and FOLFIRINOX (21.9%)).45 patients (61.6%) underwent therapeutic resection. None of the initially RES cases had radiologic progression of disease. 5 patients with BR on multi-agent chemotherapy had local progression while 0 patients in the gemcitabine group did (p=0.03). No other differences in progression were identified between groups. Poor performance status precluded surgery in 7 cases. (Table 1). R0 resection was achieved in 93.3% of cases. Median overall survival for patients treated with neoadjuvant Gemcitabine was 29.9 months compared to 23.5 months for those treated with multi-agent chemotherapy (p=0.66).

Conclusion
Progression of RES pancreas cancer is rare during neoadjuvant chemotherapy. Single agent Gemcitabine may not be inferior to multi-agent chemotherapy.

ABSTRACT #29
CoC Paper Competition

CONTRALATERAL AXILLARY METASTASES: STAGE IV DISEASE OR A LOCOREGIONAL EVENT?

James W. Jakub, Swadha D. Guru, Elizabeth Yan
Mayo Clinic

Background
Contralateral axillary metastasis (CAM) in breast cancer is currently treated as stage IV disease. We hypothesize that this disease pattern most likely represents direct lymphatic spread due to aberrant drainage and is expected to behave more similar to advanced locoregional disease.

Objective
To investigate our institutional experience and describe clinical outcomes for breast cancer patients presenting with CAM.

Methods
Single site, retrospective chart review of adult female patients with biopsy proven CAM from 2008-2017 was conducted. Patients with a breast tumor ipsilateral to CAM were excluded. Tumor and treatment variables for the primary tumor, and oncologic outcomes after CAM was diagnosed were evaluated. A descriptive analysis was performed.

Results
Of the 23 patients with CAM who met inclusion criteria, 10 (43.5%) were identified on routine breast screening, 6 (26.1%) on systemic imaging, 6 (26.1%) via sentinel lymph node biopsy (SLNB) and 1 (4.3%) by clinical exam. In patients with metachronous disease, the median time from treatment of the primary tumor and diagnosis of CAM was 56 months with an interquartile range (IQR) of 26-144.
Treatment for the CAM included axillary lymph node dissection (ALND) in 15 (65.2%), SLNB followed by ALND in 4 (17.4%), SLNB alone in 3 (13%) and excisional biopsy in 1 (4.3%). For those who underwent an ALND, the median number of total lymph nodes harvested was 26 (IQR:19-34). For the entire cohort the median number of positive nodes was 2.5 (IQR:1-10) and the size of the CAM metastasis was known for 15 (83.33%) of these patients; median value of 14mm (IQR:5-22) and 9 (56.3%) patients were found to have extranodal extension. 12 (57.1%) patients received adjuvant radiotherapy to the side of the CAM; 3 (25%) axillary radiation alone, 6 (50%) had the ipsilateral chest wall included in the field and 3 (25%) patients received ipsilateral whole breast radiation. 10 (43.5%) patients underwent chemotherapy, 6 (26.1%) underwent combined endocrine and chemotherapy, 3 (13%) received endocrine therapy alone while 4 (17.4%) patients were observed without systemic therapy.
16 (69.6%) patients recurred after treatment of CAM, with a median recurrence free interval of 11 months (IQR:5-21). 13 (56.5%) patients developed distant metastases after they underwent surgery for CAM with a median distant metastases free survival of 12 months (IQR:6-19). On the date of last follow up, 8 (34.8%) patients were alive with no evidence of disease, 7 (30.4%) were alive with disease progression and 8 (34.8%) were dead. The median overall survival was 30.5 months (IQR:20-58).

Conclusion
Development of CAM is associated with prior surgery and/or radiation to the breast. The short disease free interval and high progression to additional stage IV disease suggests these patients behave similar to traditional stage IV patients. Ours is one of the largest studies in the literature; unfortunately, the sample size still prohibits definitive conclusions.

ABSTRACT #30
CoC Paper Competition

MTH1 INHIBITION AS A PHENOTYPIC LETHAL TARGET IN PANCREATIC CANCER

Matthew C Hernandez MD, John R Bergquist MD, Jennifer L Leiting MD, Lin Yang PhD, Mark J Truty MD
Mayo Clinic Rochester

Background
Chemoresistance and development of metastases in pancreatic cancer (PDAC) are hallmarks of this malignancy and portends poor clinical outcomes. PDAC is characterized by significant fibrosis resulting in a hypoxic environment that increases cellular oxidative stress. An antioxidant enzyme, MTH1, is upregulated in several cancers and these cancers require increased MTH1 activity to avoid incorporation of oxidized dNTPs, resulting in DNA damage and cell death. Novel MTH1 inhibitors (phenotypic lethal) have been developed in order take advantage of the non-oncogene addiction concept for anticancer treatment and cause incorporation of oxidized dNTPs in cancer cells, leading to DNA damage, cytotoxicity and therapeutic response.

Objective
We utilized an immunohistochemistry screen to ascertain the functional MTH1 status of both patient and patient-derived xenograft PDAC tissue hypothesizing that (1) patients with high MTH1 expression would demonstrate worse overall survival and (2) that MTH1 expression would correlate with sensitivity to a novel MTH1 enzyme inhibitor.

Methods
With informed consent and institutional approval, a prospective gastrointestinal malignancy patient-derived xenograft (PDX) catalog, cryopreserved biobank, and clinical database is maintained. During 2013-2017, patients with pathologically confirmed PDAC (untreated or neoadjuvant) were implanted into immunodeficient mice from surgically resected cancerous tissue. Patient/PDX MTH1 enzyme status was assessed using immunohistochemistry (IHC) and immunoblot. PDAC tissue from engrafted PDX models was digested; cells were seeded onto 96 well plates and cultured in complete media. Increasing concentrations of a novel MTH1 inhibitor were administered. Cell viability was assessed using Prestoblue dye and a cell plate reader. Cell viability of treated cells was normalized to controls. Kaplan-Meier survival analysis with hazard ratios and 95% confidence intervals were determined.

Results
For this specific study 62 successful PDX engraftments (untreated n=24 and neoadjuvant n=38) were assessed. IHC for MTH1 enzyme demonstrated variable expression in patients untreated or receiving neoadjuvant therapy. Kaplan-Meier analysis demonstrated reduced survival in patients with high MTH1 status (2,3+) compared to low (0,1+) despite treatment status, Figure. In patients with high MTH1 expression, median survival time was diminished compared to low expressers, 26.7 [20.7-32.1] vs 38 [31-45] months, p=0.01. Patients with high MTH1 expression demonstrated a hazard ratio of 2.9 95%CI (1.3-6.1). In selected models, MTH1 inhibition correlated well with degree of expression. PDX models with high expression demonstrated sensitivity to inhibition whereas cells derived from models with low expression resulted in increased cellular viability, Figure.

Conclusion
PDAC represents a lethal cancer type with few treatment options for patients with chemoresistant or metastatic disease. We revealed that patients with high MTH1 expression as determined on IHC and immunoblot were associated with diminished overall survival compared to those with low MTH1 expression. In several models of PDAC (untreated and neoadjuvant) we demonstrate that MTH1 expression appears to correlate with sensitivity to a novel inhibitor. These data will be utilized to enrich for in vivo trial with this MTH1 inhibitor utilizing PDX models.

ABSTRACT #31
CoC Paper Competition

ADJUVANT CHEMOTHERAPY FOR INTRAHEPATIC CHOLANGIOCARCINOMA: APPROACHING CLINICAL PRACTICE CONSENSUS?

Ariella M. Altman, Scott Kizy, Schelomo Marmor, Adam Sheka, Jane Y.C. Hui, Todd M. Tuttle, Eric H. Jensen, Jason W. Denbo
University of Minnesota

Background
No randomized trial exists defining the role of adjuvant chemotherapy in patients with resected intrahepatic cholangiocarcinoma (ICC). Retrospective studies suggest adjuvant chemotherapy may improve survival for select patients, yet treatment guidelines remain poorly defined.

Objective
We sought to describe the utilization and role of adjuvant chemotherapy in patients with resected ICC.

Methods
An augmented version of the SEER database was used to identify patients with resected ICC from 2000-2014. Patients with metastatic disease or those who received chemoradiation as first-line therapy were excluded. Patients were grouped by date of diagnosis (2000-2004, 2005-2009, 2010-2014), T, and N stage. Multivariable logistic regression models were utilized to identify predictors of chemotherapy use for each of the time-periods. Kaplan-Meier curves and Cox proportional hazard models were used to identify survival trends.

Results
We identified 1,223 patients who underwent surgical resection for ICC - 194 diagnosed from 2000-2004, 379 from 2005-2009, and 650 from 2010-2014. Patient, tumor, and treatment characteristics were similar between groups. However, the use of chemotherapy increased over time, from 33% to 37% to 41% in each respective time period, (p .05). Receipt of chemotherapy increased in lymph node positive patients (32% in 2000-2004, 57% in 2005-2009, and 60% in 2010-2014; p .05) and patients with T3/T4 tumors (40% in 2005-2009 to 60% in 2010-2014; p≤.01) over time, but not in patients with lymph node negative or T1/T2 disease (Figure 1).

No predictors were identified upon evaluation of factors associated with chemotherapy use from 2000-2004. However, from 2005-2009, lymph node positivity was significantly associated with increased chemotherapy use, while increasing age and male sex were associated with decreased use (p .05). From 2010-2014, significant predictors of chemotherapy use were lymph node positivity and T3/T4 tumors, while increasing age and male sex were associated with decreased use (p .05). Median overall survival across the three periods (2000-2004, 2005-2009, and 2010-2014) was 32, 32, and 41 months, respectively (p=0.06). After adjusting for patient factors, chemotherapy use was significantly associated with a decreased hazard ratio of death among lymph node positive patients (p .05, Table 1). Stage T3/T4 disease was associated with a significantly increased hazard ratio of death. (p≤0.05, Table 1).

Conclusion
The use of chemotherapy in patients with surgically resected ICC has evolved over the last 15 years. The majority of patients with T3/4 tumors or node-positive disease are now receiving chemotherapy. Increased utilization of chemotherapy in patients with advanced T stage and lymph node positive disease, may in part explain the improvements seen in overall survival for surgically resected ICC.