Association of Anesthesia Clinical Directors

Perioperative Leadership Summit

Abstract Competition

Association of Anesthesia
Clinical Directors
3757 Indianola Ave. * Columbus, OH 43214
614/784-9772 * www.aacdhq.org

ABSTRACT COMPETITION LIST

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FRIDAY, March 25, 2022

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2. Richard Urman – *"Patient Falls in the Operating Room Setting: An Analysis of Reported Safety Events"*

3. Kimberly Cantees - *"Surgical Scheduling in a Constrained Labor Environment: Part 1"*

4. Kimberly Cantees - *"Surgical Scheduling in a Constrained Labor Environment: Part 2"*

5. Kyle Ringenberg – *"Evolution of OR Management with Decreased Hospital Staffing and Increased Hospital Census Secondary to COVID Inpatients, with Pressure to Move Ambulatory Cases Away from Tertiary Care Center"*

Saturday, March 26, 2022

1. Christopher J. Goldstein – *"Leveraging Perioperative Artificial Intelligence (AI) Safely: Teaching Resident Physicians to Become Anesthesiologists-in-the-Loop (AITL)"*

2. Adrian Berg - *"Cost Analysis of Surgical Clipping and Endovascular Coiling for the Treatment of Unruptured Intracranial Aneurysm at the University of Vermont Medical Center"*

3. Erik J. Zhang – *"Comparative Analysis of Performance Frontiers in Operating Room Management"*

4. Kimberly Cantees - *"Actual Versus Estimated Anesthetizing: Forecasting Pitfalls"*

5. David Nelson – *"Length of Stay and Cost of Care Differences Between Post-Surgical Patients Who Board in PACU and Those that Proceed Directly to Inpatient Bed"*

MULTIDISCIPLINARY THREE PRONG APPROACH TO HIGH COST MEDICATION MANAGEMENT WITHOUT COMPROMISING PATIENT SAFETY

Keith A. Andrews, DO CA-2 Anesthesia Resident; Heather D. McFarland, DO System Director Anesthesia Value Network, Director of the Operating Room; Indrani Kar, Pharm D Drug Policy/ Formulary Coordinator System Pharmacy Services; David M. Bonnet, MD, MBA Chief Medical Officer High Reliability Medicine; Francis T. Lytle, MD Director Cardiothoracic ICU, Associate Chief Medical Officer

University Hospitals Cleveland Medical Center Cleveland, Ohio

Introduction:

The Operating Room (OR) has a long history of being a revenue producer and as well as an expenditure for hospital systems, thus driving pharmacy, OR management, and administration to look at drug usage and cost under a microscope. As our drug utilization and cost are looked at by pharmacy there needs to be a checks and balance between formulary and stewardship. We wanted to design a process inclusive of departments that use a drug as well as a continuing process to educate and audit. We hypothesized that with a three prong approach: updating drug usage guidelines, education, and accountability we could decrease the use of a high cost medication.

Methods:

During pharmacy drug utilization review it was found that the sugammadex cost for our health system was over $3 million. Table 1 shows our service line analytics which breaks down each hospital in the system and compares us to our peers. We were able to ascertain that we were above our peers in usage from our academic center to our community hospitals. We as a Department of Anesthesia were approached with this information and were tasked with decreasing the expenditure associated with the use of sugammadex. Our team began discussing a multidisciplinary three prong approach to this problem to become better stewards of a high cost medication. The first prong included updating our guidelines. Our pharmacy, ICU, and anesthesia team reviewed previous guidelines and updated by utilizing clinical indications for sugammadex. We focused on two main categories for updating, inpatient and outpatient. Our focus for outpatients was related to length of surgery as to not impede upon discharge times and efficiency. For inpatients we focused on the comorbidities that would benefit from sugammadex and limited the use for others. This allowed us to incorporate functional and proper indications for the use of sugammadex in the OR without compromising patient safety. We then developed education for these guidelines to include our disciplines and locations. This group was comprised of the ICUs, Anesthesia, and nursing which were made up of residents, advance practice providers, anesthetist, and faculty. Our final prong will include audits and feedback after the data has been collected.

Results:

We rolled out our multidisciplinary three prong approach in August of 2021. As you see in Table 1 our overall sugammadex cost for the health system surpassed $3 million. In Table 2 you will see our utilization over one year, you can see the decrease in sugammadex usage and increase in neostigmine usage as implementatioin occurred. Even with this significant decrease in usage and cost savings we did not see an increase in outpatient discharge times or adverse respiratory events. Our total savings over the three months was $155,077, actualized over 12 months is a savings of $1.8 million.

Conclusion:

Through this work we have shown that it is possible to work tcollaboratively with multidisciplinary groups across a health system to make a practice change. Anesthesia, ICU, Pharmacy, and Nursing developed a three pronged approach to making this change without removing medication from our omnicells or removing it from formulary. As we continue to work to improve value for our patients this will be a process that should be repeated.

Table 1:

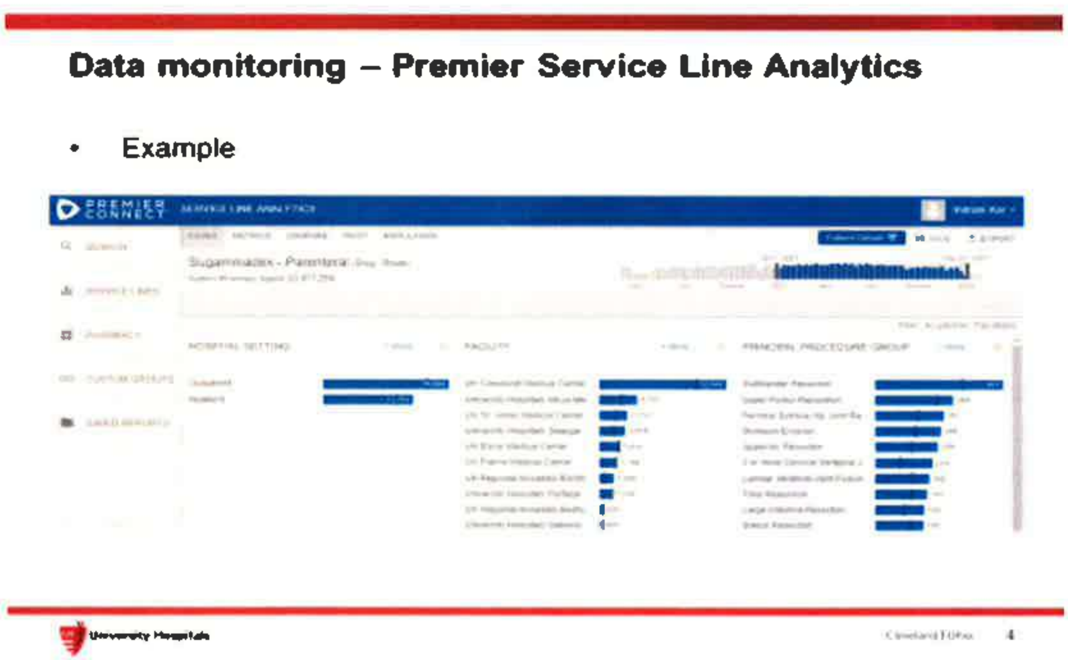
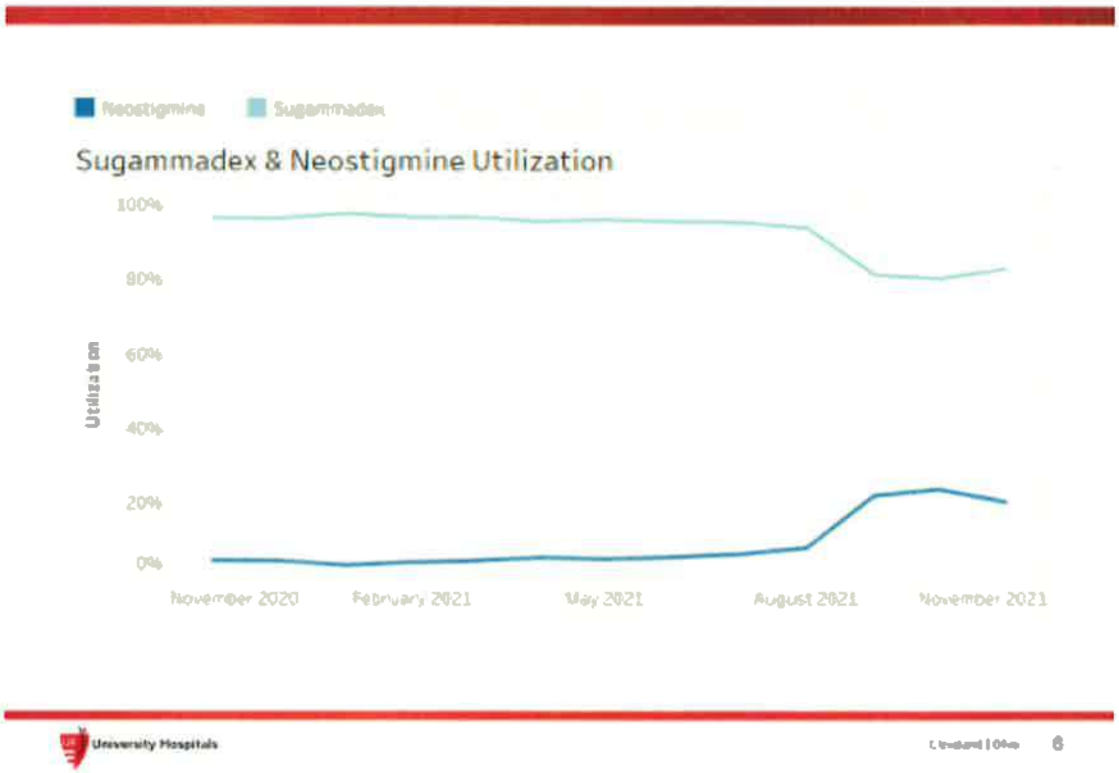


Table 2:


Neostigmine
Sugammadex
Sugammadex & Neostigmine Utilization
100%
80%
60%
40%
20%
0%
Utilization
November 2020
February 2021
May 2021
August 2021
November 2021
University Hospitals
6

Title: PATIENT FALLS IN THE OPERATING ROOM SETTING: AN ANALYSIS OF REPORTED SAFETY EVENTS

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Introduction:

Patient falls are a preventable public health problem, and they are among the most reported safety incidents in the hospital.[1,2] Data continues to emerge about the importance of falls before, during, and after surgery.[3,4] However, perioperative falls still have not been vigorously studied. We used a hospital safety reporting system to examine the nature of reported falls in the perioperative setting at an academic tertiary center. This program worked to improve patient safety and improve perioperative patient outcomes by identifying common causes of falls and exploring strategies to prevent and reduce falls in the perioperative setting.

Methods:

In this retrospective study, reports of perioperative safety events listed as "Falls" between 2014 and 2020 were analyzed for severity level and specific event type at a tertiary care academic center.

Results:

Out of a total of 8,337 safety reports from 2014-2020, 86 were "fall" related (1%). The most reported "fall" event types were "ambulating with assistance" (12.8%, 11/86), followed by "ambulating without assistance" (11.6%, 10/86), "unwitnessed/reported" (10.5%, 9/86), and from exam/operating table (9.3%, 8/86). The most commonly reported severity level was level 1 (no harm, did reach patient, 63%) followed by level 2 (temporary or minor harm, 28%). There was one reported level 3 event - permanent or major harm. There were no level 4 events (i.e., death) reported.

Discussion:

Our study demonstrated the most common causes of fall to include ambulating with or without assistance (24.4%, 21/86), out of bed or stretcher (12.8%, 11/86), unwitnessed/reported (10.5%, 9/86), and falls from the OR/ exam table (9.3%, 8/86). All falls by ambulating with assistance caused no harm, while 50% of falls by ambulating without assistance led to Level 2 harm (temporary or minor harm). Notably, "unwitnessed/ unreported" falls caused the most severe (Level 3) harm. These suggest the importance of supervision in preventing serious falls. It is also apparent that the bed is a major factor for falls, causing 20%-70% of falls at other institutions.[5] Although we do take measures to keep patients safe by asking them to stay in bed until assistance arrives, patients sometimes heed this warning due to confusion, residual anesthetic in the postoperative recovery unit.[6] Patients in the pre-operative and post recovery unit often occupy stretchers which don't have bed alarms. Yet, a study in 2018 found bed/chair alarm to be an effective way to prevent falls.[7] Perhaps risk stratification can be done in the preoperative clinic to identify patients who may benefit from a bed alarm. Another consideration would be monitoring compliance for keeping beds at low positions to minimize fall risk. Interestingly, a study in 2013 showed that acute surgical inpatient beds were kept in an elevated position about 80 minutes per day.[8] Falls from OR tables can be detrimental.[9] At our institution, causes of operating table falls included extreme positioning, insufficient use of safety restraints, and bed control malfunction. Certain risk factors for OR related falls can be anticipated such as increased risk during induction and emergence, patients with obesity, and extreme positioning such as Trendelenburg and side tilt and protocols.[9] Our institution enforces protocols to minimize these risks including at least two OR staff to be next to the patient during emergence of anesthesia in addition to transferring patient to stretcher/inpatient bed (when deemed safe) prior to emergence.

Conclusion: Our safety data reporting system identified falls as a safety event that causes patient harm in the perioperative setting that could be preventable with a multifaceted inter-disciplinary approach.[10] Risk managers can use this data to implement strategies to reduce falls such as creating screening protocols to identify high risk patients, educating and training healthcare personnel, and optimizing operating room, hospital, and equipment design.

Table 1: Severity Level of Reports in Fall Category

Severity, % (No.)	2014	2015	2016	2017	2018	2019	2020
Level 0	0.0 (0/5)	0.0 (0/10)	10 (2/20)	18.2 (2/11)	9.1 (1/11)	8.3 (1/12)	5.9 (1/17)
Level 1	60.0 (3/5)	60.0 (6/10)	65 (13/20)	54.5 (6/11)	63.6 (7/11)	41.7 (6/12)	76.5 (13/17)
Level 2	20.0 (1/5)	40.0 (4/10)	25 (5/20)	27.3 (3/11)	27.3 (3/11)	50.0 (5/12)	17.6 (3/17)
Level 3	20.0 (1/5)	0.0 (0/10)	0.0 (0/20)	0.0 (0/11)	0.0 (0/11)	0.0 (0/12)	0.0 (0/17)
Level 4	0.0 (0/5)	0.0 (0/10)	0.0 (0/20)	0.0 (0/11)	0.0 (0/11)	0.0 (0/12)	0.0 (0/17)

Table 2: Specific Event Type Rate Reported in Fall Category

Specific Event Type, % (No.)	2014	2015	2016	2017	2018	2019	2020
Unwitnessed/ Reported	20.0 (1/5)	20.0 (2/10)	15.0 (3/20)	27.3 (3/11)	0.0 (0/11)	0.0 (0/12)	0.0 (0/17)
Assisted to Floor by Employee	40.0 (2/5)	0.0 (0/10)	0.0 (0/20)	18.2 (2/11)	18.2 (2/11)	0.0 (0/12)	0.0 (0/17)

Fainted/Seizure Related	0.0 (0/5)	10.0 (1/10)	5.0 (1/20)	0.0 (0/11)	0.0 (0/11)	0.0 (0/12)	5.9 (1/17)
From Bed	20.0 (1/5)	10.0 (1/10)	10.0 (2/20)	0.0 (0/11)	0.0 (0/11)	0.0 (0/12)	5.9 (1/17)
From Chair/Gerichair	20.0 (1/5)	0.0 (0/10)	10.0 (2/20)	9.1 (1/11)	0.0 (0/11)	8.3 (1/12)	11.8 (2/17)
From Stretcher	0.0 (0/5)	10.0 (1/10)	5.0 (1/20)	9.1 (1/11)	0.0 (0/11)	16.7 (2/12)	5.9 (1/17)
Ambulating With Assistance	0.0 (0/5)	30.0 (3/10)	10.0 (2/20)	9.1 (1/11)	27.3 (3/11)	8.3 (1/12)	5.9 (1/17)
Ambulating Without Assistance	0.0 (0/5)	0.0 (0/10)	10.0 (2/20)	0.0 (0/11)	27.3 (3/11)	25.0 (3/12)	11.8 (2/17)
From Toilet/Commode	0.0 (0/5)	0.0 (0/10)	10.0 (2/20)	9.1 (1/11)	9.1 (1/11)	16.7 (2/12)	5.9 (1/17)
From Wheelchair	0.0 (0/5)	0.0 (0/10)	10.0 (2/20)	0.0 (0/11)	0.0 (0/11)	0.0 (0/12)	0.0 (0/17)
Transferring with Assistance	0.0 (0/5)	0.0 (0/10)	0.0 (0/20)	0.0 (0/11)	0.0 (0/11)	8.3 (1/12)	5.9 (1/17)
Slip/Trip	0.0 (0/5)	0.0 (0/10)	10.0 (2/20)	9.1 (1/11)	0.0 (0/11)	8.3 (1/12)	5.9 (1/17)
From Exam/ Operating Table	0.0 (0/5)	0.0 (0/10)	5.0 (1/20)	9.1 (1/11)	9.1 (1/11)	8.3 (1/12)	23.5 (4/17)
Near miss	0.0 (0/5)	0.0 (0/10)	0.0 (0/20)	0.0 (0/11)	9.1 (1/11)	0.0 (0/12)	0.0 (0/17)
Other	0.0 (0/5)	20.0 (2/10)	0.0 (0/20)	0.0 (0/11)	0.0 (0/11)	0.0 (0/12)	11.8 (2/17)

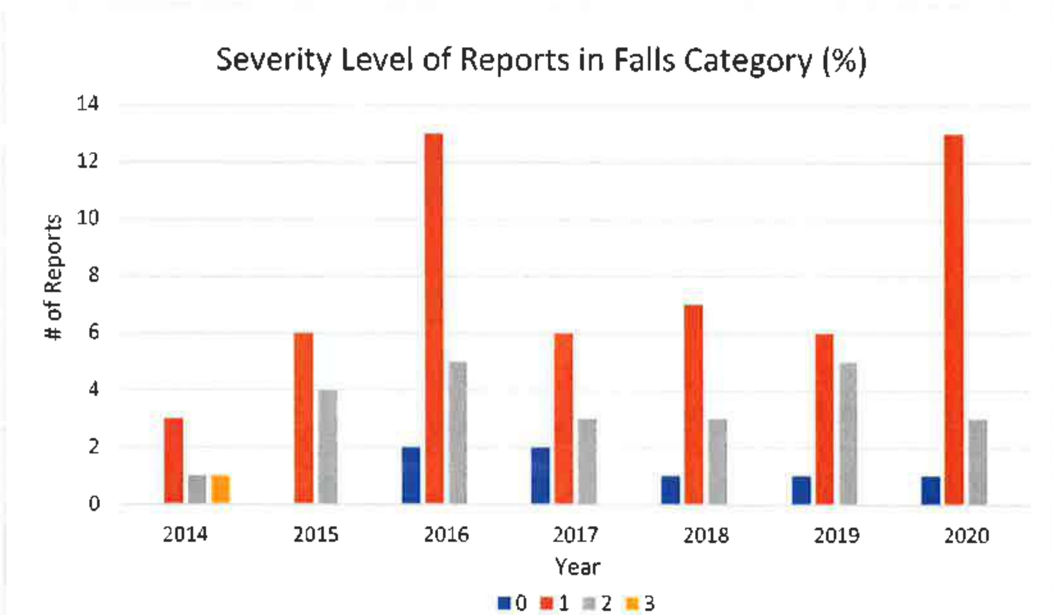

Figure 1. Severity level of reports related to patient falls; category type by % of total falls, by year of report. Severity level: 0 (blue); 1 (red); 2 (gray); 3 (yellow)

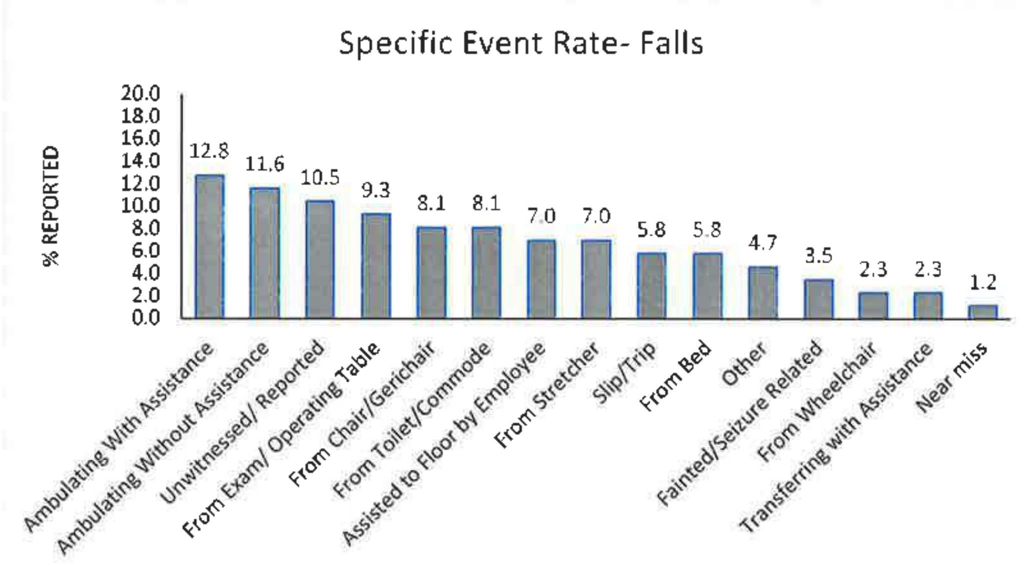

Figure 2. Circumstances surrounding the reported fall as a % of total reported falls.

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SURGICAL SCHEDULING IN A CONSTRAINED LABOR ENVIRONMENT: PART I

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INTRODUCTION:

Statistics from the United States Bureau of Labor Statistics show that 4 million Americans quit their jobs in July 2021. Of these 4 million resignations, 3.6% more health care employees quit their jobs as compared to the previous year, surpassed only by resignations within the tech field at 4.5%. In general, these resignations are higher among employees in fields that had experienced extreme increases in demand due to the pandemic, leading to increased workload and changing roles, leading to burnout. (1)

Labor shortages are impacting all sectors of the economy as we continue to struggle with the logistics of the COVID 19 pandemic. Health care job openings are at historically high levels. Estimated staff shortages in healthcare are at 12.6% since February 2020 with nursing and residential care facilities accounting for about four-fifths of the decline. (2)

Staffing constraints in surgical services because of worker resignation have not yet been as well defined. We will attempt to define our overall rate of staffing shortage due to resignation and the changes in surgical services scheduling that have resulted.

UPMC (University of Pittsburgh Medical Center) Presbyterian Hospital is a quaternary care facility; part of the 40 hospital UPMC Health care system. Over the period from April 2021 to the present we have seen an approximate 30% decrease in OR staffing numbers; both Operating Room RNs (Registered Nurses) and Surgical Technologists.

We found that as our surgical service labor force continued to decrease, we were unable to fulfill our block schedule obligation. Our capacity issues were addressed in six phases over the past 10 months.

METHODS: Descriptive: Our surgical Services Capacity Management Strategy has six phases:

Phase I: May-June 2021: Ad Hoc Phase

1. Surgical block time "released" due to vacation was closed as opposed to offering this this time to the specific surgical service involved.
2. OR availability for surgeries that were less time sensitive was restricted. These cases were moved to other hospitals and ambulatory surgical centers in the UPMC Health care system when possible.
3. Surgical time availability for Surgical services with highly elective surgery (i.e., sports orthopedics procedures, select hand surgery cases, appropriate plastic surgery cases) was decreased. These cases were also moved to other hospitals/ambulatory surgical centers when possible.
4. We attempted to move a small amount of surgical work to the bedside in the intensive care unit.

Phase II: July 2021: Daily active surgical schedule management

1. We began a daily **Surgical Services Capacity Meeting**. Attendees include the Vice President for Operations, UPMC Presbyterian Hospital, Chief Anesthesiologist, UPMC Presbyterian Hospital, as well as the Administrative and Clinical Directors of Surgical Services. These individuals met/meet each day to review staffing and surgical schedule for the next one-two weeks.
2. "Values for care" in surgical cases were identified, i.e., a surgical care mission statement was constructed. UPMC Presbyterian Hospital is a Level 1 Trauma center, a Transplant Center, a major Surgical Oncology center, and Cranial Based Neurosurgical Center within the UPMC Health care center. These cases were prioritized.

Phase III: Oct 2021: Formalized block schedule reduction

1. Block schedule revision #1: reduction of 15% of total block time available from Oct 2020 to October 2021.
2. We continued with daily surgical services meetings to further reduce available block time in addition to block reductions to meet the growing labor shortage through October. We formally changed the deadline for "standard" block scheduling guidelines. Originally standard blocks were released 72 hours prior to the day of surgery. We moved to a five-business day release of block time for standard surgical blocks.

Phase IV: Nov 2021-Jan 2022: Surgical Services capacity constraints combined with significant hospital bed capacity constraints

1. Additional Block Schedule reduction was required to meet continued OR staff attrition. Block schedule Revision #2 included a reduction of additional 10% of surgical block time available, effective Jan 3, 2022.
2. Continued daily review of elective surgery schedule by the surgical services capacity management team with specific attention to patients needing hospital admission following surgery.
3. All surgical services are targeted for block time reduction except those services caring for trauma patients (Acute Care Surgery, Orthopedic Trauma services)

Phase V: Feb 2022-present: System wide Surgical Services Capacity Management Group created

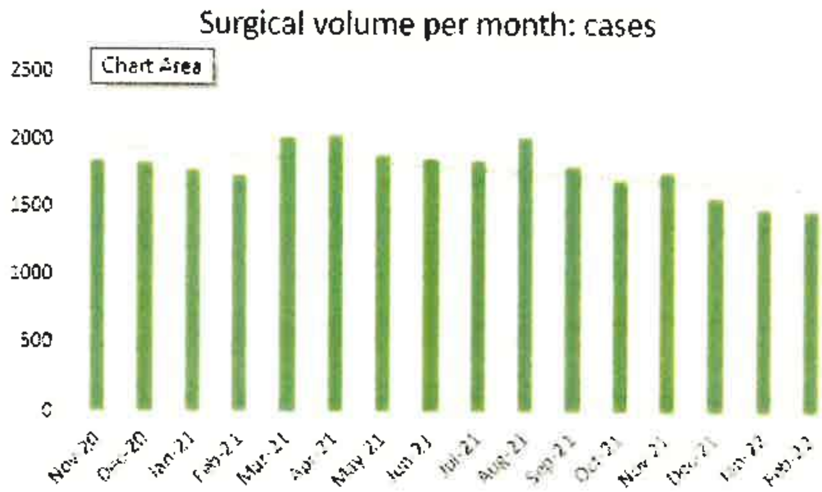
1. The "Surgical Effectiveness Group" is created to oversee surgical capacity across all hospitals in the health care system.
2. Systemwide Surgical Case Prioritization is identified and communicated to all surgical leaders. Prioritization is given to urgent/emergent cases, cancer cases, cardiovascular cases, and neurosurgical cases.
3. Surgical case backlog is identified for each institution and surgical service.
4. System-wide and site-specific efficiency data (first starts, block time utilization) are reviewed.

Phase VI: University Travel Service created; Surgical Capacity added back across the healthcare system.

1. UPMC specific travel employment agency is created and implemented the "University Travel Service" or UTS. "Traveling" OR nurse/surgical technologists are hired and deployed strategically based on individual hospital labor deficiencies and surgical case backlog with an estimated start date of March 1, 2022
2. System wide Surgical Services Effectiveness group determines surgical prioritization for adding back surgical volume. Surgical Oncology, Cardiovascular surgical care, and Neurosurgical care are prioritized.

METHODS: Measurement of outcomes

Surgical volume data was gathered from Power BI surgical services dashboard



We measured surgical volume reduction by month compared to block schedule reduction, i.e., has surgical volume decreased in step with formal reductions in available block time?

We attempted to define our overall rate of employee attrition over the in terms of total number of workers and a percentage of the total positions available. We compared this to the decrease in surgical volume.

RESULTS:

Surgical volume reduction (27% from peak surgical volume in august 2021) matches our formal block schedule reduction (25%). Our employee vacancy rate is 30% of all available positions within surgical services (Operating room RNs and Surgical Technologists).

CONCLUSIONS:

For the period May 2021 through November 2021, we had a reduction in our surgical services labor force of 30% necessitating a formal block time reduction of 25% of available surgical time over a 12-month period. As a result, the total number of operating rooms decreased from an average of 40 to 30 operating rooms per day over the Period Oct 2020-Jan 2022.

We saw a corresponding decrease in surgical volume of 27%.

The vacancy rate for OR positions (30%) is higher than the 25% reduction in surgical time available and surgical volume. We were able to offer different shift bonuses and extra overtime pay to complete more surgical procedures with fewer employees.

Our phased approach to the decrease in available surgical time with communication well in advance of the changes at our Surgical Services Oversight Committee helped to create open dialogue and collaboration with our surgical colleagues to help us to continue care for the patients that most needed care in the face of significant labor shortage.

References:

1. Cook I. Who is Driving the Great Resignation? Harvard Business Review. September 15, 2021.

2.Data Brief: Health Care Workforce Challenges Threaten Hospitals' Ability to Care for Patients. American Hospital Association. October 2021.

Surgical Scheduling in a Constrained Labor Environment: Part II

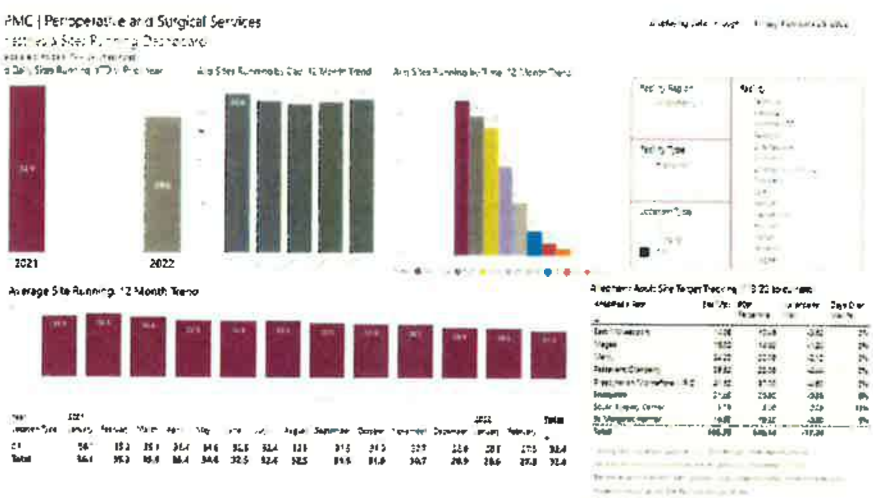
Cantees KK, MD MBA, Deis A, MS MD, Lebovitz E, MD MBA, Beaman ST, MD, Hudson ME, MD MBA

University of Pittsburgh Department of Anesthesiology and Perioperative Medicine, Pittsburgh, PA

INTRODUCTION: COVID -19 has impacted every facet of healthcare including perioperative services. Labor shortages are impacting all sectors of the economy as we continue to struggle with the logistics of the COVID 19 pandemic. Health care job openings are at historically high levels. Estimated staff shortages in healthcare are at 12.6% since February 2020 with nursing and residential care facilities accounting for about four-fifths of the decline. (1) (Data Brief: Health Care Workforce Challenges Threaten Hospitals' Ability to Care for Patients. American Hospital Association. October 2021

UPMC (University of Pittsburgh Medical Center) Presbyterian Hospital is a quaternary care facility; part of the 40 hospital UPMC Health care system. Over the period from May 2021 to the present, we have seen an approximate 30% decrease in OR staffing numbers; both Operating Room RNs (Registered Nurses) and Surgical Technologists. (2) Consequently, we made several changes to our surgical scheduling including some ad hoc and formal block schedule reductions for an overall reduction in available surgical time by 15%. We wanted to review several metrics for this period to assess the impact of our changes on operational efficiency.

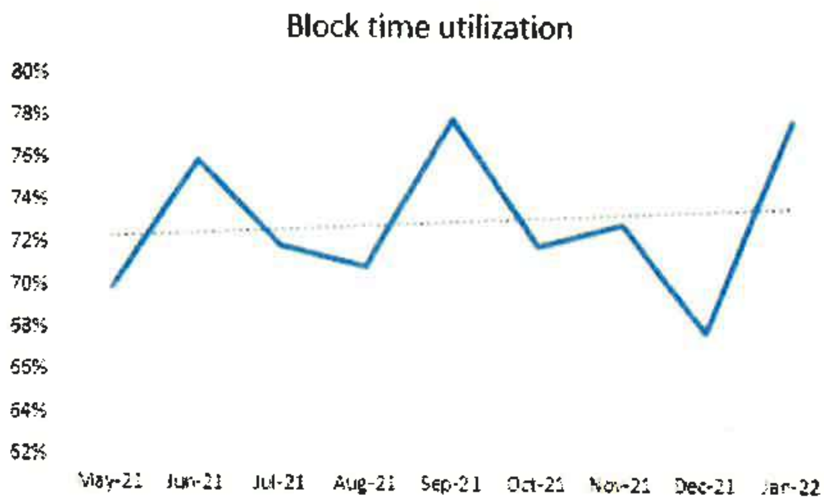
METHODS: Data was collected from multiple sources: Microsoft Power BI (Business Intelligence) data for Anesthesia sites running for the period Nov 20-Feb 2022. SA Anesthesia (Cerner, Kansas City Missouri) used for billing data: total ASA units and hours/OR /day, time units/case.



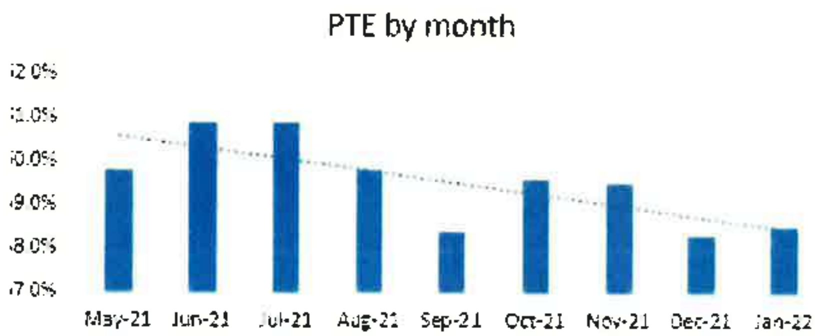
We looked at surgical volume over a nine-month period and compared several operating efficiency metrics for this period. These metrics include OR utilization as a percentage of time available and two measures of Anesthesiology personnel efficiency: Provider Team Efficiency and Anesthesia Care Team Management (concurrency).

RESULTS:

1. **OR utilization** improved with decreased surgical block time available.



2. **Provider Team efficiency,** a measure of surgical services personnel utilization, is measured by comparing the Kronos time punch data CRNAs as compared to the SA anesthesia billing data collected each day at 10am from the electronic anesthesia record. The PTE is reported daily then average monthly as a measure of the percentage of paid time that a CRNA generates revenue. This is used as a surrogate measure of implied productivity of all hourly wage employees in the OR and reflects efficiency of the entire surgical services operation.



3.Anesthesia care team management or Anesthesiologist concurrency was unchanged for the period.

May-21	2.85
Jun-21	2.94
Jul-21	2.92
Aug-21	2.84
Sep-21	2.84
Oct-21	2.84
Nov-21	2.85
Dec-21	2.84
Jan-22	2.83

CONCLUSIONS:

Decreasing surgical time available to accommodate reduced staffing needs slightly increased operating efficiency as measured by utilization of available operating time available. This increase in utilization is seen despite significant challenges with staffing shortages and subsequent delays in other areas of the hospital that impact the surgical process. T

Provider Team Efficiency, a surrogate measurement of Surgical Services personnel utilization/efficiency increased as surgical volume decreased. This is encouraging: despite multifactorial system labor shortages and inefficiencies we saw a slight increase in our utilization of personnel. Lastly, our average anesthesiologist concurrency target ratio of 1 Anesthesiologist: 2.75 hands on providers remained the same throughout the study period at 2.83. This result validated our anesthesiologist staffing model which determines the number of Anesthesiologists needed based on the number of Anesthetizing locations running.

SUMMARY:

We made several changes to out surgical scheduling process including ad hoc and formal block schedule reductions from Nov 202-Nov 2021 for an overall reduction in surgical time by 15%. We looked at surgical volume over a 12-month period and compared several operating metrics for the period.

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1. Data Brief: Health Care Workforce Challenges Threaten Hospitals' Ability to Care for Patients. American Hospital Association. October 2021.
2. Surgical Services Scheduling in a Constrained Labor Environment: Part I, Cantees KK et al. Abstract accepted for presentation at AACD Leadership Summit March 2022.

Title: Evolution of OR management with decreased hospital staffing and increased hospital census secondary to COVID inpatients, with resultant pressure to move ambulatory cases away from tertiary care center.

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Abstract:
Nebraska Medicine (NM) is an 809 licensed bed facility with 45 operating rooms that serves as the region's only 24/7 trauma center and provides comprehensive care for adults and children of the region, as well as patients from all 50 states and 47 countries.

Surgical procedures are performed at NM main campus (28 OR sites), Bellevue Medical Center (7 OR sites with limited inpatient capacity), Lauritzen Outpatient Surgical Center (6 OR sites with 23 hour overnight capability), and Village Pointe Outpatient Surgical Center (4 OR sites with 23 hour overnight capability).

During the past year considerable efforts have been made to shift cases to our ambulatory sites and to limit surgical admits on NM main campus. This shift was due to perioperative nursing shortage, inpatient nursing shortage, and an increased COVID inpatient census. This has been successful in the sense that our ambulatory centers have increased case volumes, and we have limited our total number of surgical admissions at NM main campus.

To further describe this changing OR utilization dynamic, NM OR utilization reports were evaluated from fiscal year 2020 (July 2019-June2020), fiscal 2021 (July 2020-June 2021) and the first 6 months of fiscal year 2022 (July 2021-Dec 2021). Individual utilization reports are generated monthly for all separate NM OR sites to regularly evaluate efficiency of care, personnel, and equipment needs. These reports include total number of OR cases, as well as total minutes of OR time and delineate between weekday and weekend cases.

Data:
<u>FY 2020</u>:
During the months of April and May 2020, NM encountered an unprecedented change to OR dynamics due to initial COVID-19 pandemic. During the early phase of the pandemic, our OR utilization at all sites drastically decreased. These months clearly were outliers for what NM's normal OR case volumes were and were removed from the analysis. Further reduction in September and November 2020 were caused by a cyber-attack and pandemic surge respectively.

During the study period, we quantified the total number of non-holiday weekdays within each calendar month. The total weekday OR minutes were then taken for each month from the utilization report and divided by the total number of non-holiday weekdays for a given month. This provides the total OR min/weekday for each month. Total OR cases/weekday were calculated in a similar fashion. Finally, average weekday case length was calculated.

In evaluating the first 6 months of FY 22, it is apparent that efforts to transition cases to other campuses have been effective. When compared to FY 21, NM is performing nearly 4 fewer cases (7.4%) each weekday, and 9 fewer surgical procedures per day (16.6%) when compared with FY 20. This decrease in NM main campus case volume is in line with expectations, as during this time, OR management sought to ensure that any case suitable for a facility other than NM main campus was performed at the alternate facility.

However, during the study period, the average case length for NM main campus increased 15.3 minutes per case (7.3%) between FY 20 and FY 21 and 30.4 minutes per case (13%) between FY 21 and FY 22. When FY 22 data is compared to FY 20 data, the average case length has increased nearly 46 minutes per case, representing a nearly 22% increase in case length.

Despite performing fewer cases per weekday, the average OR minutes per weekday remained similar (FY 20 = 12,212.9 min/weekday vs FY 21 = 11,911 min/weekday).

Discussion:

Inpatient census preservation has never been more important to healthcare organizations. Continued pressure from ongoing staffing issues, combined with the increased burden COVID-19 hospitalizations have placed on healthcare systems are clear contributors. In order to maintain inpatient hospital bed capacity as well as personnel and resource availability, institutions have had to make difficult decisions about which cases can be safely performed at a non-tertiary care center or postponed to a later date. This has resulted in a more complex surgical population at the tertiary care centers. Our data supports this. Despite fewer cases per day in FY 21, we experienced a similar number of total and average OR minutes per weekday.

The implications of this data are widespread. Healthcare worker fatigue and burnout are major issues throughout healthcare. Routinely, healthcare systems are experiencing high levels of personnel turnover, temporary staffing solutions such as traveling providers, and changing workforce dynamics. Much effort has been made to preserve inpatient capacity, but our data illustrates that the immediate perioperative workforce has not experienced a decrease in overall workload in terms of overall time in the OR.

In fact, while not directly evaluated with this data, it is likely that the "average" patient that has surgery at our tertiary environment now has more complex disease and requires more complex surgical procedure than the "average" patient prior to these changes. This is likely due to both the elimination of "easy" cases from the tertiary care setting, as well as the culmination of delays in surgical care that many patients experienced as a result of the pandemic. This idea is further validated by our average inpatient stay increasing 10% this fiscal year.

Conclusion:
Based on OR utilization and case length data, the NM main campus operating room environment now experiences the routine performance of longer, more complex surgical procedures on consistently sicker, more complex patient population. While case volume has moved to the outpatient surgery centers, minutes and utilization remain high due to case complexity. Additionally, the outpatient surgery centers have overall experienced increased OR utilization and increased surgery case count due to this shift.

2022 AACD PERIOPERATIVE LEADERSHIP SUMMIT: Call for Abstracts

Title:

Leveraging Perioperative Artificial Intelligence (AI) Safely:
Teaching Resident Physicians to Become 'Anesthesiologists-in-the-Loop' (AITL)

Authors / Collaborators:

J. Christopher Goldstein, M.D. and Heidi V. Goldstein, M.D.

Institution:

Department of Anesthesiology, North Florida/South Georgia VHS and the University of Florida College of Medicine, Gainesville, FL

Description:

Introduction:

Anesthesiologists operate in high-stakes environments, frequently caring for severely ill patients using complex medical devices. This is why the specialty of anesthesiology requires a high degree of "device literacy" to utilize modern technology in the safest way.[1]

Artificial intelligence (AI) technology should be no different in this regard. As AI applications are becoming part of routine medical practice, physicians and healthcare professionals who are increasingly augmented by medical AI[2] need to have at least a foundational understanding of AI to leverage its full potential while minimizing harm.

As AI technology enters our modern anesthesia environment, we need to become "AI literate" so that we can remain "in-the-loop": adequately understanding and supervising this powerful technology while also being able to intervene timely when needed. [3] Tragically, we witnessed the devastating consequences of being kept "out of the loop" in a profession ours is often compared to: aviation. When a new, automatic software system (Boeing MCAS) malfunctioned in the air, even experienced pilots were unable to rescue the situation as they had not been adequately trained on the new system, resulting in the airplanes crashing. A key lesson from these accidents was the fact that "the system's behavior was opaque to the pilots"[4]: These pilots found themselves "out-of-the-loop" and could not override the erratic system fast enough, resulting in tragic loss of lives.

Consequently, we advocate for us as physician leaders in anesthesia and patient safety to learn from this latest aviation disaster: In the age of AI, we should strive to become "Anesthesiologists-in-the-Loop" (AITL) to continue our mission to deliver state-of-the art, safe anesthesia care.[1] With that goal in mind, we created the "Fundamentals of AI for Resident Physicians in Anesthesiology" course to equip perioperative physicians with "AI literacy". [5]

Methods:

We developed a comprehensive AI fundamentals curriculum for resident physicians in anesthesiology. After departmental review and approval, we started the inaugural extra-curricular course in August 2020 and concluded it in June 2021. We conducted anonymous pre- and post-course quality surveys to internally evaluate the impact of the course and to decide if it should be continued.

Results:

Survey Question:
"**Please rate your confidence in achieving AI skills that will help your future career**"

2020, Pre-course results:

#	Answer	%	Count
1	**Not confident:** AI as a field seems intimidating. I am not sure where to begin, but with the appropriate guidance could imagine to get there.	70.00%	7
2	**Somewhat confident:** I think I know where to find the information and develop a plan to teach myself.	30.00%	3
3	**Confident:** I know where to look and feel confident that I can obtain the skills needed.	0.00%	0
	Total	100%	10

2021, Post-course results:

#	Answer	%	Count
1	**Not confident:** AI as a field seems intimidating. I am not sure where to begin, but with the appropriate guidance could imagine to get there.	0.00%	0
2	**Somewhat confident:** I think I know where to find the information and develop a plan to teach myself.	60.00%	9
3	**Confident:** I know where to look and feel confident that I can obtain the skills needed.	40.00%	6
	Total	100%	15

Data source:
Anonymous questionnaire default report, University of Florida Qualtrics 2020/2021.

Conclusions:

AI technology has arrived in Anesthesiology and is expected to further extend its impact on our specialty. Yet, AI fundamentals have not been formally incorporated in national anesthesiology residency curricula. Based on our pre-course survey data of participating anesthesiology residents, even recent medical school graduates did not feel adequately educated in AI and confident enough to use this emerging technology. Our local post-course survey data demonstrated that our course made a meaningful difference, as exemplified in the results above. The data and very positive anonymous feedback encouraged us to continue to offer this AI course. We hope to prepare anesthesiology residents for a future that will be augmented by AI applications. These 'anesthesiologists-in-the-loop' (AITL) should be able to harness the power of AI while also understanding when not to trust AI-based recommendations in the best interest of patient safety, especially when seconds count.

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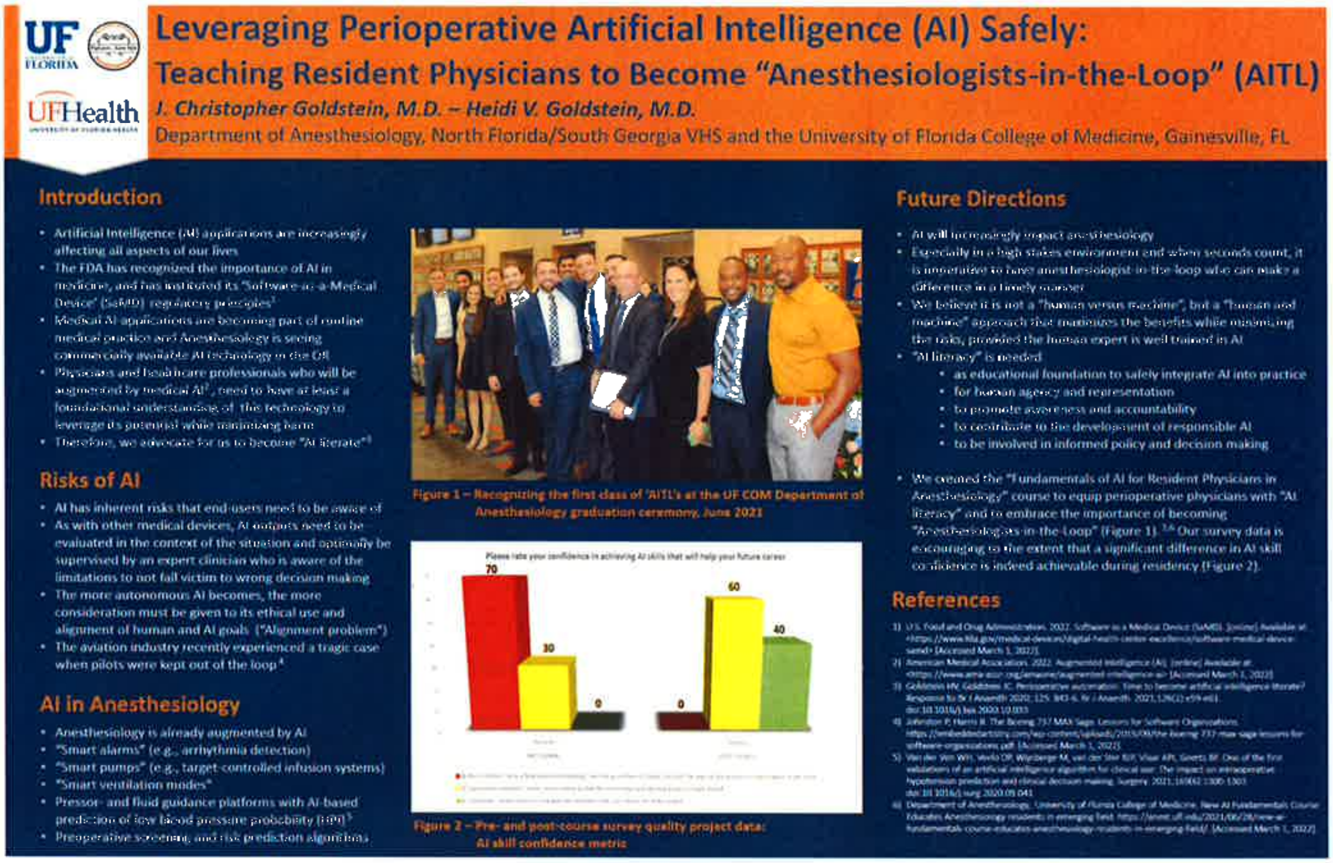
External references:

Link to Department of Anesthesiology, UF COM news article:

New AI Fundamentals course educates anesthesiology residents in emerging field » Department of Anesthesiology » College of Medicine » University of Florida (ufl.edu)

Illustrations:

Poster Draft:



Title: Cost Analysis of Surgical Clipping and Endovascular Coiling for the Treatment of Unruptured Intracranial Aneurysms at the University of Vermont Medical Center.

Authors: Adrian N. Berg BS, Adam Fakhri BS, Louis R. Briones BA, Douglas E. Sutton RN, MSN, Mitchell H. Tsai MD, MMM, FASA, FAACD, Scott B. Raymond MD, PHD, Bruce I. Tranmer MD, Brandon D. Liebelt MD. University of Vermont Medical Center Burlington, Vermont.

Institution: University of Vermont Medical Center, Burlington Vermont.

Description of program: Improved perioperative care or the care processes.

Purpose: To understand healthcare value of endovascular coiling and surgical clipping, we analyzed total costs associated with treatment of stable middle cerebral artery (MCA) aneurysm utilizing either method between 9/3/2018 and 10/2/2019 at the University of Vermont Medical Center (UVMMC)[1].

Materials & Methods: Total costs were calculated with both direct and indirect costs. Cases were identified using current procedural terminology as well as through a review of the patient's EPIC chart. Cases involving ruptured aneurysm during our interval were excluded. Expenses were gathered directly from the UVMMC Billing and Patient Financial Services center. Procedural costs included: professional fees, staffing charges, equipment charges, anesthesiology facility, anesthesia medications, and a single time-based charge for operating room. A total of 5 coiling and 8 clipping cases were analyzed. Medications were priced on wholesale acquisition cost.

Results: The average cost of endovascular coiling versus neurosurgical clipping was 88,405$ vs 60,409$ (average difference 27896 ± 13,845, $p = 0.09$). Cost of a coiling case was driven by equipment (74%), and secondarily by professional fees (22%). Surgical Intensive Care Unit (SICU) stay (3%) and staffing costs (<1%) were of minimal consequence. In comparison, time base charge for the inclusive costs of the operating room were the most important driver for the price of a clipping surgery (40%). SICU stay was a larger contribution to clipping (30%) than coiling. Professional fees (23%), and anesthesia facility charges (7%) were also of importance to clipping costs. Medications utilized were unimportant for costs associated with both procedure type.

There was variance of component factors for costs within each procedure. Post-operative length of SICU stays averaged 1.2 days (median 1 day) for coiling, and 8.4 days (median 10 days) for clipping. There was a much greater range in total costs for coiling cases (56,032$ - 135,427$) than in clipping (42,289$ - 78,653$). Professional fee for coiling cases could range from 13,989$ to 27,013$, in contrast clipping cases were a constant 14,300$ except for one anomalous case (13,798$).

Conclusion: This study highlights the high cost of endovascular treatment for stable MCA aneurysm[2]. At our institution, equipment is the primary contributor to coiling costs, while clipping cases are driven by SICU and OR charges[3-5]. As a general trend, costs associated with

coiling tend to have higher variability in comparison to the cost of clipping. We hope our single center study helps healthcare providers understand the component costs involved in MCA aneurysm treatment.

Illustrations:

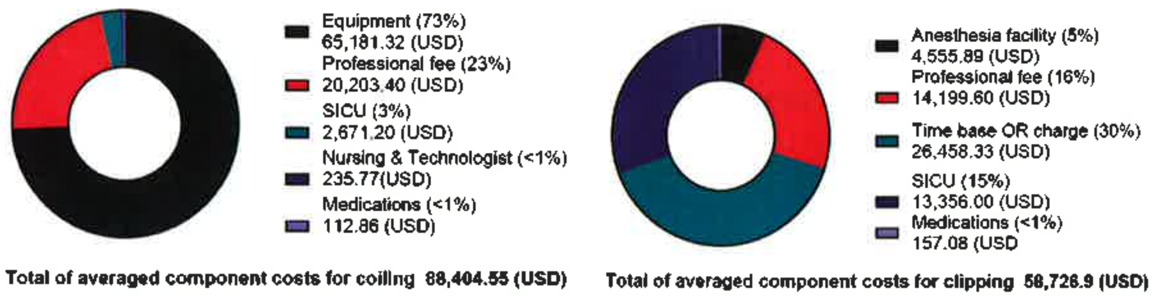


Figure 1. Parts of a whole averaged component costs for coiling and clipping stable MCA aneurysm

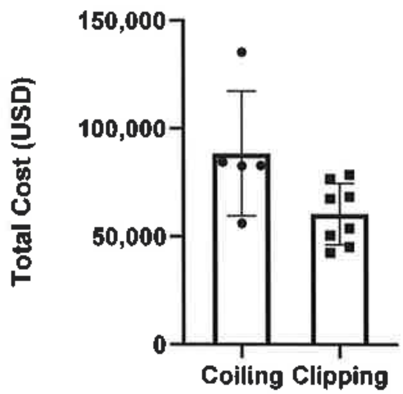


Figure 2. Total costs of coiling and clipping for stable MCA aneurysm

Coiling Case Number	Equipment	Professional fee	Technologist	Registered Nurse	SICU	Medications	Total	SICU length (Days)
1	$63,118.84	$15,014.00	$126.24	$147.12	$ 4,452.00	137.30433	$82,995.50	2
2	$60,348.81	$21,626.00	$110.46	$128.73	$ 2,226.00	143.72791	$84,583.73	1
3	$30,294.61	$23,375.00	$63.12	$73.56	$ 2,226.00	116.52265	$56,148.81	1
4	$105,914.81	$27,013.00	$126.24	$147.12	$ 2,226.00	41.09866	$135,468.27	1
5	$66,229.54	$13,989.00	$118.35	$137.93	$ 2,226.00	125.6475	$82,826.47	1

Table 1. All costs for coiling stable MCA aneurysm

Clipping Case Number	Anesthesia facility charge	Professional fee	Time based charge	SICU	Medications	Total	SICU length (Days)
1	$3,699.29	$14,300.00	$21,386.00	$28,938.00	$ 115.85	$68,439.14	13
2	$4,178.60	$14,300.00	$24,050.00	$11,130.00	$ 114.52	$53,773.12	5
3	$3,399.94	$14,300.00	$18,452.66	$31,164.00	$ 189.01	$67,505.61	14
4	$4,326.08	$14,300.00	$25,160.00	$6,678.00	$ 127.29	$50,591.37	3
5	$3,582.45	$13,798.00	$20,921.65	$6,678.00	$ 244.28	$45,224.38	3
6	$5,296.99	$14,300.00	$30,118.00	$28,938.00	$ 90.38	$78,743.37	13
7	$5,641.11	$14,300.00	$34,262.00	$22,260.00	$ 188.21	$76,651.32	10
8	$3,932.80	$14,300.00	$21,830.00	$2,226.00	$ 135.25	$42,424.05	1

Table 2. All costs for clipping stable MCA aneurysm

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Comparative Analysis of Performance Frontiers in Operating Room Management

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Introduction

Operating rooms represent high-cost, high-revenue environments. As complex adaptive systems, the operational outcomes are path-dependent based upon the myriad of interactions amongst surgeons, anesthesiologists, and nurses.[1] As a method of visualizing and analyzing basic operating room (OR) management metrics, performance frontiers support a resource-based view of the perioperative services. They have previously been used solutions to model the operational implications of changing release times, benchmark different anesthesia environments, and assess the impact of Acute Care Surgery tactical allocation.[2,3] Presumably, a comparative analysis can be utilized to characterize current practices between different medical centers. In this study, we apply a two-objective framework to operating room management data from two academic centers (University of Vermont Medical Center and Stanford Hospital) and show how tactical decisions of both centers shape the operating room efficiency.

Methods

The following monthly aggregated OR management data were extracted from the University of Vermont Medical Center (UVMMC) and Stanford Hospital (SHC) databases using WiseOR® (Palo Alto, CA):

1. After Hours minutes: Operative time utilized by a service after hours (17:30 to 7:30 Monday to Friday at UVMMC; 17:00 to 7:00 at SHC).
2. Opportunity Unused minutes: Available operative time within respective service block allocations where services can perform additional cases but did not for any reason.

3. Non-Opportunity Unused minutes: Available operative time within respective service block allocations in which additional cases cannot be performed based on the respective service's median case times.

Under-utilized time and over-utilized time were then calculated as follows:

1. Under-utilized time = (Opportunity Unused minutes) + (Non-Opportunity Unused minutes)
2. Over-utilized time = After Hours minutes

Data available from January 2010 to August 2021 were analyzed.

We begin by building a performance frontier to represent the operational efficiency of each institution under examination in GraphPad Prism 8 (La Jolla, CA). Monthly aggregates of over-utilized time and under-utilized time as defined above were plotted against each other. Performance frontiers were estimated and represented by the line $Y=C/X$, where Y is represented by the under-utilized time, X is represented by the over-utilized time, and the constant C is represented by the minimum values for each respective value in the equation $C = XY$. The performance frontiers represent the theoretical trade-offs between over-utilized and under-utilized times; data points that are closer to the performance frontiers represent more efficient performance (the actual performance of the operating room more closely matches the theoretical optimal trade-off between over-utilized time and under-utilized time than the performance represented by a point that is further away). All data and calculations were maintained in Microsoft Excel (Redmond, WA).

Results

In the two-dimensional space of Fig. 1, the performance frontier representing the pareto-optimal fronts of UVMMC lies closer to the origin than the performance frontier representing the SHC data. That the optimal performance frontier trends closer towards the origin for the UVMMC data reflects the relative proximity of individual monthly data points in the UVMMC dataset to the origin.

Conclusion

The performance frontier defining the productivity of UVMMC is more efficient than the performance frontier defining the productivity of SHC. The overall efficiency for UVMMC can be attributed to the smaller patient volumes, lower number of operating rooms, and qualitatively different patient populations. Although management is rarely as simple as a two-factor analysis,[4] performance frontiers represent a tool visualizing operating room efficiency and guiding strategic changes to operating room management. More importantly, the inherent difference in efficiencies implies that there may be a limit to scale for organizations with large perioperative services. Future studies should elucidate these limits. Operating room managers must be privy to the implications underlying performance frontiers to generate and apply normative judgments about the efficiency of their respective services.

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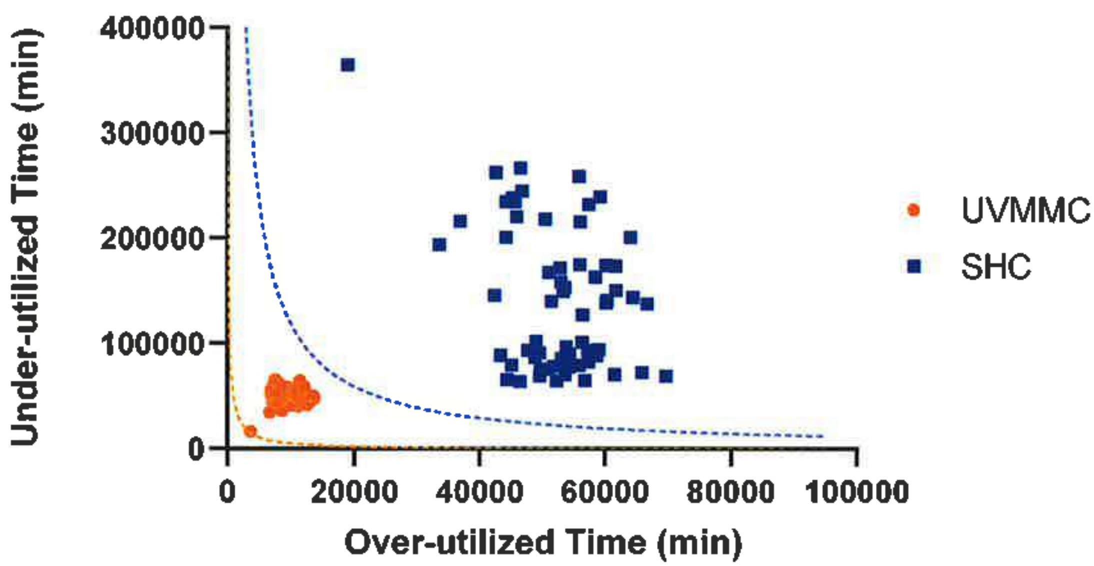

Figure 1. Monthly aggregates of over-utilized and under-utilized times at UVMMC and SHC. Performance frontiers generated from the demonstrated best performance of each service are overlaid.

Actual Versus Estimated Anesthetizing Locations: Forecasting Pitfalls

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Introduction: Anesthesia staffing models rely on accurate and reproducible surgical and non-surgical schedule forecasting to develop correct and predictable staffing models and budgets. Anesthesia service is increasingly provided in both surgical suites and "Non OR anesthetizing locations" or NORAs. Surgical Service/OR scheduling and efficiency are well studied and there is increasing focus on NORA scheduling and efficiency. (1)

At UPMC (University of Pittsburgh Medical Center) Presbyterian Hospital, we staff up to 50 anesthetizing locations (ALs) daily, with 39 of these locations in the actual operating room in addition to 12 NORAs. The NORAs include two Electrophysiology suites, up to six endoscopy suites, a daily neurointerventional suite, and ECT (electroconvulsive therapy) service daily. We provide Anesthesia Service for MRI (Magnetic Resonance Imaging), a general interventional radiology suite, and the cardiac catheterization lab once per week. Lastly, we provide care in the bronchoscopy suite Tuesday through Friday.

Anesthesia service forecasting occurs 72 hours (3 business days) prior to the day of service and again at 24 hours prior to the day or surgery/procedure. The final 24-hour forecast is completed at noon of the business day prior to the date of surgery by the Chief Anesthesiologist. Our aim in this project was to determine the accuracy of our estimated anesthetizing locations one day prior to service.

Methods: We analyzed 15 months of data from Nov 1, 2020, through Jan 31, 2022, excluding holiday and weekend work. We recorded the final 24-hour forecast of anesthetizing locations for a given day at 7 am and compared this to the actual SA Anesthesia (Cerner, North Kansas City, MO) billing data from all anesthetics provided in both surgical and NORA locations for a specific date of service. This query occurs daily at 10 am; active anesthesia records are tallied and reported in a Microsoft Power BI (Business Intelligence) Dashboard of Anesthesia sites running.

UPMC | Perioperative and Surgical Services

Anesthesia Sites Running Dashboard

[illegible]

Detailed Sites Running by Day

Location Name	7A - 10A	12P	3P	5P	7P	9P
MUH BRONCH LAB	1.0	1.0	0.0	0.0	0.0	0.0
MUHOR 31	1.0	1.0	0.0	0.0	0.0	0.0
MUHOR 32	1.0	1.0	0.0	0.0	0.0	0.0
MUHOR 33	1.0	1.0	1.0	1.0	0.0	0.0
MUHOR 34	1.0	1.0	0.0	0.0	0.0	0.0
MUHOR 37	1.0	1.0	0.0	0.0	0.0	0.0
MUHOR 38	1.0	1.0	1.0	1.0	0.0	0.0
MUHOR 39	1.0	1.0	1.0	1.0	0.0	0.0
MUHOR 40	1.0	1.0	1.0	1.0	1.0	0.0
PUHGI 04	1.0	1.0	1.0	0.0	0.0	0.0
PUHGI 06	1.0	1.0	1.0	0.0	0.0	0.0
PUHGI 11	1.0	1.0	0.0	0.0	0.0	0.0
PUHOR 06	1.0	1.0	0.0	0.0	0.0	0.0
PUHOR 07	1.0	1.0	1.0	1.0	0.0	0.0
PUHOR 06	1.0	1.0	1.0	1.0	1.0	1.0
PUHOR 09	1.0	1.0	0.0	1.0	1.0	0.0
PUHOR 10	1.0	1.0	0.0	0.0	0.0	0.0
PUHOR 12	1.0	1.0	0.0	0.0	0.0	0.0
PUHOR 13	1.0	1.0	0.0	0.0	0.0	0.0
PUHOR 16	1.0	1.0	0.0	0.0	0.0	0.0
PUHOR 17	1.0	1.0	0.0	0.0	0.0	0.0
PUHOR 19	1.0	1.0	0.0	0.0	0.0	0.0
PUHOR 20	1.0	1.0	1.0	1.0	1.0	0.0
PUHOR 22	1.0	1.0	0.0	0.0	0.0	0.0
PUHOR 25	1.0	1.0	1.0	0.0	0.0	0.0
PUHOR 27	1.0	1.0	1.0	1.0	0.0	0.0
PUHOR 28	1.0	1.0	1.0	1.0	1.0	0.0
PUHOR 29	1.0	1.0	0.0	0.0	0.0	0.0
MUHOR 36	1.0	0.0	0.0	0.0	0.0	0.0
Total	**39.0**	**28.0**	**18.0**	**10.0**	**5.0**	**2.0**

The difference between the forecasted numbers and the actual billing data were compared daily and reported as a delta between estimated versus actual versus estimated anesthetizing locations that day. Days where the actual and estimated projections matched were reported as a delta 0. Days when rooms were opened were also reported as a plus delta. These daily delta values were then averaged **monthly** and reported for the 15-month study period. This difference is reported as both actual location count and as a percentage of total daily and monthly anesthetizing locations.

Results: We found that our forecasted numbers matched our actual billing data in total anesthetizing locations (Delta 0) on average only **13%** of the time. We added an anesthetizing location 5 months of the 15-month period or **2%** of the time.

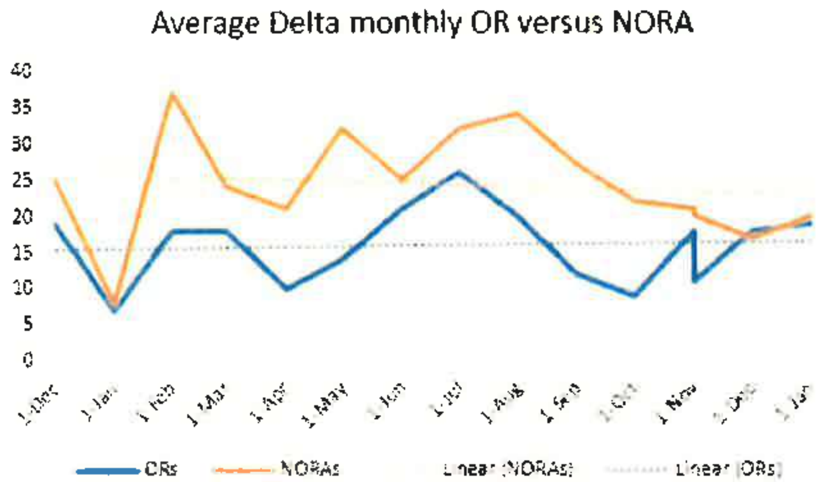
Estimated versus actual anesthezing locaions

Actual anesthetizing locations

	ORs	NORAs	delta	% ORs	% NORAs	delta:0	# days/Mo	% delta 0	delta pos	% delta pos
1-Nov	18	21	39	46%	53%	0	20	0%	2	5%
Dec-20	19	25	44	43%	57%	3	22	7%	0	0%
Jan-21	7	8	15	44%	56%	9	19	47%	1	5%
Feb-21	18	37	55	33%	68%	0	20	0%	0	0%
Mar-21	18	24	42	43%	57%	3	23	13%	0	0%
Apr-21	10	21	31	32%	68%	3	21	14%	1	5%
May-21	14	32	46	30%	70%	3	20	15%	0	0%
Jun-21	21	25	46	45%	54%	3	22	14%	0	0
Jul-21	26	32	58	45%	55%	0	20	0%	0	0%
Aug-21	20	34	54	37%	63%	1	22	5%	0	0%
Sep-21	12	27	39	32%	68%	6	22	28%	0	0%
Oct-21	9	22	31	30%	70%	5	21	24%	0	0%
Nov-21	11	20	21	35%	65%	2	20	10%	1	5%
Dec-21	18	17	35	51%	49%	2	20	10%	2	5%
Jan-22	19	20	39	49%	51%	3	19	15%	0	0
AVG	16	24	40	40%	60%	2.9	21	13%		2%

Most of the variation came from differences in forecasted NORAs versus actual. Incorrect forecasting of the NORA locations occurred 60% of the time while OR forecasting was incorrect 40% of the time. The largest delta in forecasted versus actual ALs was 7 rooms per day and **58 rooms** per month over the twelve-month period; the minimum monthly delta was **15 rooms**.

The degree of daily variation between estimated and actual anesthetizing locations *decreased* over the measurement period.



We had significant attrition of operating room personnel over the 15-month study period, both surgical technologists and Operating Room RNs (Registered Nurse). Our vacancy rate at present is 30% of overall budgeted positions in Surgical Services. Over the period from June 2021 to the present we have had to reduce available surgical time available with both ad hoc closures of available ORs (operating rooms) and with formal block schedule reductions. At present we have reduced daily available surgical block time by 25%. Despite these reductions we see a slight increase in the number of ORs that we have forecasted to run that we are unable to run, usually due to surgical services staffing issues.

Conclusions: Our forecasting of NORAs and ORs, was often incorrect when compared to actual billing data day of surgery/procedure using our current system. This is a constant source of dissatisfaction among schedulers, providers, and proceduralists.

We have extremely strict block release guidelines for our surgical locations at 72,48, and 24 hours prior to the expected surgical date, but do not enforce block release guidelines in our procedural areas (NORAs). We postulate that enforcing block release guidelines in these NORAs at 72 and 24 hours could help to bring our forecasted and actual anesthesia service demands closer to the same to improve predicted staffing and budgeting models.

There have been interesting approaches to scheduling in these NORA locations that include the availability of open block time for specific areas like the gastroenterology suite (2). Perhaps another approach is to use an open booking model between all NORA sites. This could potentially involve added administrative scheduling support to ensure that a realistic schedule between the NORA sites was created.

The mismatch between forecasted numbers and actual billing information represents anesthetizing locations that are staffed but not utilized. Each anesthetizing location that is staffed without revenue generated results in an estimated cost of $600/CRNA per 8-hour shift. Anesthesiologists are expected to maintain a concurrency of 2.75 CRNAs staffed per Anesthesiologist. Variation in sites staffed but not utilized significantly impacts this concurrency metric negatively as well.

The heath care labor shortage is predicted to continue. (3) There are significant health care labor force constraints in most institutions; adequate forecasting is essential to utilization of the scare resource that is labor in both NORAs and ORs.

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3. https://www.fitchratings.com/research/us-public-finance/not-for-profit-healthcare-staffing-shortage-has-long-term-effects-27-10-2021.

Length of Stay and Cost of Care Differences Between Post-Surgical Patients Who Board in PACU and Those That Proceed Directly to Inpatient Bed.

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Introduction

Modern hospital economic reality necessitates careful attention to perioperative patient flow in order to maximize revenue and mitigate cost. One challenge that OR managers may face is prolonged waiting in the PACU for a clean and ready inpatient bed after phase I PACU discharge criteria have already been met, otherwise known as "boarding." Several studies have already evaluated the impact of boarding in other hospital units such as the emergency department on length of stay and mortality (1). We hypothesized that boarding in PACU would be associated with longer length-of stay (LOS) and higher cost compared to patients who did not board in PACU.

Methods

Same-day admit surgical cases between July 1st 2020 and June 30th 2021 at Thomas Jefferson University's Center City Philadelphia hospitals were considered for analysis. Urgent/emergent cases were excluded, as were those where ICU-level care was requested. Cases were sorted by procedure type and then into two groups: "Did Not Board" and "Boarded" in the PACU, with "Board" group defined as greater than 6 hours awaiting an inpatient bed while no longer receiving PACU-level care. While there is no universally accepted length of time required to meet the definition of "excessive boarding," a 6 hour cutoff has been used in the literature previously (2). Using this definition, nine orthopedic procedures were identified as having a minimum of 4 cases boarding in the PACU within the dates studied. Orthopedic procedures were selected as they represent an outsized share of the total case volume at our hospital and somewhat homogenous care pathways with targeted LOS goals. After adjusting for outliers, total hospital LOS and cost of care was compared between the "Did-Not-Board" vs. "Board' groups for each of the selected orthopedic procedures.

Results

The total number of cases analyzed were 1,976 across nine procedures. For each procedure, the shares of cases that boarded >6 hours in PACU was approximately 5% (see Table 1). In every case, length of stay (LOS) for those in the Boarded group was longer than those in the Did Not Board group, for an average of 15% longer (5% to 37%). In every case but two procedure subtypes, the average cost of care for those in the Boarded group was more than that in the Did Not Board group, for an average of 31% more expensive (-9% to 84%). Statistical analysis was performed on the two data sets using unpaired t-test (Microsoft Excel for Mac 2018), which failed to demonstrate statistical significance between LOS differences ($p<0.05$), but show significance for 5 of the 9 procedure cost-of-care comparisons (see table 1 for p-values).

Discussion

In today's healthcare landscape there is great emphasis on reducing healthcare costs while still maintaining high quality, patient centered care. Nowhere in the business of healthcare delivery is this more relevant than in the perioperative arena, where delays in patient flow have far-reaching consequences in several domains, including patient experience and safety, operational efficiency, and financial performance. While other studies have examined the direct financial and operational impact of PACU bottlenecks, particularly with regards to OR productivity, this study sought to quantify the impact on downstream performance metrics like overall length of stay and cost of care. We found that excessive boarding in the PACU resulted in longer overall hospital LOS by an average of 15% and increase in cost of care by 31%, when compared to those who proceed directly to their inpatient bed after recovering in PACU without delay. We suspect the underlying reasons for our results are multifactorial but can likely be explained by variation in post-operative care pathways between PACU and specialty units, which may be better suited to optimize rehabilitation including earlier ambulation, advancing diet and activity, team rounding on primary floor patience first and writing discharge orders earlier in the day, and overall progress toward timely discharge. More study is needed to better elucidate the factors that contribute towards LOS and cost of care differences. And, while not every comparison demonstrated statistically significant differences between length of stay and cost-of-care, we feel the results still tell a compelling narrative that is of interest to OR managers. We suspect that as we expand the population size and consider broadening the procedural scope while controlling for confounding factors, the power of the analysis will increase as will the statistical significance. In summary, we see our results as strongly supportive of the business case for addressing PACU bottlenecks—which have consequences beyond patient satisfaction and can seriously impact LOS and bottom-line.

Figure 1:

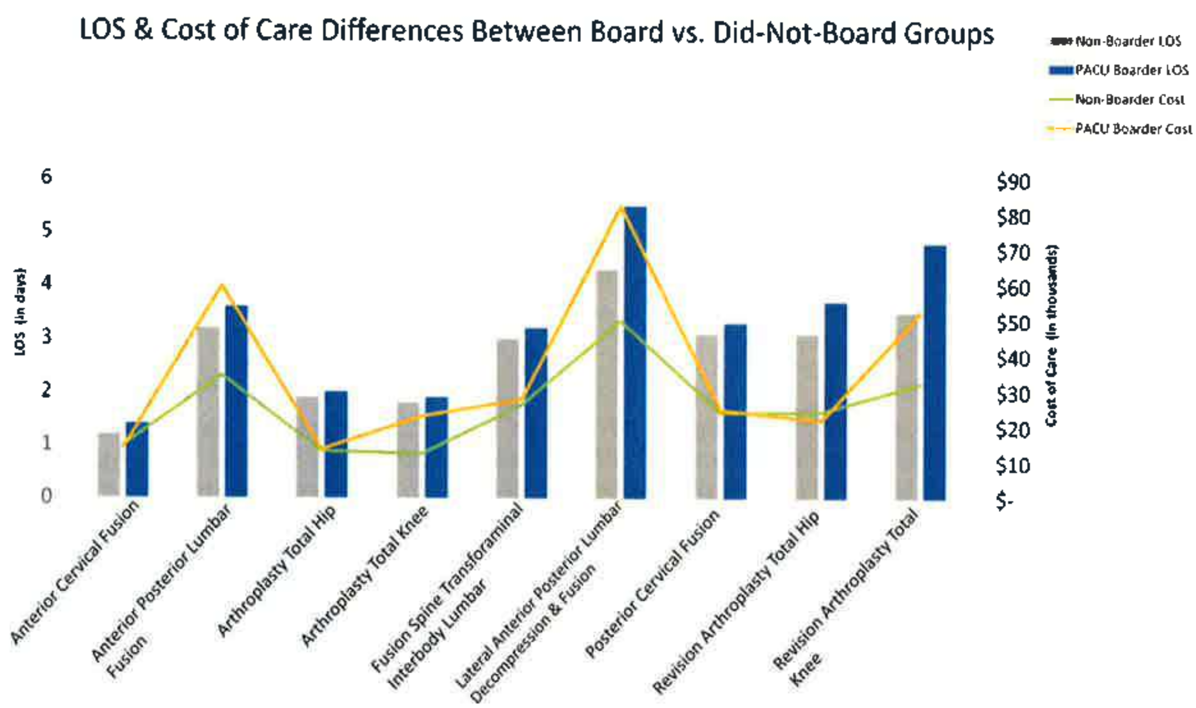

Table 1: Did-Not-Board vs. Board groups mean LOS, direct cost, and statistical analysis

		Between 0 and 6 Hours off PACU Level Care			Greater Than 6 Hours off PACU Level Care				
Primary Procedure	**LOS**	**Count**	**LOS (days)**	**Direct Cost**	**Count**	**LOS (days)**	**Direct Cost**	***LOS p value***	***Cost p-value***
ANTERIOR CERVICAL FUSION	1.7	*76*	**1.2**	**$14,863**	*8*	**1.4**	$13,989	*0.13*	*1*
ANTERIOR POSTERIOR LUMBAR FUSION	3.8	*103*	**3.2**	**$34,566**	*5*	**3.6**	**$59,915**	*0.24*	*0.02*
ARTHROPLASTY TOTAL HIP	2.1	*416*	**1.9**	**$13,323**	*16*	**2.0**	**$13,816**	*0.34*	*0.99*
ARTHROPLASTY TOTAL KNEE	1.8	*396*	**1.8**	**$12,631**	*17*	**1.9**	**$23,240**	*0.29*	*0*
FUSION SPINE TRANSFORAMINAL INTERBODY LUMBAR	3.8	*295*	**3.0**	**$26,385**	*17*	**3.2**	**$27,910**	*0.29*	*0.03*
LATERAL ANTERIOR/POSTERIOR LUMBAR DECOMPRESSION AND FUSION	7.0	*68*	**4.3**	**$50,111**	*4*	**5.5**	**$82,369**	*0.16*	*0.01*
POSTERIOR CERVICAL FUSION	5.1	*108*	**3.1**	**$24,234**	*4*	**3.3**	**$25,070**	*0.41*	*0.38*
REVISION ARTHROPLASTY TOTAL HIP	10.6	*191*	**3.1**	**$24,459**	*7*	**3.7**	$22,143	*0.28*	*0.62*
REVISION ARTHROPLASTY TOTAL KNEE	4.1	*239*	**3.5**	**$32,523**	*6*	**4.8**	**$52,618**	*0.17*	*0*

References:

(1) Forster, A.J., Stiell, I., Wells, G., Lee, A.J., Van Walraven, C. The effect of hospital occupancy on emergency department length of stay and patient disposition (2003) Academic Emergency Medicine, 10:2, 127-133.

(2) Bing-Hua YU, Delayed admission to intensive care unit for critically surgical patients is associated with increased mortality. The American Journal of Surgery 2014;208:2

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CALL FOR ABSTRACTS
2023 AACD PERIOPERATIVE LEADERSHIP SUMMIT

You are invited to submit an abstract for a poster exhibit and competition at the 2022 AACD Perioperative Leadership Summit which will be held **March 24-26 at the Wyndham Lake Buena Vista Disney Springs Resort in Orlando, FL.** Your abstract will be exhibited in poster format during the Friday afternoon, Saturday morning and Saturday afternoon sessions. The top five abstracts will be required to give a two-minute "elevator pitch" followed by a three-minute group discussion on Saturday, March 25th. The Top three abstracts will win Amazon Gift Cards. **Winners will be announced on Sunday, March 26th**. We look forward to your participation.

Abstracts should cover one or more of the programs your institution has implemented to:

1. Improve efficiency without compromising patient safety;
2. Improve patient safety;
3. Improve perioperative patient outcomes;
4. Improve perioperative care or the care process;

Abstracts need only cover one of the topics stated above although you are free to include two or more of these topics if you desire. Also, please include in your abstract a discussion of the financial impact of the program(s), if relevant.

FORMAT

Abstracts must be in PDF document format only. The type size should be 12-point in Times New Roman or similar font. Abstracts are limited to 5 pages in length. They should contain the following sections in sequence:

1. **Title:** The title should be brief and accurately reflect the content of the abstract and the poster. The title must be typed in UPPER CASE.
2. **Author(s):** Please use a new line to list the author(s) immediately after the title by first name(s), middle initial(s) and last name(s). Include the author(s)' degree(s) (e.g., MD, RN) and title(s).
3. **Institution:** Please state the name and location of the institution which is the subject of the abstract.
4. **Description of Program:** Please describe the program(s) that addressed one or more of the topics stated above and which will be the subject of the poster exhibit. Please make sure the abstract covers the items that will be included in the poster exhibit. Do not use jargon and undefined abbreviations. Following a standard formatting of Introduction/Methods/Results/Conclusions is suggested but not mandatory.
5. **Illustrations:** Any charts, graphs and pictures must be included in the abstract and not submitted separately.
6. **References:** Any references should be numbered in the order in which they appear in the abstract. The journal, volume and page number are required.

Online submission: Click HERE

The deadline for abstract submissions is February 24, 2023. Please e-mail your abstract (as an attached PDF document) to Kim Corey at the AACD Office at krc@aacdhq.org with appropriate contact information (i.e.; phone number and/or email address).

The AACD will inform the author(s) if the abstract has been accepted for a poster exhibit at the Summit. Authors whose abstracts are accepted for a poster exhibit must pay the Summit registration fee and attend the Summit in order for their poster to be exhibited. If there are multiple authors, at least one of them must attend the Virtual Summit in order for their poster to be considered in the competition. All authors also must sign an agreement giving the AACD permission to post their abstracts on the AACD website. Winners will be chosen based upon on impact of the material presented, organization of the abstract, and clarity of the executive summary presentation.

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