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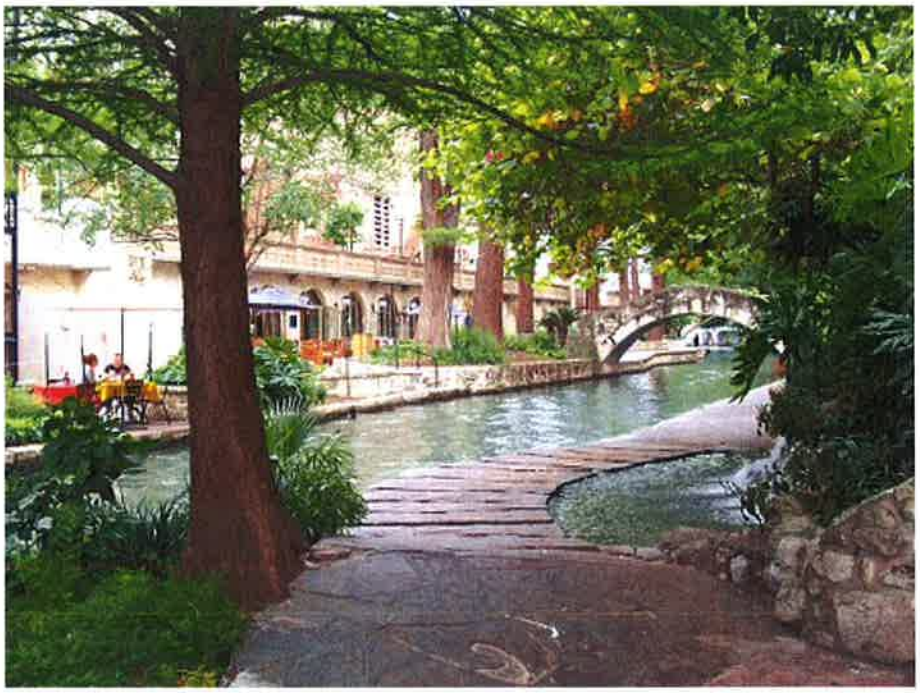
Perioperative Management Summit

Abstract Competition



Association of Anesthesia
Clinical Directors

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ABSTRACT REQUIREMENTS

- **Authors should be prepared to give a 5 minute "elevator pitch" during the abstract rounds**
- **Authors should be prepared to give a 10 minute oral presentation at the podium if their abstract wins first place**

JUDGING CRIETERIA:

- **Relevance and impact of topic on Perioperative Leadership**
- **Appropriate grammar and syntax**
- **Organization, structure, and clarity of thought through the abstract**
- **Visual appeal of abstract and any tables/figures**
- **Effectiveness of 5 minute discussion during abstract rounds**

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e-mail: krc@aacdhq.org
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AACD 2019 ABSTACT COMPETITION

Hyatt Regency Riverwalk – San Antonio, TX

1. Multi-Modal System Checks in an Attempt to Eliminate Narcotic Discrepancies
   Thomas E. Schulte, MD; Ellen K. Roberts, MD; Allyson L. Hascall, MD and Steven J Lisco, MD Department of Anesthesiology, University of Nebraska Medical Center, Omaha, NE 68198

2. USING THE PROCEDURAL TIMES GLOSSARY AS A ROADMAP TO IMPROVE EFFICIENCY TRACKING IN NON-OPERATING ROOM ENVIRONMENTS
   Timothy Wong BS[1]; Brandon S. King, MD[1]; Steven A. Boggs, MD, MBA[2]; Richard D. Urman, MD, MBA[3]; Mitchell H. Tsai MD, MMM[1,4,5] [1]Department of Anesthesiology; University of Vermont Larner College of Medicine, Burlington, VT [2]Department of Anesthesiology; University of Tennessee Health Science Center, Memphis, TN [3]Department of Anesthesiology; Perioperative and Pain Medicine, Brigham and Women's Hospital, Boston MA [4]Department of Orthopaedics and Rehabilitation (by courtesy); [5]Department of Surgery (by courtesy), University of Vermont Larner College of Medicine, Burlington, VT

3. A DEDICATED ORTHOPAEDIC TRAUMA ROOM INCREASES EFFICIENCY BY INCREASING OPERATING ROOM THROUGHPUT WITHOUT INCREASING AFTER-HOURS UTILIZATION
   Mark A. Haimes, MD, Caleb L. Watkins, BS, Derek W. Tan, BS, Patrick C. Schottel, MD, Craig S. Bartlett, MD, Mitchell H. Tsai, MD, MMM University of Vermont Medical Center
   Burlington, Vermont

4. ADDING ADDITIONAL DEDICATED CARDIAC OPERATING ROOMS DID NOT REDUCE AFTER-HOURS ELECTIVE CARDIAC WORK
   Chris D. Denny M.D., Resident; Edwin A. Bowe M.D., Professor; Dung D. Nguyen M.D., Associate Professor; Shira G. Gambrel, M/D., Assistant Professor; Emily A. Topmiller, Senior Administrative Project Resources Manager, Brian C. Sindelar, B.S., Data Analyst Department of Anesthesiology, University of Kentucky College of Medicine, Lexington, Kentucky

5. ADDITION OF NEW OPERATING ROOMS DECREASES UTILIZATION RATE DESPITE AN INCREASE IN SURGICAL VOLUME
   Daniel P Hopkins, MD, Resident; Edwin A Bowe, MD, Professor; Kelley A Findley, BA, Department Administrator; Deng D Nguyen, MD, Associate Professor, Emily A Topmiller, Senior Administrative Project Resources Manager, Brian C. Sindelar, BS, Data Analyst; Shira G. Gambrel, MD, Assistant Professor. Department of Anesthesiology, University of Kentucky College of Medicine, Lexington, Kentucky

6. NURSING STRIKES AND OPERATING ROOM MANAGEMENT
   Niketu P. Patel, B.A[1]; Chris R. Mayhew, MD[2]; Mitchell H. Tsai, MD, MMM[3] [1]Medical Student, Larner College of Medicine at UVM, Department of Anesthesiology [2]Resident, Department of Anesthesiology [3]Associate Professor, Department of Anesthesiology, Department of Orthopaedics and Rehabilitation (by courtesy), Department of Surgery (by courtesy) University of Vermont Larner College of Medicine, Department of Surgery, Department of Anesthesiology. 111 Colchester Avenue, Burlington, VT 05401

7. **Measuring Clinical Productivity in a Large Academic Anesthesia Department**
   Jose M. Soliz M.D., Richard Carlson M.D., Ryan Thompson MBA, Thomas Rahlfs M.D. Department of Anesthesiology and Perioperative Medicine University of Texas MD Anderson Cancer Center, Houston, TX

8. **Impact of major medical conferences on scheduled clinical operations**
   Charles E. Cowles M.D., Jose M. Soliz M.D., Laurie Hafner CRNA, Young Shrout CRNA, Larissa Ramos CRNA, Clint Westaway CRNA, Mark Veazie CRNA, Gilda Matute CRNA, Garry Brydges CRNA Department of Anesthesiology and Perioperative Medicine University of Texas MD Anderson Cancer Center, Houston TX

9. **UTILIZING A QI TIME SERIES STUDY TO INFORM QI INITIATIVES FOR IMPROVING INPATIENT ENDOSCOPY WORKFLOW**
   Sonali Palchaudhuri MD, Sara Attalla MD, Jaime Gilbo RN, Mark Weiss MD, Shivan J. Mehta MD MBA MSHP, Jan-Michael A Klapproth MD, Gregory Ginsberg MD, David C. Metz MD, Michael L. Kochman MD, Nuzhat Ahmad MD, Shazia M. Siddique MD MSHP University Of Pennsylvania, Philadelphia, PA

10. **DELAYS IN PERIOPERATIVE PATIENT FLOW—AN INITIAL ANALYSIS**
    David F. Nelson MD, MBA, Kent B. Berg, MD, MBA, Oren Guttman, MD, MBA, Rebecca A. Barnett MD, MBChB Department of Anesthesiology, Sidney Kimmel Medical College at Thomas Jefferson University, Philadelphia, PA

11. **Departmental Intranet Dashboard Compiling EMR, Scheduling and Billing Data to Prioritize End-of-Day Relief of Providers by Anesthesia Clinical Directors**
    Chad Slater-Scott, BA (Applications Developer); Anil Marian, MD, FRCA (Vice-Chair, Clinical Operations) Department of Anesthesia, University of Iowa, Iowa City, Iowa

Multi-Modal System Checks in an Attempt to Eliminate Narcotic Discrepancies

Thomas E. Schulte, MD; Ellen K. Roberts, MD; Allyson L. Hascall, MD and Steven J Lisco, MD

Department of Anesthesiology, University of Nebraska Medical Center, Omaha, NE 68198

ABSTRACT

Substance Abuse is very high among anesthesiologist. Recent data has shown that 32% of anesthesiologist have used drugs to "get high," while 16% have stated they were drug dependant.[1] Anesthesiologist have a 2.5 times higher rate of drug abuse than the average physician.[2] Multiple factors play a role in explaining the high incidence of substance abuse among anesthesiologists. Proximity to large quantities of highly addictive drugs, relative ease at diverting small quantities of drugs, and a high stress environment all play a factor. Additionally, a workplace that sensitizes reward pathways and promotes substance abuse also contributes.[3]

We tracked narcotic discrepancies for six years, from 2013 through 2018. We received the total number of narcotic discrepancies from data through the hospital reporting system (Table 1).

In the span of the six years, multiple process changes were put into place to reduce the number of narcotic discrepancies. In 2015, the Omnicell automatic drug delivery system was placed into each operating room (OR). This offered both customized access to narcotics throughout a surgical procedure and clear documentation of quantities of narcotics taken out for each patient.

Even with the Omnicells, narcotic discrepancies were occurring. In 2016, pharmacy started e-mailing anesthesia providers if their narcotic documentation was not accurate. This added a second check to narcotic quantities and brought about the most dramatic decrease in discrepancies.

The last process we added was a narcotic hand off tool in the electronic medical record (Figure 1 & 2). This tool documents narcotic quantities being handed off to another anesthesia provider during staffing changes.

No single process change resulted in complete resolution of all narcotic discrepancies. When the pharmacy started to give feedback on the narcotic discrepancies, the total number of discrepancies decreased dramatically by 85%. The addition of the "hand-off tool" also reduced the number by an additional 29%.

In conclusion, when there are multiple system and personnel checks, the number of narcotic discrepancies decreased more than just one system or check in place.

Table 1.

Year	Number of Narcotic Discrepancies
2013	455
2014	494
2015	343
2016	51
2017	56
2018	40

At this time, I, {Anesthesia Provider #1} completed a thorough handoff of the patient's care including but not limited to patient's pertinent medical history, procedure details,
LDA's, and medication reconciliation.

Controlled Substances were reconciled between providers as follows:

Midazolam:
Amount Removed _mg; Amount Administered _mg; Remaining/reconciled _mg

Fentanyl:
Amount Removed _mcg; Amount Administered _mcg; Remaining/reconciled _mcg

Propofol:
Amount Removed _mg; Amount Administered _mg; Remaining/reconciled _mg

At anesthesia provider handoff or break relief, all other medications and solutions were reviewed and reconciled by entering and exiting personnel.

***

I, {Anesthesia Provider #2}, received an accurate and comprehensive transfer of care.

Anesthesia Provider #2, MD
10:58 AM, 11/28/2018

Figure 1. Handoff Tool placed in the Electronic Medical Record documenting all narcotics between

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1. Skipper GE, *et al*. "Anesthesiologists with Substance Use Disorders: A 5 Year Outcome Study from 16 State Physician Health Programs." Anesthesia & Analgesia: 109 (3), 2009; 891 – 896.

2. Hyman SA, *et al*."A Survey Evaluating Burnout, Health Status, Depression, Reported Alcohol and Substance Use, and Social Support of Anesthesiologists." Anesthesia & Analgesia: 125 (6), 2017; 2009-2018.

3. Bryson EO and Silverstein JH. "Addiction and Substance Abuse in Anesthesiology." Anesthesiology: 109 (5), 2008; 905-917.

USING THE PROCEDURAL TIMES GLOSSARY AS A ROADMAP TO IMPROVE EFFICIENCY TRACKING IN NON-OPERATING ROOM ENVIRONMENTS

Timothy Wong BS[1]; Brandon S. King, MD[1]; Steven A. Boggs, MD, MBA[2]; Richard D. Urman, MD, MBA[3]; Mitchell H. Tsai MD, MMM[1,4,5]

[1]Department of Anesthesiology; University of Vermont Larner College of Medicine, Burlington, VT

[2]Department of Anesthesiology; University of Tennessee Health Science Center, Memphis, TN

[3]Department of Anesthesiology; Perioperative and Pain Medicine, Brigham and Women's Hospital, Boston MA

[4]Department of Orthopaedics and Rehabilitation (by courtesy); [5]Department of Surgery (by courtesy), University of Vermont Larner College of Medicine, Burlington, VT

Introduction

The Operating Room (OR) has long been a substantial source of revenue and expenditures for hospitals. Subsequently, OR management has long looked at improving efficiency and clinical productivity in these settings. In 1987, the Association of Anesthesia Clinical Directors (AACD) created the AACD Procedural Times Glossary (PTG) to aid in the development of quality improvement measure and benchmarking by terms of OR efficiency and utilization [1, 2]. Since it's creation over three decades ago, it has been a leading source of procedural times in the analysis of efficiency in the OR setting. Recent research has been focused on expanding the concept of OR management to outside of the operating room.

The case volumes of non-operating room anesthesia (NORA) environments have expanded over the past decade [3]. This increased volume of NORA services offers opportunities to research the applicability of OR efficiency measures outside of the operating room. However, the methodological application of the AACD PTG to NORA has not been well studied. A PubMed search for documentation of AACD procedural times in NORA yields no results. The Electrophysiology (EP), Interventional Radiology (IR) and Endoscopy services at the University of Vermont Medical Center (UVMMC) are several of the NORA services on site. This study looks to analyze procedure workflow documentation from the respective NORA services to assess the extent of what procedural information is tracked.

Methods

Procedure workflow documentation from the Electrophysiology, Interventional Radiology and Endoscopy services at the University of Vermont Medical Center was obtained. Using the UVMMC IR Whiteboard (South Burlington, VT) and Epic (La Crosse, WI), IR cases with and without anesthesia were pulled for comparison. Endoscopy and electrophysiology data were obtained from clinical workflow documentation tracked by the respective services. Using the AACD PTG and Microsoft Excel (Redmond, WA) a database was created tracking the differences between the various workflows.

Results

The AACD Procedural Times Glossary defines thirty procedural times that may be useful in analyzing efficiency. The database created between the Electrophysiology, Endoscopy, and Interventional Radiology services at the University of Vermont Medical Center are shown in Table 1.

Conclusion

The AACD PTG provides clinical directors an operational management framework for data collection and analysis of workflow efficiency. Looking at the NORA services at UVMMC, there are no standardized workflow documentation protocols for collecting information. IR and Endoscopy both contain very few of the items that are logged in EP. Interestingly, Endoscopy tracks Procedure Start Time and Procedure End Time but does not collect Patient In Room and Patient Out of Room times while IR tracks the opposite. Although EP tracking has been more extensive, many of the crucial times necessary to track efficiency of NORA workflows are absent from all services. For example, information tracking Room Set-up Time and Room Clean-up Time are missing from the workflows. Similarly, none of the services keep track of data after the patient leaves the procedure room (i.e. Discharge from PACU or Arrival in Same-Day Recovery Unit).

Looking forward, more data will need to be collected to analyze the operational and financial impacts of better data tracking for NORA services to ultimately apply benchmarks and roadmaps like the AACD PTG to NORA environments. However, NORA is a complex system made up of a network of adaptive parts (i.e. nurses, surgeons, anesthesiologists), that all see the system differently. It requires complex decision making supported by a solid governance structure [4]. The AACD PTG may serve as a road map to improve efficiency tracking of non-operating room services at UVMMC and future directions should offer insight into the applicability of OR management metrics outside of the operating room [5].

References

1. Association of anesthesia clinical directors (AACD). Available at http://www.aacdhq.org.

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4. Wu A, Sanford JA, Tsai MH, O'Donnell SE, Tran BK, Urman RD. Analysis to establish differences in efficiency metrics between operating room and non-operating room anesthesia cases. J Med Syst. 2017; 41(8):120.

5. Wong T, Tsai MH, Urman RD. The expansion of non-operating room anesthesia services. Periopera Care Opera Room Manag. 2017; 9:39–42.

Service	AACD Procedural Times Glossary Definition	Electrophysiology	Interventional Radiology	Endoscopy
	Patient in Facility (PIF)			
	Patient Ready for Transport (PRT)			
	Patient Sent For (PSF)			
	Patient Available (PA)	X		
	Room Set-up Start (RSS)			
	Anesthesia Start (AS)			
	Room Ready (RR)			
	Patient In Room (PIR)	X	X	
	Anesthesiology, First Available (AFA)			
	Procedure Physician, First Available (PFFA)			
	Anesthesiologist of Record In (ARI)			
	Anesthesia Induction (AI)	X	X	X
	Anesthesia Ready (AR)	X		
	Position-Prep Start (PS)			
	Preparation Completed (PC)	X		
	Procedure Physician of Record In (PPRI)	X		
	Procedure-Surgery Start Time (PST)	X		X
	Procedure-Surgery Conclusion Begun (PCB)	X		
	Procedure Physician of Record Out (PPRO)	X		
	Procedure-Surgery Finish (PF)	X		X
	Patient Out of Room (POR)	X	X	
	Room Clean-up Start (RCS)			
	Arrival in Postanesthesia Care Unit-Intensive Care Unit (APACU)	X		
	Anesthesia Finish (AF)	X		
	Room Clean-up Finished (RCF)			
	Ready for Discharge From PACU (RDPACU)			
	Discharge From PACU (DPACU)			
	Arrival in Same-day Surgery Recover Unit (ASDSR)			
	Ready for Discharge From SDSR unit (RDSDSR)			
	Discharge From SDSR Unit (DSDSR)			
Total	**30**	**13**	**3**	**3**

Table 1: Summary of the Association of Anesthesia Clinical Directors Procedural Times Glossary and corresponding procedural times tracked in the Electrophysiology, Interventional Radiology and Endoscopy services at the University of Vermont Medical Center.

Title:
A DEDICATED ORTHOPAEDIC TRAUMA ROOM INCREASES EFFICIENCY BY INCREASING OPERATING ROOM THROUGHPUT WITHOUT INCREASING AFTER-HOURS UTILIZATION

Authors:
Mark A. Haimes, MD, Caleb L. Watkins, BS, Derek W. Tan, BS, Patrick C. Schottel, MD, Craig S. Bartlett, MD, Mitchell H. Tsai, MD, MMM

Institution:
University of Vermont Medical Center
Burlington, Vermont

Introduction:
Operating after-hours is associated with increased costs, inferior clinical outcomes, and higher levels of provider (surgeons, anesthesia, nursing, ancillary) burnout. In this study, we examine the efficiency of a dedicated orthopaedic trauma operating room (OTOR) using operating room utilization data as a surrogate for financial analyses.

Methods:
The orthopaedic trauma service (OTS) at a rural ACS level 1 center was allocated two additional elective OR blocks per week. This allowed the OTS to offload elective cases from regular OR trauma time in order to improve access for acute trauma cases by establishing dedicated orthopaedic trauma time. Unused elective time was either released to the OR or utilized for additional trauma cases. Two orthopaedic traumatologist (Surgeons A and B) were granted access to this additional block time. Surgeon C, a separate traumatologist, did not receive additional block time, and their schedule remained unchanged. Using WiseOR® (Palo Alto, CA), we extracted the total number of cases, after-hours utilization minutes, and opportunity-unused minutes for the orthopaedic trauma service and the dedicated OTOR for the nine months prior to this change (December 2015 – August 2016) when surgeons A & B started operating within the service and for the twenty months after the change (October 2016 – May 2018). For each month, we analyzed the data for the orthopaedic traumatologists individually (Surgeons A, B, and C) and for the OTS collectively. As each minute of after-hours utilization demands a higher cost compared to allocated block time, the cost per minute of after-hours utilization was calculated using Childers et al.'s inpatient OR costs as a guideline[1]. After-hours utilization represents a variable cost. Pareto frontiers were calculated for the appropriate variables and Pareto optimality was graphically represented using GraphPad Prism (La Jolla, CA).

Results:
There was a significant increase in total case volume per month for the surgeons (A and B) who were assigned to the additional dedicated OTOR blocks (32.2 vs 45.4 cases per month, $p = 0.0001$). There was no significant difference in the total case volume performed by the surgeon (C) whose operating schedule had not changed (10.2 vs. 9.8 cases per month, $p = 0.804$). There was no significant difference in the number of after-hours utilization minutes per month by Surgeons A and B (1030 min. vs. 1180 min., $p = 0.452$) or by the unaffected traumatologist (8.3 min. vs. 16.5 min., $p = 0.455$). Pareto efficiency (Figure 1) and cost efficiency (Figures 2 and 3)

were both increased by establishing a dedicated OTOR. There was no significant difference in monthly associated after-hours utilization costs ($41,752 vs. $51,722, p = 0.2510). This equated to an estimated marginal variable cost of $9,970 per month. There was no significant difference in opportunity-unused minutes after establishing a dedicated OTOR (2530 min. vs. 2912 min., p = 0.4101).

Discussion and Conclusion:
In this study we demonstrate that operating room utilization data can be used as a surrogate for financial analyses and that the establishment of a dedicated OTOR can increase OR efficiency by increasing OR throughput without increasing after-hours utilization.

Illustrations

Figure 1:
pareto-OTS Utilization Per Block

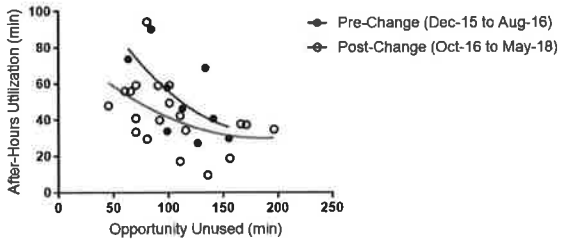


Figure 2:
Surgeon A + Surgeon B
pareto-After Hours Cost

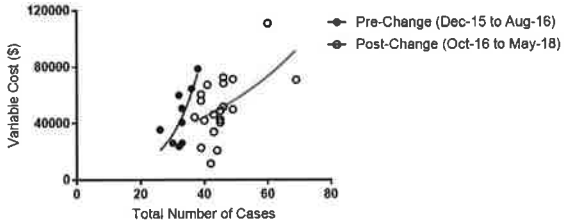
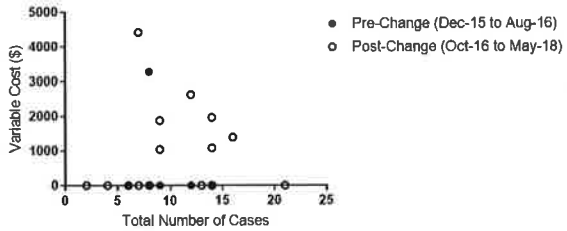


Figure 3:
Surgeon C
pareto-After Hours Cost



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Title: ADDING ADDITIONAL DEDICATED CARDIAC OPERATING ROOMS DID NOT REDUCE AFTER-HOURS ELECTIVE CARDIAC WORK

Authors: Chris D. Denny M.D., Resident; Edwin A. Bowe M.D., Professor; Dung D. Nguyen M.D., Associate Professor; Shira G. Gambrel, M/D., Assistant Professor; Emily A. Topmiller, Senior Administrative Project Resources Manager, Brian C. Sindelar, B.S., Data Analyst

Institution: Department of Anesthesiology, University of Kentucky College of Medicine, Lexington, Kentucky

PROGRAM: Expansion of the amount of Block Time dedicated to adult cardiac surgery was implemented in an attempt to decrease the number of Overrun Hours and increase surgeon satisfaction.

Introduction: Surgical cases running late into the evening can increase costs; when the cases are complex and require specialized teams (e.g., cardiac surgery), late cases may also impact the availability of resources for the following day. Like many institutions, the team caring for adults undergoing cardiac surgery at the University of Kentucky Albert B. Chandler Hospital (UKABCH) includes a subset of operating room (OR) nurses and scrub technicians with expertise in cardiac surgery as well as anesthesiologists who have specific proficiency in anesthesia for cardiac surgery and transesophageal echocardiography. These requirements result in a smaller pool of individuals to provide this service which, in turn, results in more frequent call. From July 1, 2017 through June 30, 2018 UKABCH performed 587 adult cardiac surgical cases requiring cardiopulmonary bypass. For the majority of this time there were 468 hours of OR Block Time (defined by the Association of Anesthesia Clinical Directors, AACD, Procedural Time Glossary as "hours of OR time reserved for a given service") dedicated for adult cardiac surgery during each 4-week period. Review of case data revealed that 70 cases (15% of the total) were weekend cases (defined as some part of the case occurring between midnight on Friday and 0700 Monday) and an additional 169 cases (32% of the total) involved after-hours work (defined as between 1900 one day and 0655 the following day Monday through Friday). Time between those hours meet the AACD definition of "Overrun Hours" (time after the scheduled completion of the room). In August, 2018 UKABCH opened six new ORs. In an attempt to reduce the amount of Overrun Hours devoted to cardiac work, the plan was to increase the number of hours of Block Time for adult cardiac surgery to 1010 hours per 4-week period. We hypothesized that increasing the amount of OR Block Time would decrease the amount of Overrun Hours for adult cardiac surgery with a consequent decrease in the demands placed on cardiac anesthesiologists and nurses to work late.

Methods: Using the software which tracks cases performed in the UKABCH OR (OR Manager by Picis), we selected adult cardiac surgery cases requiring cardiopulmonary bypass for the 3 months immediately before ("PRE") and the 3 months immediately after ("POST") the new ORs were opened. Using the time the patient entered the OR ("Pt In") and the time the patient left the OR ("Pt Out"), we identified cases for which some component of the case occurred after 1900 or before 0655 on weekdays as constituting cases with Overrun Hours, i.e., "late" cases. The number of late cases and the number of days on which late cases were performed were determined for both PRE and POST and the percentages were compared using chi-square. The total duration of Overrun Hours in each time period was calculated then averaged over the total number of weekdays in that period to get the mean number of Overrun minutes per day. We also

determined the average number of Overrun minutes per day for those days on which there were late cases.

Results: The number of prime time (0700 – 1900) cardiac surgical block time increased from 468 hours/4-weeks during PRE to 770 hours/4-weeks during POST.

Data are presented in Table One.

Table One.

	PRE	**POST**
Number of Weekdays	71	62
Total Number of Cases	143	122
Number of Late Cases	41	37
Overrun Minutes/Day Worked (Mean ± SD)	187 ±147	171 ±145
Overrun Minutes/Weekday (Mean ± SD)	53 ± 115	52 ± 112
Percentage of Late Cases	29%	30%
Percentage of Days with Late Cases	52%	53%

Independent samples t-tests were performed to compare minutes of Overrun time per weekday and Overrun time for each day doing late cases of PRE and POST periods. There was not a significant difference between PRE and POST with regard to the number of Overrun minutes worked per day or when late cases were performed at the $p < .05$ level.

We also performed chi-square tests to determine if there was a difference in the percent of days when late cases were performed or the percent of cases that were late. During the PRE period, 29% of non-emergency adult cardiac cases were late; during the POST period, 30% of non-emergency adult cardiac cases were late. There was no difference in the percentages of late cases between PRE and POST, $X^2(1, N = 167) = 0.06, p > 0.25$. During the PRE period 52% of days had a late case while during the POST period 53% of days had a late case. There was no difference in the percentages, $X^2(1, N = 265) = 0.36, p > 0.25$.

Conclusions: We were primarily interested in the amount of late work performed by the team caring for adult cardiac surgery patients. The cardiac surgeons had indicated that the lack of available OR Block Time during prime-time hours resulted in their need to be doing elective cardiac surgery after 1900. We hypothesized that having additional cardiac surgery Block Time between 0700 and 1900 would reduce the amount of late work by allowing the service to do more cases during prime time through a combination of more surgeons operating simultaneously and the ability to eliminate turnover time by having the second patient for a specific surgeon in an OR before the first patient was physically out of another room. Data analysis revealed that, despite an increase in the amount of prime time cardiac surgery Block Time from 468 hours/4-weeks to 770 hours/4-weeks, there was no significant reduction in the percentage of adult cardiac surgery cases with a component of late work. Nor was there a significant difference in the average number of Overrun minutes (either per day or per day when late cases were running) between PRE and POST. (Note that although the plan was to increase the prime-time cardiac Block Time to 1010 hours/4-week period, problems with nursing staffing precluded full implementation during the first 3 months after the new ORs were opened.) This suggests that the

primary factor driving Overrun Time in cardiac surgery is not the availability of prime OR time, but rather the cardiac surgeons' schedules.

References:

1. Donham RT, Mazzei WJ, Jones RL. AACD Procedural Times Glossary. http://aacdhq.org/?s=glossary. Last accessed December 14, 2018.

TITLE: ADDITION OF NEW OPERATING ROOMS DECREASES UTILIZATION RATE DESPITE AN INCREASE IN SURGICAL VOLUME

AUTHORS: Daniel P Hopkins, MD, Resident; Edwin A Bowe, MD, Professor; Kelley A Findley, BA, Department Administrator; Deng D Nguyen, MD, Associate Professor, Emily A Topmiller, Senior Administrative Project Resources Manager, Brian C. Sindelar, BS, Data Analyst; Shira G. Gambrel, MD, Assistant Professor.

INSTITUTION: Department of Anesthesiology, University of Kentucky College of Medicine, Lexington, Kentucky

PROGRAM: Expansion of the number of operating rooms was implemented to meet increasing demand for prime time availability, decrease operating room utilization rate below 80%, and increase surgeon satisfaction.

INTRODUCTION

For several years, largely due to an increase in the number and complexity/duration of surgical procedures, the operating room (OR) capacity in the University of Kentucky Albert B. Chandler Hospital (UKABCH), a Level I Trauma Center, was inadequate to meet demand for elective cases in prime time (0700 – 1530). The reported "Prime Time Utilization" rate was consistently between 81% and 85%. (Within our institution the calculation of Prime Time Utilization includes the time a patient is in the OR as well as the time between cases, effectively equivalent to the Association of Anesthesia Clinical Directors (AACD) Procedural Times Glossary definition of Adjusted Percent Utilized Resource Hours. However, if the time between cases, AACD "Between Case Gap," is greater than 90 minutes it is excluded from the calculation. This time was expressed as a percentage of the number of hours scheduled for elective cases in each room, (i.e., "Resource Hours" according to the AACD Glossary).

In August, 2018 six new ORs were opened. We wanted to determine the impact of these ORs on the percentage of time patients were in the OR (AACD, "Raw Utilization"). We hypothesized that the expanded number of ORs would result in additional cases being performed but that the Raw Utilization Rate would decrease.

METHODS

By using the "Patient In" and "Patient Out" fields of the institution's OR tracking program (OR Manager by Picis), we determined the Raw Utilization every weekday during a 3-month period immediately after opening the new ORs (August-October, 2018). We compared those results with the same period for 2017. The time later than the scheduled close time for a room, AACD "Overrun," was excluded from the analysis. We used the Block Time Allocation Schedule created each month to determine the total number of hours scheduled for elective cases in each room. We also compared the Raw Utilization Rate we calculated with the Prime Time Utilization Rate reported by the OR Executive Committee for both periods.

RESULTS

Data are presented in the Table.

	Before New ORs	After New ORs
Total Patient In-Room Time (min)	639,901	667,451
Raw Utilization Rate (Mean ± Std Dev)	66 ± 4%	55 ± 4%
Reported Prime Time Utilization	83%	75%

A two-tailed t-test was conducted to compare the Raw Utilization Rate before and after opening the additional ORs. Despite an increase in surgical volume (as reflected in the Total Patient In-Room Time) there was a significant difference in the utilization rates between the two time periods at the $p < 0.01$ level; $t = 14.31$, $p = 0.0000000000000000000000000007$.

DISCUSSION

Most experts recommend that the OR utilization rate for a trauma center should be approximately 75%. The Prime Time Utilization Rate in our institution was consistently greater than 80%. (An explanation is warranted about the way Prime Time Utilization is calculated. In our institution a substantial number of cases are added on the day of surgery. As a result, it is sometimes difficult to coordinate an available OR with an available surgeon, resulting in a prolonged interval between cases. According to the AACD Glossary, "Turnover Time" applies to "sequentially scheduled cases." Since add-on cases were not sequentially scheduled and were commonly cases for a different service, the calculation of time between cases does not meet the AACD definition of "Turnover Time." Because the interval between cases was used as a metric for OR efficiency, a prolonged interval between cases was considered not to reflect OR efficiency so these intervals were excluded. The decision was made that Between Case Gap time longer than 90 minutes would not be included in calculation of Prime Time Utilization. The result of these exclusions was that the reported Prime Time Utilization Rate was factitiously elevated.)

Faced with continuously increasing demand for OR time, the institution elected to complete the build-out of six ORs that had been shelled-in during a prior construction phase. Subsequently a series of decisions (e.g., construction of another Hybrid OR) resulted in construction taking more than two years. Since the number of minutes of surgery continued to increase, the OR Executive Committee (composed of representatives from Anesthesiology, Surgery, Nursing, and Hospital Administration) responded by encouraging the completion of more procedures at satellite facilities in our system and by further expanding the number of Resource Hours by scheduling 10 – 12 hours of Block Time (time reserved for a given service) or Open Time (time that is available for any service) for most ORs on weekdays and to run elective rooms on Saturday.

In our opinion the Prime Time Utilization reported within our institution overstated the actual Adjusted Percent Utilized Resource Hours. We perceived that the prolonged Between Case Gap) was exacerbated by inefficiencies due to several factors including:

- Inadequate nursing resources on the floors and in the intensive care units, which resulted in "boarders," patients being held in the Post Anesthesia Care Unit (PACU) until beds on the floor or in the ICU became available; this, in turn, resulted in

patients in the OR being placed on PACU Hold (i.e., patients in the OR who were ready for transfer to PACU but for whom no PACU bed was available);

- Inadequate nursing resources in the PACU (because physical beds were essentially always available even when boarders were present), which exacerbated the problems of PACU Holds;
- Problems with staffing in Materials Management, which resulted in prolonged turnover times, sometimes exceeding 90 minutes, even between sequentially scheduled cases for the same service, and was therefore not reported as turnover time by the institution;
- Geography of Materials Management, moving materials management into a new space resulted in a distance of over 0.5 mile between Materials Management and one bank of ORs.

CONCLUSION

Addition of ORs was effective in decreasing Prime Time Utilization and the Raw Utilization Rate despite an increase in the numbers of cases performed.

The reported Prime Time Utilization in our institution does not accurately reflect the Raw Utilization Rate or the Productivity Index as defined by AACD.

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NURSING STRIKES AND OPERATING ROOM MANAGEMENT

Niketu P. Patel, B.A[1]; Chris R. Mayhew, MD[2]; Mitchell H. Tsai, MD, MMM[3]

[1]Medical Student, Larner College of Medicine at UVM, Department of Anesthesiology

[2]Resident, Department of Anesthesiology

[3]Associate Professor, Department of Anesthesiology, Department of Orthopaedics and Rehabilitation (by courtesy), Department of Surgery (by courtesy)

Institution: University of Vermont Larner College of Medicine, Department of Surgery, Department of Anesthesiology. 111 Colchester Avenue, Burlington, VT 05401

Abstract: Perioperative processes represent complex systems consisting of several working parts that rely on one another to function efficiently and effectively. The nurses' union at the University of Vermont Medical Center (UVMMC) went on strike for two days in July 2018, and the hospital implemented measures to maintain patient safety and continue normal operations by hiring travelling nurses. UVMMC operated at 35% less than its normal case load in the operating room. First Case Start Delay times increased (+69%), Scheduling Error decreased (-42%) and After-Hours case duration decreased (-70%). The changes in overall OR workflow resulted in additional expenses and concomitant lost revenue from cancelled cases but improved some OR efficiency metrics. The push to maintain clinical operations with temporary nurses must be counterbalanced by consultation with OR directors, analyzing patient safety, long-term implications and accounting for unrealized costs.

Introduction

"Hospitals absolutely cannot afford any interruptions in service caused by work stoppages. Health care facilities are not like assembly lines." - Fink, 1989[1]

Perioperative processes represent complex systems consisting of several working parts that rely on one another to function efficiently and effectively. Nurses are a fundamental part of this system and a nursing strike creates a large ripple effect. Perioperative services and emergency departments feel the impact of variances in staffing issues due to their role in admitting patients. The University of Vermont nurses' union went on strike for two days in July 2018.[2] The hospital administrators hired 600 traveling nurses. Surgeons cancelled 68 scheduled cases and all ambulatory center cases were moved to the main hospital. Perioperative managers and clinical directors can estimate the OR efficiency impact with operational metrics.

Methods

Following approval from the Institutional Review Board at the University of Vermont, data was extracted from WiseOR® (Palo Alto, CA) at UVMMC from June 4, 2018 to August 13, 2018. The institutional review board provided a waiver of informed consent for a retrospective, de-identified review of process metrics. OR efficiency was analyzed with first-case start delays, prolonged turnover times, after-hours utilization, volume of cases, and scheduling error. The hospital staffed 12 operating rooms from 07:30 to 17:30 to handle the elective and trauma

surgical workload. Holidays and weekends were excluded from the overall analysis. Data were imported into Microsoft Excel (Redmond, WA).

Results

The average number of cases performed at the University of Vermont Medical Center from June 4th, 2018 to August 13th, 2018 was 46.8 cases per day. During the strike, it was 30.5, a decrease of 35% from the average. The average after hours' time of 636 minutes decreased to 194 minutes (70% decrease). The average percent of cases with scheduling errors was 38.8% and during the strike that number was 22.5% (a 42% decrease). The average turnover time is 40.3 minutes and during the strike, the average turnover time was 38 minutes (decrease of 6%). The average total first case start delays is 195 minutes and during the strike, it increased to 320 minutes (69% increase). Table 1 below outlines the aforementioned results.

Discussion

Perioperative services account for a large portion of a hospital's expenses and a significant source of revenue. A nursing strike increases staffing costs, decreases OR efficiency, and lowers the clinical productivity of a perioperative service.[3] Elective and major surgeries were postponed or cancelled and UVMMC functioned at 35% less than its normal caseload. UVMMC paid for staffing during periods when the OR was not at optimal or maximal capacity. Under-utilized time can be 60% greater than over-utilized OR costs due to "zero surgical productivity."[4,5] The hospital paid for fixed costs and missed opportunities to generate hospital revenue. New employees require time to "develop competencies"[6] and may explain increased first case start delays. Improved operational efficiencies without compromising patient safety in this study may be attributed to fewer cases, decreased complexity of surgical cases, and higher staffing ratio.

In a way, the hospital transitioned from a mixed-patient workload to an ambulatory surgical queue and hired travelling nurses to ensure patient safety, but this safety engineering feature is not sustainable. If the strike extended, the loss of productivity and revenue would force the hospital to return to a normal surgical queue and expose patients to significant risks.

Limitations

The impact of temporary nurses on the OR alone could not be evaluated because the hospital system adapted by decreasing the OR case volume, the complexity of cases and staffing. Advanced statistics could not be performed because of low power and a high standard error. The impact of rescheduled cases on OR overutilization was not analyzed. A full financial analysis of the nursing strike could not be performed, only estimated.

Future studies should analyze hiring costs of replacement nursing staff and the losses associated with lower clinical productivity levels. Although no metric fully encapsulates a nurse's knowledge, hospital administrators must appreciate the opportunity costs associated with a nursing strike. In regions with stiff health care competition, these long-term implications include patient satisfaction and perception, further altering the future revenue streams of the hospital.

Conclusion

The push to maintain clinical operations with temporary nurses must be counterbalanced by analyzing patient safety, long-term implications and unrealized costs. Evaluating the realized and unrealized opportunity cost a nursing strike has on the OR helps perioperative managers and clinical directors understand the financial and operational impact for future strikes. OR directors need to be part of discussions before a hospital goes on strike. With a rational list of priorities, organizations can balance multiple competing objectives (e.g. patient safety, open access, anesthesia clinical productivity) by leveraging the operating rooms to maintain basal operations.

Table 1: Summary of OR efficiency data collected from June 4 to August 13, 2018

	Average	Strike	% change
Volume	46.8 cases	30.5 cases	-35%
After Hours' Time (total)	636.0 minutes	193.5 minutes	-70%
Elective Cases	417.1 minutes	104.5 minutes	-75%
Emergent Cases	218.9 minutes	89.0 minutes	-59%
Scheduling Errors	38.8%	22.5%	-42%
Turnover Time	40.3 minutes	38.0 minutes	-6%
First Case Start Delay	194.8 minutes	320.0 minutes	+69%
Ambulatory Center Volume	17.3 cases	0 cases	-100%

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Nursing Strikes and Operating Room Management

The University of Vermont
LARNER COLLEGE OF MEDICINE

[1]Niketu P. Patel, BA, [2]Chris R. Mayhew, MD, and [2]Mitchell H. Tsai, MD

1. University of Vermont Larner College of Medicine, 2.Department of Anesthesiology

THE University of Vermont MEDICAL CENTER

Background

- Perioperative processes represent complex systems consisting of several working parts that rely on one another to function efficiently and effectively
- Traveling staff decreases efficiency, increases costs and impacts safety
- University of Vermont nurses' union went on strike for two days after disagreement over salaries negotiations
- The hospital hired 600 traveling nurses to maintain safety and continue normal operations and surgeons cancelled about 68 scheduled cases

Study objective: To evaluate the opportunity costs and to estimate the impact of changes made during a nursing strike on OR efficiency using operational metrics

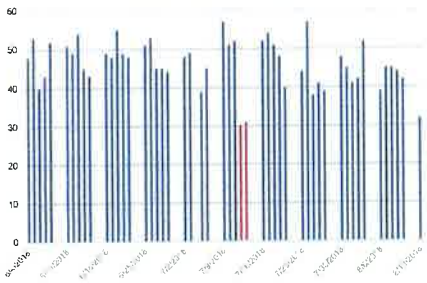
Methods

- Data was extracted from WiseOR® (Palo Alto, CA) at UVMMC from June 4, 2018 to August 13, 2018
- Efficiency of OR utilization was analyzed with first-case start delays, prolonged turnover times, after-hours utilization, volume of cases, and scheduling error
- Holidays and weekends were excluded
- Opportunity-unused time represents under-utilized time that can accommodate an additional case and is the best metric for assessing utilization and efficiency

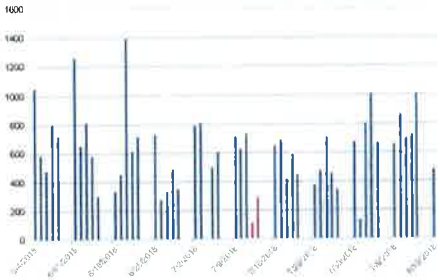
Results

	Average	Strike	% change
Volume	46.8 cases	30.5 cases	-35%
After Hours' Time (total)	636.0 minutes	193.5 minutes	-70%
Elective Cases	417.1 minutes	104.5 minutes	-75%
Emergent Cases	218.9 minutes	89.0 minutes	-59%
Scheduling Errors	38.8%	22.5%	-42%
Turnover Time	40.3 minutes	38.0 minutes	-6%
First Case Start Delay	194.8 minutes	320.0 minutes	+69%
Ambulatory Center Volume	17.3 cases	0 cases	-100%

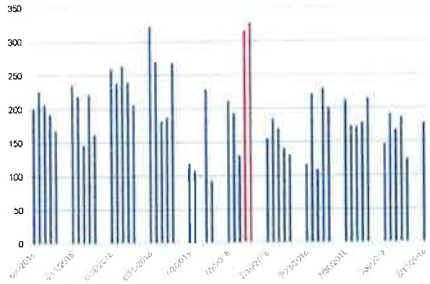
Total Volume at UVMMC



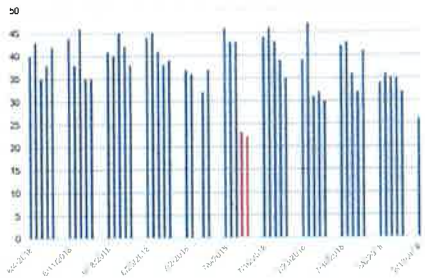
Daily Total After Hours Time Spent (minutes)



First Case Start Delays (minutes)



Total Percent Scheduling Error



Discussion

- The strike increased the administrative burden on OR directors and changed the workflow
- The institution transitioned from a mixed-patient workload to an ambulatory surgical queue to maintain patient safety
- The hospital still paid for fixed costs and missed opportunities to generate hospital revenue
- A nursing strike increases staffing costs, decreases OR efficiency, and it lowers the clinical productivity of a perioperative service
- Improved operational efficiencies without compromising patient safety in this study may be attributed to fewer cases, decreased complexity of surgical cases, and higher staffing ratio

Conclusion

- There was a financial and operational impact of nurses on strike and the hiring of travelling nurses to maintain normal operations
- Evaluating the realized and unrealized opportunity cost a nursing strike has on the OR can help perioperative managers and clinical directors better understand the financial and operational impact for future strikes
- OR directors need to be part of discussions before members of a hospital go on strike to ensure patient safety and maintain efficiency

Measuring Clinical Productivity in a Large Academic Anesthesia Department

Jose M. Soliz M.D., Richard Carlson M.D., Ryan Thompson MBA, Thomas Rahlfs M.D.

Department of Anesthesiology and Perioperative Medicine
University of Texas MD Anderson Cancer Center, Houston, TX

Introduction:

Various models have been proposed to measure clinical productivity in an academic anesthesiology department. These models often do not address required non-billable clinical activity or factor non-clinical work that supports the institutional mission. We propose the use of a hybrid productivity model, measuring adjusted clinical productivity (ACP), to address the deficiencies in current clinical productivity models.

Methods:

The University of Texas MD Anderson Cancer Center employs 71 academic anesthesiologists. In our department, clinical productivity is measured through adjusted anesthesia minutes (AAM). AAM include minutes from direct billable care, but also clinical care from non-billable activity (covering PACU, code pager, Anesthesia Assessment Center, On-call, Acute Pain Service, float physician, etc.). The AAM value for the non-billable minutes is predetermined via committee, which is comprised of a diverse set of individuals representing all of the various niches within the practice.

The standard number of minutes is determined by the number of minutes generated on an average daily amount of billable time in the operating rooms, or Average OR Day (AOD). The minute value of non-billable clinical activity is based on the length of required clinical activity (Table 1), and then calculated by calibrating that activity with the AOD. Clinical effort (CE) is determined multiplying employment FTE (full time equivalent) by Clinical FTE (Table 2). The Adjusted Clinical Productivity (**ACP**) is measured by the formula below:

$$\textbf{ACP} = \text{AAM}/\text{CE}$$

Results:

Seventy one anesthesiologists were included in the analysis. The mean CE was 0.794, with the mean AAM was 64,274. The overall group Adjusted Clinical Productivity was 80,950. (Table 3). Figure 1 depicts graphically the Adjusted Clinical Productivity by all 71 anesthesiologists.

Discussion:

Measuring clinical productivity in a large academic anesthesiology department presents unique challenges as billable minutes do not correlate with the entire clinical staffing needs, nor factor the required non-clinical activity of the anesthesiologist. The proposed model factors these deficiencies using pre-

determined values attached to non-billable activity, as well as does not penalize faculty for non-clinical roles/duties.

Table 1: Minute value of non-billable clinical work

Role	Clinical time	Non-billable clinical minute value
PACU Physician	7am-430pm (9.5 hrs.)	Avg. OR Day (AOD*)
Code Physician	7am-430pm (9.5 hrs.)	AOD
AAC	8am-5pm (9 hrs)	AOD
Acute Pain	24 hr. call (home)	1.5 AOD
Weekday Call Physician	14.5 hrs.	1.5 AOD
Weekend Call Physician	24 hrs.	2.5 AOD
Float Physician	6 hrs.	0.5 AOD

*AOD: minutes equivalent of an average OR day based on previous fiscal year.

Table 2: Formula calculation for adjusted anesthesia minutes, clinical effort, adjusted clinical productivity

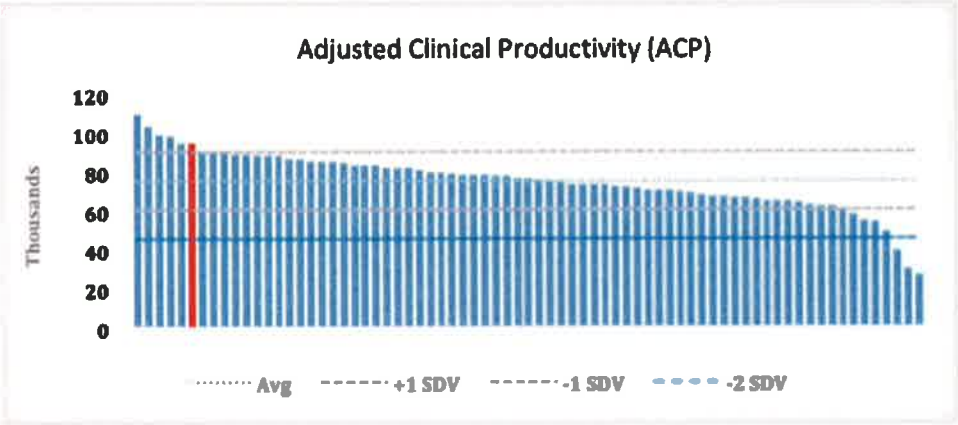
	Calculations
Adjusted Anesthesia Minutes	AAM = billed clinical minutes + non-billable clinical minutes*
Clinical Effort	CE = employment FTE X Clinical FTE¥
Adjusted clinical productivity	ACP = AAM/CE

* See Table 1 for non-billable clinical minutes
¥ FTE=full time equivalent

Table 3: Average adjusted anesthesia minutes, clinical effort, adjusted clinical productivity

	#	Avg. AAM (range)	Avg. CE (range)	**Avg. ACP (range)**
Anesthesiologists	71	64,274 (5309-101,456)	0.794 (0.2-0.92)	80,950 (26,546-110,279)

Figure 1: Adjusted Clinical Productivity



Impact of major medical conferences on scheduled clinical operations

Charles E. Cowles M.D., Jose M. Soliz M.D., Laurie Hafner CRNA, Young Shrout CRNA, Larissa Ramos CRNA, Clint Westaway CRNA, Mark Veazie CRNA, Gilda Matute CRNA, Garry Brydges CRNA

Department of Anesthesiology and Perioperative Medicine
University of Texas MD Anderson Cancer Center, Houston TX

Introduction:
Predictive analytics are essential to optimizing personnel requirements for staffing anesthetizing locations. Often, these analytics fail to incorporate events in their analysis such as major medical conferences that occur at varying times throughout the year. At our hospital, a major academic cancer center, the aim was to determine if national medical conferences impacted scheduled clinical operations during the corresponding dates of the conferences.

Methods:
After institutional review, the project design was exempt from needing IRB or QIAB approval. During the calendar years 2017 and 2018 (to date) all daily surgical case volume and percent utilizations were collected and analyzed for our operating room and endoscopy suites. As our institution is a large center dedicated to the care of cancer patients, dates for relevant medical conferences were collected including American College of Surgeons (ACS), Society of Surgical Oncology (SSO), American Society of Clinical Oncology (ASCO), Digestive Disease Week, and American College of Gastroenterology. Excluding major U.S. holiday weeks and weekends, daily personnel counts, case volume and percent capacity utilization was included for analysis. Data related to the dates of major medical conferences was compared and analyzed to baseline data. Descriptive statistics were performed, and a paired t-test was used to analyze continuous variables. A p-value <0.05 was considered statistically significant.

Results:
Overall, during dates of selected major medical conferences, our institution had a 10.8% reduction in percent utilization of our anesthetic services in our OR and endoscopy suites. Descriptive data is described in Table 1. When compared to baseline data in the operating room, surgical related conferences resulted in a 7.7% statistically significant reduction in case volume ($p=0.021$), though the OR percent capacity utilization did not show a statistical significant reduction ($p=0.757$). Similarly, the gastrointestinal related medical conferences resulted in an overall statistically significant reduction of 15.3% cases ($p=0.026$) in the endoscopy suite when compared to baseline (Table 2).

Conclusion:
At our institution, the dates of major surgical and gastrointestinal medical conferences corresponded to a decrease in anesthetic location volume. Using the

historical data, we plan on incorporating this analysis into our staffing plan during future conference dates. Knowledge and tracking of case volume trends related to extra-institution related activities are important considerations for optimizing institutional resource utilization.

Table 1: Operating room clinical operations during surgical/oncology meetings

	Baseline	**During Major Oncology/Surgical Meetings**	**p-value**
OR cases	59.1 ± 7.9 59.5 (33-80)	54.9 ± 7.4 55.5 (41-69)	0.021*
OR starts	31 ± 2.4 32 (20-34)	30.8 ± 2.8 32.5 (24-34)	.757
Capacity utilization %	85.8 ± 13.4 87 (42-118)	84.2 ± 13.2 85 (58-108)	0.603
MDs scheduled	19.2 ± 2 19 (8-28)	19.4 ± 2.1 19.5 (16-23)	0.675
CRNAs Scheduled	30.2 ± 2.6 30 (18-49)	30.4 ± 2.1 31 (26-34)	0.772

* Denotes statistically significant value. Values described as n ± std, median (range) unless otherwise specified. Major surgical/oncology meetings include American College of Surgeons, Society of Surgical Oncology, and American Society of Clinical Oncology.

Table 2: Endoscopy suite clinical operations during major gastrointestinal meetings

	Baseline	**During Major GI Meetings**	**p-value**
Endoscopy cases	39.9 ± 9.6 39 (17-65)	33.8 ± 11.4 36 (9-50)	0.026*
Endoscopy starts	5.9 ± 1 6 (3-8)	5.4 ± 1.6 5 (3-8)	0.059
MDs scheduled	2.9 ± 0.5 3 (2-6)	2.8 ± 0.7 3 (2-4)	0.682
CRNAs Scheduled	7.4 ± 1.2 7 (4-11)	6.6 ± 1.8 7 (4-10)	0.023*

* Denotes statistically significant value. Values described as n ± std, median (range) unless otherwise specified. Major gastrointestinal meetings include Digestive Disease Week and American College of Gastroenterology.

UTILIZING A QI TIME SERIES STUDY TO INFORM QI INITIATIVES FOR IMPROVING INPATIENT ENDOSCOPY WORKFLOW

Sonali Palchaudhuri MD, Sara Attalla MD, Jaime Gilbo RN, Mark Weiss MD, Shivan J. Mehta MD MBA MSHP, Jan-Michael A Klapproth MD, Gregory Ginsberg MD, David C. Metz MD, Michael L. Kochman MD, Nuzhat Ahmad MD, Shazia M. Siddique MD MSHP

University Of Pennsylvania, Philadelphia, PA

Background & Aims: Inpatient endoscopy workflow is complex due to the need for multidisciplinary care coordination and on-demand scheduling. At our facility, weekday inpatient procedures are performed in dedicated operating rooms (ORs) with anesthesia support, with staff resource changes after 17:00. Delays result in unpredictable schedules and extended work days, negatively impacting patient care and both patient and provider dissatisfaction. This initiative sought to find targetable opportunities to streamline endoscopy workflow and minimize time between cases by utilizing a time-series study, with the goal to decrease days with cases extending beyond 17:00.

Methods: We conducted an IRB-approved QI (Quality Improvement) retrospective analysis of all weekday inpatient endoscopy cases from 7/2017 through 9/2018. Our primary outcomes were number of cases performed each day and the day's finishing time, defined as the endoscope-out time for the day's last case. For all weekday inpatient cases over a two-month period, we conducted a time series study of the processes involved in completing an endoscopic procedure to find the takt time and identify sources of variability. All OR cases are completed with anesthesia support in consecutive order, unless resources are provided to staff other ORs for simultaneous cases. We engaged stakeholders to build a detailed process map, known as a swim lane diagram, and identify barriers in care that lead to delay.

Results: The process map for inpatient endoscopy shows key areas of variability and delay (Figure 1). During 315 weekdays over a 15 months period, the total number of cases was 2220, with a mean of 7 per day (SD 2, range 2-17), finishing time of 17:46 (SD 2:23 hours, max 1am). The time series study included 28 weekdays of OR consecutive cases (176 procedures, 45 of which were same-day add on cases mixed into the caseload). We calculated the mean times of each process step per procedure with total takt time, accounting for whether the patient goes to the peri-op holding (PRA) (Figure 2). The total amount of time for the patient from leaving the hospital room to leaving the OR was 2:38 and 1:53, with and without PRA respectively. The average total OR time per patient, defined as the time of a patient's OR arrival to the next patient's OR arrival, was 1:33 and 1:56 with and without PRA respectively, where the latter included transport time. The mean time spent on endoscopy per case was 26 minutes (IQR 12-36 min), which was 26% of the total OR time (from 7:30 to last case endoscope-out). The OR was unoccupied for 31% of total OR time, with an average time between cases of 34 minutes (SD 22 min).

Conclusions: There was high variability in caseload and finishing time, and substantial amount of time between cases. The time-series study identified barriers in workflow, which will be targets for improvement with measurable process and outcome metrics. This study shows how

quality improvement tools and methods may be used to improve efficiency of inpatient endoscopic procedures.

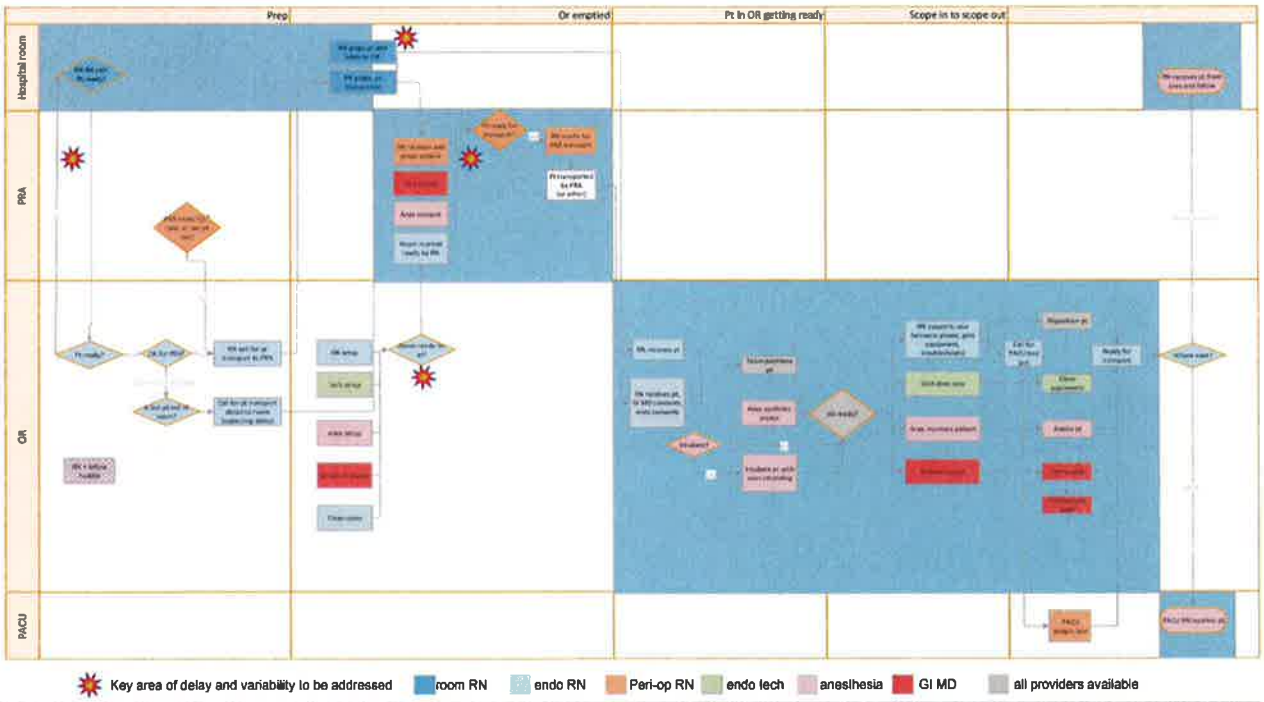


Figure 1. Flowchart of the workflow of how a patient gets an inpatient endoscopic procedure. Swimlane rows indicate different locations involved. Stages of the process are indicated in the columns labeled on the top. The blue background follows the patient's location through the process. The colors of each process indicate the team member(s) managing the task, as listed in the key.

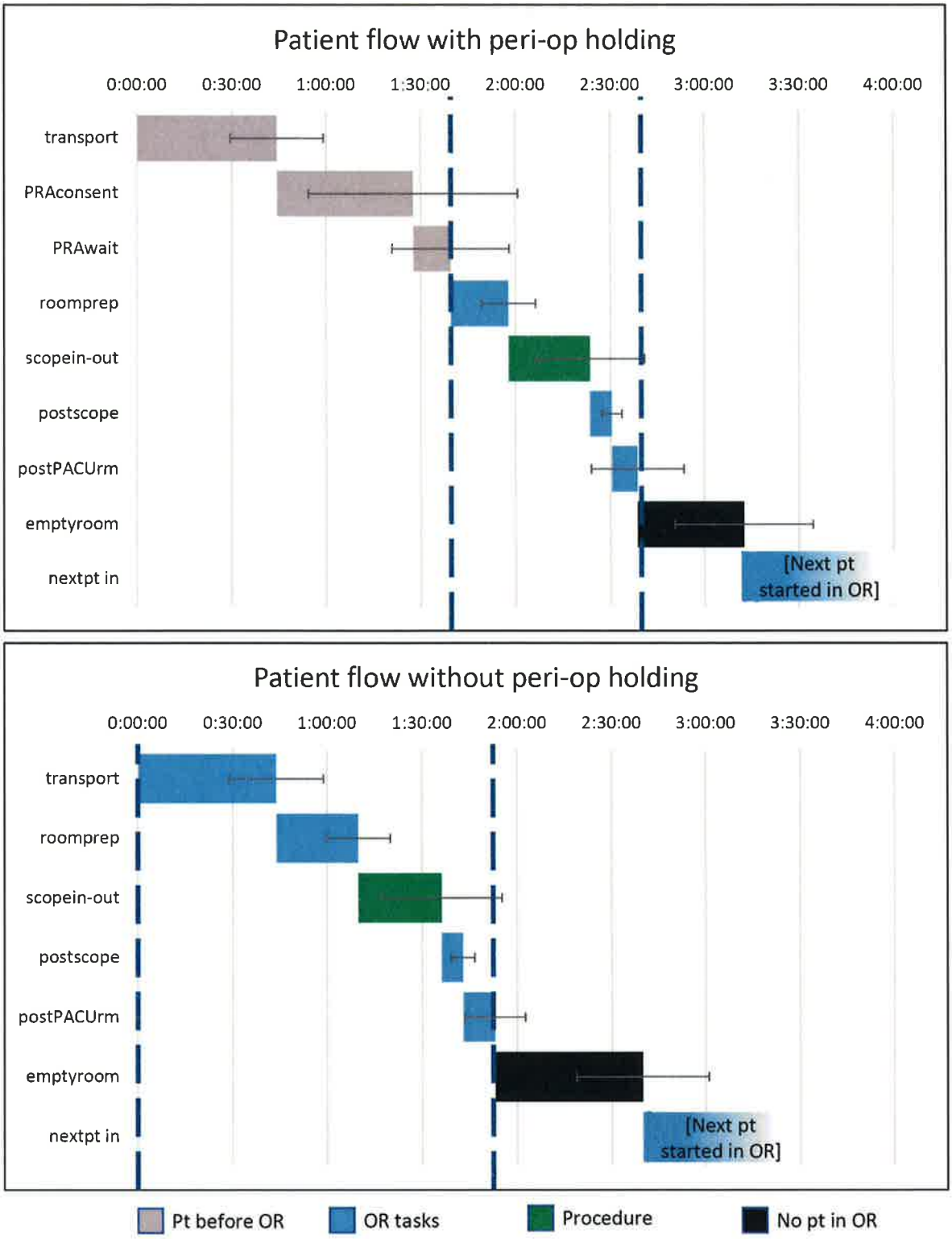


Figure 2. Gantt chart with processes involved in each patient's procedure. Dashed lines indicate processes with the patient in the OR. A)For patients that had pre-procedure holding in the peri-op area. Takt time is 3:13. B) For patients who came directly from the hospital room to the OR, with no peri-op holding. This occurs for patients under ICU care and for cases after the PRA closes. Takt time is 2:40.

DELAYS IN PERIOPERATIVE PATIENT FLOW—AN INITIAL ANALYSIS

Authors: David F. Nelson MD, MBA, Kent B. Berg, MD, MBA, Oren Guttman, MD, MBA, Rebecca A. Barnett MD, MBChB

Contact: David.Nelson@jefferson.edu. c: (859) 552-6424

Institution: Department of Anesthesiology, Sidney Kimmel Medical College at Thomas Jefferson University, Philadelphia, PA

Introduction

While considering the operating room (OR) suite as a hospital business unit, one must acknowledge its revenue-earning potential and contribution to financial solvency yet also the liability of incurring considerable margin-eroding cost when utilized inefficiently.[1] There are many operational performance metrics that describe OR efficiency such as adjusted utilization, turnover times, and billed-to-staffed ratios, all of which describe how well resources are matched to surgical demand.[2] However, one particularly challenging contributor to perioperative inefficiency is when patients are prevented from moving out of the OR into downstream phases of care once surgery has been completed. These so-called "PACU delays" (also known as recovery room admission delays) are particularly concerning for OR leadership because they not only represent sources of high direct labor costs, but can also lead to opportunity cost of lost revenue when OR locations are prevented from being used to meet the demands of the system. At Thomas Jefferson University Hospital in Philadelphia, PA, PACU delays increased in frequency and magnitude in a relatively short period of time, prompting data-driven evaluation and innovation to determine underlying cause.

Methods/Program Design

September 2018 OR-PACU delay (OPD) data was obtained for the two PACU locations at our institution, "Thompson" and "Gibbon," and was defined as minutes per case that patients were held in the OR despite being ready to move to the PACU. Baseline delay rates on a total case basis were determined to be 13% for "Thompson" PACU bound patient and 22% for "Gibbon" PACU patient. Mean delay time was 22 minutes (standard deviation 32 min) and 32 minutes (SD 59 min) for each PACU location, respectively (see figure 1 and figure 2). Financial analysis was performed that focused on the variable costs of OR labor (conservatively estimated at $25.63/min), yielding an estimated annualized financial impact of $4.9M. Interviews were conducted with unit managers including PACU nursing leadership, perioperative leadership, and patient flow management (PFMC) to gather data for analysis of cultural, institutional, and systematic barriers to patient flow. The results of these interviews led to hypothesizing that hospital bed capacity and PACU staffing were the primary drivers of delays. Thus initial interventions were aimed at increased PACU RN staffing to capacity by adding overnight shift RN (50% staffing capacity increase), as well as financial incentives for overtime. At the same time, 13 additional hospital beds were made available in attempt decompress ED and PACU overflow.

Results

Post-initial intervention OR-PACU delay metrics were then obtained for November 2018 and are displayed in Figures 3 and 4. OR-PACU delay rate for the two PACU locations "Thompson" and "Gibbon" were found to be 14% and 20%, respectively, an increase of 1% for Thompson and 2% for Gibbon PACUs. The magnitude of delays decreased to mean of 17 minutes (SD 24 min.) and 26 minutes (SD 50 min.) for each PACU, respectively.

Discussion

Clearly the impact of delays in perioperative patient flow have urgent and far-reaching consequences in several domains, including patient experience and safety, operational efficiency, and financial performance. The aforementioned financial burden of $4.9M is a conservative estimate that highlights incremental labor cost alone, and does not reflect opportunity cost of not performing surgery. Moreover, the effect on staff morale and patient satisfaction is unquantifiable and unsustainable. The results of the initial analysis for this continual process improvement project indicate that capacity and staffing are likely only partial contributors to defects in perioperative patient flow. While the mean and standard deviation of OR-PACU delay minutes decreased modestly, the raw rate of delayed cases was essentially unchanged in months were surgical volume was similar. Despite increasing structural and operational capacity by augmenting PACU staffing and increasing downstream bed availability, the results suggest that process defects exist that warrant further investigation. Such process-related hypotheses include inefficient service-line bed allocation, bed availability by level of patient acuity, and changes in case mix that represent decanting opportunities to other systemwide facilities. Further investigation is underway, and notably includes in-depth process analysis and value-stream mapping.

Figure 1: Heat map of September 2018 PACU delays

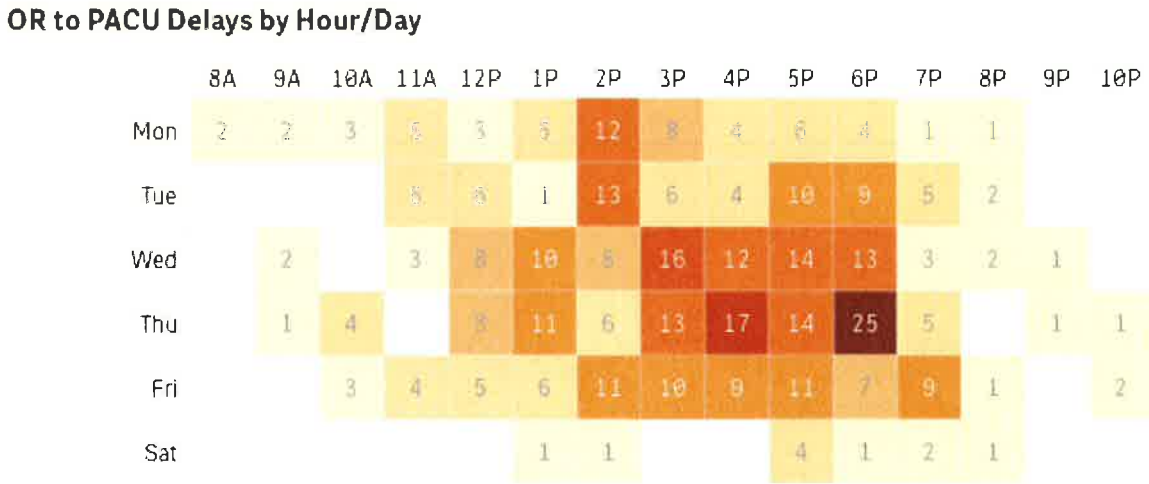


Figure 2: September 2018 PACU delay data

PACU Location | Location | Service | PACU Area | Month Year | Case ID | Primary Physician | Day

Measures

	OR to PACU Delay Cases	OR to PACU Delay Minutes	OR to PACU Delay Hours	Cases	OR to PACU Delay Rate	OR to PACU Delay Minutes Per Delayed Case ..	OR to PACU Delay Minutes Per Delayed Case (1σ)
TJUH 5 Thompson PACU	5	108	2	40	13%	22	32
TJUH 7 Gibbon PACU	354	11,292	188	1,511	23%	32	59

Figure 3: Heat map of November 2018 PACU delays

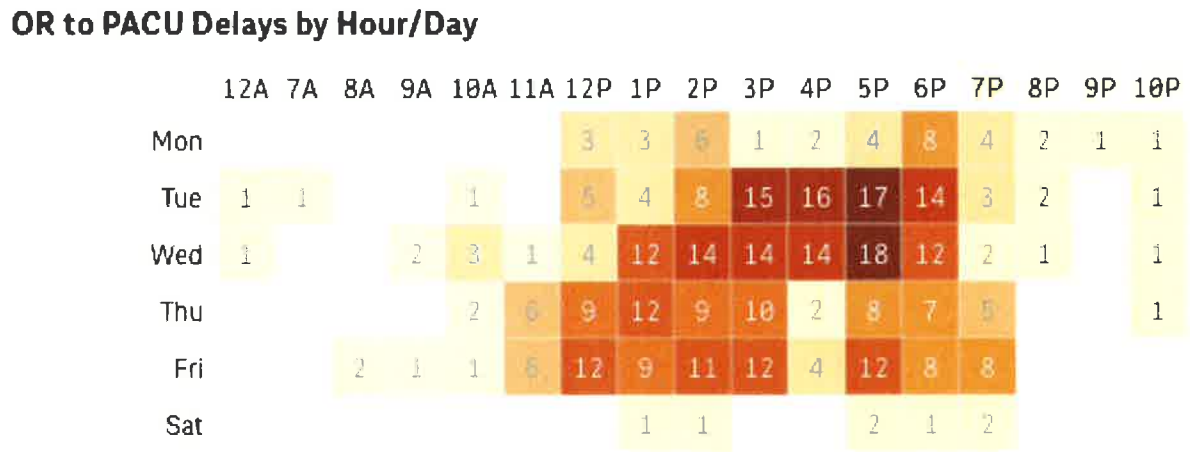


Figure 4: September 2018 PACU delay data

Jefferson. OR To PACU Delay

PACU Location | Location | Service | PACU Area | Month Year | Case ID | Primary Physician | Day

Measures

	OR to PACU Delay Cases	OR to PACU Delay Minutes	OR to PACU Delay Hours	Cases	OR to PACU Delay Rate	OR to PACU Delay Minutes Per Delayed Case (Mean)	OR to PACU Delay Minutes Per Delayed Case (1σ)
TJUH 5 Thompson PACU	10	169	3	69	14%	17	24
TJUH 7 Gibbon PACU	331	8,744	146	1,634	20%	26	50

References

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Departmental Intranet Dashboard Compiling EMR, Scheduling and Billing Data to Prioritize End-of-Day Relief of Providers by Anesthesia Clinical Directors

Chad Slater-Scott, BA (Applications Developer); **Anil Marian, MD, FRCA.** (Vice-chair, Clinical Operations)
Department of Anesthesia, University of Iowa, Iowa City, Iowa

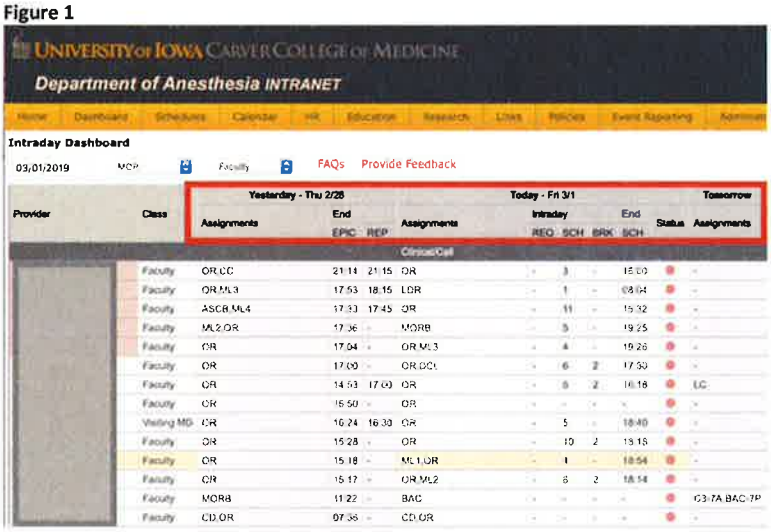
Background

Lack of visibility to the previous day's extended work hours and other scheduling information leads to end-of-day decision making by Clinical Directors (CD) that is inconsistent and perceived by anesthesia providers as unfair. The aims of the QI project were: 1) Incorporate multiple unconnected sets of data into one view of current and historical scheduling and case data allowing CDs to make more informed decisions about prioritizing reliefs of anesthesia providers, and 2) Make the dashboard transparent to all providers in the department to view the decisions being made by coordinators on a daily basis to reduce perceptions of unfairness and inconsistency

Methods

Data were acquired from relevant historical and real-time data from multiple sources. The data sources included EMR (EPIC™ AIMS), Departmental Scheduling (Qgenda™) and Billing (EPIC™ AIMS). These were then analyzed to determine the necessary data points to incorporate into the dashboard. Optimal layout for real-time decision making was made in discussion with the CDs. The dashboard was then developed and published on the Anesthesia Department Intranet with access to all providers (Figure 1). The dashboard displayed provider details (with ability to sort in groups as Faculty, Residents, Fellows, CRNAs and SRNAs), and their assignments on the previous day, on the day of, and the day after. The data compiled from various sources were used to show their assigned schedule, EMR case end times (from EMR/billing) and self-reported end times (from department reporting system) from the previous day. Additionally, the anticipated end times based on scheduled cased from EMR on the day of were displayed.

Figure 1



Results

The new dashboard went live on August 14th, 2018. Usage patterns indicate that the dashboard is being utilized on a daily basis by both CDs and providers. CDs provided positive feedback on its usefulness in decision making. There has been a reduction in complaints and negative comments by providers related to end-of-day relief decisions. Alignment in types of providers working extended hours (faculty, CRNAs, and trainees) more equally sharing in the burden of working later than expected. Preliminary analysis of relief times for faculty who are on a clinical assignment without any call assignments were done to identify early patterns. For analyzing data, we excluded the month of go-live and looked at data for 3 months before and 3 months after. There were 890

assignments before and 683 assignments after the changes were made. The time of relief (80th percentile) was **17.30** before and **17.15** after, a difference of **15 minutes**.

Discussion

This process improvement project involved developing and implementing a new tool to aid staffing coordinators in making fair and consistent decisions concerning end-of-day relief. Due to the highly variable nature of the length of, the number of, and add-on cases in operating rooms, it is difficult to predict and schedule the correct end times for anesthesia providers' assignments. This causes several providers a day to work extended/overtime hours resulting in unpredictability of individual schedules and work-like balance issues. This unpredictability manifests itself in the form of complaints and comments surrounding unfairness and inconsistency. Upon review of the process staffing coordinators used to make end-of-day staffing solutions, it became obvious that both the coordinators and the providers lacked insufficient information to understand the complexities of these decisions. The new electronic dashboard brought together a more complete picture of a provider's previous, current and future workloads, and helped in decision making on relief by coordinators. While preliminary analysis showed only moderate (15 min) improvement in the time of relief times, we awaiting more detailed analysis of on the impact on decision making and times. Also, such improvements, though small, can have an impact on work-life balance and provider satisfaction.

Conclusion

In a busy and unpredictable operating room environment, many factors go into deciding which anesthesia providers work extended hours/overtime. The data used to make these decisions must be transparent and readily available to both coordinators and providers. By applying a consistent process using the dashboard, coordinators can reduce the perception of unfairness and distribute the burden of extended hours/overtime more equitably. Also, providers can begin to understand the complexities of the process and interconnectedness of multiple factors related to decision making by clinical directors.