


ERAS (Enhanced Recovery After Surgery)
Improving Opioid Stewardship Across the Surgical Continuum

Health Services Advisory Group (HSAG)

Tuesday, May 23, 2023

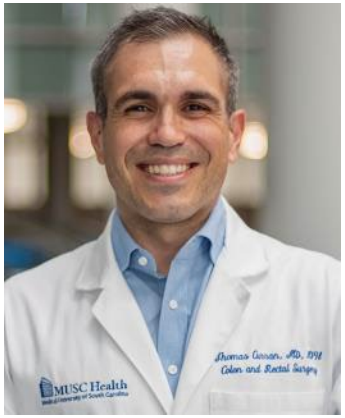
Learning Objectives

- Gain insight on the implementation of the ERAS program at the Medical University of South Carolina (MUSC).
- Hear about its impact on the reduction of patient's hospital stays and the use of PCAs (post-controlled analgesia) following colorectal surgeries and other procedures.
- Understand the importance of implementing opioid-free surgery to curb opioid use and potential addiction for patients.

Our Guest speakers

Dr. Mark Lockett, MD

Associate Professor of Surgery at the Medical University of South Carolina



Dr. Thomas Curran, MD, MPH, FACS, FASCRS

Assistant Professor of Surgery, Division of Colon and Rectal Surgery

Dr. Katherine Morgan, MD, FACS

Chief of GI and Laparoscopic Surgery

South Carolina Surgical Quality Collaborative

Mark Lockett, MD

March 8, 2023

South Carolina Surgical Quality Collaborative (SCSQC)

- Established in 2015
- Joint effort to improve the quality and value of surgical care in South Carolina
- Originally funded by the Blue Cross Blue Shield of South Carolina Foundation and the Duke Endowment

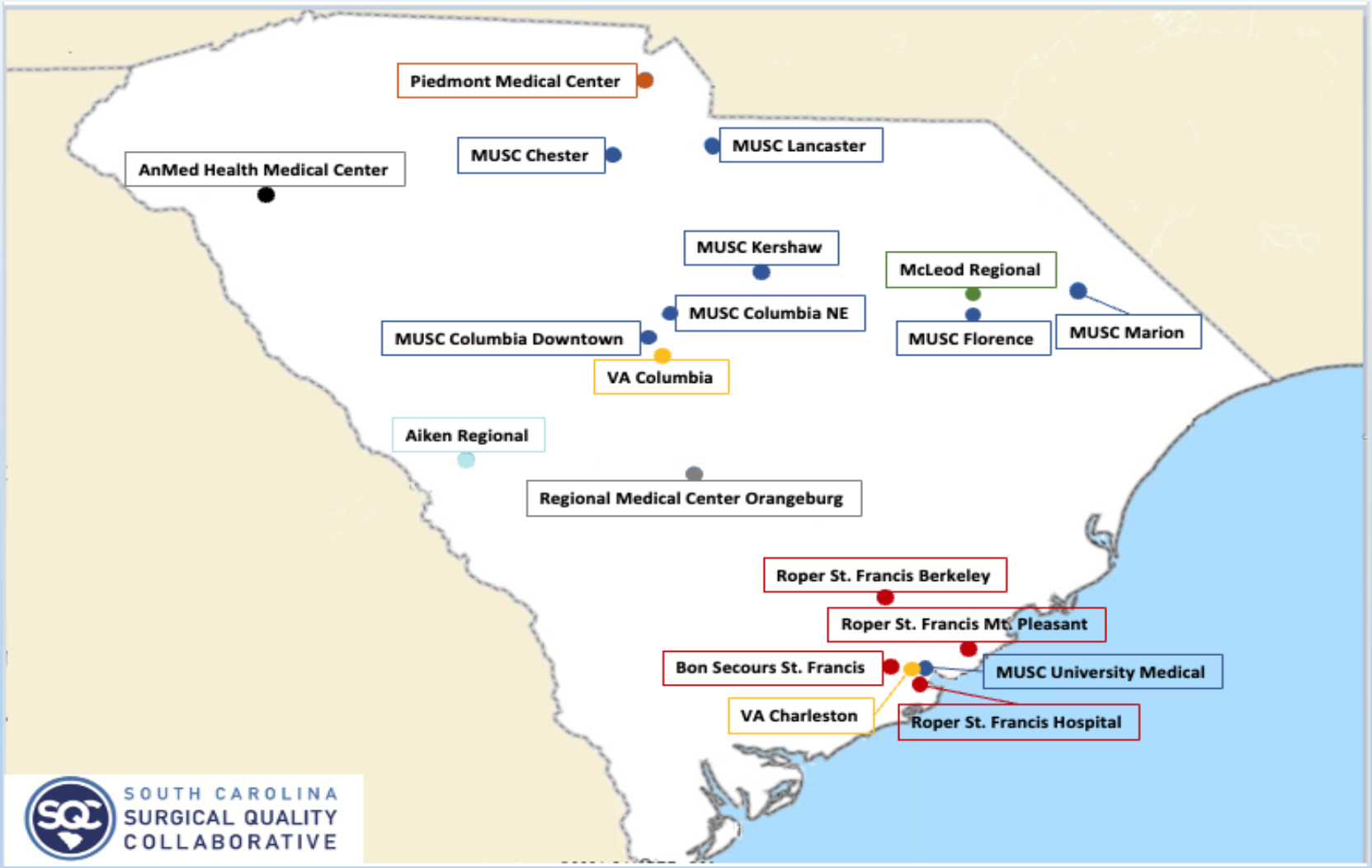
HEALTH SCIENCES SOUTH CAROLINA

MUSC Medical University of South Carolina

South Carolina

SCHA SC HOSPITAL ASSOCIATION

SQC SOUTH CAROLINA SURGICAL QUALITY COLLABORATIVE


Piedmont Medical Center
MUSC Chester
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McLeod Regional
MUSC Columbia NE
MUSC Columbia Downtown
MUSC Florence
MUSC Marion
VA Columbia
Aiken Regional
Regional Medical Center Orangeburg
Roper St. Francis Berkeley
Roper St. Francis Mt. Pleasant
Bon Secours St. Francis
MUSC University Medical
VA Charleston
Roper St. Francis Hospital
SOUTH CAROLINA
SURGICAL QUALITY
COLLABORATIVE

Key Components of the SCSQC

- Continuous quality improvement utilizing actionable and reliable data
- Group learning through collaborative meetings
- Training the next generation of surgical leaders in quality improvement techniques
- Achieve measurable reductions in post-operative complications and lower general surgery costs

SOUTH CAROLINA SURGICAL QUALITY COLLABORATIVE

SCSQC Collaboration

SCSQC leaders have regular conference calls and face-to-face meetings with facility leaders

- Collaboration
- Disseminate information
- Review data
- Share best practices
- Learn from each other
- Shortens the learning curve for Quality Improvement projects

SOUTH CAROLINA SURGICAL QUALITY COLLABORATIVE

SCSQC Data Abstraction

- Web-based input of patient specific clinical data by trained abstractors
- Reliable, risk-adjusted outcomes, state comparators
- Surgeons and quality officials at each hospital have access to see their risk-adjusted outcomes compared to their de-identified peers
- Site specific data is not shared with other facilities or outside entities

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SURGICAL QUALITY
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General Surgery

1. Amputation
2. Bowel
3. Breast
4. Soft Tissue
5. Cholecystectomy
6. Colon
7. Endocrine
8. Hernia
9. Pancreas
10. Stomach

SOUTH CAROLINA SURGICAL QUALITY COLLABORATIVE

SCSQC Goals

- Achieve measurable outcomes of highest importance to patients, clinicians, and payors
- Decrease health disparities in South Carolina through reducing surgical morbidity and mortality
- Improve health care value for patients undergoing surgical procedures
- Deliver the highest quality care at the lowest cost
- Assure sustainability of the program

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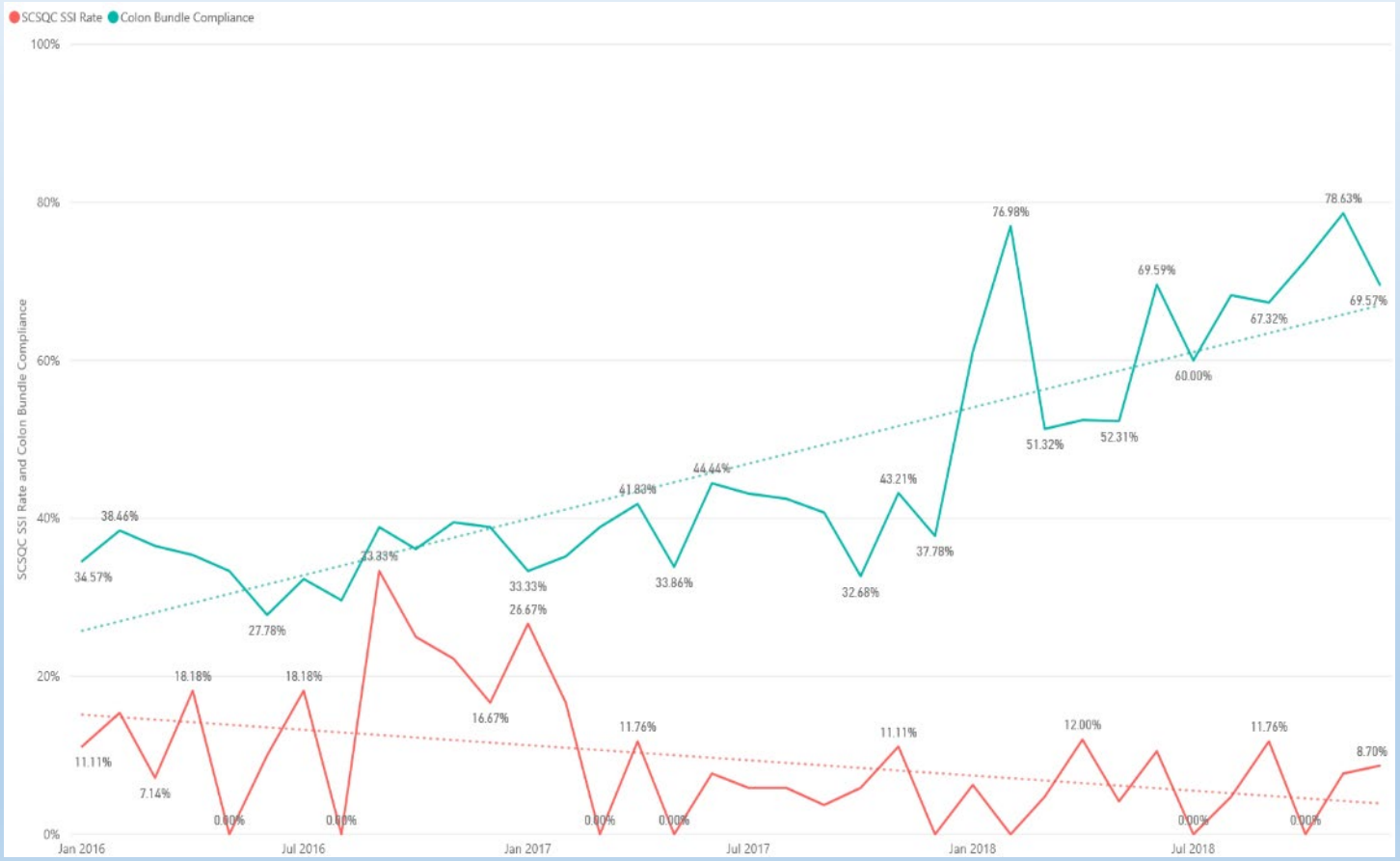
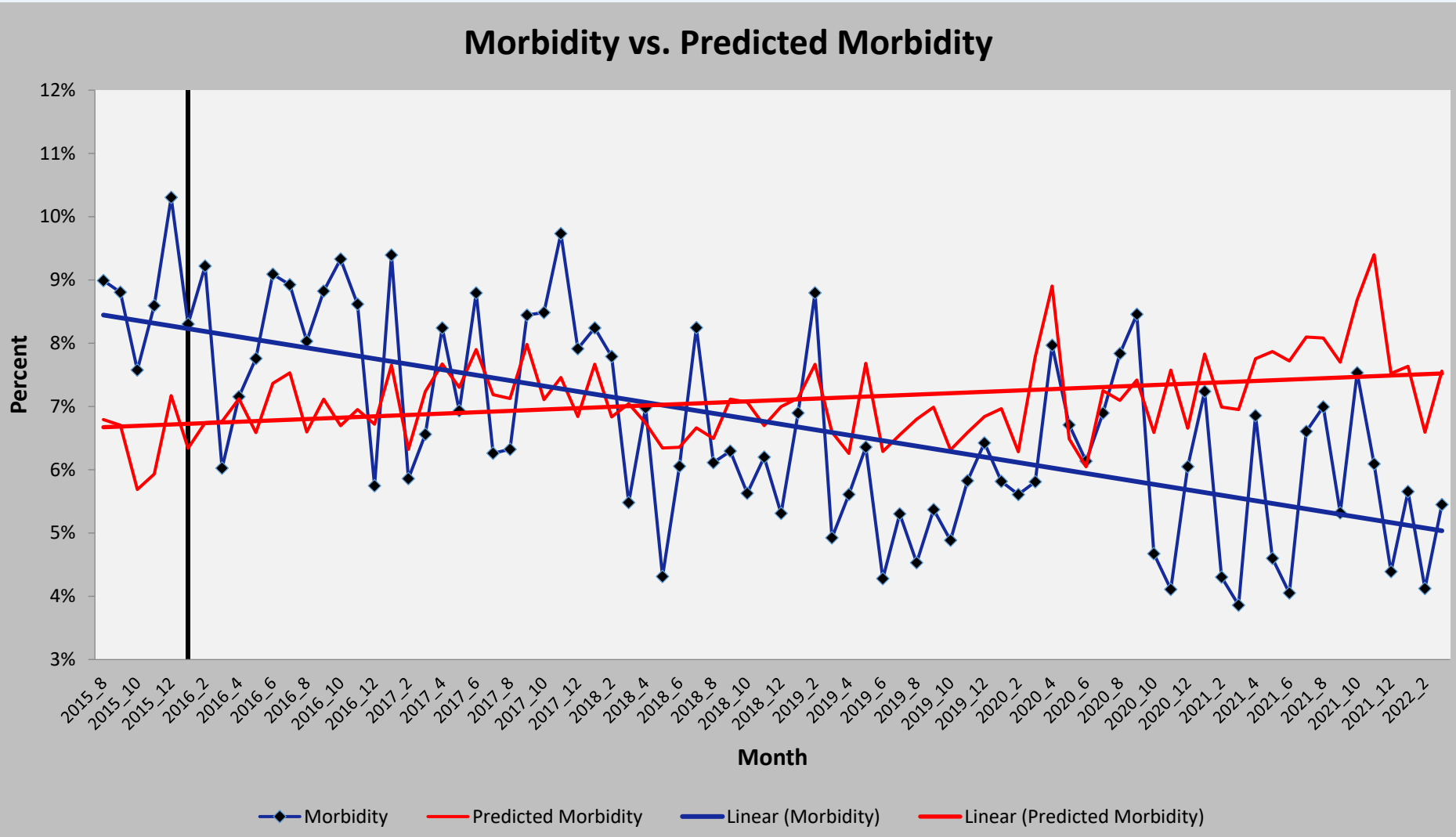
Colon Surgery Enhanced Recovery

Antibiotics, temperature / bowel prep, glucose / closing tray, gown change, wound protector / laparoscopic and OR time

Green – Colon bundle compliance rate
Red – surgical site infection rate



The Amount of Opioid Tablets		2018	2019	2020	2021	2022	p-value
Overall	N of Surgeries	1,118	5,884	5,016	4,116	3,477	
	Mean (STD)	22.9 (13.1)	19.2 (14.9)	13.6 (10.5)	12.2 (12.1)	11.4 (9.0)	<.0001
	Median	20	15	12	10	10	<.0001
Colon	N of Surgeries	293	1,459	1,218	1,169	929	
	Mean (STD)	24.3 (14.7)	19.8 (15.7)	13.7 (11.1)	12.9 (12.3)	12.3 (12.2)	<.0001
	Median	20	15	12	10	10	<.0001
Cholecystectomy	N of Surgeries	205	1,150	1,014	670	624	
	Mean (STD)	22.1 (11.7)	17.9 (12.5)	12.6 (7.0)	11.1 (9.2)	10.0 (4.7)	<.0001
	Median	20	15	12	10	10	<.0001
Hernia	N of Surgeries	225	1,204	1,071	989	928	
	Mean (STD)	23.9 (12.3)	20.3 (12.1)	14.0 (8.6)	11.4 (8.9)	10.7 (5.8)	<.0001
	Median	21	20	12	10	10	<.0001
Breast	N of Surgeries	161	821	820	564	380	
	Mean (STD)	19.4 (9.5)	14.9 (11.1)	10.3 (6.1)	8.8 (6.1)	8.2 (5.2)	<.0001
	Median	20	12	10	7	6	<.0001


Morbidity vs. Predicted Morbidity
12%
11%
10%
9%
8%
7%
6%
5%
4%
3%
Percent
2015_8
2015_10
2015_12
2016_2
2016_4
2016_6
2016_8
2016_10
2016_12
2017_2
2017_4
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2020_8
2020_10
2020_12
2021_2
2021_4
2021_6
2021_8
2021_10
2021_12
2022_2
Month
Morbidity
Predicted Morbidity
Linear (Morbidity)
Linear (Predicted Morbidity)

Outcomes - Overall

Overall	Time Frame Aug15-Jan16 (n=2968)	Time Frame Feb16-Mar22 (n=40673)	p-value
Morbidity (%)	8.76	6.56	<0.0001
SSI (%)	2.86	2.42	0.1281
Pulmonary (%)	2.86	1.69	<0.0001
Renal (%)	1.92	1.66	0.2902
DVT (%)	3.17	2.58	0.0528
Stroke/Cardiac (%)	2.06	1.38	0.0027
Sepsis (%)	2.12	1.61	0.0352
Transfusion (%)	4.68	3.55	0.0014
Reop (%)	6.74	5.92	0.0695
ReturntoED (%)	9.84	7.75	<.0001
Readmit (%)	6.30	6.02	0.5301
Mortality (%)	1.82	1.41	0.0677
LOS, Mean	3.75	3.42	0.0071
LOS, Median	1.52	1.45	0.0110

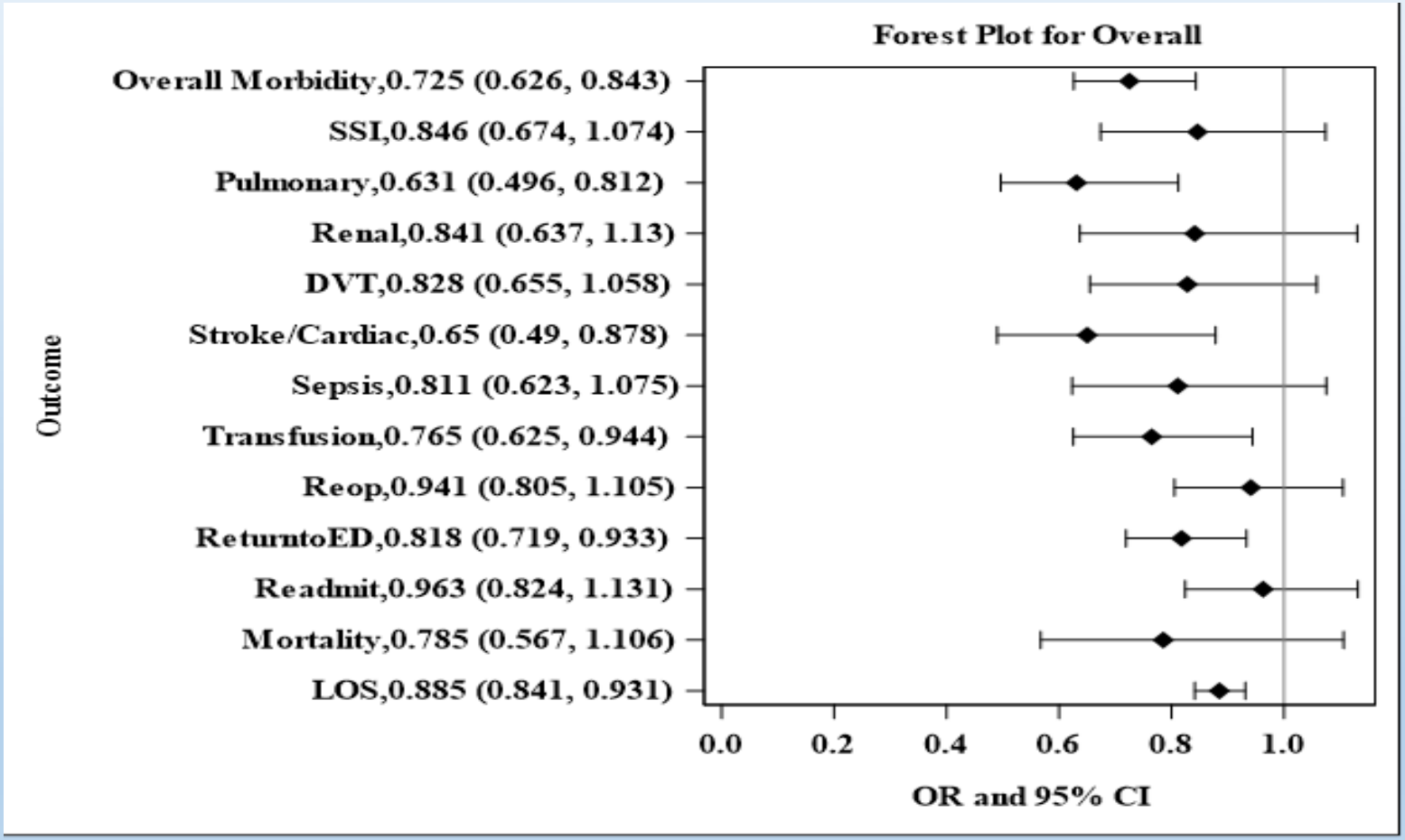
P-value <= 0.05; 0.05< P-value <= 0.10; 0.10< P-value < 0.20.

Outcomes– Non-Commercial

Non-Commercial	Time Frame Aug15-Jan16 (n=1661)	Time Frame Feb16-Mar22 (n=23572)	p-value
Morbidity (%)	11.50	8.40	<0.0001
SSI (%)	3.49	2.78	0.0900
Pulmonary (%)	4.21	2.32	<0.0001
Renal (%)	2.59	2.22	0.3249
DVT (%)	4.70	3.49	0.0106
Stroke/Cardiac (%)	3.13	2.04	0.0030
Sepsis (%)	2.59	2.10	0.1825
Transfusion (%)	7.10	4.87	<0.0001
Reop (%)	8.55	6.92	0.0123
ReturntoED (%)	11.08	9.22	0.0119
Readmit (%)	7.77	7.28	0.4576
Mortality (%)	3.01	2.16	0.0220
LOS, Mean	4.81	4.23	0.0003
LOS, Median	2.00	1.65	0.0032

P-value <= 0.05; 0.05< P-value <= 0.10; 0.10< P-value < 0.20.

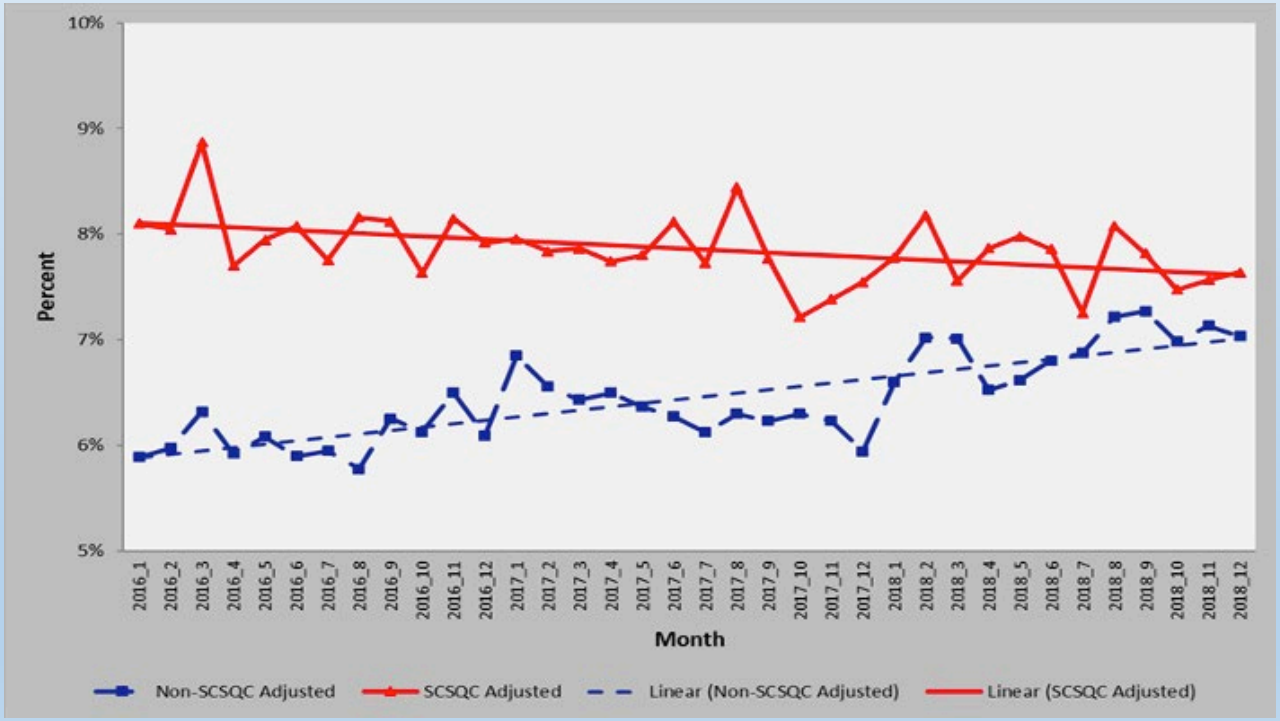
Multivariable Regression



Facilitated Regional Collaboration and In-Hospital Surgical Complication

JACS Journal of the American College of Surgeons

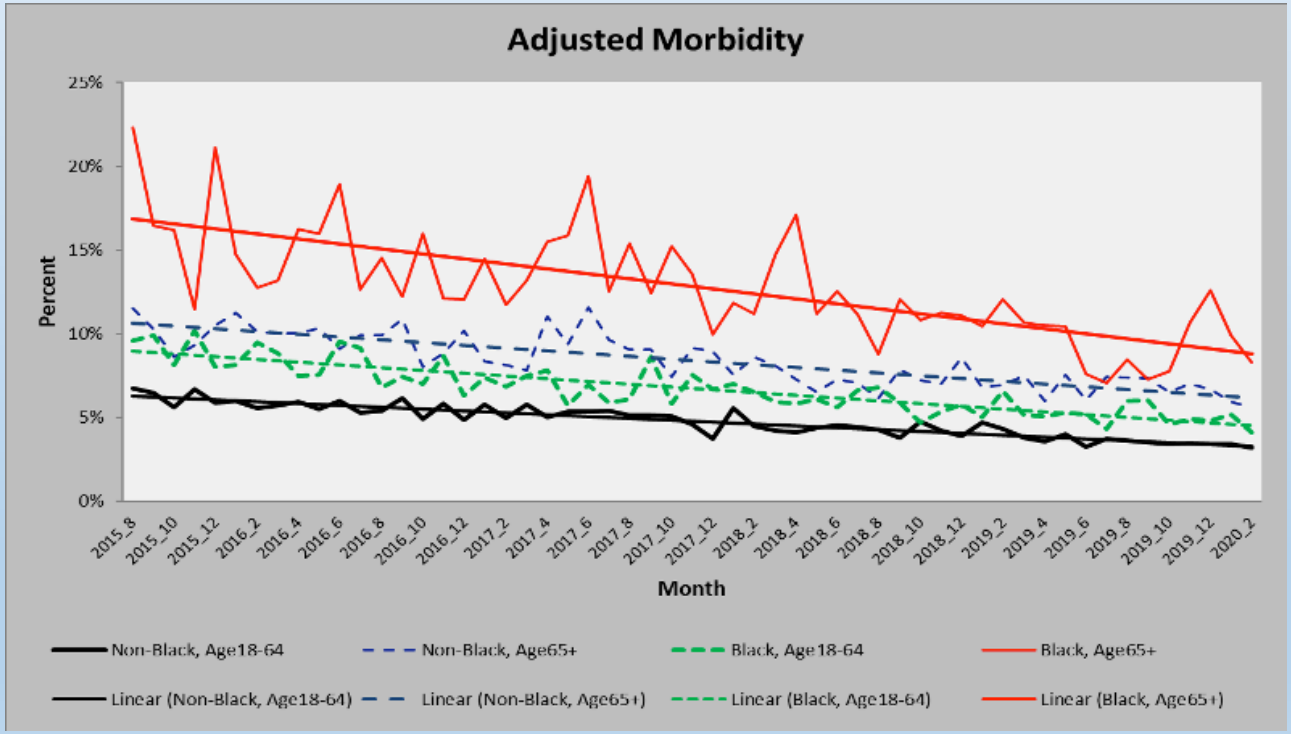
J Am Coll Surg. 2021 Apr 1;234(4):536-543. doi: 10.1016/j.jamcollsurg.2020.11.025. Epub 2020 Dec 28.



Surgical Outcomes Improvement and Health Inequity in a Regional Quality Collaborative

JACS Journal of the American College of Surgeons

J Am Coll Surg. 2022 Apr 1;234(4):607-614. doi: 10.1097/XCS.0000000000000084



Enhanced Recovery after Colorectal Surgery: How to Use Data to Engage, Improve, and Iterate

Thomas Curran, MD MPH FACS FASCRS
Assistant Professor of Surgery
Division of Colon and Rectal Surgery

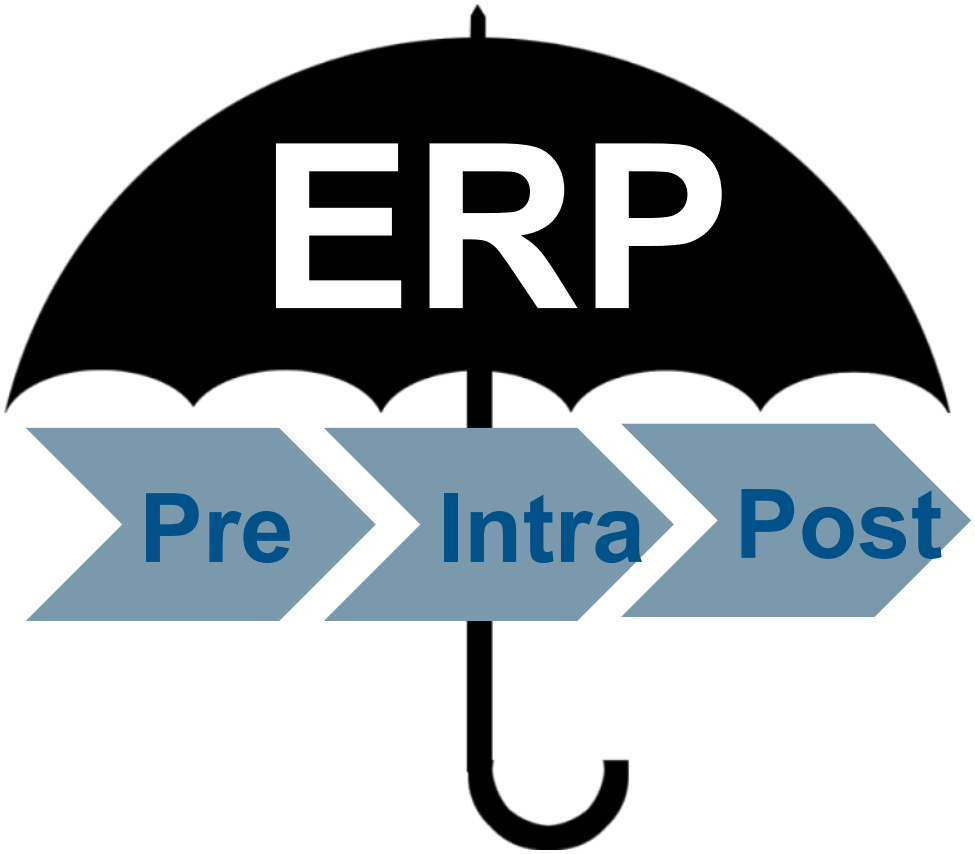
MUSC Health
Medical University of South Carolina
Changing What's Possible | MUSChealth.org

Goals & Objectives

- What is ERP and why is it important?
- How to implement ERP at your institution
- Application of ERP to special populations

Does my institution need ERP?

ERP principles: Minimization of variability



Carmichael JC, et al. Dis Colon Rectum. 2017

Which things fall under “ERP?”

ERP Involves changing expectations

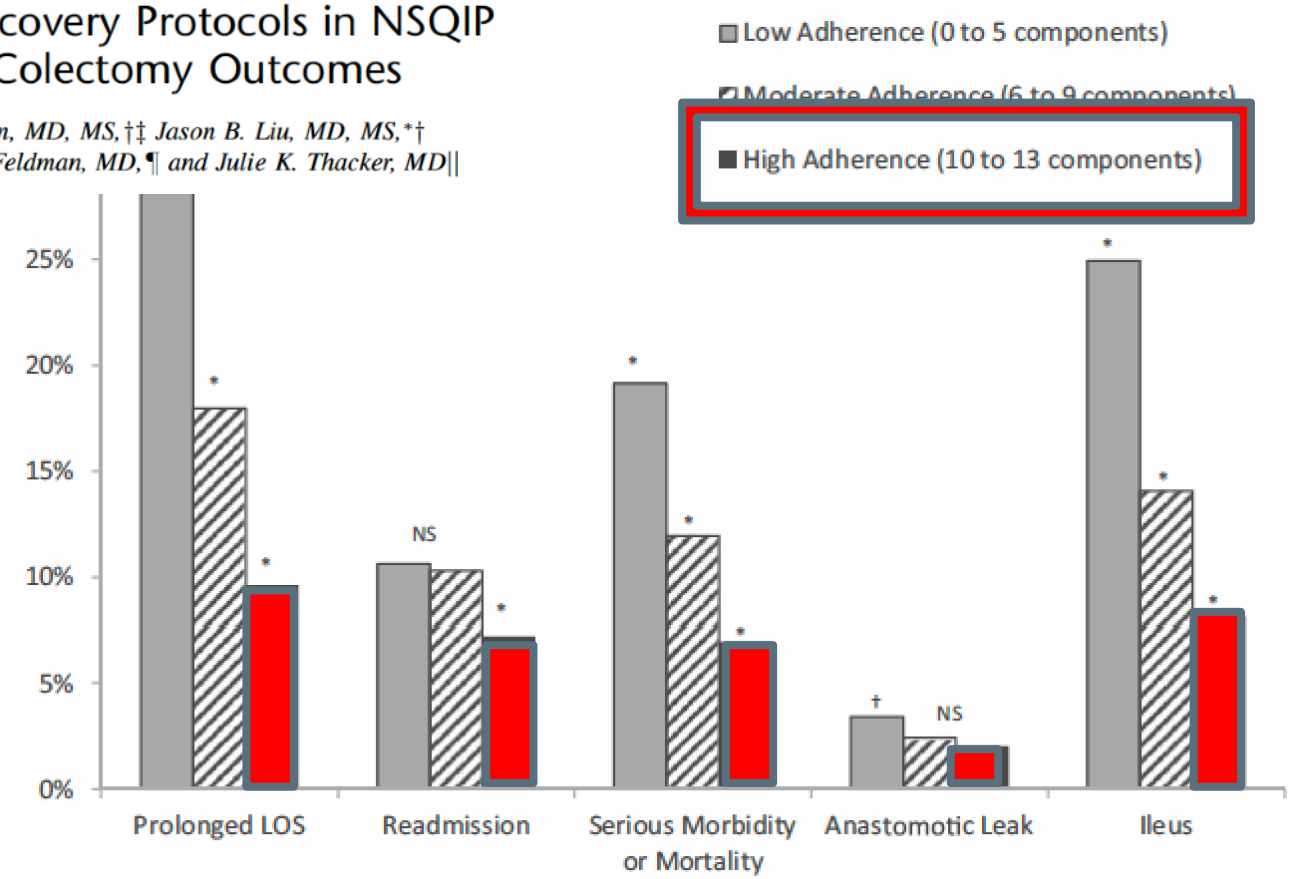
ERP Involves changing expectations

Why ERP: National ata

Adherence to Enhanced Recovery Protocols in NSQIP and Association With Colectomy Outcomes

Julia R. Berian, MD, MS,† Kristen A. Ban, MD, MS,†‡ Jason B. Liu, MD, MS,*† Clifford Y. Ko, MD, MS, MSHS,†§ Liane S. Feldman, MD,¶ and Julie K. Thacker, MD||*

A la carte ERP doesn't work!



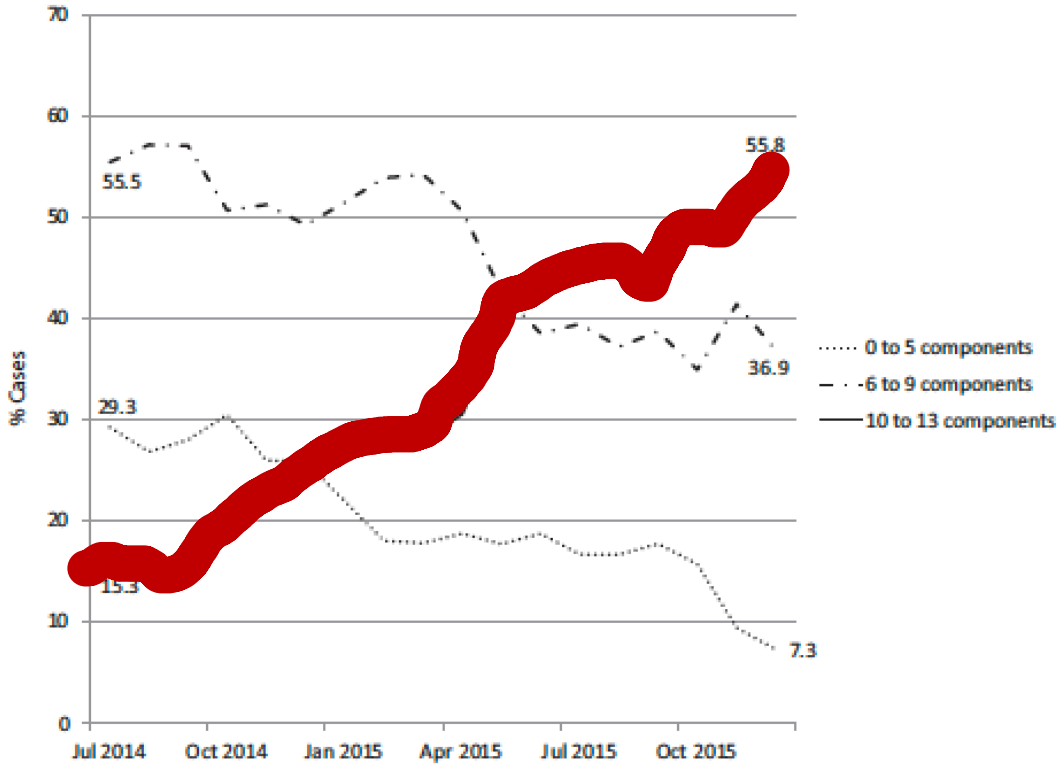
ERP challenges: Buy in from everyone

Table 1
Summary of nursing barriers in an effective enhanced recovery after surgery program implementation

Nursing Barriers	Subcategories	Mitigation Strategies	Responsible Parties
Adoption of EBPs	ERAS is an EBPs	1. Integrate ERAS implementation as an annual strategic goal and align it appropriately with the additional nursing goals	Chief nursing officer Nursing directors Nursing managers
Nursing staffing	Leadership turnover	1. Create a culture of safety 2. Manage nursing leadership priorities and include time dedicated to ERAS implementation 3. Reward high performers	Chief nursing officer Nursing directors
	Frontline staff turnover	1. Create a culture of safety 2. Manage the projects that frontline nurses are undertaking 3. Educate the "why" behind ERAS implementation 4. Reward high performers	Nursing manager Nursing educators
	Culture and behaviors	1. Obtain buy-in for ERAS at the hospital and nursing leadership level (ie, chief nursing officer, chief executive officer, and assistant vice presidents) 2. Support nursing leadership with time to dedicate to new EBP initiatives such as ERAS	Chief nursing officer Nursing directors Nursing managers
	Education	1. Create a consistent ERAS education pathway for nurses 2. Create education plan for new and existing nursing staff	Nursing manager Nursing educators
Hospital resources	ERAS coordinator	1. Create a business case for the role and its importance in patient outcomes to include return on investment	ERAS coordinator Project manager
	Wound ostomy nurses	1. Assess needs of organization	Hospital leadership
	Data availability	1. Creating a role that oversees data 2. Build ERAS-specific dashboards 3. Publish ERAS process metrics 4. Conduct weekly manual chart audits (first 8 wk of implementation) 5. Publish monthly data updates 6. Encourage organizational transparency in data sharing	ERAS coordinator Nursing leadership Nursing educator

Brown D, et al. Surg Clin N Am. 2018

Culture change takes time



Berian JR, et al. Ann Surg. 2019

Institutional data: ERP and iterative improvement

MUSC experience: Early Foley catheter removal

ORIGINAL CONTRIBUTION

Early Urinary Catheter Removal Following Pelvic Colorectal Surgery: A Prospective, Randomized, Noninferiority Trial

Devin N. Patel, M.D. • Seth I. Felder, M.D. • Michael Luu, M.P.H. • Timothy J. Daskivich, M.D.
Karen N. Zaghiyan, M.D. • Phillip Fleshner, M.D.

TABLE 2. Primary and secondary outcomes

Variables	*All (n = 142)*	*Early catheter removal (n = 71)*	*Standard catheter removal (n = 71)*	*p*
Acute urinary retention (%)	13 (9.2)	6 (8.5)	7 (9.9)	1.00
PVR, mL	0 (0–50)	30 (0–50)	0 (0–50)	0.14
Symptomatic UTI	8 (5.6)	0 (0)	8 (11.3)	0.01
LOS, days	4 (3–7)	4 (3–6)	5 (4–7)	0.03

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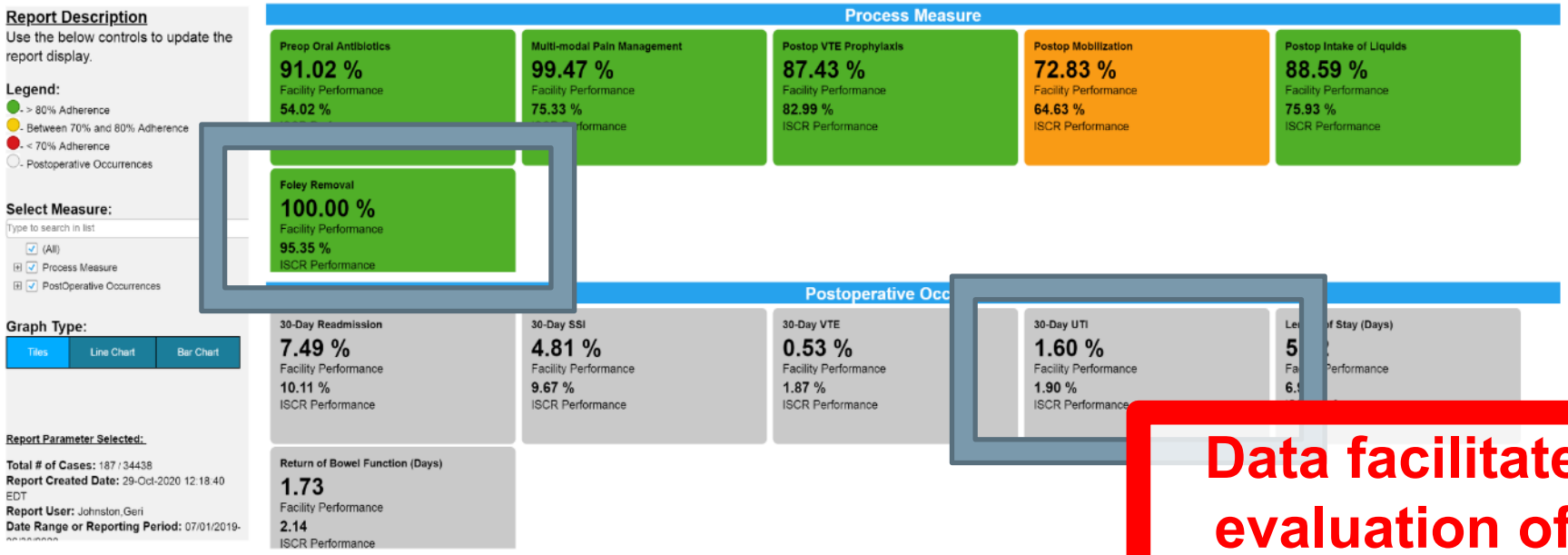
MUSC data: Early Foley catheter removal



Data facilitate evaluation of new protocols

MUSC data: Opioid utilization

- Opioid usage - prevalence
  - 1/25 Americans misused opioids in the last year[1]
  - 16-33% of CRS patients with recent opioid use[2,3]

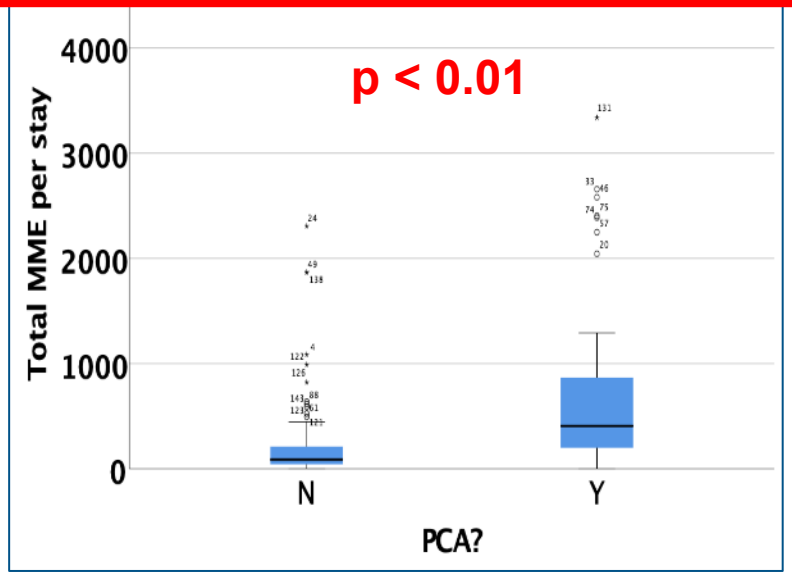
- Opioid usage – adverse effects in CRS
  - Increased complications[2], LOS[2], readmission[3], costs[2,3]

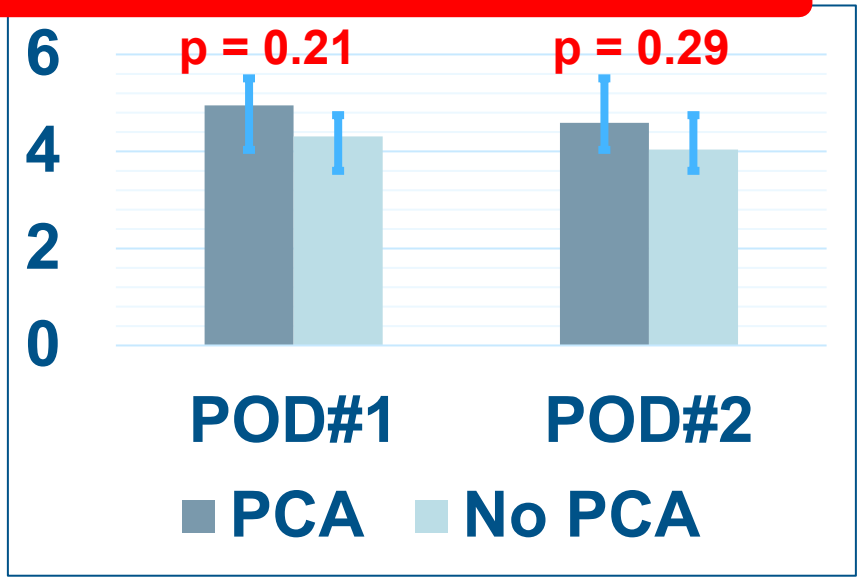
1. *www.hhs.gov/opioids*
2. *Hassinger TE, et al. Surg Endosc. 2020*
3. *Cortez AR, et al. Surgery. 2019*

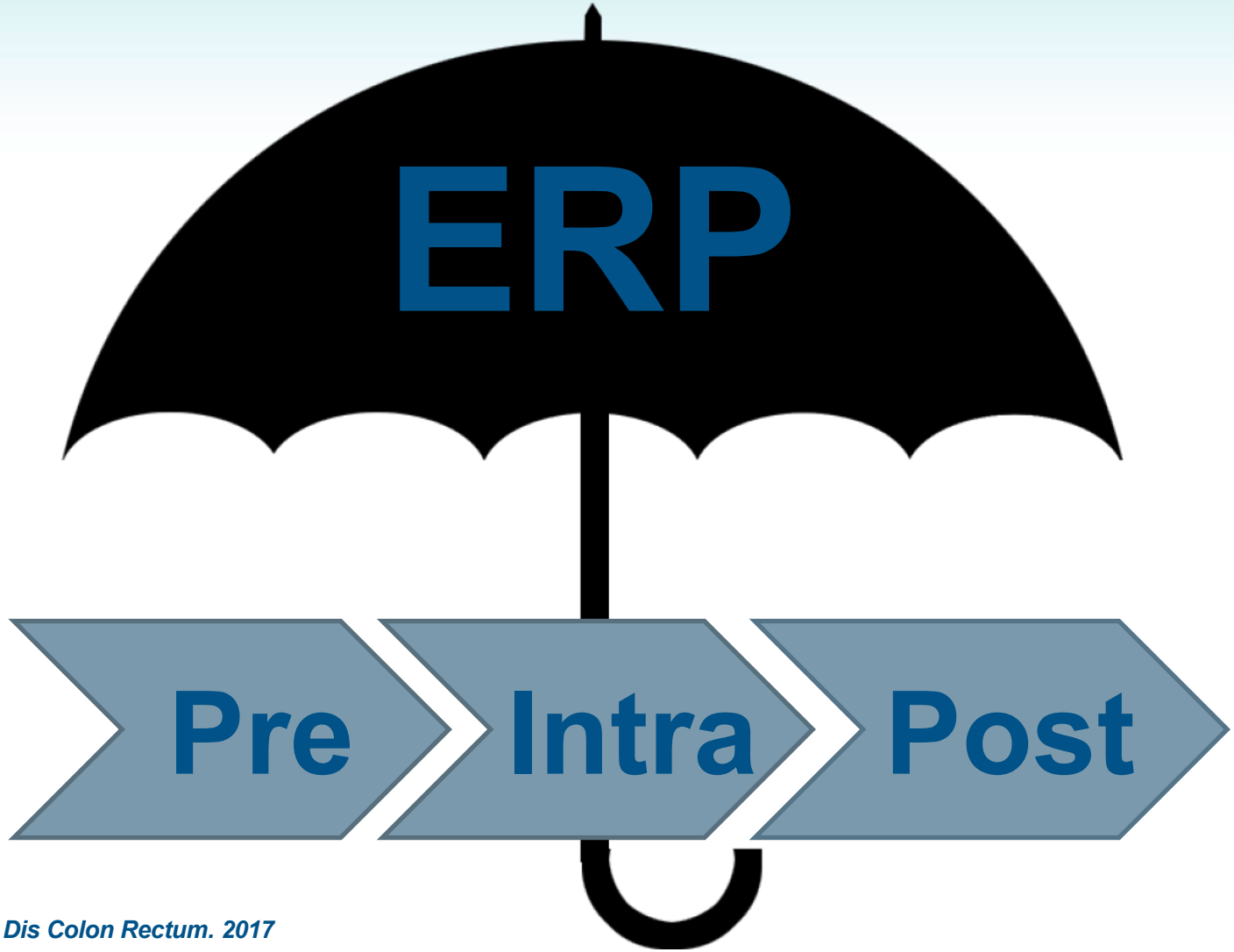
MUSC data PLUS: Avoidance of postop PCA

- Protocol change to omit routine postop PCA
  - Internal pharmacy data added to NSQIP/ISCR

Additional data elements expand QI opportunities







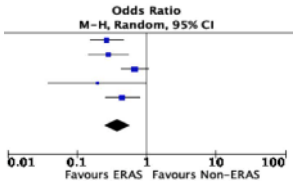
Carmichael JC, et al. Dis Colon Rectum. 2017

Do *geriatric* patients benefit from ERP?

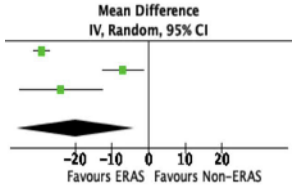
- Age 65+: 16% of Americans[1] but HALF of all surgery in the US[2]
- Meta-analysis 2020[3]: 65+ undergoing colorectal surgery
  - RCT x 3, Cohort x 3
  - N = 1,174

1. www.census.gov
2. Ostermann S, et al. Dis Colon Rectum. 2019
3. Tan JK, et al. Surg Endoscopy. 2020

Do *geriatric* patients benefit from ERP?

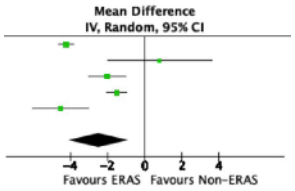


Morbidity? ✓

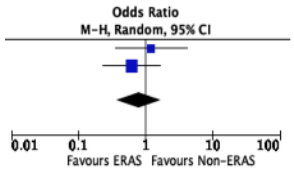


Length of stay? ✓

Yes!



Time to flatus? ✓



Readmission? ⟺

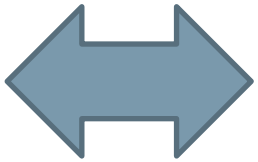
Tan JK, et al. Surg Endoscopy. 2020

ERP in non-elective surgery

- Non-elective = Common!
  - 17% of colectomy in ACS-NSQIP[1]
- Feasible ?
  - N = 28; Compliance 57%[2]
  - Variable preop compliance

1. *Ozathil DK, et al. J Surg Res. 2011*
2. *Roulin D, et al. World J Surg. 2014*

Do *non-elective* patients benefit from ERP?

- **Morbidity[1,2]** 
- **LOS[1,2]** ✓
- **Cost[2]** ✓

Yes!

1. *Lohsiriwhat V, et al. World J Gastroenterol. 2014*
2. *Liska D, et al. Ann Surg. 2020*

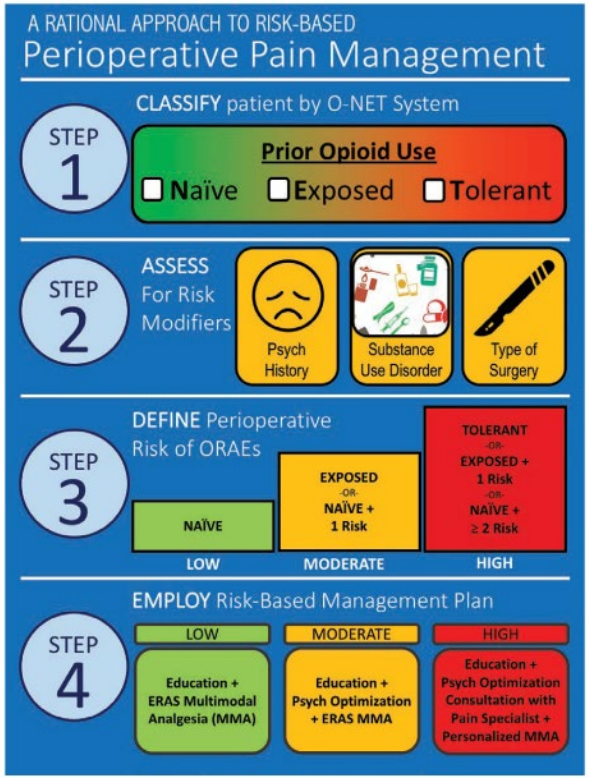
Do *opioid tolerant* patients benefit from ERP?

- LOS[1] ✓
- Inpatient MME[1] ✓
- Outpatient rx[1] ✓

Yes!

1. *Cortez AR, et al. Surgery. 2019*

Analgesic planning for opioid tolerant patients



- **Classify**
- **Assess**
- **Define**
- **Employ**
  - ERP multi-modal analgesics
  - ***Even ketorolac !***

1. *Edwards DA, et al. Anesth Analg. 2019*

Conclusions

- ERP works…for patients, surgeons, nurses, etc.
  - Improved bundle adherence = improved outcomes
  - Change takes time and “buy in”
- Institutional data facilitates local quality improvement initiatives
- ERP is important even in special populations

Questions & thank you!

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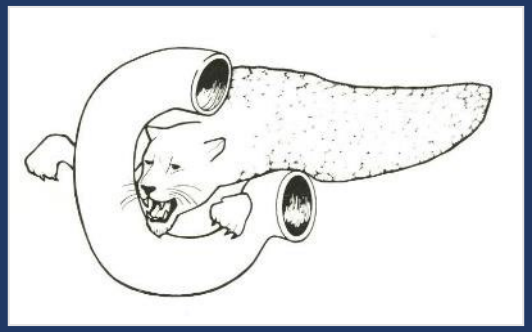
ERAS in Pancreas Surgery



Katy Morgan, MD
Professor, Head Division of HPB Surgery
Medical University of South Carolina
May 23, 2023

“It is worth emphasizing that the recovery rate in abdominal cases depends less on the individual ability of the surgeon than on any other single factor…The all important factor is the system, not the surgeon”

- Douglas Jolly 1941

ERAS vs “Fast-track”

- Fast-track protocols (1990s)
  - Surgeon driven
  - Postoperative pathways
  - Encourage early ambulation, feeding, discharge
- ERAS protocols (2000s)
  - Multidisciplinary
  - Include preop, intraop, and postop care
  - Reduce surgical stress

ERAS is Multidisciplinary

- Anesthesiologists
- Surgeons
- Intensivists
- Physician Assistants
- Nurse coordinators
- Ward nurses
- Clinic staff

**Buy in is essential*

ERAS is Multidisciplinary

Herding cats

MUSC Pancreas ERAS Protocol

Preoperative	Patient education Smoking cessation Prehabilitation exercise Individual nutritional assessment Immunomodulating nutritional supplementation Carbohydrate loading Pre-emptive antiemetics Adjunctive non-narcotic analgesics Regional anesthetic
Intraoperative**	Normothermia protocol Venous thromboembolism prophylaxis Antibiotic prophylaxis Wound protector ****Goal directed fluid administration**
Postoperative	Avoidance or early removal of nasogastric tube Avoidance or early removal of surgical drains Early removal of foley catheter Intravenous fluid restriction Early diet advancement Early ambulation

Preoperative elements

- Neoadjuvant prescription—cytotoxic therapy…deconditioning…sarcopenia
- Opportunity (Time) to optimize physiology
- Exercise, smoking cessation, nutrition, mindfulness
    - Sell Ann Surg 2020

Preoperative nutritional optimization

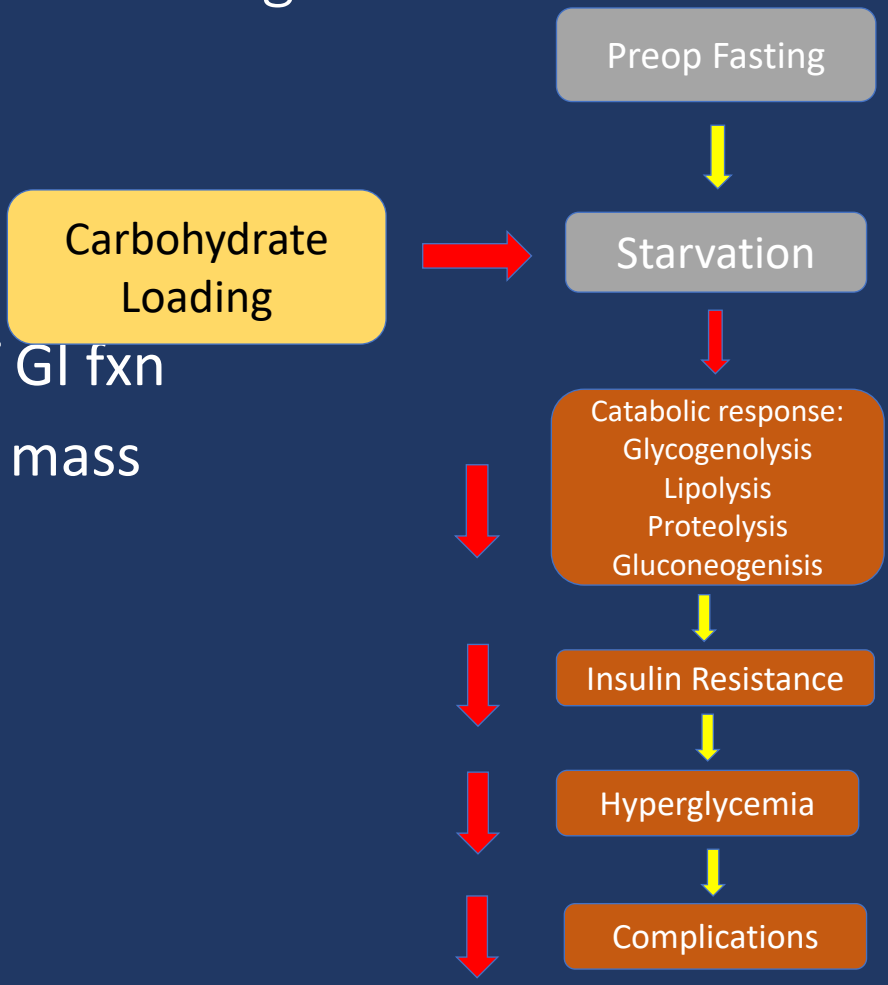
- Malnourished
- Nutritional assessment (RD)
- Pancreatic exocrine insufficiency (PEI)…Pancreatic enzyme replacement therapy (PERT)

Preoperative immunomodulating nutrition

- Immune modulating supplement
  - Protein
  - Omega-3 fatty acids
  - Arginine, glutamine
  - Nucleotides
- 5 days preop
- Blunts inflammatory response from surgery
- Decreases postoperative infection rates (↓ 36%)
- Decreases length of stay
  - Marimuthu Ann Surg 2012
  - Yang Nutrients 2020

Preoperative carbohydrate loading

- Preop carb loading
- 3 hours p/t surgery
- Reduces time to return of GI fxn
- Preserves skeletal muscle mass
  - Noblett Colorectal Dis 2006

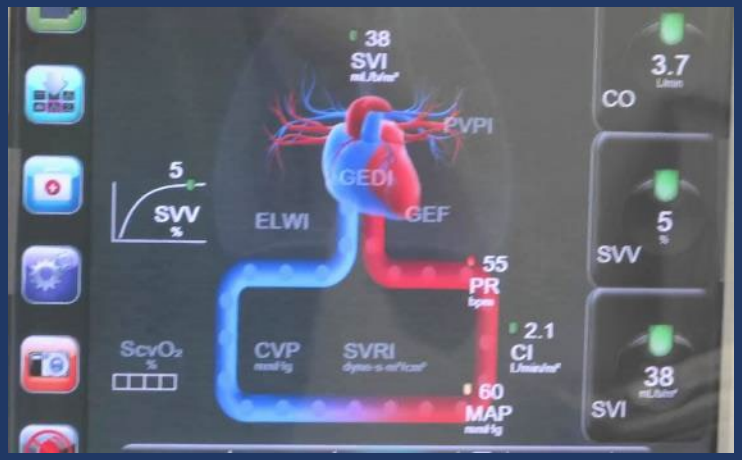


Intraoperative factors: SSI prevention

- Perioperative antibiotics (Zosyn)
    - Ellis Ann Surg 2023
- Wound protector
    - Bressan Ann Surg 2018
- Negative pressure wound therapy
    - Burkhart HPB 2017
- Minimize incision (laparoscopic, robotic)

Perioperative goal directed fluid management

- Intraoperative hemodynamic monitoring
  - Stroke volume variation
- IVF restriction postop
- Protocol directed fluid management



Perioperative goal directed fluid management

- Avoiding fluid overload
  - Tissue edema (delayed return of GI function, poor wound healing)
  - Hypertensive cardiac stress
  - Respiratory failure
- Euvolemia
  - Decreased postop complications
  - Decreased LOS
    - Vadarhan Proc Nutr Soc 2010

Postoperative elements: drain management

- Verona protocol
- Drain amylase POD1 <5000 U/L (NPV 98%)
- Early drain removal POD 3
  - decreases POPF, abdominal complications, pulmonary complications, median LOS, cost
    - Molinari Ann Surg 2007
    - Bassi Ann Surg 2010

Introduction of MUSC Pancreas ERAS protocol

Methods

- Retrospective review of prospective pancreas surgery database
- August 2012 to April 2015
- ERAS protocol was initiated October 2014
- “PreERAS” vs “ERAS”
- Preoperative, intraoperative and postoperative data were tabulated and compared
- Cost and length of stay data were obtained and analyzed from a hospital administrative database

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Results: Demographics

	Pre ERAS	ERAS	p
N	297	81	
Male (%)	138 (46%)	44 (54%)	NS
Mean age, years	54	54	NS
Mean BMI (kg/m2)	27.5	28.4	NS
Tobacco use (%)	126 (42%)	42 (52%)	NS
Mean albumin (g/dl)	3.6	3.6	NS

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Preoperative Diagnosis

	Pre ERAS	ERAS	p
Pancreatic adenocarcinoma	37	14	NS
Cholangiocarcinoma	8	3	NS
Duodenal adenocarcinoma	5	1	NS
Ampullary adenocarcinoma	2	1	NS
IPMN	30	6	NS
Pancreatic neuroendocrine tumor	16	7	NS
Mucinous cystic neoplasm	5	1	NS
Serous cystadenoma	6	2	NS
Pancreatitis	176	42	NS
Other	12	4	NS

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Intraoperative data

	Pre ERAS	ERAS	p
Mean EBL, cc	431	511	NS
Mean length of surgery, minutes	190	191	NS
Surgery performed			
Pancreatoduodenectomy	82	27	NS
Distal pancreatectomy	93	29	NS
Total pancreatectomy	48	11	NS
Lateral pancreaticojejunostomy	24	5	NS
Necrosectomy	21	3	NS
Transduodenal sphincteroplasty	22	2	NS
Other	7	4	NS

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Postoperative data

	Pre ERAS	ERAS	p
Overall complication, %	63	59	NS
Significant complication, %	25	21	NS
Wound infection, %	6	9	NS
Pneumonia, %	7	8	NS
Pancreatic fistula, %	26	28	NS
Pancreatic fistula, grade C, %	3	1	NS
Delayed gastric emptying, %	26	13	0.025
Mean Length of stay, days	9.2	7.4	0.0001
Mean ICU length of stay, days	1.85	1.16	NS
Readmission, %	29	32	NS
Mortality, 90 days, N	2	0	NS

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*greater than Clavien Dindo grade 2

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Hospital Cost

- PreERAS vs ERAS
  - $27387 vs $23303, $p<0.0001$
- Cost savings $4080

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Conclusions

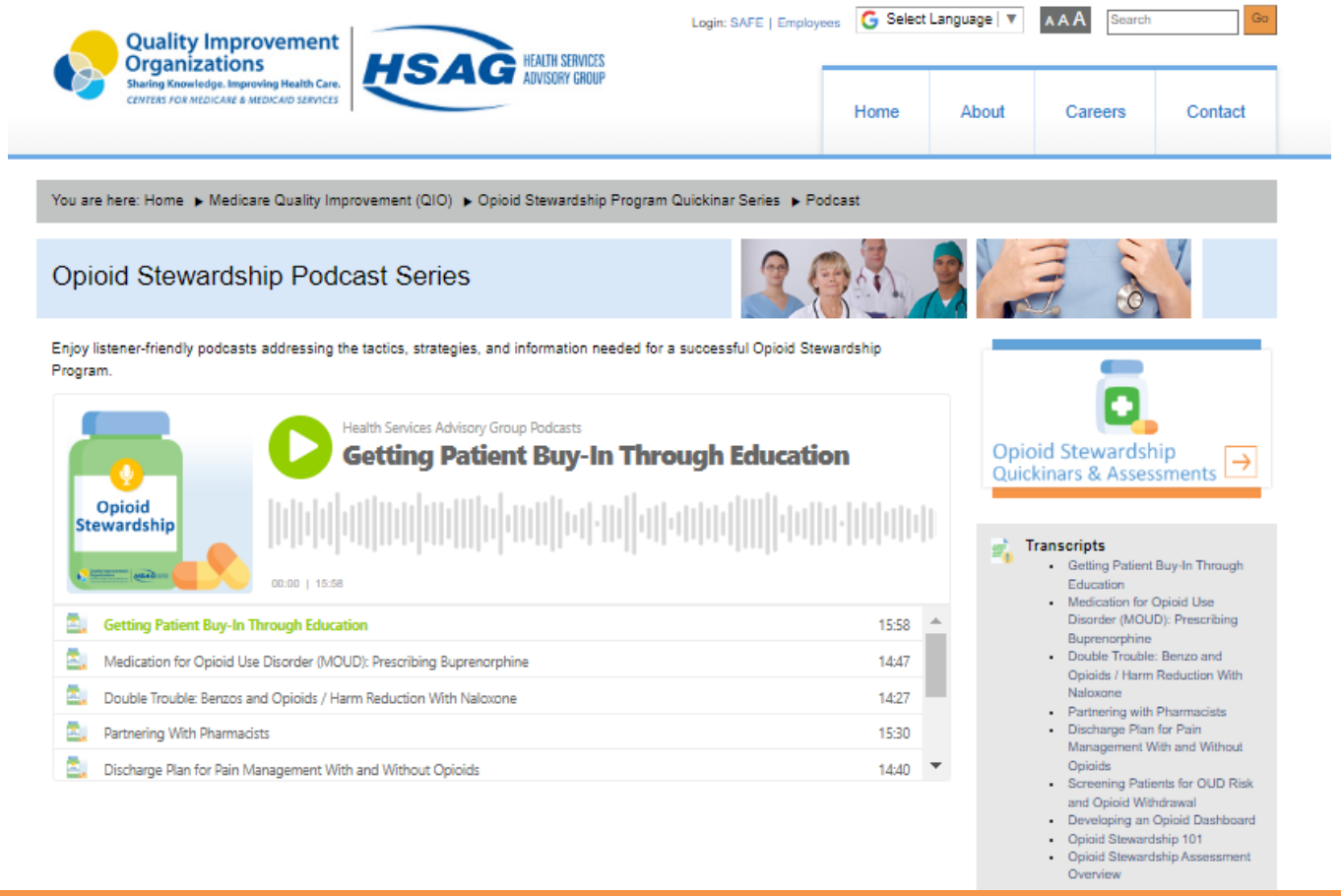
- ERAS protocols are effective in pancreatic surgery
- Improve efficiency (hospital length of stay, cost)
- Decrease morbidity (delayed gastric emptying)
- Safe (no increase in readmission rates, morbidity or mortality)

Discussion

- Multidisciplinary approach is fundamental
- Standardization is key
- Evidence based practice is essential
- “The all important factor is the system, not the surgeon”

Q&A

HSAG Tools and Resources | Podcast Series



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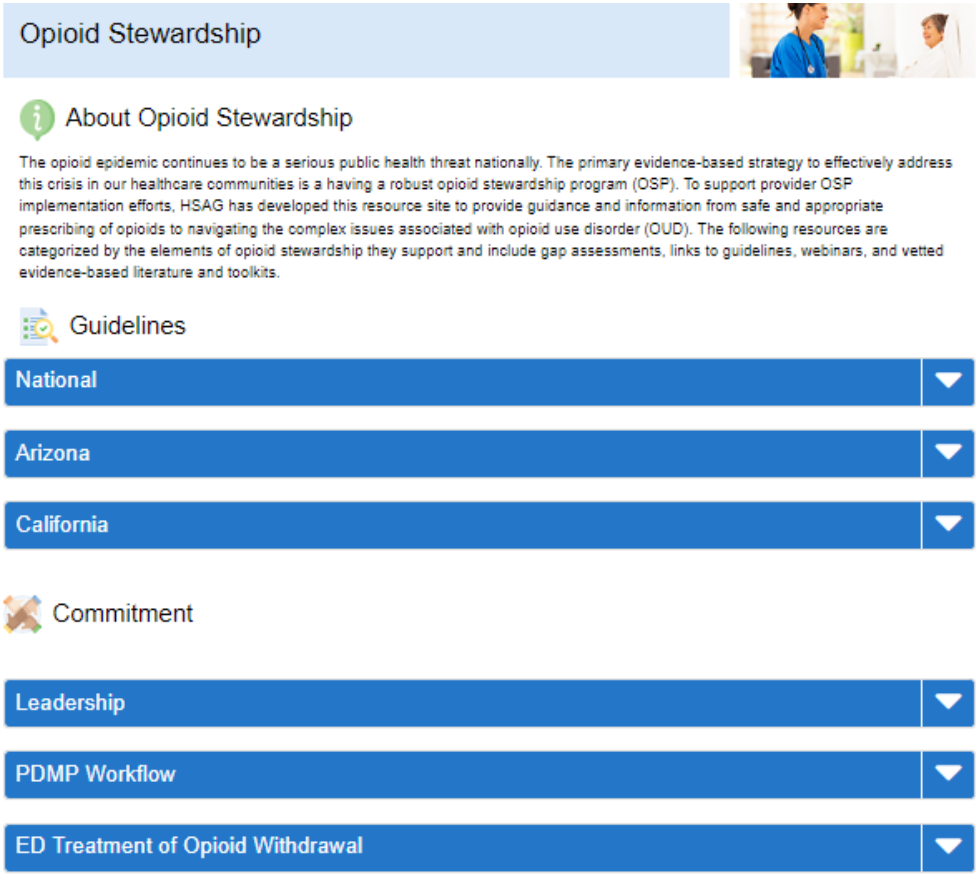

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