

Enhanced Recovery after Colo-Rectal Surgery

Roy M. Dressner, D.O.

ERP -"Fast track"

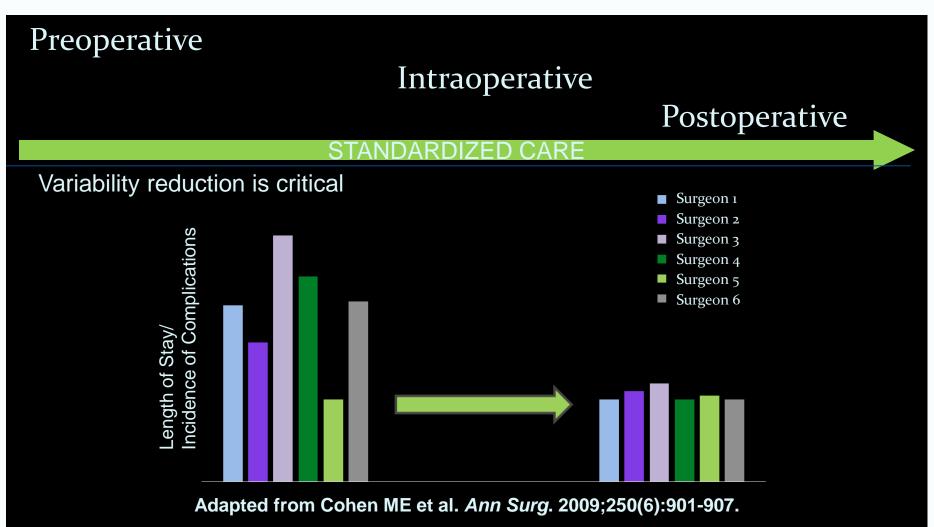
- Clinical programs reduce physiologic stress response to surgery
- Facilitate recovery early return of bowel function
- Multidisciplinary team approach
 - Surgery, anesthesia, nursing, patients
- Improve efficiency of healthcare
 - Length of stay
 - Healthcare costs
 - Hospital operating expenses
- No adverse effects on readmission, complications

ENHANCED RECOVERY PROGRAM

- Pre OP management
 - Pt education, mechanical bowel prep, oral Abx, carb loading
- Intra OP care
 - MIS, fluid management, analgesia, VTE prophylaxis
- Post OP recovery
 - Multimodal opioid sparing analgesia
 - Fluid restriction
 - Early feeding
 - Ambulation
 - Prevention of post op ileus (delay of bowel function>3 days)
 - Standardized Order Sets



Current Surgical Challenges

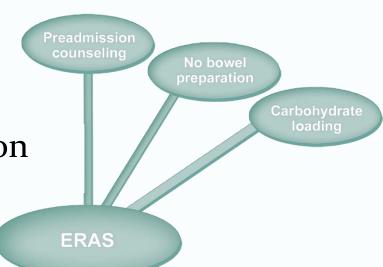




The Preoperative Phase

Scheduling of surgery to arrival in pre-op holding

- Information management Education
- Nutritional optimization and carbohydrate loading
- Exercise/prehabilitation
- Mental health assessment
- As applicable, smoking cessation



The Preoperative Phase

- NPO ρ MN obsolete
- Complex carb fluids 2-3 hrs prior to surgery
 - metabolically fed state
 - decreases post-op insulin resistance
 - improves PONV
 - increases patient satisfaction
 - NO INCREASE ANESTHESIA RISKS

The Preoperative Phase

- Mechanical bowel prep: (osmotic +/ stimulant)
- 2011 Cochrane Review (18 RCT >5000 pts)
 - NO CHANGE
 - Wound infection
 - Anastamotic leaks
 - Surgical site infection
 - Need for re-operation
- Pre-op oral antibiotics decrease SSI by 67%
 - Neomycin/Erythromycin and Metronidazole

Intra OP Phase

- Minimally invasive approach (~50% CR resections)
 - Reduces surgical trauma and inflammatory response
- Restricting IVF ~ 2 liters
 - Goal directed therapy (Conventional vs TE Doppler)
 - Decreases cardio-pulmonary complications
 - Decreases bowel edema
 - Reduces delayed gastric emptying
- Peripheral nerve block
 - Local infiltration to wound
 - Transversus Abdominis Plane block
 - Liposomal bupivicaine
- Neuraxial regional block (Epidural/ Spinal)



Types of Non-Opioids Used in Multimodal Pain Treatment Plans

Acetaminophen	Alpha-2 agonists	Gabapentinoids	
acetaminophen	clonidine dexmedetomidine	gabapentin pregabalin	

Local anesthetics	NMDA receptor antagonists	NSAIDs
bupivacaine lidocaine liposomal bupivacaine	ketamine	celecoxib ibuprofen ketorolac diclofenac

Note: The agents listed above are commonly employed in the perioperative management of acute pain. This list is not meant to be a comprehensive directory of all available analgesic agents.



Multiple Organizations Recommend a Non-Opioid Foundation to Multimodal Analgesia

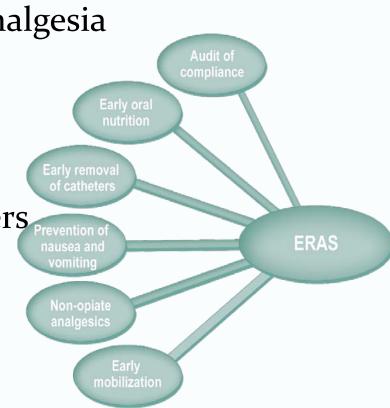
- Society Recommendations
 - American Society of Anesthesiologists (ASA)¹
 - American Society of Pain Management Nursing (ASPMN)²
 - American Society of PeriAnesthesia Nurses (ASPAN)³
 - American Geriatrics Society (AGS)⁴
 - Society for Critical Care Medicine (SCCM)⁵
 - Surgical Societies (e.g., American Academy of Orthopaedic Surgeons)⁶
 - Enhanced Recovery After Surgery (ERAS) Society⁷
- Accrediting and Quality Organizations
 - The Joint Commission (TJC)³
 - Agency for Healthcare Research and Quality (AHRQ)³

^{1.} ASA Task Force on Acute Pain Management. *Anesthesiology*. 2012; 116: 248-273. 2. Jarzyna D, Jungquist CR, Pasero C, et al. *Pain Manage Nurs*. 2011; 12: 118-145. 3. Wells N, Pasero C, McCaffery M. In Hughes RD, ed. Agency for Healthcare Research and Quality; 2008. 4. The American Geriatrics Society. Pain management in the elderly. http://www.americangeriatrics.org/gsr/anesthesiology/pain_management.pdf. Accessed September 10, 2014. 5. Barr JU, Fraser GL, Puntillo K, et al. *Crit Care Med*. 2013; 41(1): 263-306. 6. American Academy of Orthopaedic Surgeons. Management of hip fractures in the elderly: evidence-based clinical practice guideline. September 5, 2014. Available at: http://www.aaos.org/Research/guidelines/HipFxGuideline_rev.pdf. Accessed March 23, 2015. 7. Feldman LS, Delaney CP, Ljungqvist O, Carli F. (Eds.) *The SAGES/ERAS® Society Manual of Enhanced Recovery Programs for Gastrointestinal Surgery*. Springer: 2015.



The Postoperative Phase: Enhanced Recovery

- Timeframe
 - Arrival on ward until return to baseline function
- Maximize use of multimodal analgesia
- Stimulation of gut motility
- Early enteral feeding
- Early mobilization
- Early removal of drains/catheters
- Information management
 - Expectation management



Post OP Recovery Phase

- Analgesics maximize multimodal regimen
- Fluid restriction (D/C IVF 24 -48 hours)
- Avoid NGT
- Early feeding soft diet POD #1
 - Well tolerated 90%
 - Decrease insulin resistance
 - Early return of bowel function
 - Decreases length of stay
- Alvimopan peripherally acting mu-opioid receptor antagonist

Post Op Phase

- Venous Thromboembolism Prophylaxis
 - CMS "never event" in hospitalized patients
 - Post discharge DVT (o.47%); PE (o.26%)
 52,555 CR surgery pts NSQIP database

 DCR 2010;53(10) 1355-1360
 - Cochrane meta-analysis (4 RCT) showed decrease
 VTE 1.7 -> 0.2% with 4 weeks prophylaxis
 - Oncologic patients should be given extended DVT prophylaxis
 (4wks)
 World J Surg 2013:259-74

Laparoscopy in Combination with Fast Track Multimodal Management is the Best Perioperative Strategy in Patients Undergoing Colonic Surgery

A Randomized Clinical Trial (LAFA-study)

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Michael F. Gerhards, MD, PhD,** Bart A. van Wagensveld, MD, PhD,†† Edwin S. van der Zaag, MD,‡‡
Anna A.W. van Geloven, MD, PhD,§§ Mirjam A.G. Sprangers, PhD,¶¶ Miguel A. Cuesta, MD, PhD,*** and
Willem A. Bemelman, MD, PhD,* on behalf of the collaborative LAFA study group

- First trial addressing FT/standard with lap/open
- 427 pts randomized (2005-2009)
- Lap reduced L.O.S. by 21%
- LAP/FT pts significantly faster recovery
 - Quicker bowel function return
 - Quicker acceptance of discharge

ORIGINAL CONTRIBUTION

Reducing Readmissions While Shortening Length of Stay: The Positive Impact of an Enhanced Recovery Protocol in Colorectal Surgery

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Table 1. University of Virginia enhanced recovery protocol

Preoperative

- The ER protocol and the role of patients in their recovery are described in detail, including checklists to be completed with the nursing staff.
- · Patients are given a goal of discharge on the second to third postoperative day.
- · The ER protocol patients are flagged in the electronic medical record and on the operative schedule.
- The night before surgery, patients receive a mechanical bowel preparation consisting of 4L of GoLytely, as well as erythromycin (1 g × 3), neomycin (1 g × 3), and metoclopramide (10 mg × 3). Regular diet ceases at 6:00 pm, after which clear liquids can be consumed ad libitum until 2 hours before surgery.
- · Chlorhexidine is provided for showering before surgery

Day of surgery

- Patients are asked to consume 20 oz of Gatorade Thirst Quencher G Series, 2 hours before induction.
- Patients receive 200 mg of celecoxib, 600 mg of gabapentin, and 975 mg of oral acetaminophen unless contraindicated before surgery.
- Alvimopan is administered preoperatively and twice daily for <7 days.
- · Patients receive antibiotic prophylaxis with cefazolin and metronidazole.
- A morphine spinal (250 μg) is administered.
- · Unfractionated heparin (5000 U) is administered immediately after placement of the spinal.
- N-Methyl-p-aspartate antagonists are used with induction (magnesium 30 mg/kg and ketamine 0.5 mg/kg) and throughout surgery (ketamine 10 μg/kg per min).
- Intravenous lidocaine is infused during surgery (40 μg/kg per min) and for 48 hours after the procedure (1 mg/min).
- Intraoperative fluid management is guided by a goal-directed fluid algorithm using the Masimo Pleth Variability Index to guide fluid responsiveness.
- · A separate clean fascial closure tray is used at the end of the case.
- · Patients get out of bed in postanesthesia care unit to be weighed and are out of bed the night of surgery.
- · Clear fluids are administered in postanesthesia care unit.

Postoperative

- Intravenous fluids are continued at 40 mL/h on the night of surgery and discontinued at 8:00 AM on the first postoperative day.
- · A soft diet begins on the first postoperative day.
- Patients are placed on scheduled acetaminophen and celecoxib. The primary postoperative opioid analgesic agent is oral oxycodone (every 4
 hours on the day of surgery, scheduled daily at 6:00 AM on the first postoperative day for the open cases).

After discharge

- · Patients are called within 72 hours after discharge.
- · New ostimates are referred for home health and seen within 1 week in the enterostomal therapy clinic.

Table 2. Demographic and clinical comparison of pre-ER and ER patients			
Variable	Pre-ER (N = 383)	ER(N = 324)	P
Patient demographics			
Age, mean (SEM), y	57.1 (0.07)	58.3 (0.83)	0.27
Men, n (96)	182 (48)	147 (45)	0.57
Race, n (%)			0.83
Asian	1 (-)	2 (-)	
Black White	33 (10)	46 (12)	
Other	329 (86)	284 (88)	
Diabetes mellitus	6 (2) 59 (15)	6 (2) 43 (13)	0.42
Hypertensive	177 (46)	132 (41)	0.14
Smoking	62 (16)	66 (20)	0.15
BMI, median (IQR)	27 (23.4–31.3)	27 (22.8-32.2)	0.84
Diagnosis, n (96)			0.29
Neoplasm	224 (59)	194 (61)	
IBD	68 (18)	53 (17)	
Diverticular	47 (12)	48 (15)	
Other	43 (11)	24 (8)	
ASA, n (%)			0.88
1	2 (-)	1 (-)	
2	179 (47)	159 (49)	
3	194 (51)	158 (49)	
4	8 (2)	5 (2)	
Laparoscopic, n (%)	119 (31)	175 (54)	<0.0001
Rectal surgery, n (%)	158 (44)	128 (41)	0.52
Ostomy, n (%)			0.66
None Colostomy	245 (64) 39 (10)	197 (61) 34 (10)	
lleostomy	99 (26)	93 (29)	
Clinical outcomes	99 (20)	93 (29)	
Index median LOS	5.0 (4.7)	4.0 (3.5)	< 0.0001
(IQR), d			
Reoperation within	23 (6)	13 (4)	0.23
30 d, 11 (90)			
Surgical site infection,	68 (18)	25 (8)	0.0001
n (96)			
Superficial/deep, ir (%)	43 (11)	13 (4)	0.0004
Organ space, n (%)	25 (7)	12 (4)	0.12
Pneumonia, n (96)	6 (2)	4 (1)	0.76
Thromboembolism, n (%		7 (2)	1.0
Acute renal failure, n (96)		2 (1)	0.21
Urinary tract infection,	17 (4)	13 (4)	1.0
n (%) Bleeding/transfusion,	42 (11)	21 (2)	0.05
bieeding/transitusion,	42 (11)	21 (7)	0.05
Any complication, n (96)	125 (33)	71 (22)	0.002
30 d mortality, n (%)	0 (0)	3 (1)	0.10
Discharged to a	20 (5)	24 (7)	0.27
facility n (%)	77 (10)	20 (22)	0.000
30-d readmission, n (%)	72 (19)	38 (12)	0.009
Readmitted cause,			0.94
n (%) Nausea/emesis	23 (6)	11 (3)	
Infectious	27 (7)	13 (4)	
Ostomy related	11 (3)	5 (2)	
Other	11 (3)	7(2)	
		- 1-1	

ER = enhanced recovery; IQR = interquartile range; LOS = length of stay. *Data show significance at p < 0.05.

ORIGINAL CONTRIBUTION

Improving Conventional Recovery With Enhanced Recovery in Minimally Invasive Surgery for Rectal Cancer

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TABLE 1. Comparison between conventional pathway and enhanced recovery pathway ¹⁰		
Pathway component	Enhanced recovery pathway	Conventional pathway
Preoperative	Celecoxib 400 mg	None
analgesia	Gabapentin 600 mg	
Postoperative	Standardized based on risk factors	Recommended based on risk factors
nausea	Dexamethasone 4-8 mg IV + 5HT-3 antagonist	Dexamethasone 4-8 mg IV or 5HT-3 antagonist
prophylaxis	Can add droperidol 0.625 mg	
Fluid balance	Fluids at 500 mL/h unless hypovolemic	No target rates in the operating room
	Postoperative rate 40 mL/h, then saline lock at 0800 hours on day after surgery	Postoperative rate 80-125 mL/h until oral intake > 600 mL
Intraoperative	No epidural	No epidural
analgesia	Intrathecal analgesia injection at discretion of anesthetist	IV opioids ± ketorolac
	IV opioids	
	IV ketorolac (end of case)	
Postoperative	No epidural	No epidural
analgesia	Oral oxycodone as needed for pain score ≥ 4	IV PCA transitioned to as-needed oxycodone
	Scheduled acetaminophen every 6 h	Scheduled acetaminophen every 6 h
	Scheduled NSAIDS (ketorolac IV for 4 doses, then ibuprofen scheduled)	Scheduled NSAIDs for 3 days, then as needed
Diet	NGT removed at end of procedure	NGT removed by 0600 hours on postoperative day 1
	Goal 800 mL oral intake within 4h of return to patient care	Evening of surgery: sips of clear fluid
	area	Postoperative day 1: full liquid diet (800 mL oral intake)
	Regular diet started 4h after procedure	Day 2: soft diet
	Encourage 2000-2500 mL/day fluids/supplements	Day 3: normal diet
Ambulation	Evening of surgery: out of bed for >2 h (1 walk + up in chair)	Evening of surgery: mobilize 1 or more times
	Postoperative day 1: out of bed for >8 h (4 or more walks +	Postoperative day 1: mobilize at least 4- 6 times
	up in chair)	Day 2: mobilize >6 times
	Day 2: out of bed for >8 h (4 or more walks + up in chair)	Day 3: normal activity

 $IV = intravenous; 5 \text{HT-3} \ antagonist = on dansetron \ or \ granisetron; PCA = patient-controlled \ analgesia; NSAID = nonsteroidal \ anti-inflammatory \ drug; NGT = nasogastric \ tube.$

Mayo Clinic Experience

- 346 patients minimally invasive surgery (rectal Ca)
- 78 pts ERP vs. 268 pts conventional
- L.O.S. 4.1 days vs. 6.1 days (p<0.0001)
- 30 day readmission 7.7% vs. 13.8% (p=0.15)
- 31% pts discharged POD #2 vs. <1%



Sample Protocol

Pre-Op (Before Hospitalization)	Same Day Surgery	OR
 Bowel prep as prescribed by physician Antibiotics day before: Metronidazole 500 mg po TID one day Neomycin 1 g po TID one day Diet day before surgery: Breakfast: Full, liquids Lunch and dinner: Clear liquids Expected LOS is 3 days 	 Meds to be ordered by physician: Alvimopan 12 mg po Liposomal bupivacaine (intra-op use) SDS RN to administer alvimopan 12 mg po Meds to be ordered and administered by Anesthesia: Pregabalin 50 mg po Methylprednisolone 125 mg IV 2 hours prior clear liquid regimen consisting of 20 grams of carbohydrate (we use Ensure Boost) 	 Minimize narcotic use Meds to be given in the OR: Ondansetron 4 mg IV Acetaminophen: 1 g IV Ketorolac 30 mg IV Liposomal bupivacaine Limit IV fluids to less than 2.5-3 liters



Sample Protocol

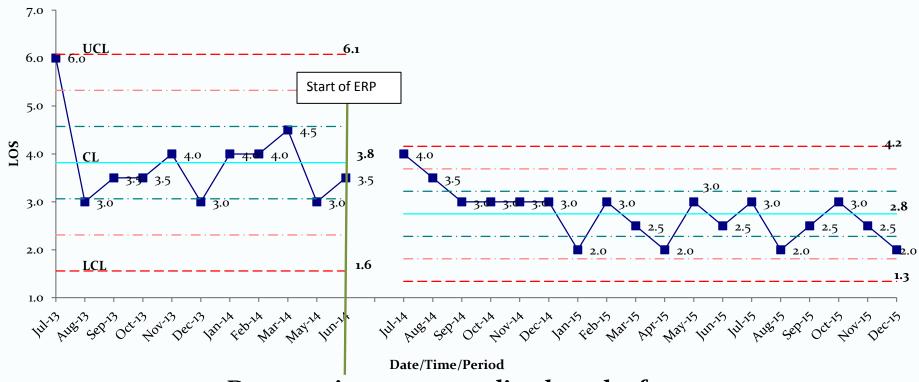
Multimodal Analgesia	Post-Op Day 0	Post-Op Day 1	Post-Op Day 2
 Continue IV ketorolac 15 or 30 mg q6h around the clock for 48 hours Start ibuprofen 400 to 600 mg po q4-6h after ketorolac d/c Continue IV acetaminophen 1 g q8h around the clock for 48h Continue pregabalin 25 or 50 mg po TID until day of discharge Use oxycodone 5 mg one tab po q4h prn for mild-to-moderate breakthrough pain 	 Diet Clear diet for dinner as tolerated Activity Out of bed to chair 2h postop Monitor I & Os Continue oxygen 2L NC for 48h 	 Minimize IV fluids Discontinue IV fluids at 4 pm if patient tolerating po intake an output is adequate Discontinue Foley Monitor I & Os Labs Start alvimopan 12 mg po BID Activity Out of bed for 8h or more 4 or more walks per day Diet Soft diet Gum chewing TID for 20 min (enhances bowel movement) Continue oxygen 2L NC for 48h 	 Patient may shower Continue same medications Continue activity Continue diet Continue oxygen 2L NC for 48h

Methods

- Procedures grouped via ICD-9 & ICD-10 codes
- All elective laparoscopic colon procedures
 - We excluded any open or emergent procedure
- Cases analyzed from July 2013 to Dec 2015
 - 11 months prior to implementation of ERAS and 18 months afterwards
 - Total of 283 cases
- Data were analyzed using control charts via QI Macros to assess for process changes
- Measures assessed:
 - Length of stay
 - Direct cost
 - 30-day readmissions
 - Complications

Results – Length of Stay

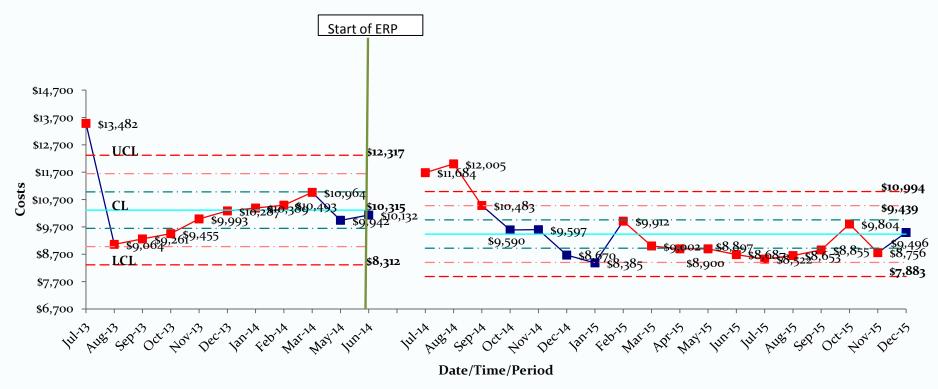
Elective Colon Surgery Median LOS



Decrease in average median length of stay from 3.8 days to 2.8 days

Results- Costs

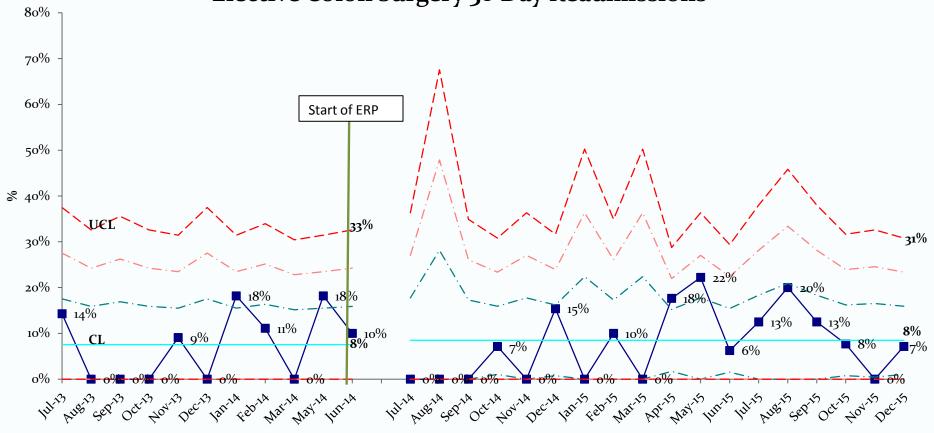
Elective Colon Surgery Median Direct Costs



\$876 (8.5%) Average median direct cost savings

Results-Readmission

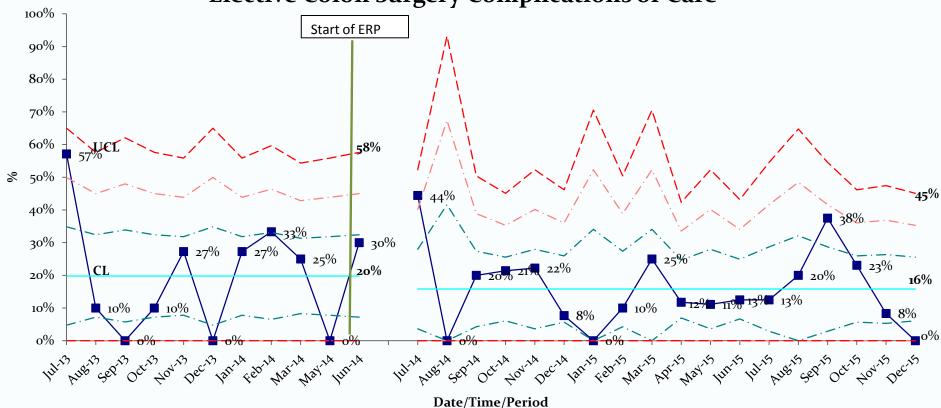
Elective Colon Surgery 30 Day Readmissions



No change in 30 day readmission rate (8%)

Results- Complications





Decrease in average complication rate 20% to 16%

Summary

- Enhanced recovery program + MIS
 - Reduction in post op morbidity
 - Decrease length of hospital stay
 - Low readmission rate
 - Improve quality of care
 - Reduce healthcare costs
- Expand programs to other surgical subspecialties

For more information, these organizations may be helpful:

- American Society for Enhanced Recovery www.aserhq.org
- •Enhanced Recovery After Surgery Society www.erassociety.org
 - Evidence Based Peri-Operative Medicine www.ebpom.org