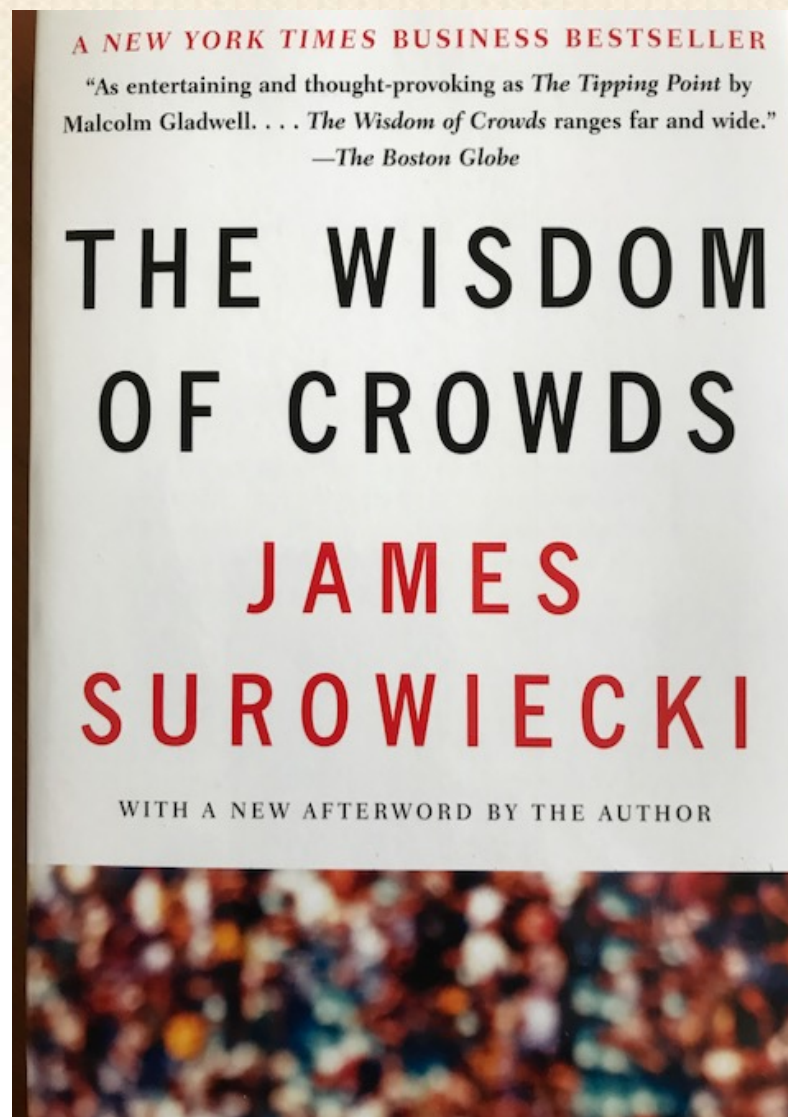


Reducing the Risk of SSI Using a Collaborative, Evidence Based Process

Darrell A. Campbell, Jr MD
Wisconsin SSI Prevention
Summit V
Sept 29, 2017



Marquette General Hospital
Northern Michigan Regional Hospital
Munson Medical Center
Mercy Hospital Cadillac
McLaren – Central Michigan
Sparrow Hospital
Mercy Health Partners
Holland Hospital
Saint Mary's Health Care
Metro Health Hospital
McLaren – Greater Lansing
Spectrum Health Hospitals
Borgess Medical Center
Lakeland Hospitals
Bronson Methodist Hospital
Allegiance Health System
Bronson Battle Creek
ProMedica Bixby Hospital

University of Michigan Health System
St. Joseph Mercy Hospital
St. Mary Mercy Hospital, Livonia
Garden City Hospital
Oakwood Annapolis Hospital
Beaumont Hospital, Grosse Pointe
Botsford Hospital
Henry Ford Wyandotte Hospital

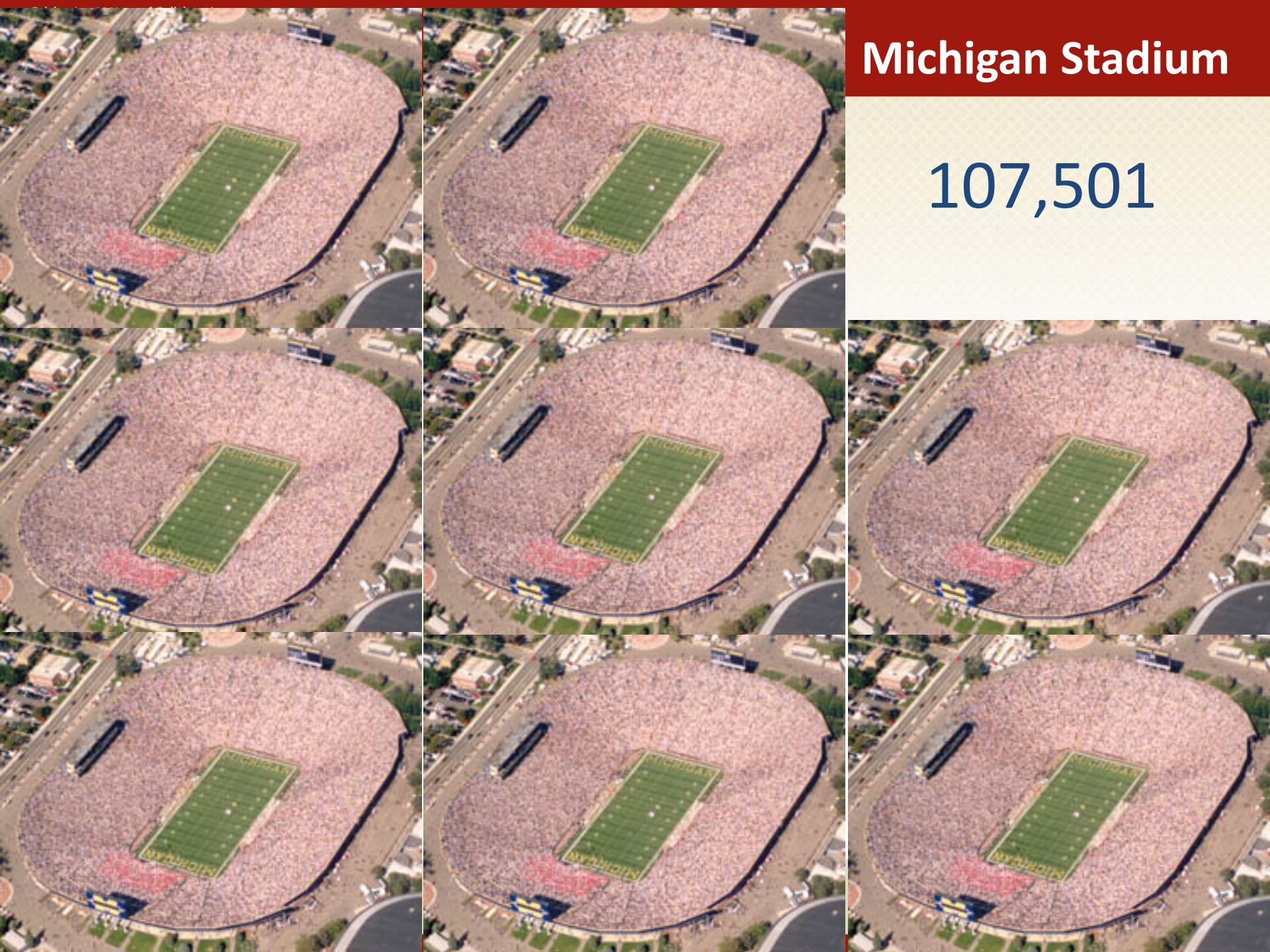
Covenant Medical Center
McLaren – Bay Region
St. Mary's of Michigan Medical Center
Genesys Regional Medical Center
McLaren – Flint
McLaren – Lapeer Region
Hurley Medical Center
St. Joseph Mercy Oakland
Crittenton Hospital Medical Center
McLaren – Oakland
Henry Ford Macomb Hospital
St. John Macomb Oakland Hospital
St. Joseph Mercy Port Huron
Port Huron Hospital
Beaumont Hospital, Troy
Henry Ford West Bloomfield Hospital
Beaumont Hospital, Royal Oak
Providence Hospital
McLaren – Macomb
Huron Valley Sinai Hospital
Sinai-Grace Hospital
Henry Ford Hospital
St. John Hospital and Medical Center
Detroit Receiving Hospital and Medical Center
Harper University Hospital
Oakwood Hospital And Medical Center

Members/affiliates as of March, 2012

For more information about MSQC, please visit our website www.msqc.org

Michigan Stadium

107,501





- Prospective
- Standardized definitions
- trained nurse reviewers
- interrater reliability
- defined endpoints
 - 30 day mortality
 - 30 day morbidity
- RISK ADJUSTMENT

Michigan Surgical Quality Collaborative

A Patient Safety Organization



<http://www.msqc.org/>

MSQC
Michigan Surgical Quality
Collaborative



Blue Cross
Blue Shield
Blue Care Network
of Michigan

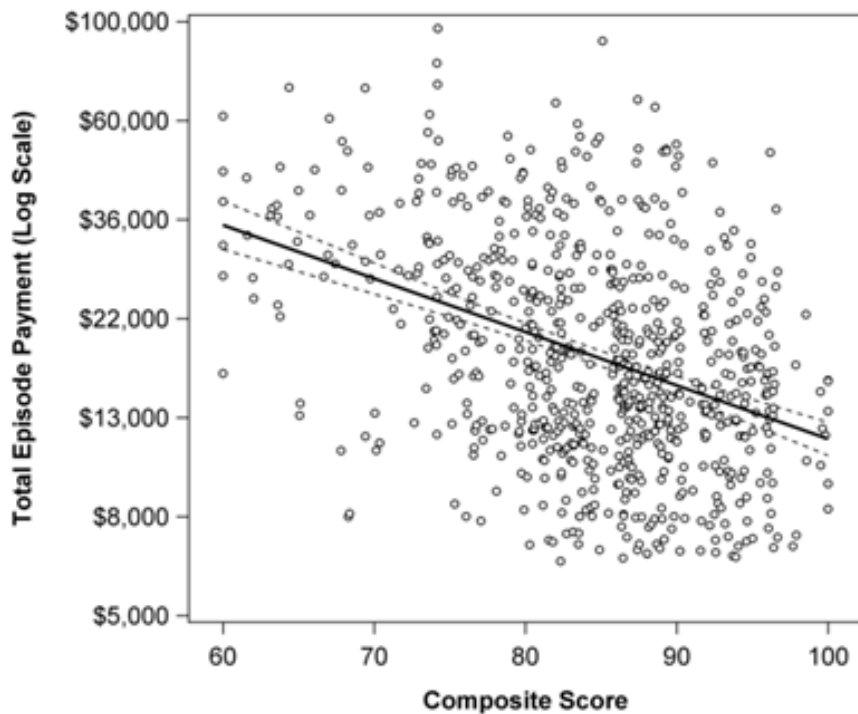
Nonprofit corporations and independent licensees
of the Blue Cross and Blue Shield Association

2011 Blue Works Award



90 day episode cost vs Quality Composite

Figure . Composite Score and Total Episode Payment with 95%CI for Regression Fit



BCBSM pays less as quality improves

MSQC

Celebrating 12 Years of
Collaboration

2005-2017

Celebrating 10 Years of Collaboration

MSQC
2005
2015

Michigan Surgical Quality
Collaborative



Data driven, hands on

- Develop a positive culture
- Establish a Learning Health System
- Prioritize
- Standardize definitions, endpoints, collect data
- Use data to inform strategy
- Feedback data on implementation
- Determine best practices for implementation
- Evaluate results

Develop a positive culture

Why we do what we do

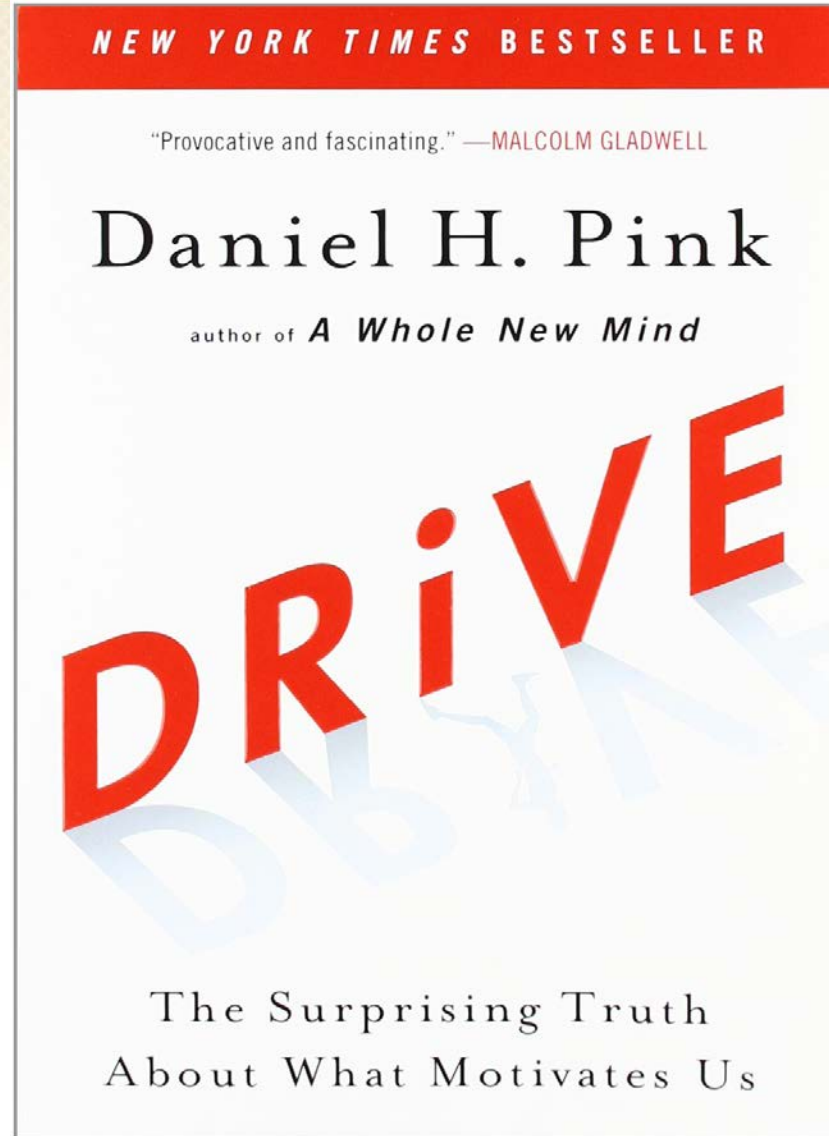
Autonomy

Mastery

Purpose

“The best use of money as a motivator is to pay people enough to take the issue of money off the table”

(Pay for participation)



Culture is important

FRIENDLY

- Collegial
- Non-competitive
- Evidence-based





- We will not use the data for competitive advantage (no billboards)
- Information shared at working group meetings is confidential
- There are no secrets among our group

Site Visits to MSQC Hospitals





The site visit fills an important gap

- **Team building!**
 - Validate quantitative information- does it have “face value”
 - Identify barriers to implementation
 - Collect new qualitative info
- Troy-Beaumont
 - Allegiance
 - Genesys
 - Marquette
 - Hurley
 - Sparrow
 - St Joseph-AA
 - Oakwood

“Best Practice” Colectomy Panel



12/08/2011 14:45

Establish a Learning Health System

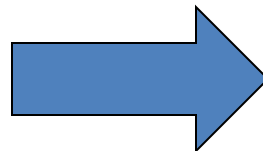
- Routinely and efficiently study and improve itself
- Develop data and analytics
- Feedback of knowledge
- Change behavior to improve health outcomes



Success factors for the MSQC

STRUCTURE

- Financial support
- Flexible to user needs
- Reliable data (doctors believe it)
- Quality data (robust IRR audit schedule)
- Regional rather than national organization
- 24/7 web-based , risk-adjusted reporting & data entry
- Multidisciplinary & interdisciplinary
- Academically-based
- Nurses as data reviewers
- Site visits



CULTURE

- High standards
- Non-threatening
- Non-competitive
- Engagement
- Exceptional customer service
- **Commitment to discovery and innovation**

Prioritize

Dangerous

Frequent

Costly

Claims data 24 million cases

- Pressure ulcers 3.9\$ billion
- **Post op infections 3.7\$ billion**
- Mechanical complications of devices, implants or grafts 1.1\$ billion
- Postlaminectomy syndrome 1.1\$ billion
- Hemorrhage complications .96\$ billion

How to prevent SSI in Michigan

A Major MSQC Initiative



Evidence base not followed

- SCIP 1 **82%** overall compliant (**57%** for emergent)
- SCIP 2 **80%** overall compliant (**53%** for emergent)
- Weight based dosing **55%** compliant
- Redosing at 3 hours **7%** compliant
- Oral antibiotic w bowel prep **39%**

Standardize definitions and endpoints, collect data

Use data to inform strategy

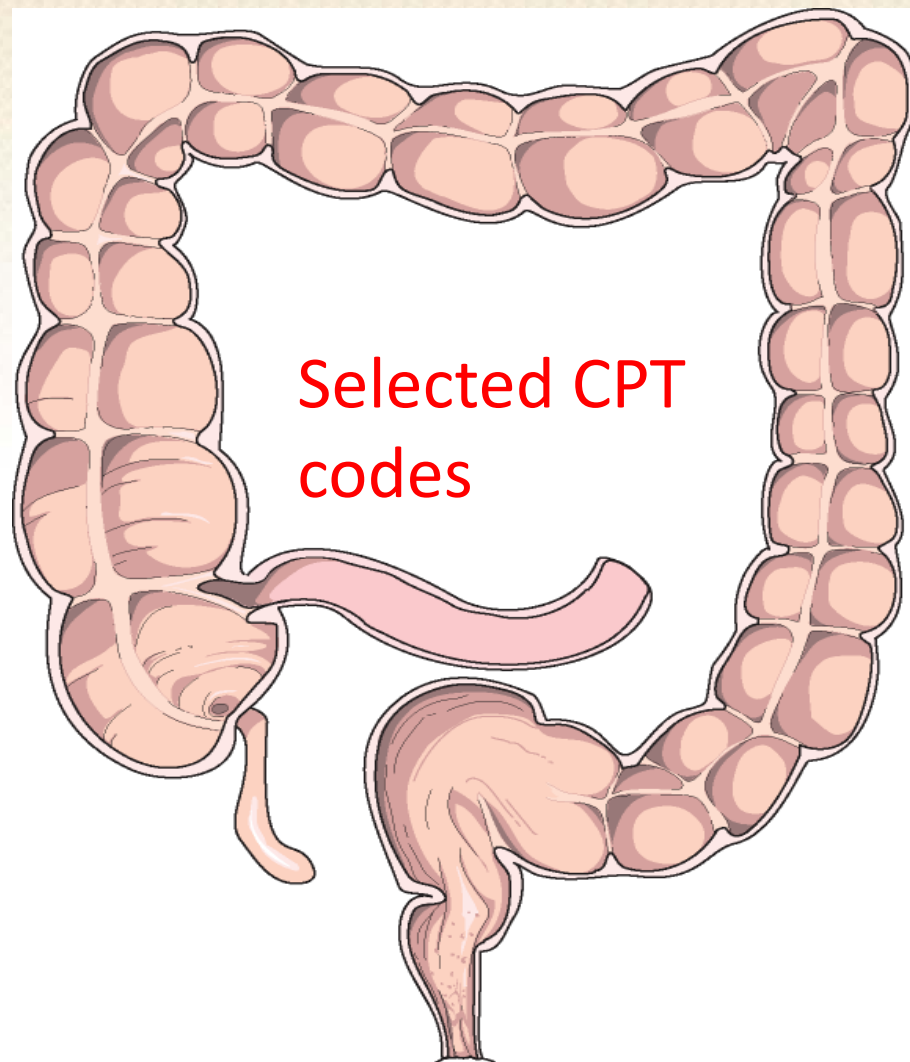
420,000 cases in MSQC database

137 variables per case

What factors are independently
associated with low infection rates?

The Colectomy Bundle

- Commonly performed procedure
- Surgical technique changing rapidly
- High incidence of complications



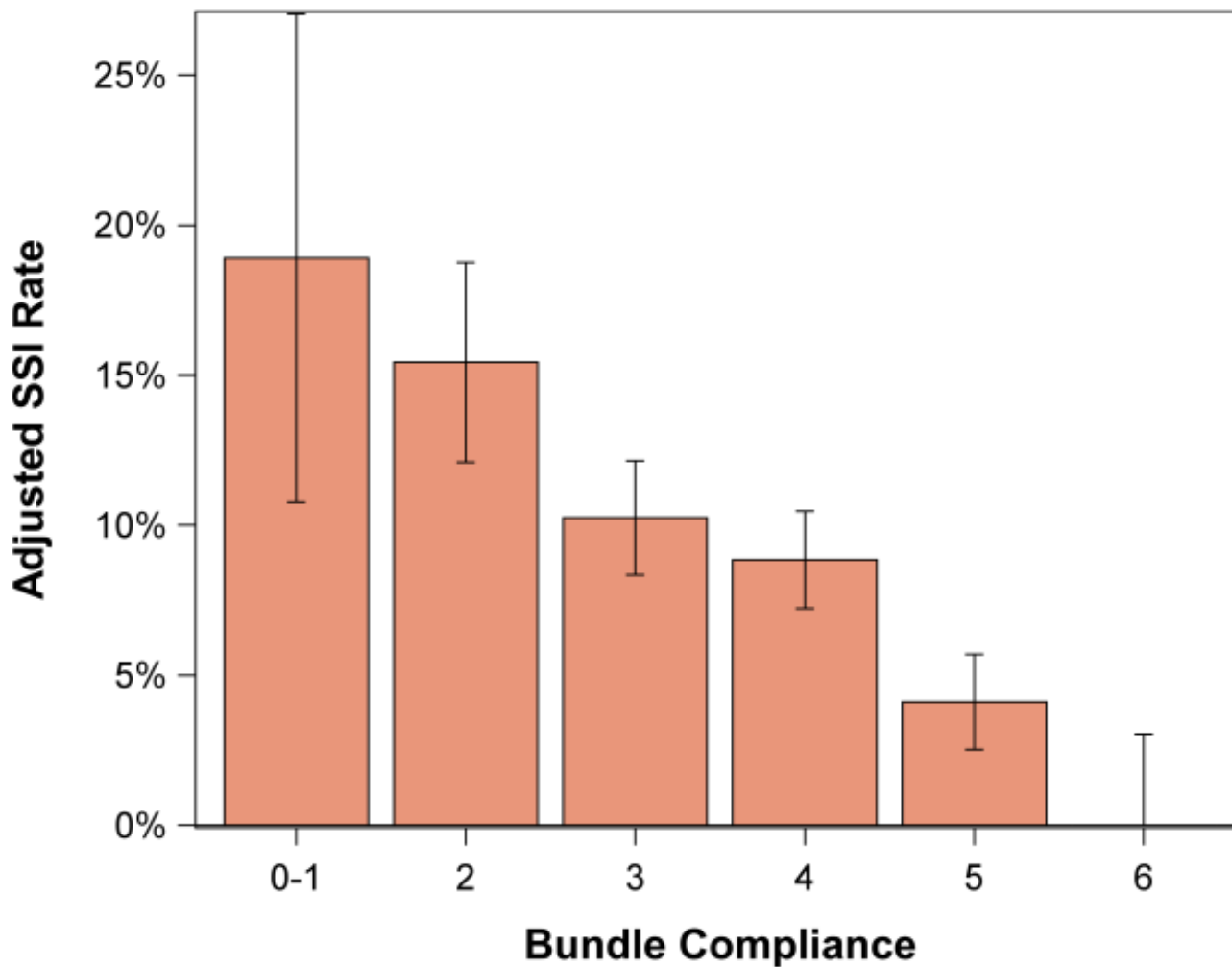
Six “Colon bundle” elements

Derived from multivariable logistic regression analysis

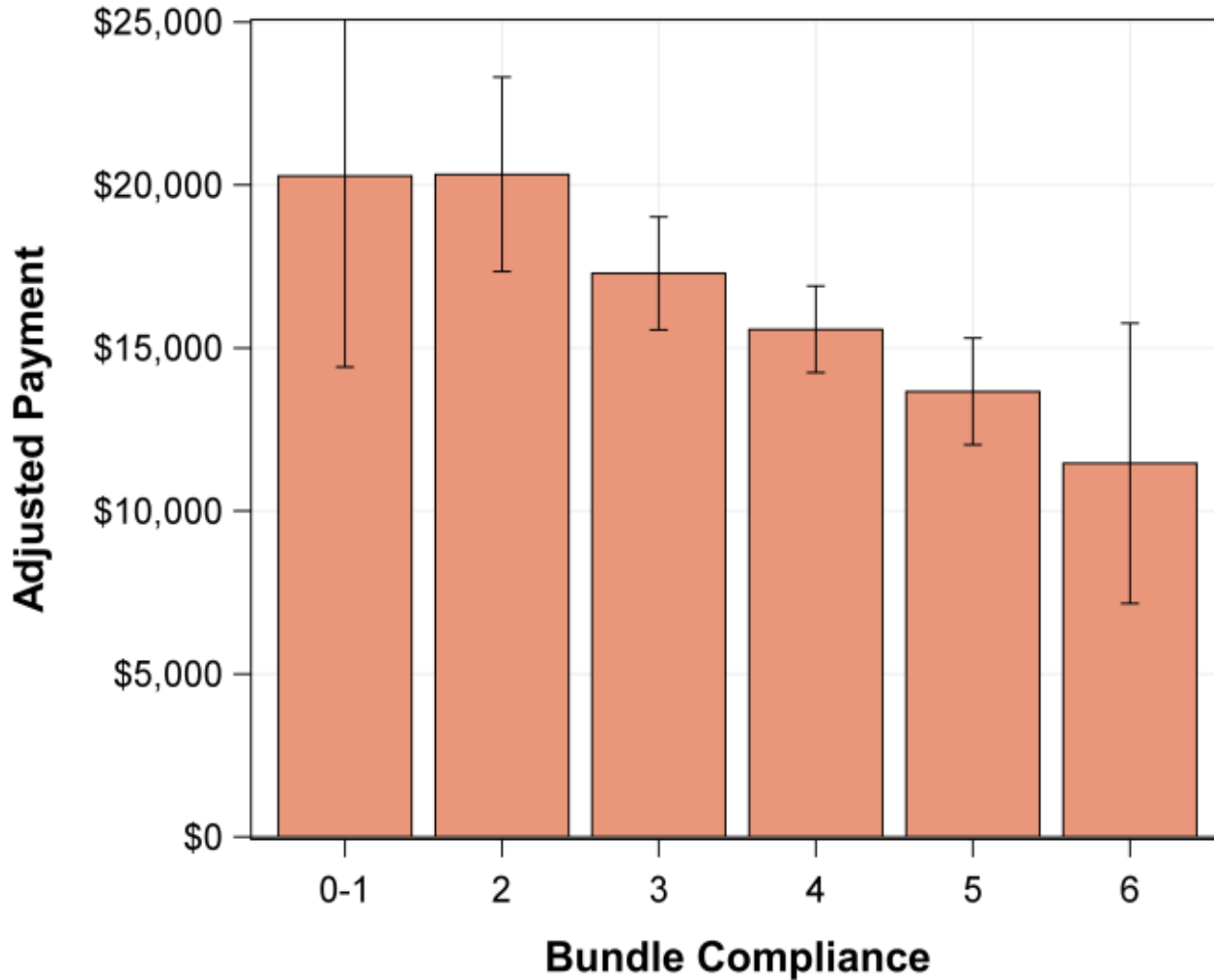
- Use of appropriate parenteral antibiotics
- Oral non absorbable antibiotics also
- Maintenance of temperature during surgery
- Control of blood glucose level
- Use of laparoscopic approach to surgery
- Short duration of surgery

How many bundle elements per case?

SSI-Total Rate by Bundle Score



Average Total Payment by Bundle Score

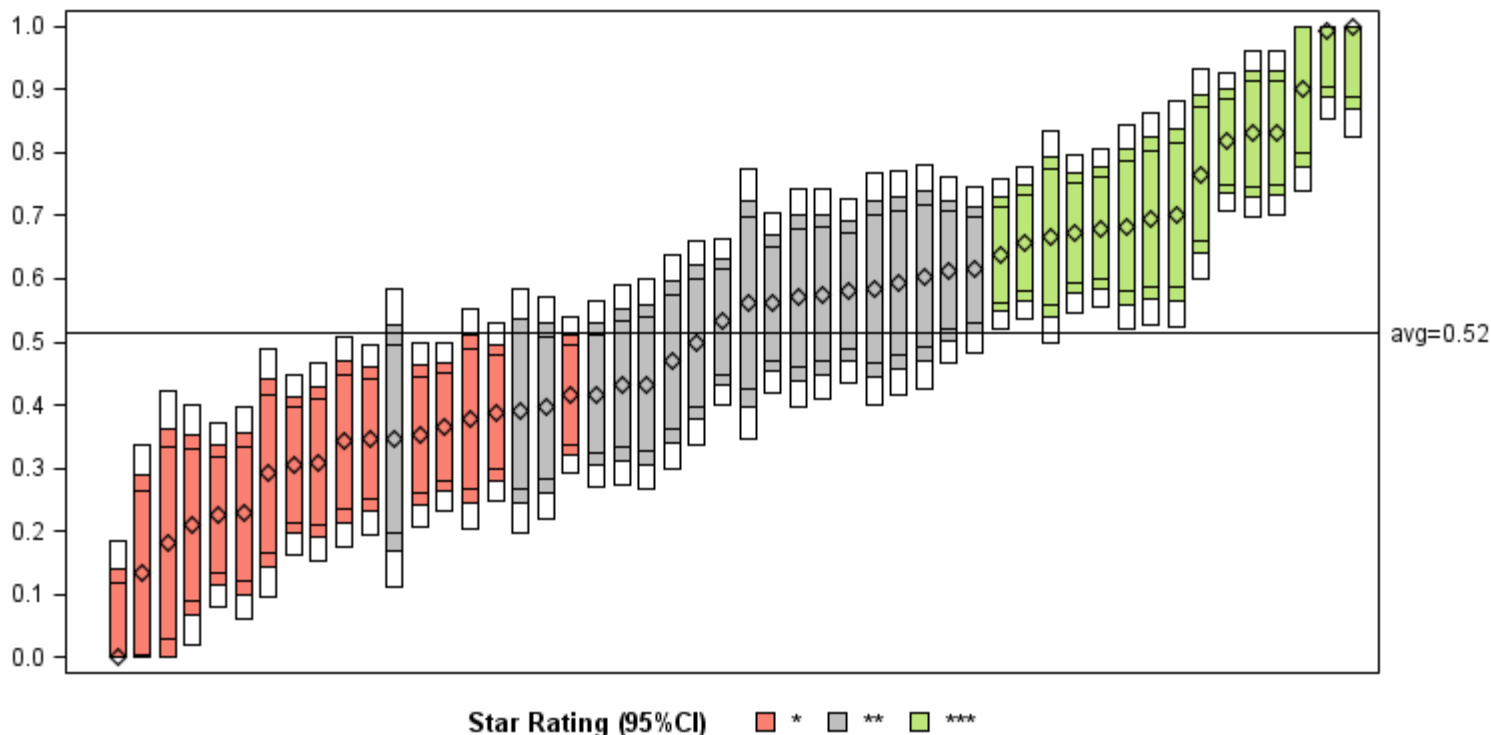


Feedback data on implementation

Colectomy Composite Score

DOMAIN D: SSI COLECTOMY BUNDLE*

Adjusted and Rescaled Average with 90%, 95% and 99% CIs by Hospital and Star Rating**
 Elective Colectomy***, MSQC 2012-2014 (50 hospitals, 4,042 cases)

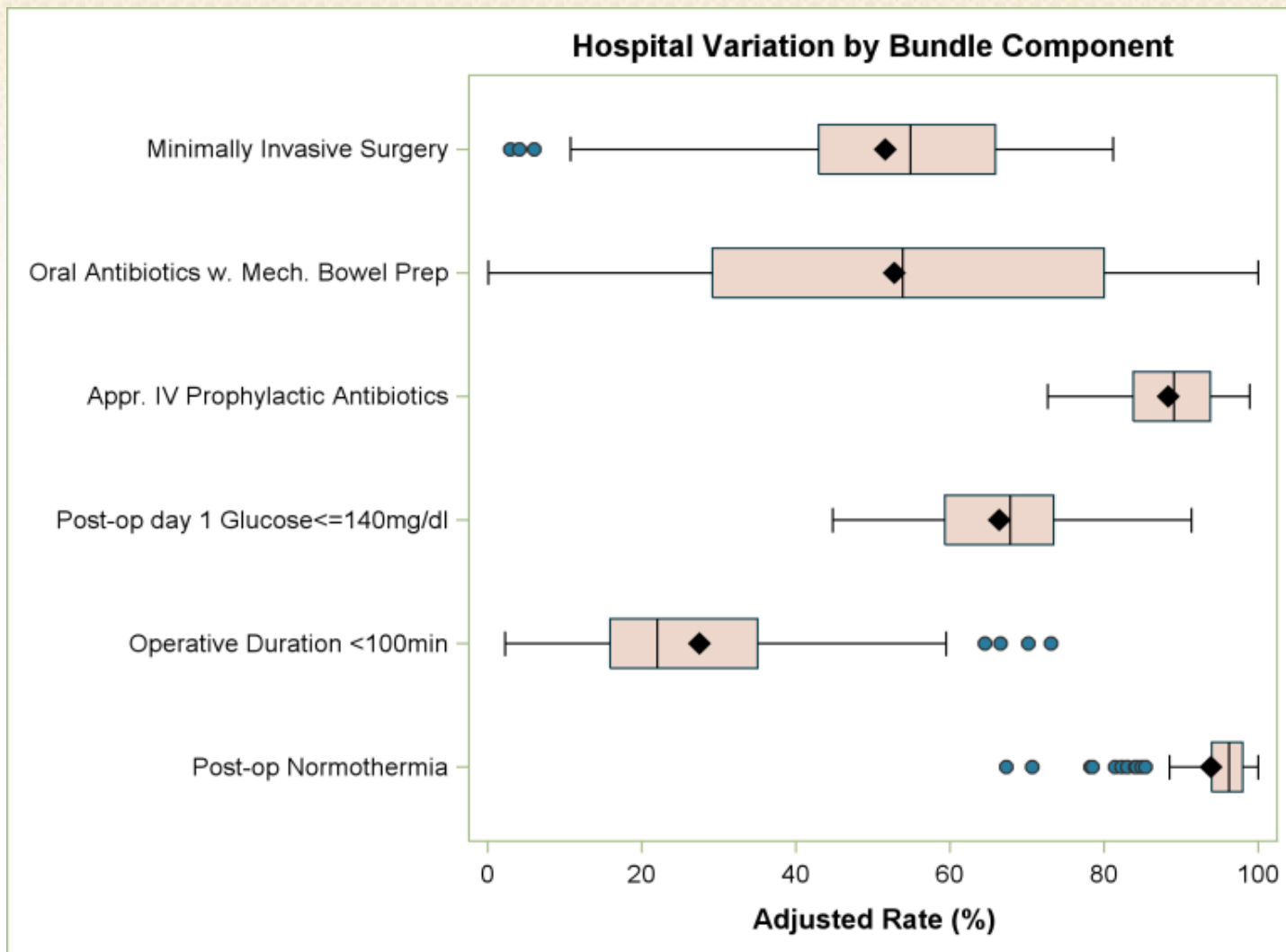


*Calculated as the sum of point values for six components: 1) Appropriate IV prophylactic antibiotics, 2) Postoperative normothermia (temp>96.8°F), 3) Oral antibiotics with mechanical bowel prep, 3) Postoperative day 1 glucose =140mg/dl, 4) Minimally invasive surgery, 5) Short Operative Duration (<100min).

**Reliability adjusted for hospital as a Bayesian random effect. Scaling on a 0 to 1 range. Star rating is determined by non-overlap of 95% CIs with the overall average.

***CPT code in 44140, 44160, 44204 and 44205.

SSI Bundle Colectomy



SSI Bundle Colectomy

SSI Bundle Component	Portion of Explained Variation (%)
Minimally Invasive Surgery	10.2
Oral Antibiotics w. Mech. Bowel Prep	6.3
Appr. IV Prophylactic Antibiotics	5.6
Post-op day 1 Glucose \leq 140mg/dl	3.5
Operative Duration <100min	3.0
Post-op Normothermia	0.4

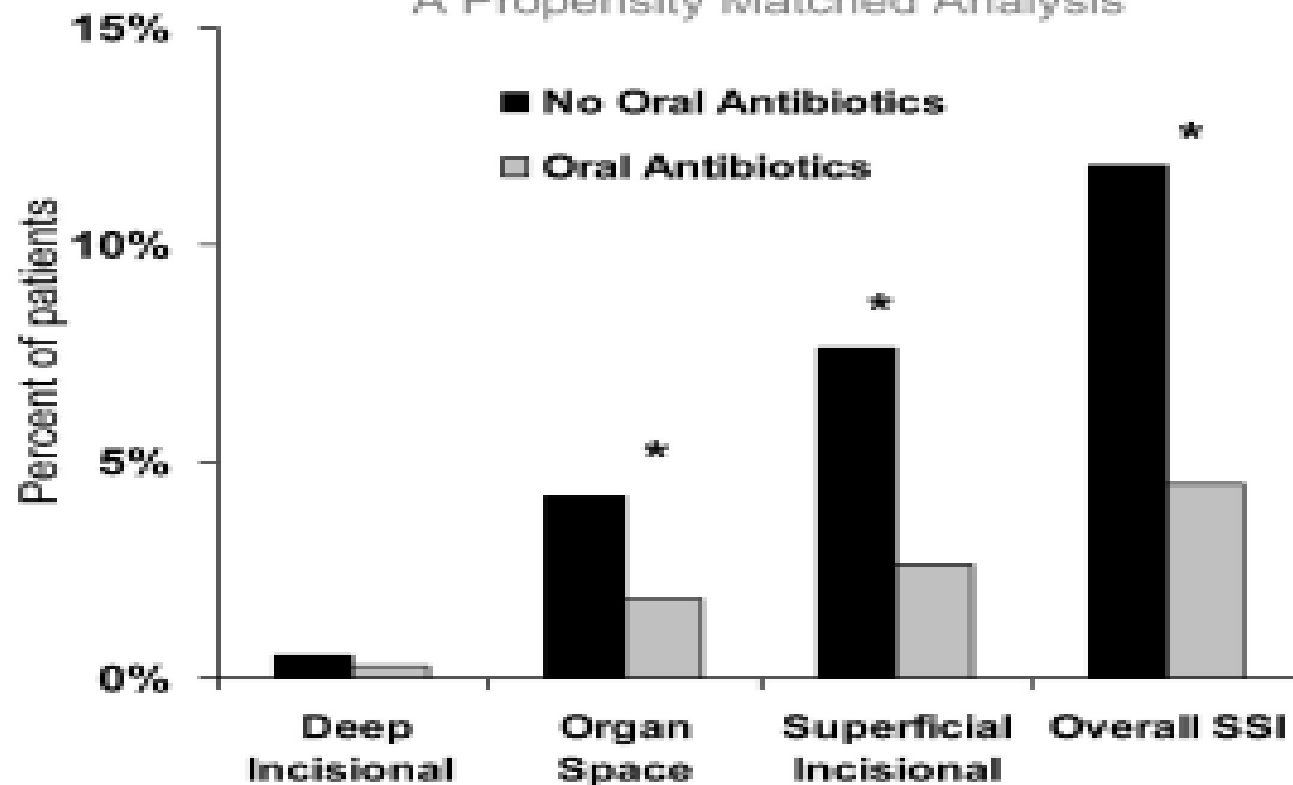
A Statewide Assessment of Surgical Site Infection Following Colectomy

The Role of Oral Antibiotics

Michael J. Englesbe, MD, Linda Brooks, RN,* James Kubus, MS,* Martin Luchtefeld, MD,†
James Lynch, MD,‡ Anthony Senagore, MD,† John C. Eggenberger, MD,§ Vic Velanovich, MD,¶
and Darrell A. Campbell, Jr., MD**

Oral Antibiotics with a Bowel Preparation Prior to Elective Colon Surgery

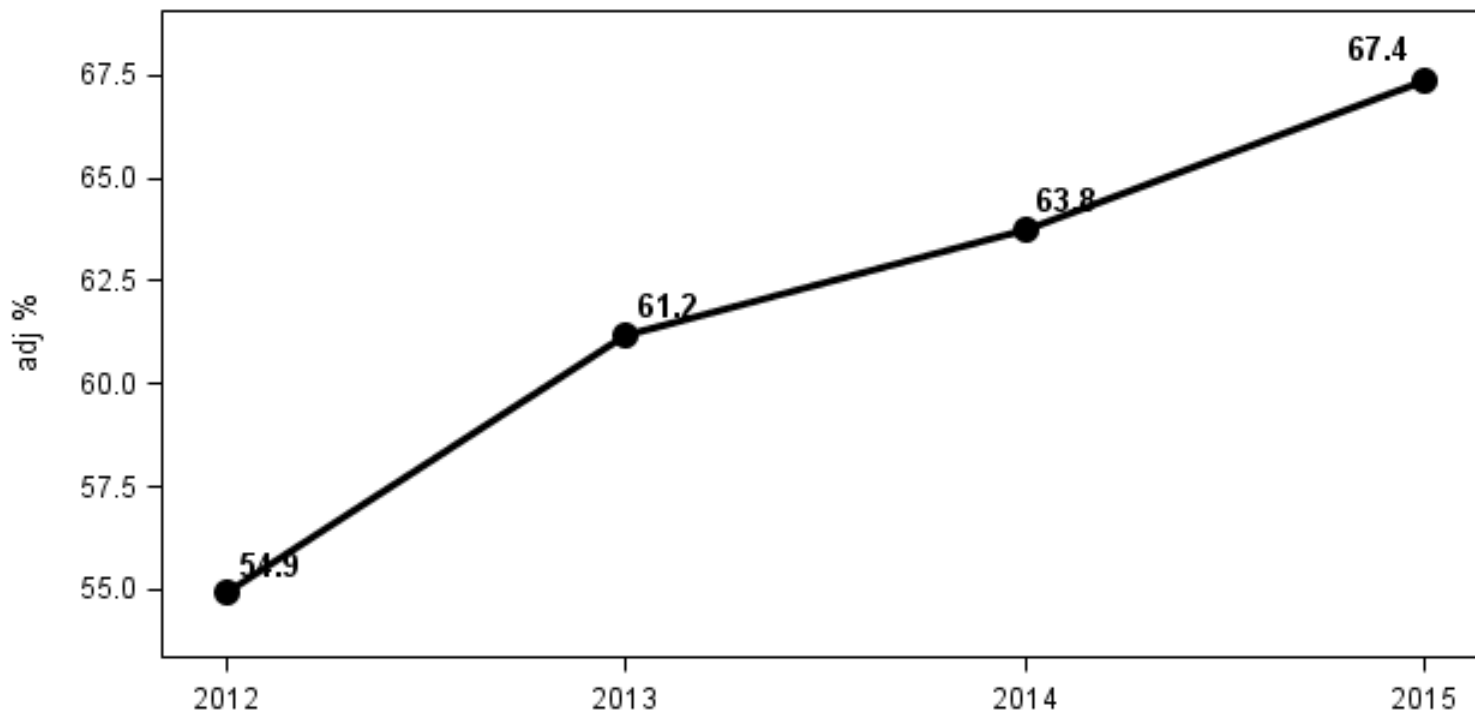
A Propensity Matched Analysis



* $P < 0.05$

FIGURE 3. Surgical site infection rates among propensity matched cohorts of patients who either did or did not receive oral nonabsorbable antibiotics at the time of mechanical bowel preparation prior to elective colon surgery. Patients that received oral antibiotics were observed to have significantly lower rates of organ space infections, superficial surgical site infection, and overall surgical site infection rates.

Oral Antibiotics w. Mech. Bowel Prep by Year Elective Colectomy*, MSQC 2008-2015



*CPT codes 44140, 44160, 44204, 44205.

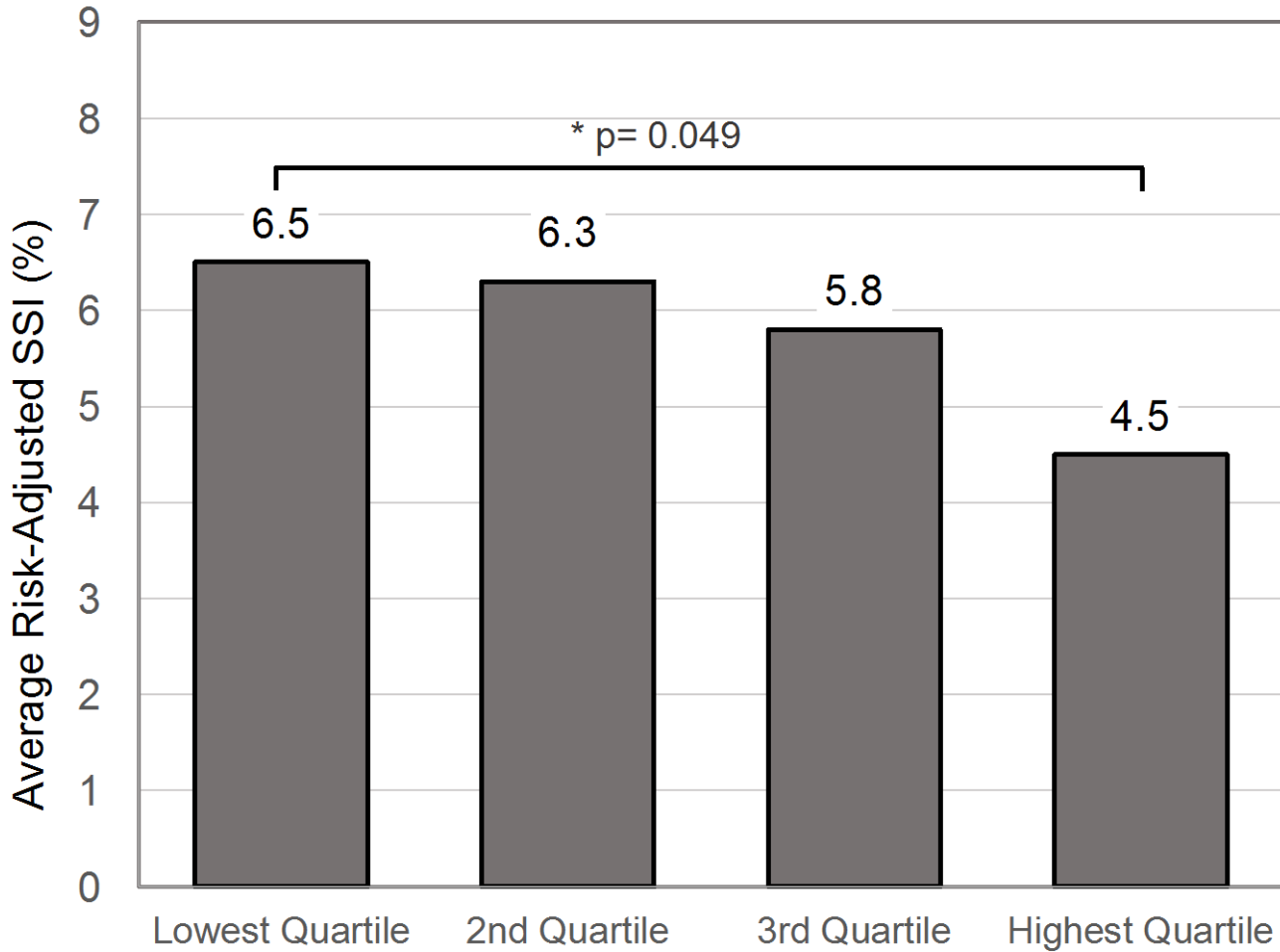
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Bundle Implementation

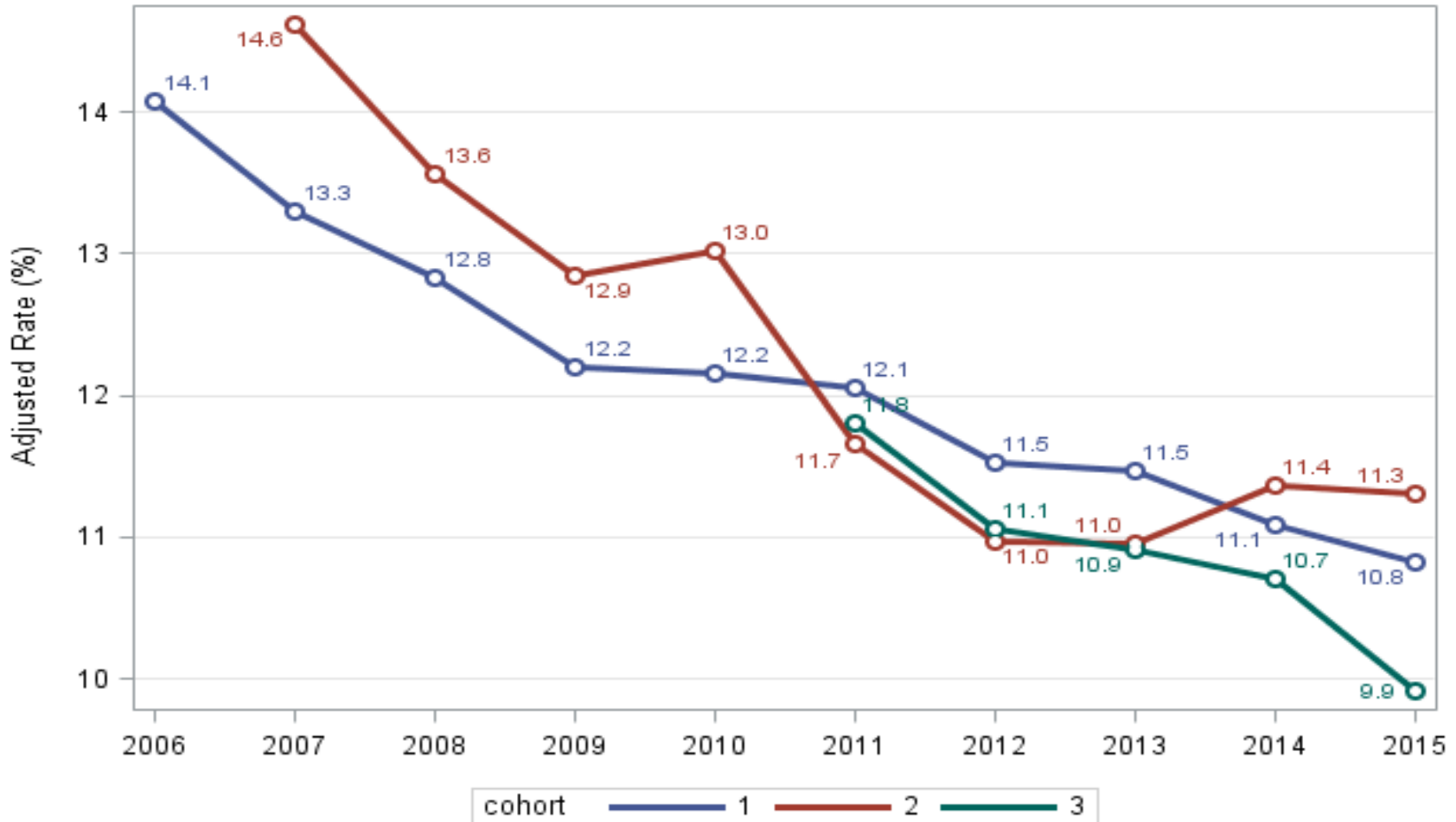
Bundle Elements	2012	2015	% Change
Appropriate Antibiotics	87.4%	89.1%	+ 2
Normothermia	94.8%	96.3%	- 3
Oral Antibiotics	54.9%	67.4%	+ 23
Glucose < 150	57.2%	66.1%	+ 16
Weight Based Dosing	87.1%	95.4%	+ 10
Redosing > 3 Hours			
Minimally Invasive Surgery	44.0%	56.2%	+ 28
Operative Duration < 100 min	33.4%	27.9%	- 16
Ave. Bundle Elements/Case	3.56%	3.95%	+ 11

Evaluate results



Hospital Quartile by Six-Item Bundle Compliance Score

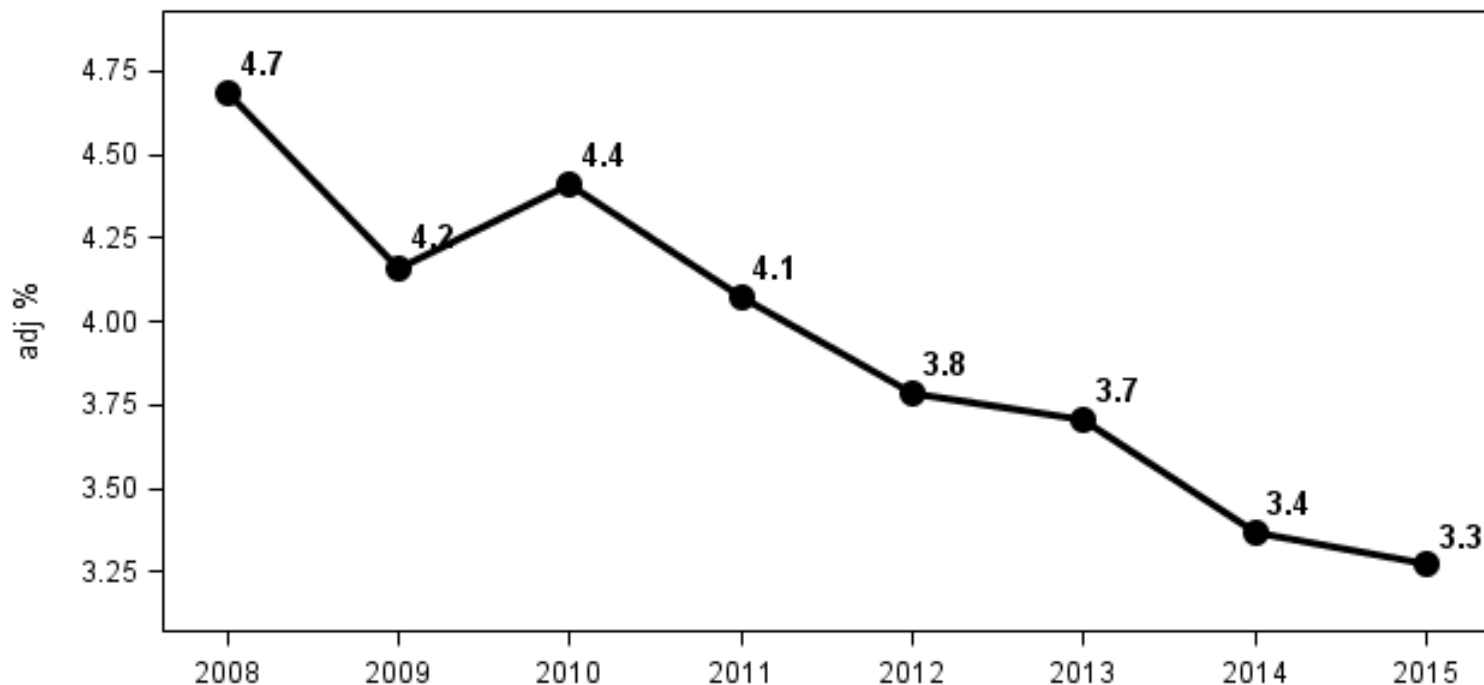
Any Morbidity Core MSQC Sample Only



Elective General Surgery

SSI-Total by Year

Non-Emergent General Surgery, MSQC 2008-2015

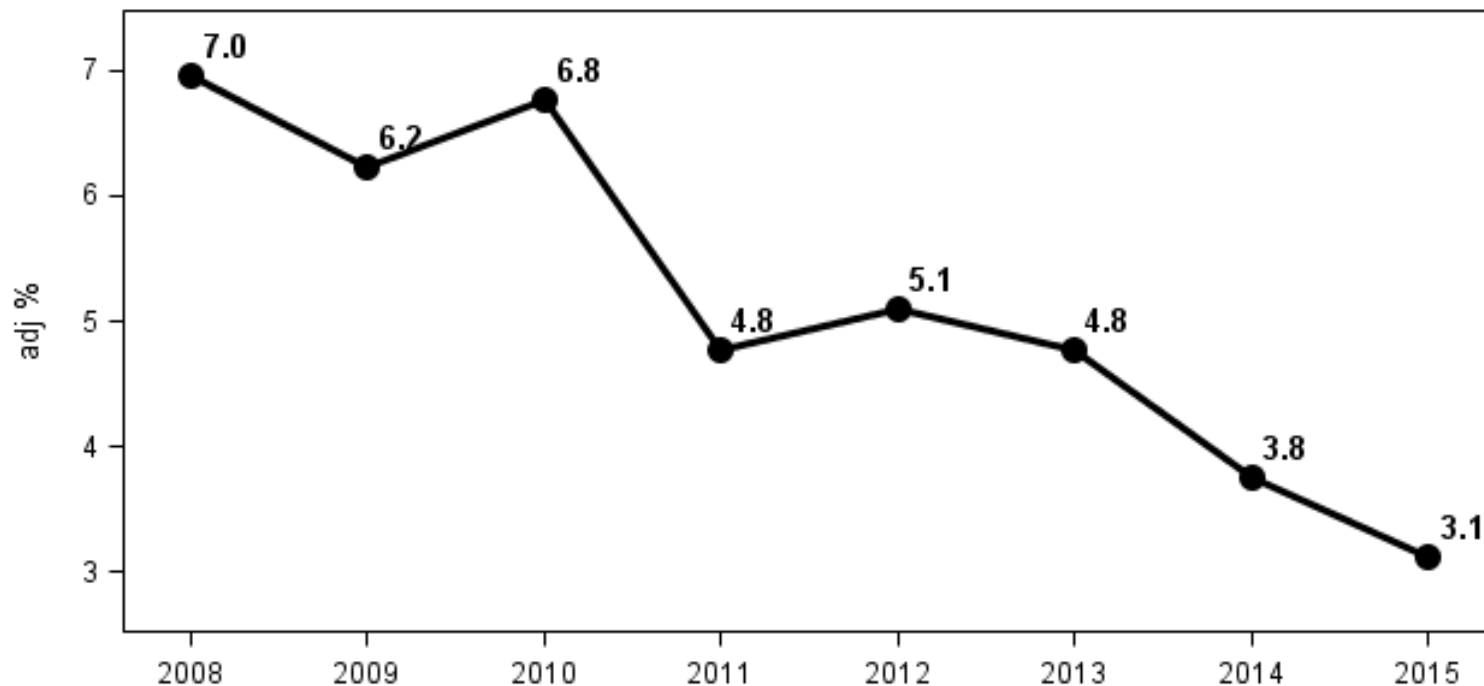


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Elective Colectomy

SSI-Superficial by Year Non-Emergent Colectomy, MSQC 2008-2015



*CPT codes 44140, 44204, 44207, 44208, 44141, 44143, 44144, 44146, 44206, 44145, 44147, 44160, 44205, 44150, 44151, 44210, 44155, 44156, 44157, 44158, 44211, 44212.

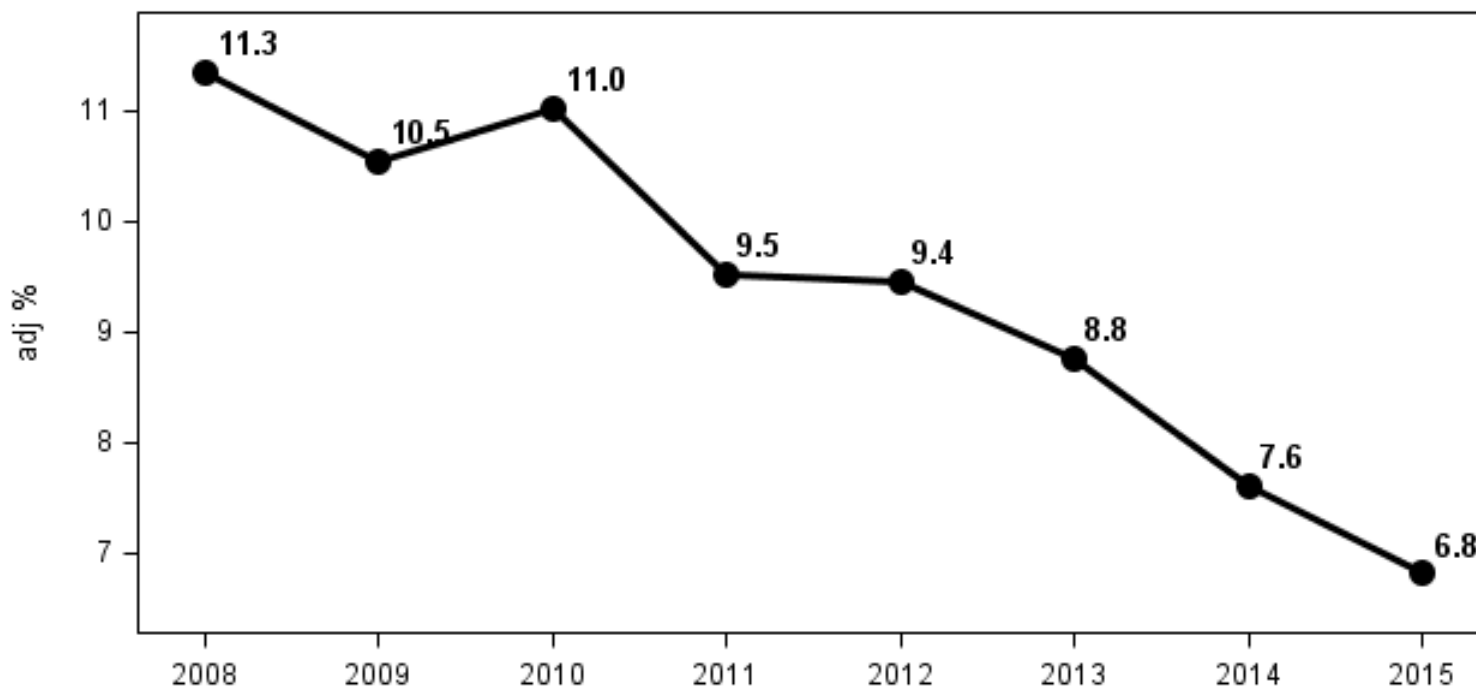
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Elective Colectomy

SSI-Total by Year

Non-Emergent Colectomy, MSQC 2008-2015



*CPT codes 44140, 44204, 44207, 44208, 44141, 44143, 44144, 44146, 44206, 44145, 44147, 44160, 44205, 44150, 44151, 44210, 44155, 44156, 44157, 44158, 44211, 44212.

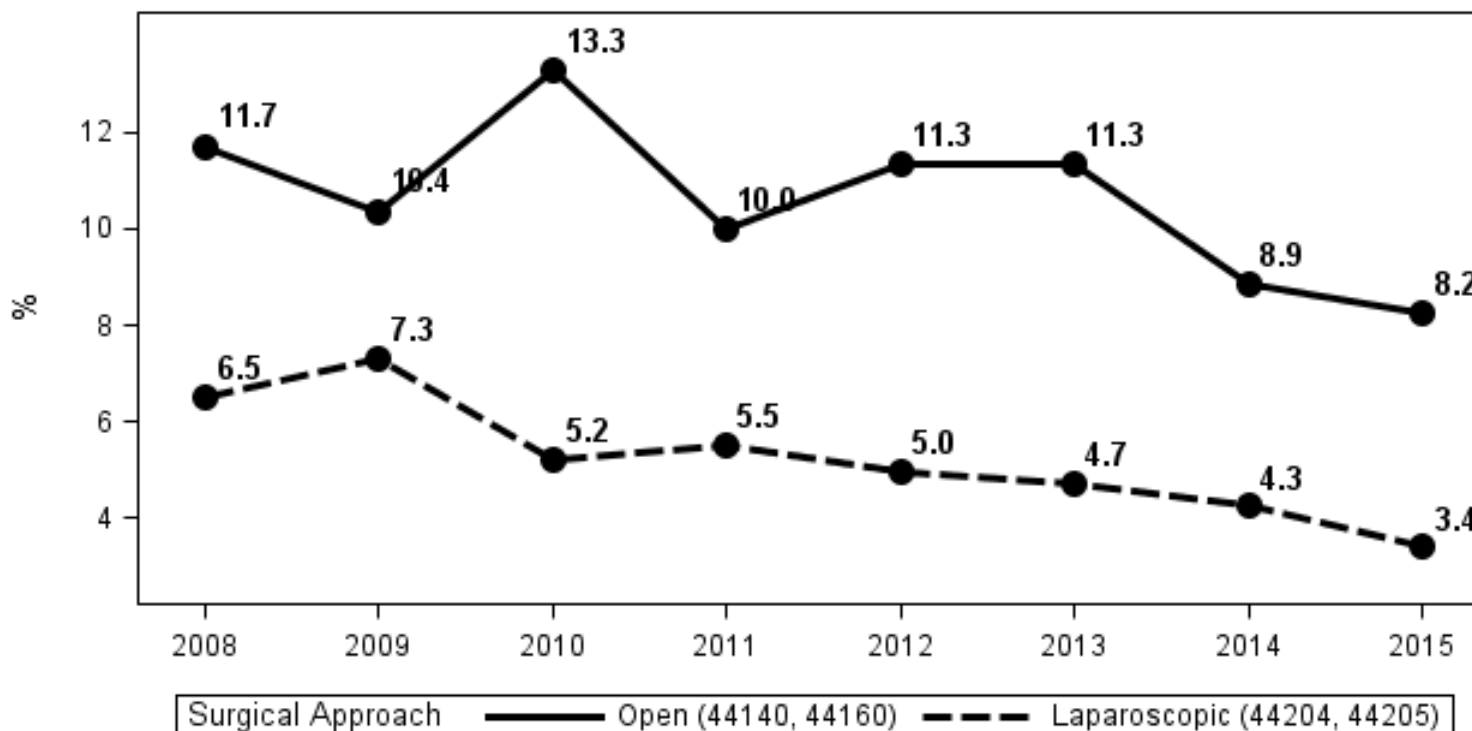
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Open vs lap SSI

SSI-Total by Year

Non-Emergent Colectomy, MSQC 2008-2015



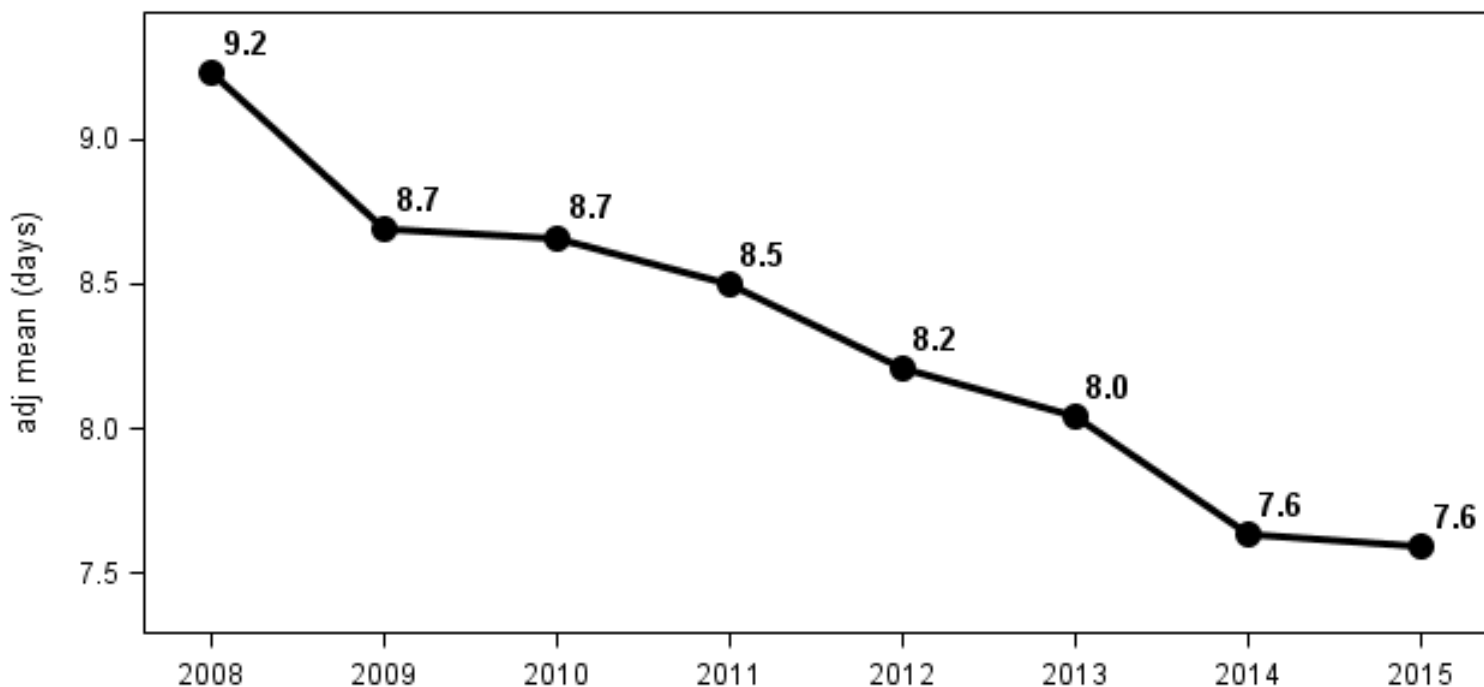
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Elective Colectomy

LOS by Year

Non-Emergent Colectomy*, MSQC 2008-2015



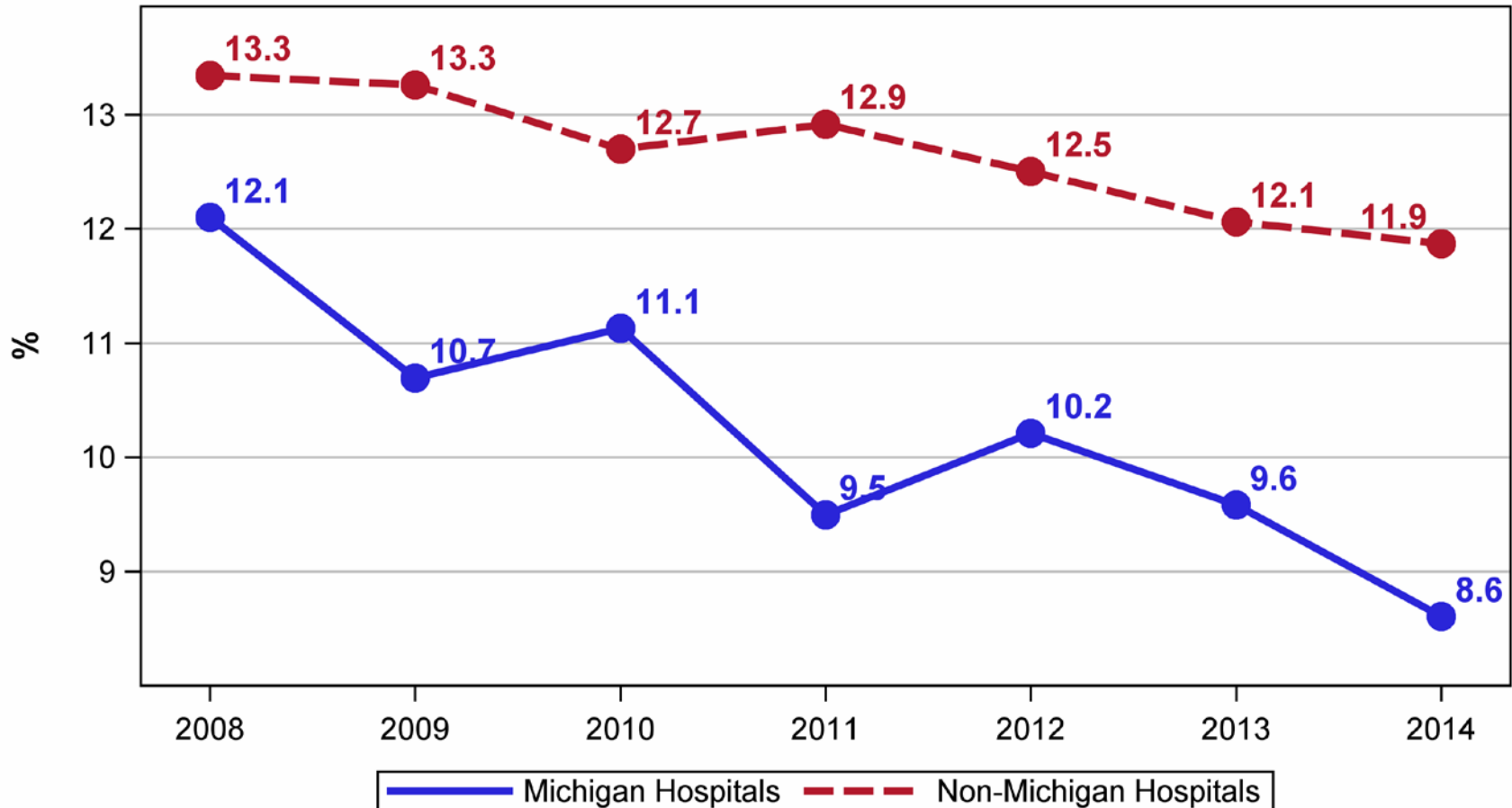
*CPT codes 44140, 44204, 44207, 44208, 44141, 44143, 44144, 44146, 44206, 44145, 44147, 44160, 44205, 44150, 44151, 44210, 44155, 44156, 44157, 44158, 44211, 44212.

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Total SSI After Colectomy*

Hospitals in Michigan vs Hospitals Outside of Michigan, 2008-2014



*CPT code in 44140 44141 44143 44144 44145 44146 44147 44150 44151 44155 44156 44157 44158 44160 44204 44205 44206 44207 44208 44210 44211 44212.

What about parenteral antibiotics?

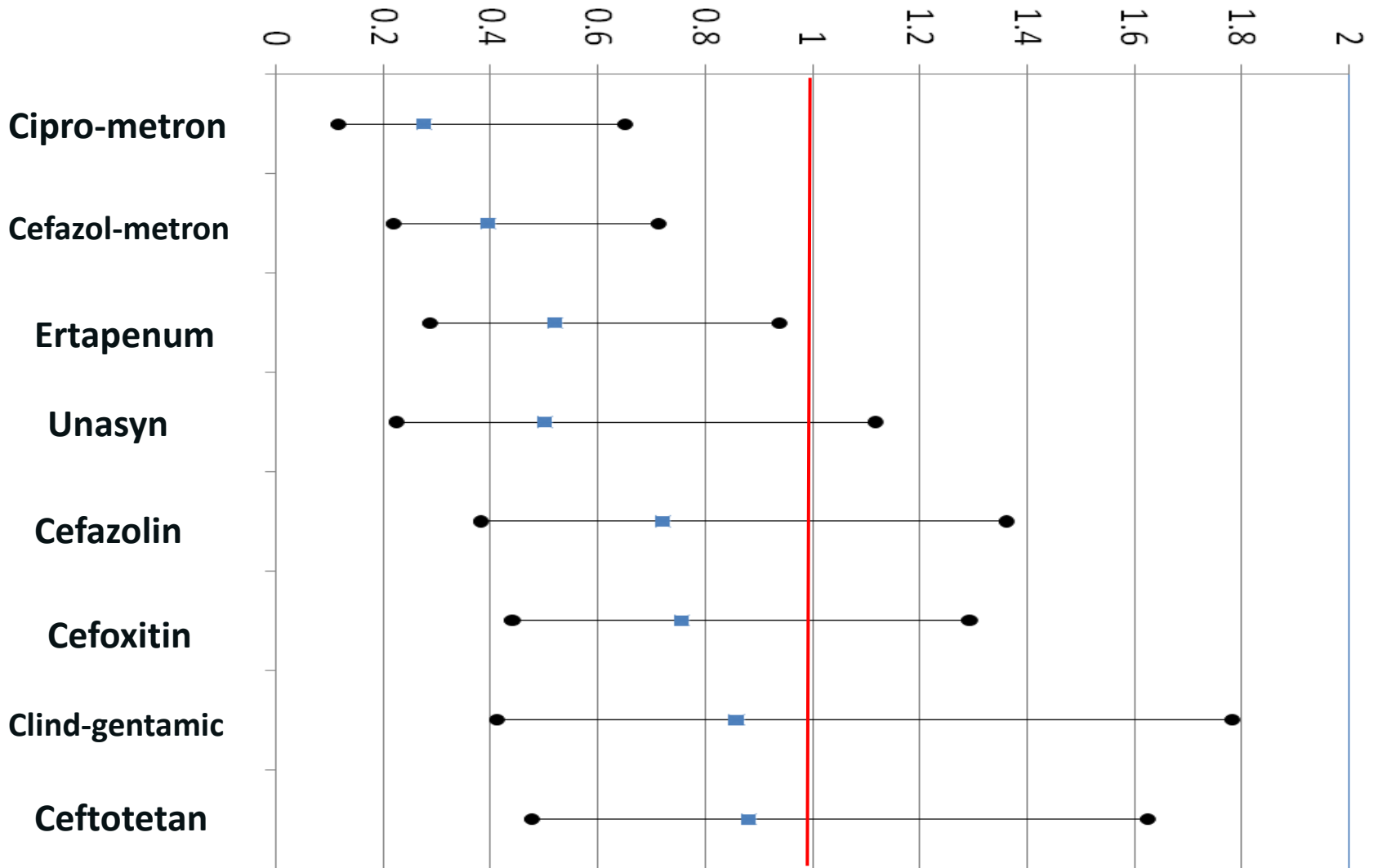
\

- 121 different antibiotic combinations for the same operation
- SCIP-2 compliant 2,431
- SCIP-2 **non-compliant** 389 (16%)

- cefoxitin (n=602),
- cefazolin and metronidazole (n=554),
- ertapenem (n=506),
- ampicillin/sulbactam (n=215), and
- cefotetan (n=206)
- ciprofloxacin and metronidazol (n=121)
- cefazolin (n=193)

Collection SSI Logistic HLM SCIP2 Drug Model: Odds Ratios and Confidence Intervals

Adjusted Odds Ratio



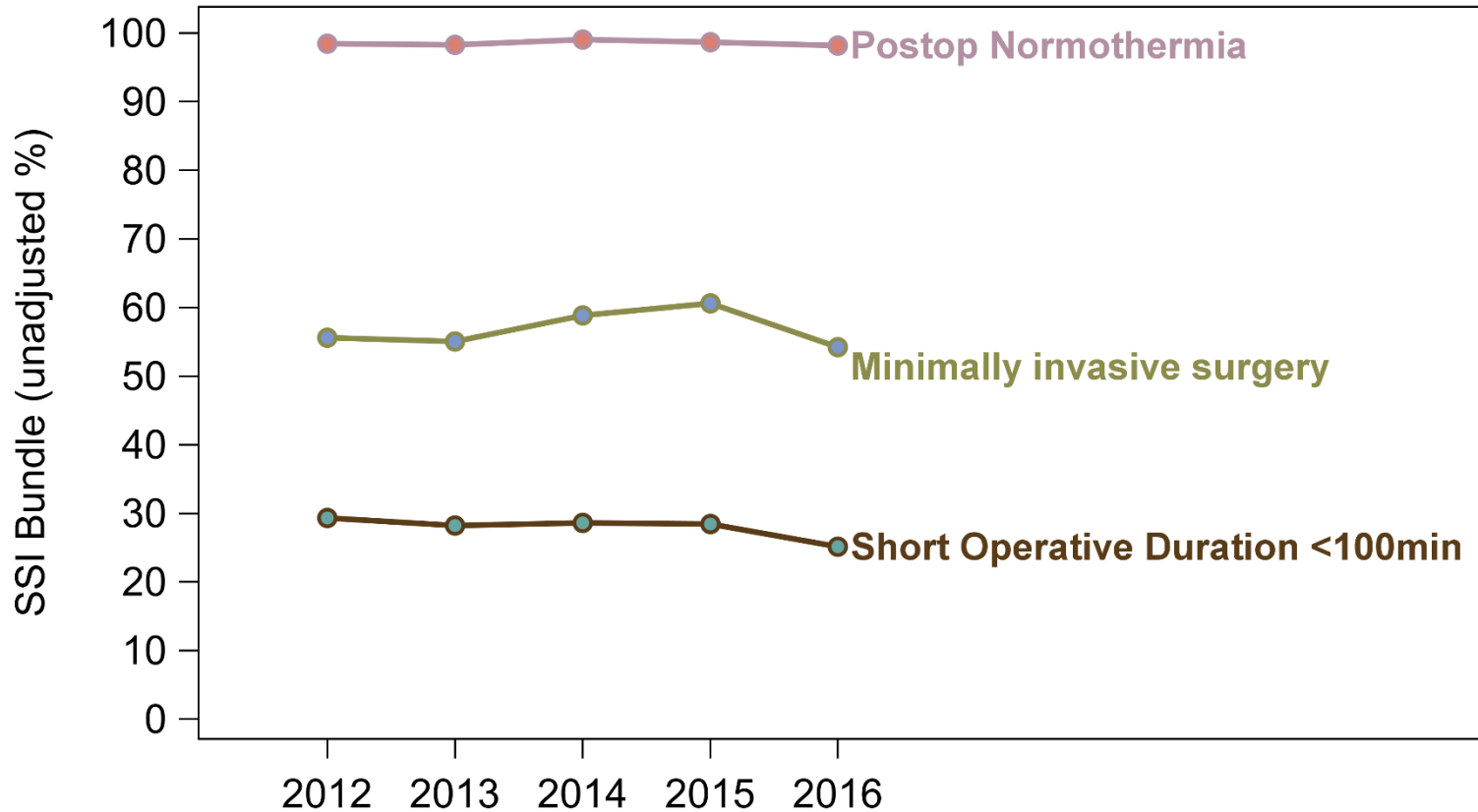
Determine best practices for implementation

Bundle Elements

Antibiotic Choice (Parenteral)

SSI Bundle Colectomy

Trends for Non-actionable Bundle Items



*Elective colectomy with a principal procedure CPT of 44140, 44160, 44204, or 44205 and an operation date between 1-jul-2012 and 31-mar-2016.
 MsqcStatsTicket: t1030e3721v6_fig4

Six Bundle Elements

Appropriate SCIP-2 prophylactic intravenous antibiotics

Postoperative normothermia (temperature of >96.8F)

Oral antibiotics with mechanical bowel preparation (“Nichols prep”)

Minimally invasive surgery

Postoperative day-1 glucose < 140 mg/dL

Short operative duration



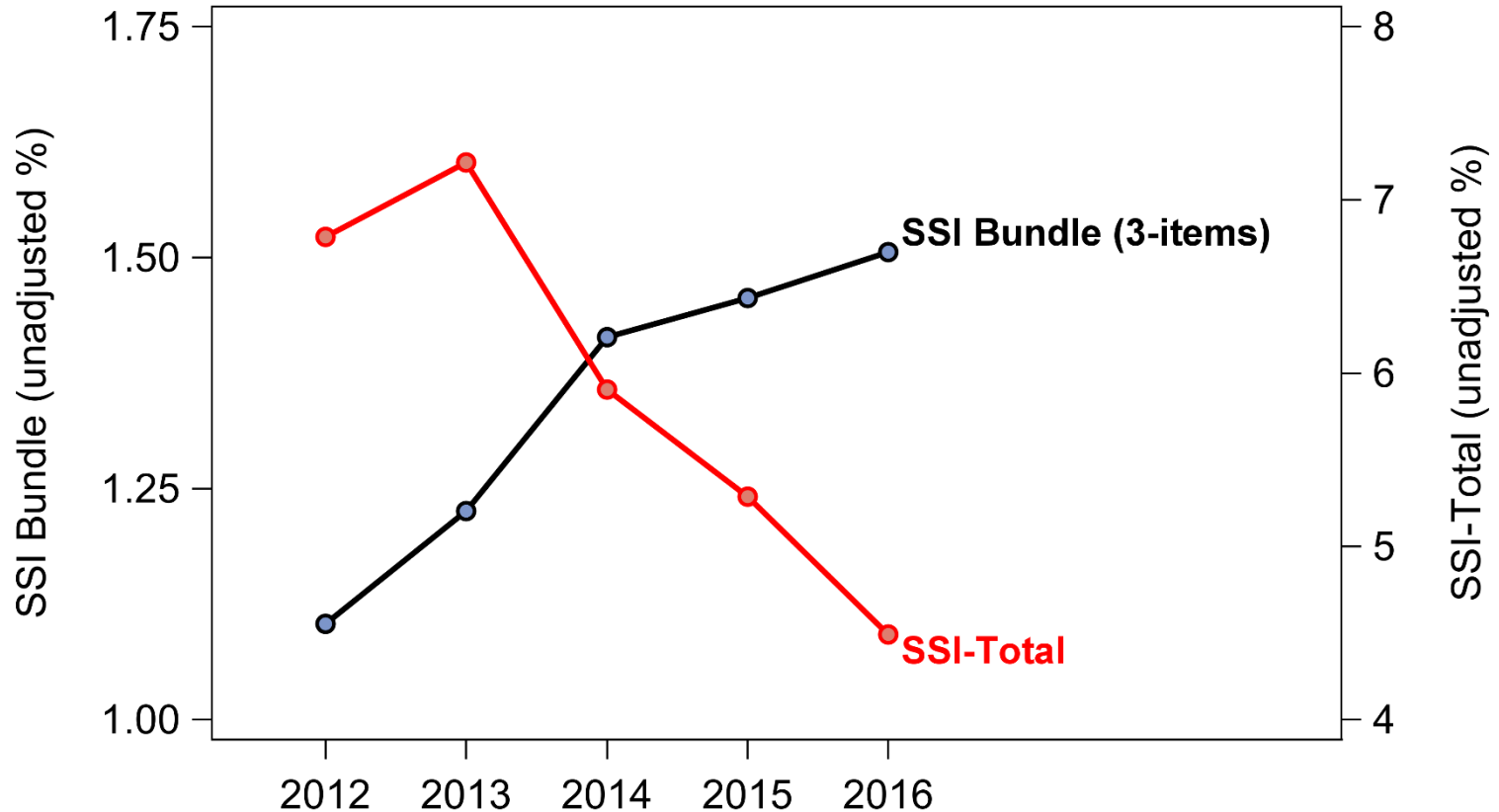
Actionable Process Measures

Cefazolin-metronidazole

Oral antibiotics with mechanical bowel preparation

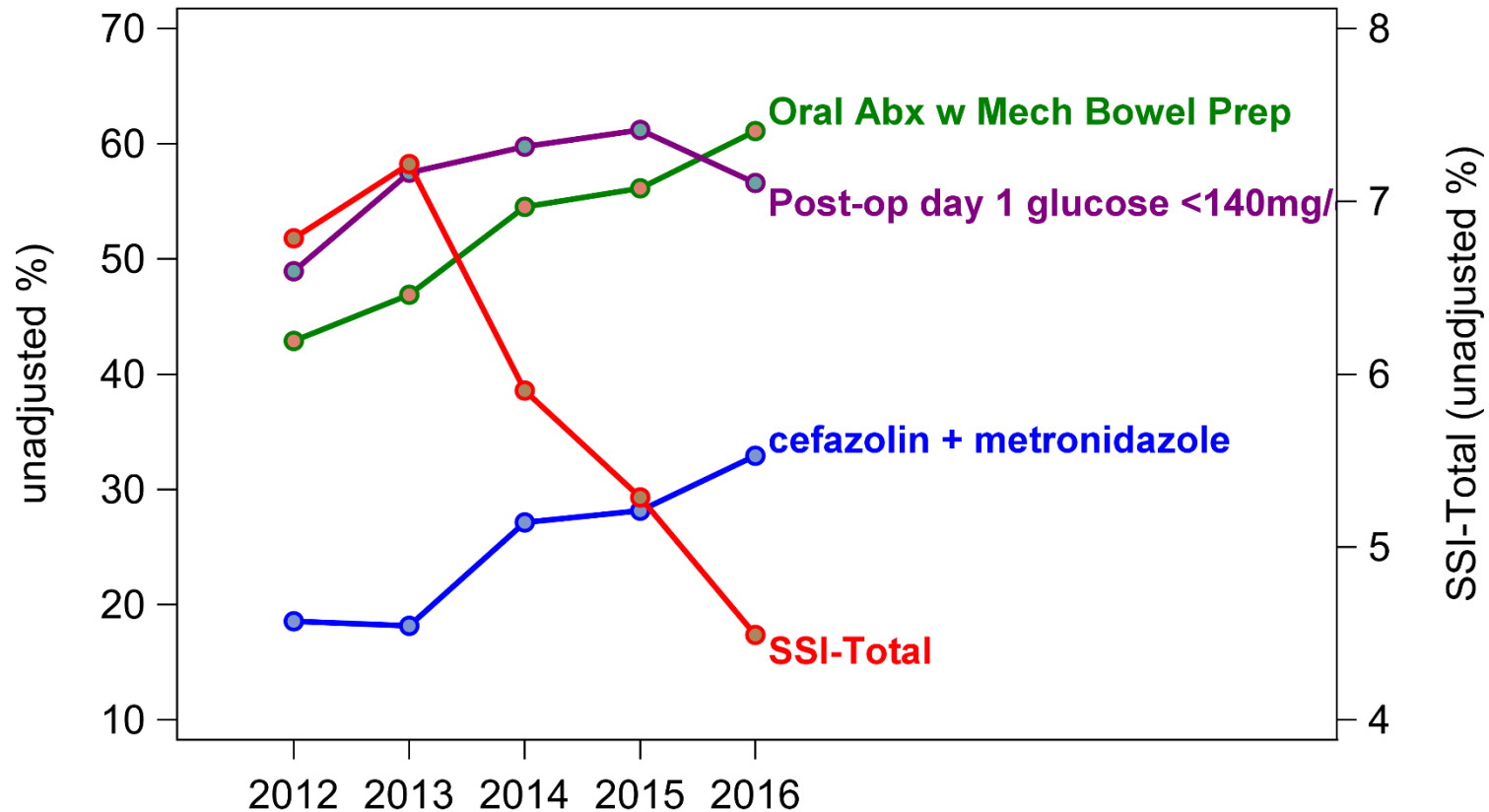
Postoperative day-1 glucose < 140 mg/dL

Trends for SSI-Total and SSI Bundle (3-items)



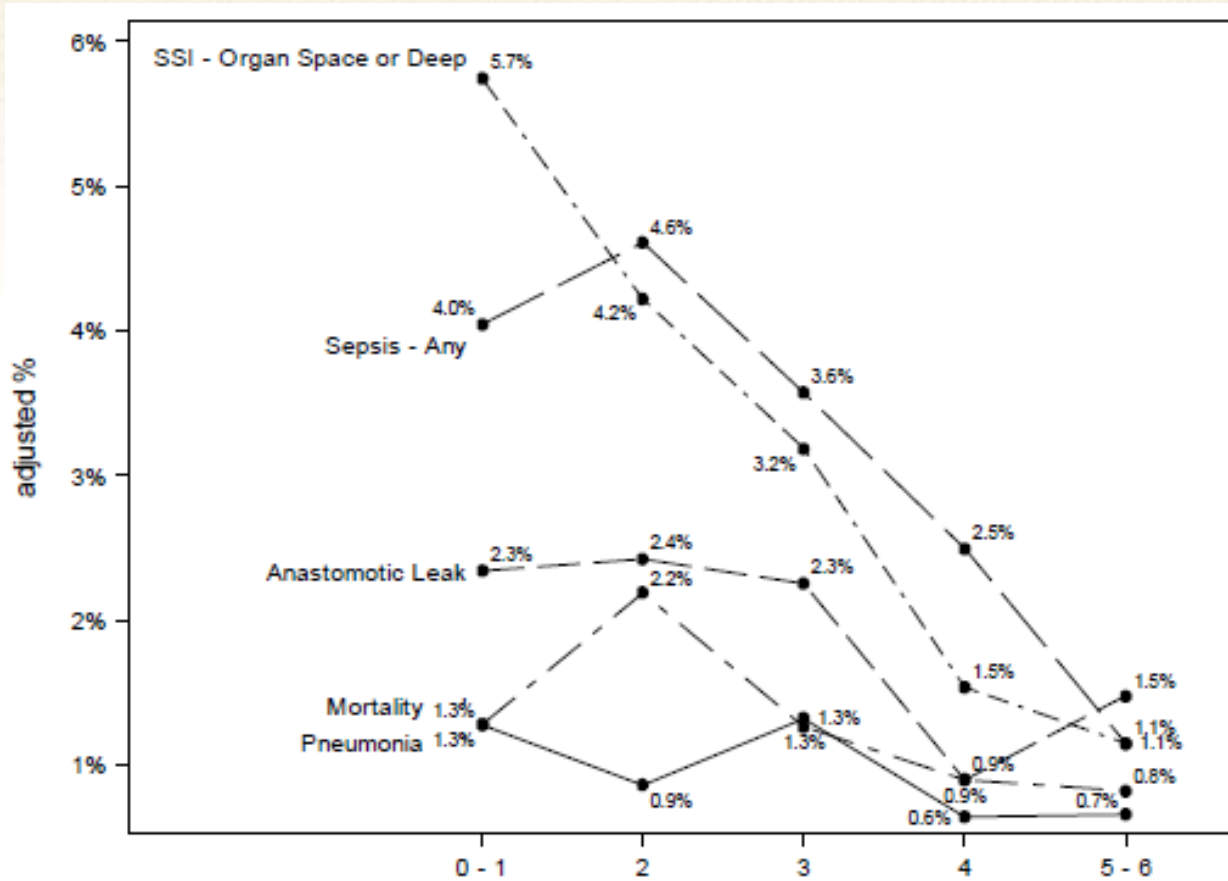
*Elective colectomy with a principal procedure CPT of 44140, 44160, 44204, or 44205 and an operation date between 1-jul-2012 and 31-mar-2016.
 MsqcStatsTicket: t1030e3721v6_fig1

Trends for SSI-Total and SSI Bundle (3-items)

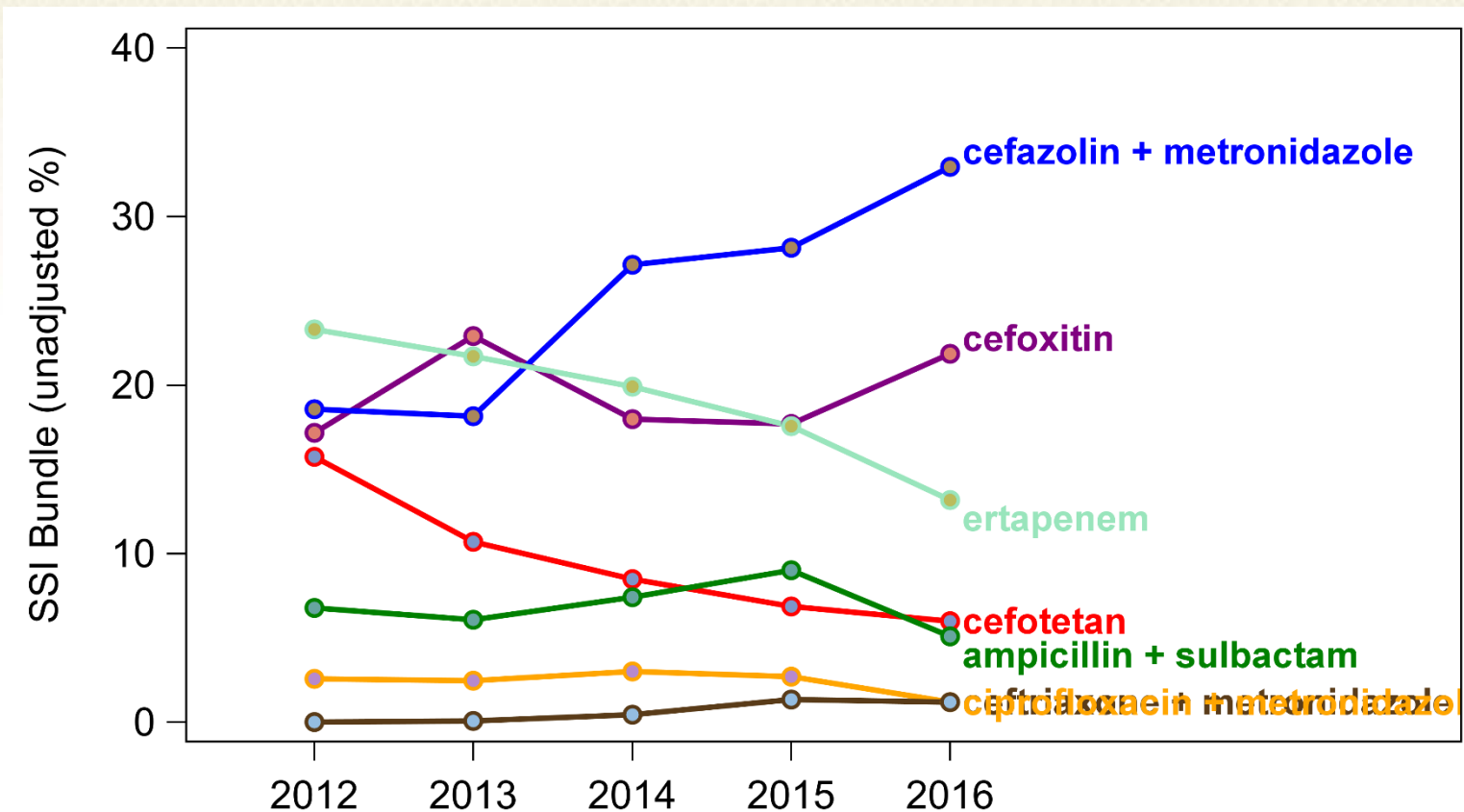


*Elective colectomy with a principal procedure CPT of 44140, 44160, 44204, or 44205 and an operation date between 1-jul-2012 and 31-mar-2016.
 MsqcStatsTicket: t1030e3721v6_fig2

Greater Colectomy Bundle Compliance Associated with Decreased Rates of Complications



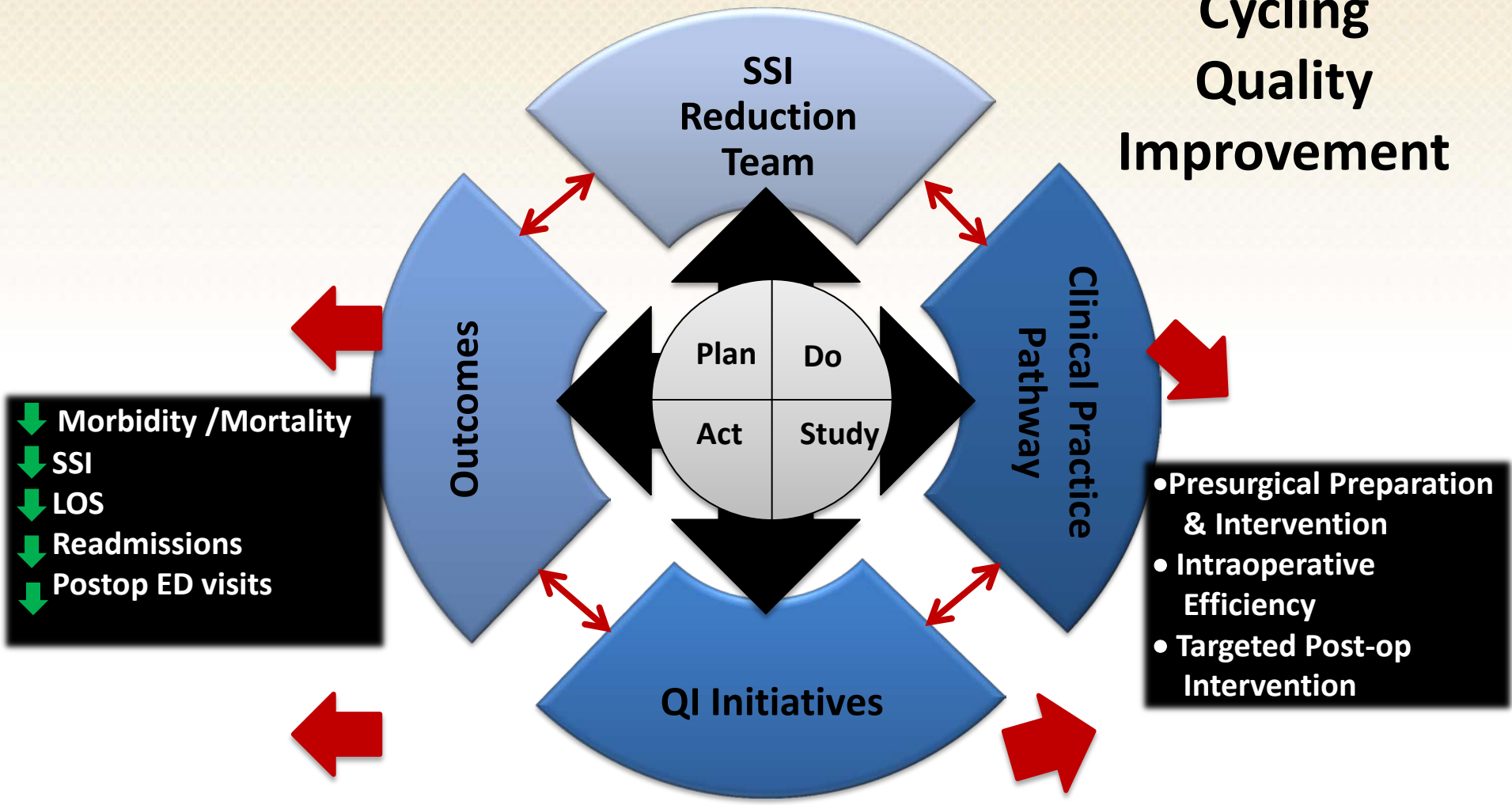
Antibiotic Choice Trends



*Elective colectomy with a principal procedure CPT of 44140, 44160, 44204, or 44205 and an operation date between 1-jul-2012 and 31-mar-2016.
 MsqcStatsTicket: t1030e3721v6_fig4

Evaluate Progress

Cycling Quality Improvement



GYNECOLOGY

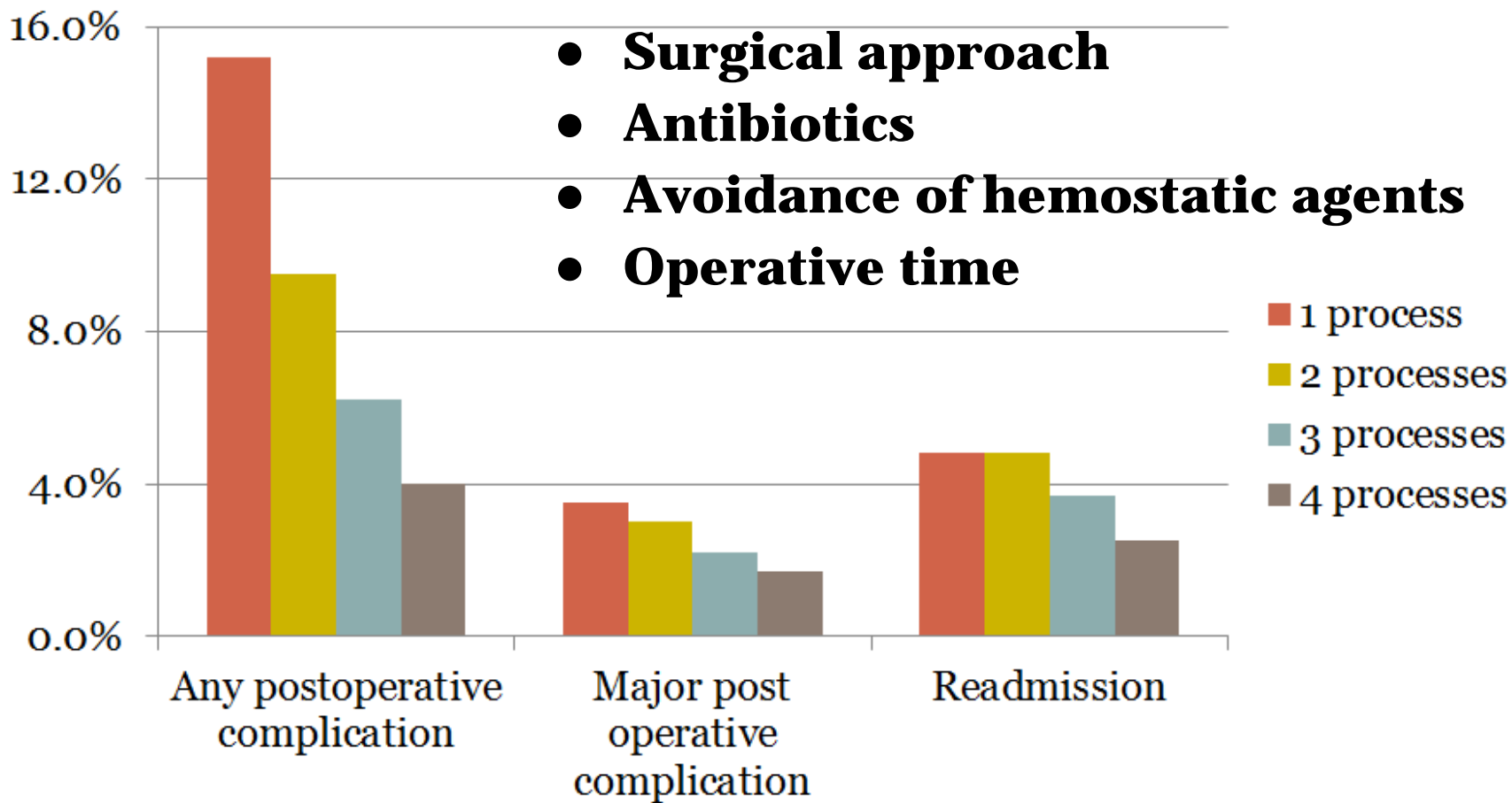
Are perioperative bundles associated with reduced postoperative morbidity in women undergoing benign hysterectomy? Retrospective cohort analysis of 16,286 cases in Michigan

John A. Harris, MD, MSc; Anne G. Sammarco, MD, MPH; Carolyn W. Swenson, MD; Shitanshu Uppal, MD; Neil Kamdar, MA; Darrel Campbell, MD; Sarah Evilsizer, RN; John O. DeLancey, MD; Daniel M. Morgan, MD

AJOG 2016

- **Surgical approach**
- **Antibiotics**
- **Avoidance of hemostatic agents**
- **Operative time**

Outcomes with Hysterectomy Bundle



GYNECOLOGY

Are perioperative bundles associated with reduced postoperative morbidity in women undergoing benign hysterectomy? Retrospective cohort analysis of 16,286 cases in Michigan

John A. Harris, MD, MSc; Anne G. Sammarco, MD, MPH; Carolyn W. Swenson, MD; Shitanshu Uppal, MD; Neil Kamdar, MA; Darrel Campbell, MD; Sarah Evilsizer, RN; John O. DeLancey, MD; Daniel M. Morgan, MD

AJOG 2016

- Surgical approach
- **Antibiotics**
- Avoidance of hemostatic agents
- Operative time

Antibiotic choices

1. Cephalosporins equivalent to Gentamicin and Clindamycin?
2. Cefazolin equivalent to 2nd generation (cefotaxime)?
3. Cefazolin versus Cefazolin + Flagyl?

Prophylactic Antibiotic Choice and Risk of Surgical Site Infection After Hysterectomy

Shitanshu Uppal, MBBS, John Harris, MD, Ahmed Al-Niaimi, MD, Carolyn W. Swenson, MD, Mark D. Pearlman, MD, R. Kevin Reynolds, MD, Neil Kamdar, MS, Ali Bazzi, MS, Darrell A. Campbell, MD, and Daniel M. Morgan, MD

Beta-lactam antibiotics
(n=17,827; 79.1%)

- Cephalosporins, 1st generation: 15,178; 85%
- Cephalosporins, 2nd generation: 2,415; 13.5%
- Ampicillin and sulbactam: 213; 1.2%
- Ertapenem: 21; 0.3%

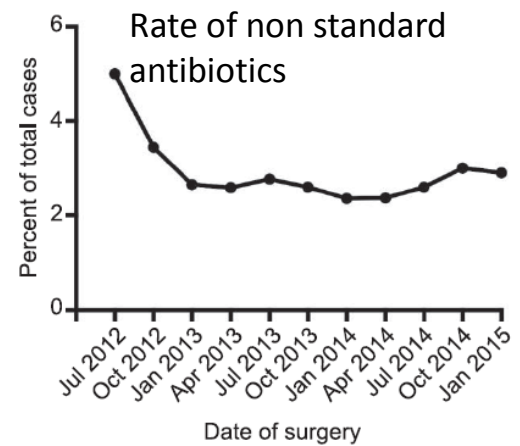
Beta-lactam alternatives
(n=2,878; 12.8%)

- Clindamycin and gentamicin or quinolone or aztreonam: 2,404; 83.0%
- Metronidazole and gentamicin or quinolone: 450; 15.6%
- Others[†]: 24; 0.8%

Nonstandard antibiotics
(n=653; 2.8%)

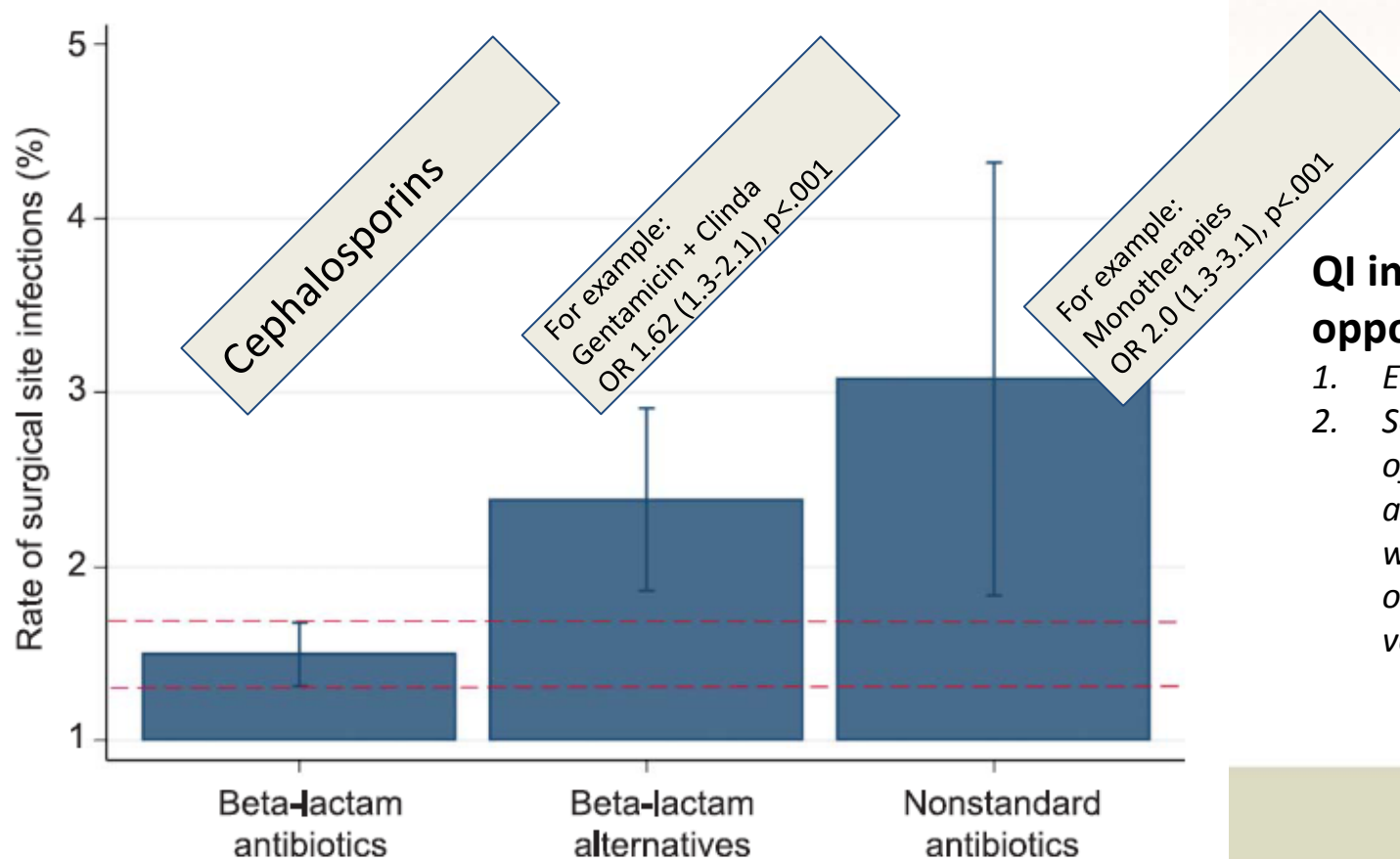
- Clindamycin alone: 438; 67.0%
- Gentamicin alone: 53; 8.1%
- Aztreonam alone: 36; 5.5%
- Metronidazole alone: 30; 4.6%
- Others[†]: 96; 14.7%

79% Beta Lactam
13% Beta Lactam Alternatives



Prophylactic Antibiotic Choice and Risk of Surgical Site Infection After Hysterectomy

Shitanshu Uppal, MBBS, John Harris, MD, Ahmed Al-Niaimi, MD, Carolyn W. Swenson, MD, Mark D. Pearlman, MD, R. Kevin Reynolds, MD, Neil Kamdar, MS, Ali Bazzi, MS, Darrell A. Campbell, MD, and Daniel M. Morgan, MD (Obstet Gynecol 2016;127:321–9)



QI improvement opportunity?

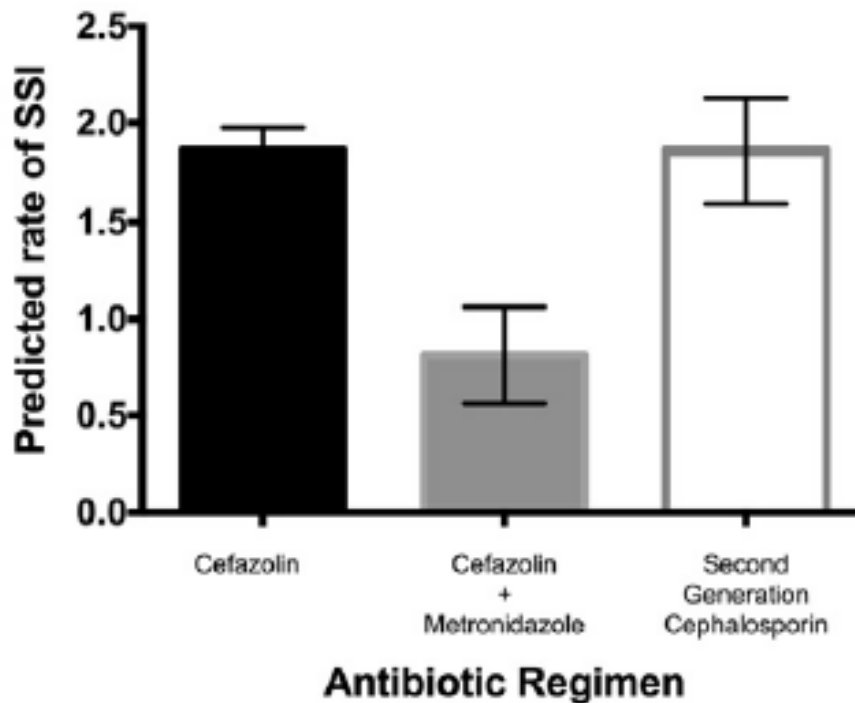
1. Eliminate monotherapies
2. Safely decrease the use of beta lactam alternatives in patients with unknown allergies or intolerance (nausea & vomiting)?

GYNECOLOGY

Reducing surgical site infections after hysterectomy: metronidazole plus cefazolin compared with cephalosporin alone

Sara R. Till, MD, MPH; Daniel M. Morgan, MD; Ali A. Bazzi, MD; Mark D. Pearlman, MD; Zaid Abdelsattar, MD, MSc; Darrell A. Campbell, MD; Shitanshu Uppal, MBBS

Risk adjusted* rates of surgical site infection



Blue Cross
Blue Shield
Blue Care Network
of Michigan

“Non traditional” approaches to reducing SSI

Linkage to anesthesia

Local anesthesia

Prehabilitation

Minimally invasive surgery

Anesthesiology Performance Improvement and Reporting Exchange



www.aspirecqi.org

Anesthesia management profoundly influences “surgical” outcomes and resource utilization



At present non-standardized

- Use of Nerve block vs GA
- Epidural vs GA
- Transfusion threshold
- Volume of resuscitation
- BP mgt w Neosynephrine
- Mgt of Post op Nausea and Vomiting
- Mgt of Post op pain
- Intra op glycemic control
- Maintenance of Normothermia
- Discontinuation of pre op ASA
- Use of pre op Beta blockers, statins

Local Anesthesia: A Strategy for Reducing Surgical Site Infections?

Jay S. Lee • Awori J. Hayanga • James J. Kubus • Henry Makepeace • Max Hutton • Darrell A. Campbell, Jr. • Michael J. Englesbe

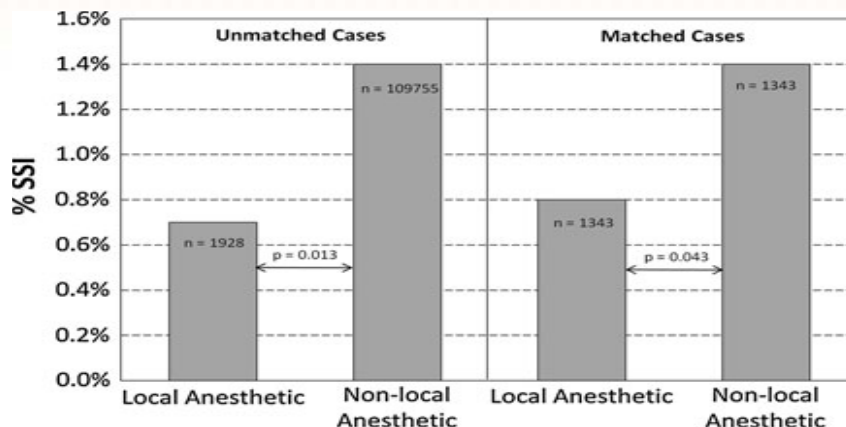


Fig. 1 Surgical site infection (SSI) rates in unadjusted and propensity-matched local anesthesia and nonlocal anesthesia outpatient cases. In the unmatched analysis, patients given local anesthesia had a significantly lower incidence of SSIs than patients given nonlocal anesthesia (0.7 vs. 1.4%, P = 0.013). Similarly, after propensity matching, the incidence of SSIs for patients given local anesthesia was significantly lower than for that of patients given nonlocal anesthesia (0.8 vs. 1.4%, P = 0.043)

Michigan Surgical Home and Optimization Program

CMS Innovation Center 2014: \$6.4 million to place MiSHOP in 40 MSQC Hospitals



Stop smoking-incentive
spirometer

Progressive ambulation
(pedometer)

HgbA1c for diabetics

Correct anemia (hct <30%)

Nasal culture for Staph

Evaluate for sleep apnea

Antibacterial soap X 3 days

Consider starting a Beta blocker

Consider starting a statin

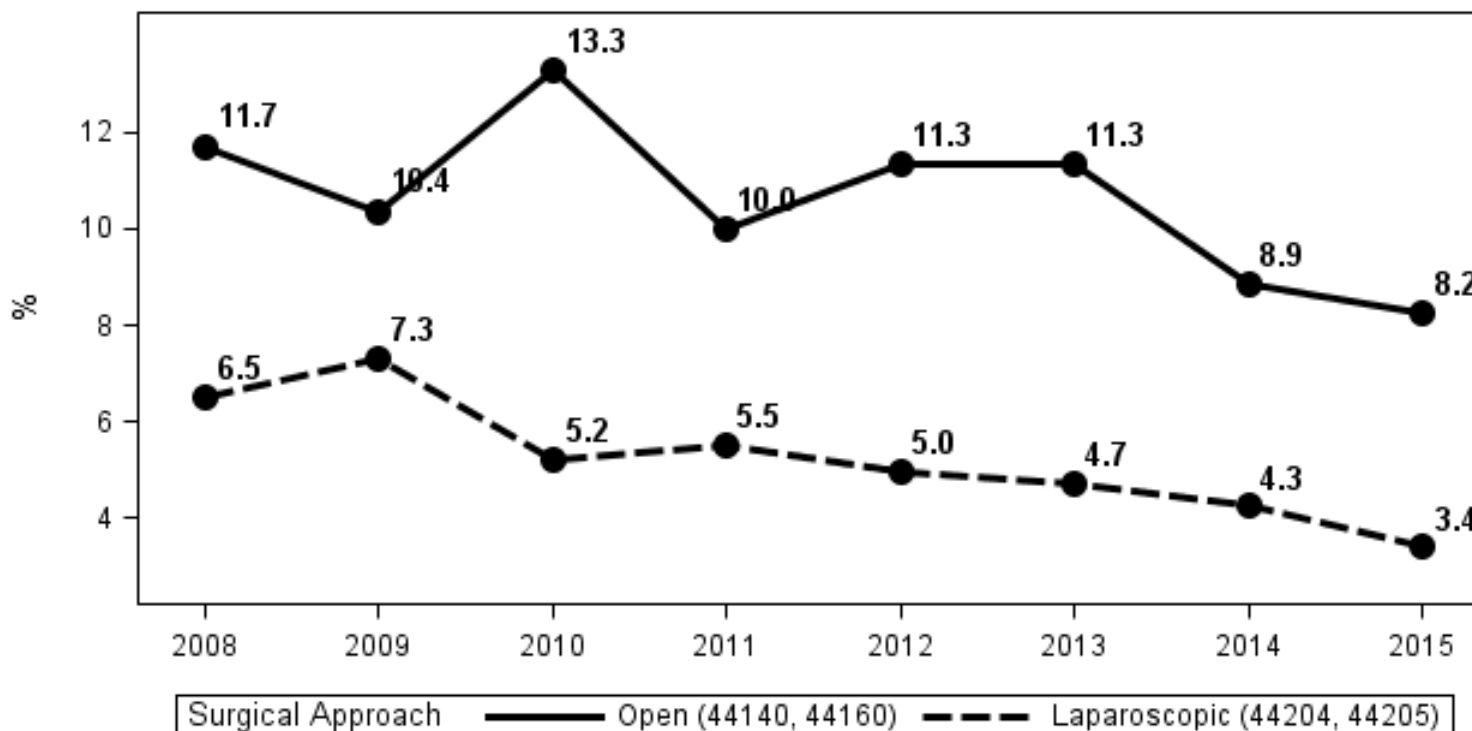
Nutritional Counseling



Open vs lap SSI

SSI-Total by Year

Non-Emergent Colectomy, MSQC 2008-2015



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DAC at 10



DAC at 65



Even older



Success...

...is a relative term

Age 4

Not peeing in your pants

Age 80

Age 12

Having friends

Age 75

Age 18

Having a drivers license

Age 70

Age 20

Having Healthy sex life

Age 60

Age 35

Having money

Age 50

MSQC Team



