Preventing Surgical Site Infections

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Disclosures

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- Royalties from UpToDate, Online

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Outline

- Impact of SSI
- Surveillance for SSIs
- Strategies for Prevention
  - Basic recommendations
  - Special strategies
- Implementation
- Rates and reporting

Impact of SSI

- SSIs are the most common and most costly HAI
- An estimated 16 million operations were performed in acute care hospitals in 2010
- Prevalence
  - 2-5% of surgical patients develop an SSI
  - ~160,000-300,000 SSIs per year in US
  - SSI is now the most common and costly HAI
- Impact
  - Each SSI results in 7-11 additional hospital days
  - Patients with SSI have a 2-11 times higher risk of death
  - 77% of deaths among patients with SSI are directly due to SSI
  - Cost (2007 dollars): $3.5 to $10 billion annually

Surveillance

- Direct vs. indirect methods
  - Indirect method reliable (sensitivity, 84%–89%) and specific (specificity, 99.8%) compared with direct surveillance
- Indirect combines
  - Review of microbiology reports and patient medical records
  - Screening for readmission and/or return to the operating room
  - Other information, such as coded diagnoses, coded procedures, operative reports, or antimicrobials ordered
  - Surgeon and/or patient surveys

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Baker et al. AJIC 1995.
Cardo et al. ICHE 1993.

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Surveillance – Electronic Data Helps

- Strategy 1 – antibiotics and readmissions
  - Improve the sensitivity and reduce effort
- Strategy 2 – diagnosis codes
  - Medicare claims data can be used to enhance traditional surveillance methods for SSI and to identify hospitals with unusually high or low rates of SSI

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Chalfine et al ICHE 2006.
Calderwood et al. ICHE 2013.
Huang et al. ICHE 2011.

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Surveillance – Post-Discharge

- Important for internal review
- Not useful for hospital comparisons

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Rates and Reporting

- Rate
  - Number of infections/100 procedures
- SIR – Standardized Infection Ratio
  - Number of observed infections/number of expected infections
    - >1 is bad
- Methods for risk adjustment exist, but are not very good

Example

- SSI following colon=10
  - Number of procedures=250
- NHSN says rate of colon SSI=2.0
  - So expected number of SSIs for 250 procedures would be 5 (5/250=2 SSI/100 procedures)
- SIR = 10/5 = 2

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JUNE 2014, VOL. 35, NO. 6

SHEA/IDSA PRACTICE RECOMMENDATION

Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update

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PURPOSE

Previously published guidelines are available that provide comprehensive recommendations for detecting and preventing healthcare-associated infections (HAIs). The intent of this document is to highlight practical recommendations in a concise format designed to assist acute care hospitals in implementing

ventable by using evidence-based guidelines.[10,11]

B. SSIs account for 20% of all HAIs in hospitalized patients.[12]

C. Each SSI is associated with approximately 7–11 additional postoperative hospital-days.[3,9,13,14]

D. Patients with an SSI have a 2–11-times higher risk of

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Most Recent Update

- Compendium documents originally published in 2008
- Reconvened and diversified writing group to update (inclusion of surgeons!)
- 6 sections
  - Rationale
  - Strategies
  - Performance measures
  - Detection
  - Recommendations
  - Implementation

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What's New?

- Modification of grading of evidence
- Expansion of recommendations
  - 15 Basic Practices
  - 5 Special Approaches
  - 4 Don't Dos
  - 4 Unresolved Issues
- Addition of the section on implementation

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Other Recent Guidelines

- WHO – 2016
- ACS – 2016
- CDC – 2017
- Minor differences

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Basic Practices - SCIP

- Dose
- Timing
- Discontinuation
- No shaving
- Post-op glucose control
  - 180 mg/dL
  - Cardiac and non-cardiac
  - 18-24 hours after end of anesthesia
- Normothermia

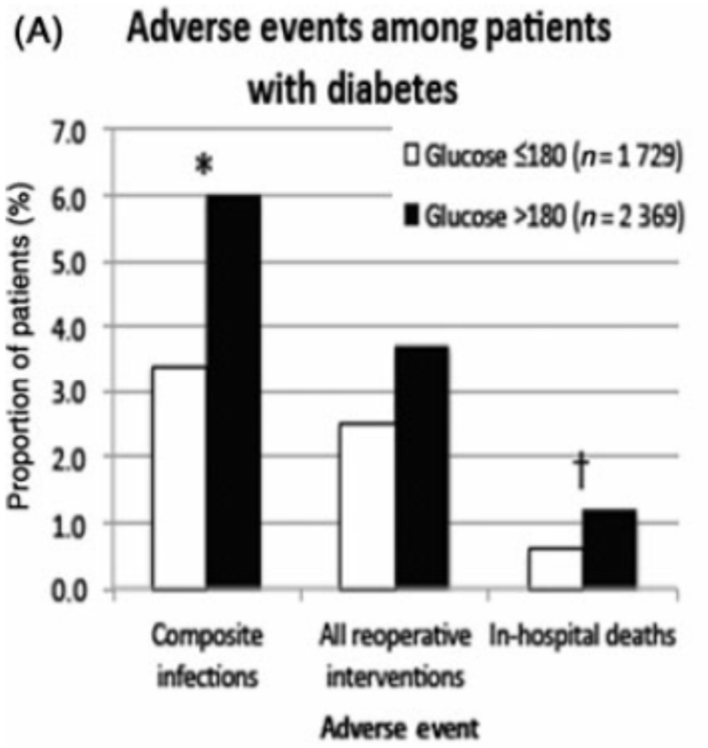
Post-op Glycemic Control

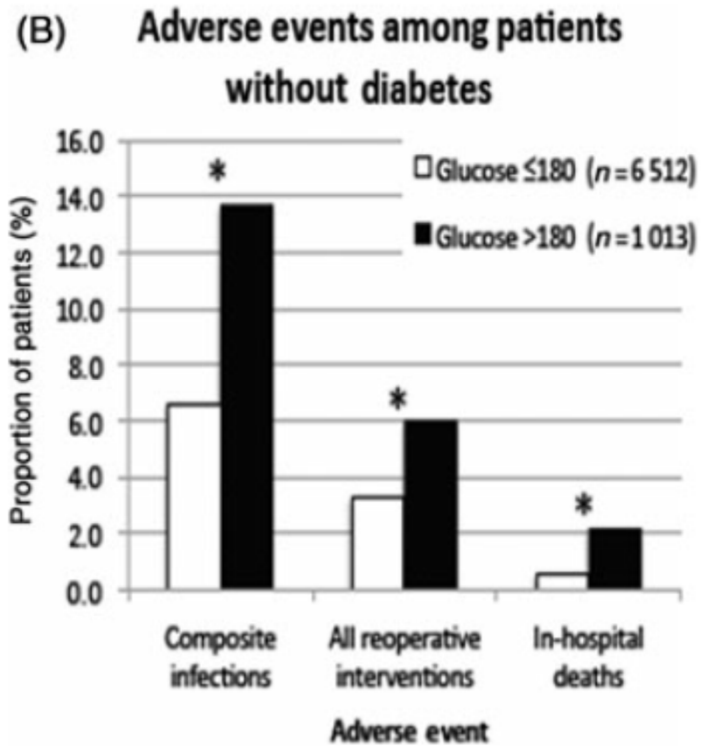
- Surgical Care and Outcomes Assessment Program in Washington State
  - 11,633 patients (57% colorectal)
- Notes
  - 25% had glucose>180
  - Hyperglycemia = 2-fold increase in SSI risk
    - Adjusted

Kwon et al. Ann Surg 2013;257:8-14.

Post-op Glycemic Control

- S
- M





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Kwon et al. Ann Surg 2013;257:8-14.

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How?

- RCT of basal-bolus insulin vs. SS insulin
  - 211 general surgery patients with diabetes
- Results
  - 3.4-fold decrease in composite outcome
    - SSI, pneumonia, BSI, resp/renal failure
  - Average post-op glucose 145 v. 172 ($p<0.01$)
  - No statistically significant difference in patients with BG<40, but close (4 v. 0, $p=0.06$)

Basic Practices – Build on SCIP

- Weight-based dosing
- Redosing of prophylactic antibiotics for prolonged procedures
- Bowel prep

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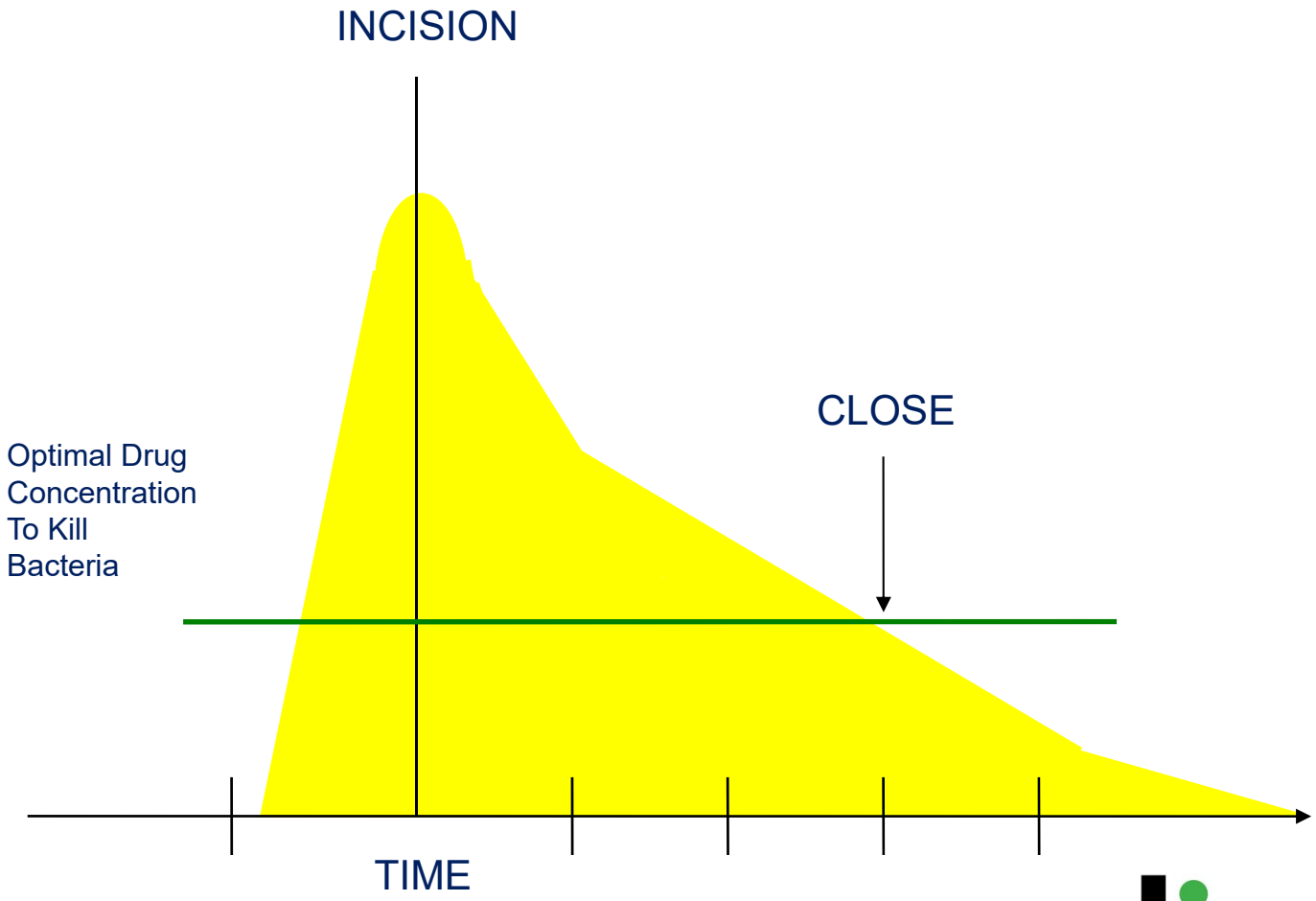
Prophylaxis: Ideal Scenario



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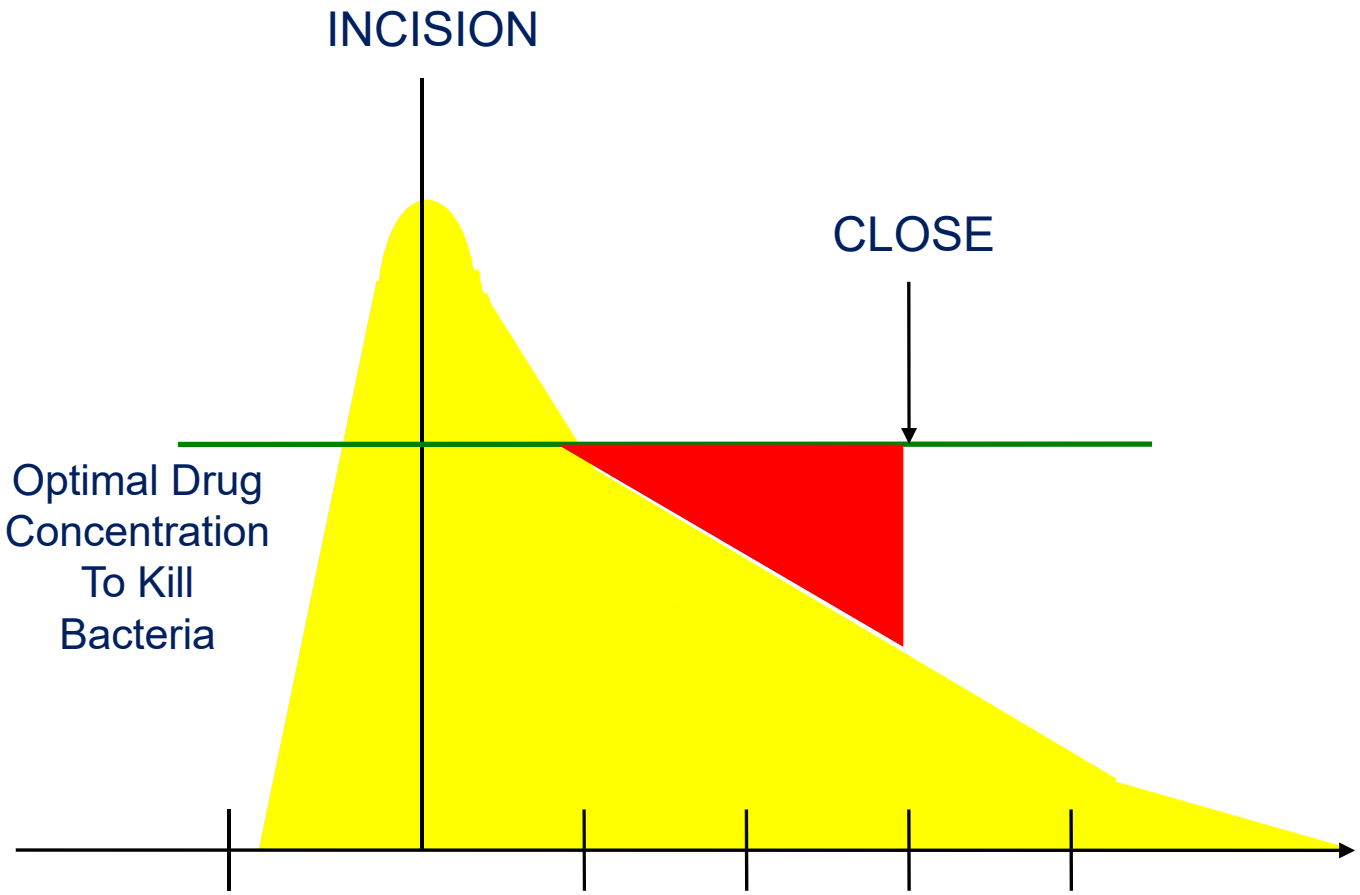
Obesity and Surgical Duration

- Both significantly impact antibiotic levels in tissue
- Obesity is a risk factor for SSI
- Prolonged surgical duration is risk factor for SSI

Prophylaxis: Obesity



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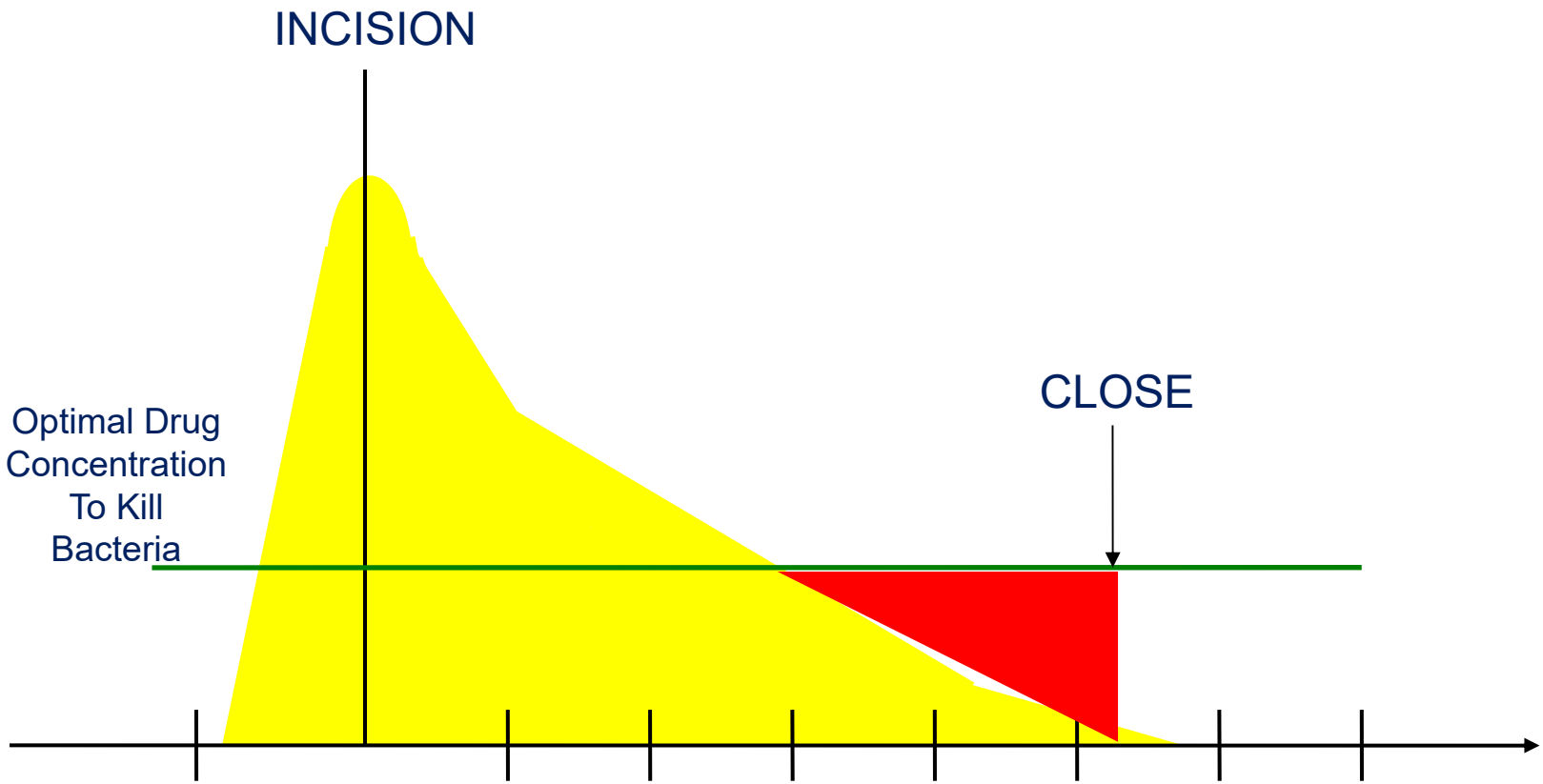
Impact of Increasing Dose

- Trial comparing 1g cefazolin v. 2g cefazolin among obese patients undergoing bariatric surgery
- Baseline rates of infection
  - 16.5/100 in obese
  - 2.5/100 in non-obese (undergoing other clean-contaminated surgery)
- Tissue and serum concentrations were lower in patients who received 1g ($p<0.0001$)
- Rate decreased to 5.6/100 procedures in obese patients

Forse et al. Surgery 1989;106:750-6.

Prophylaxis: Long Procedure



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Re-Dosing: Data Show it Works

- Review of published literature
- Analysis of 801 patients undergoing clean-contaminated operations:
  - 1g cefazolin
  - 1g cefazolin + 1g 3 hours later
- If procedure > 3 hours, then rate of SSI reduced from 6.1 to 1.3

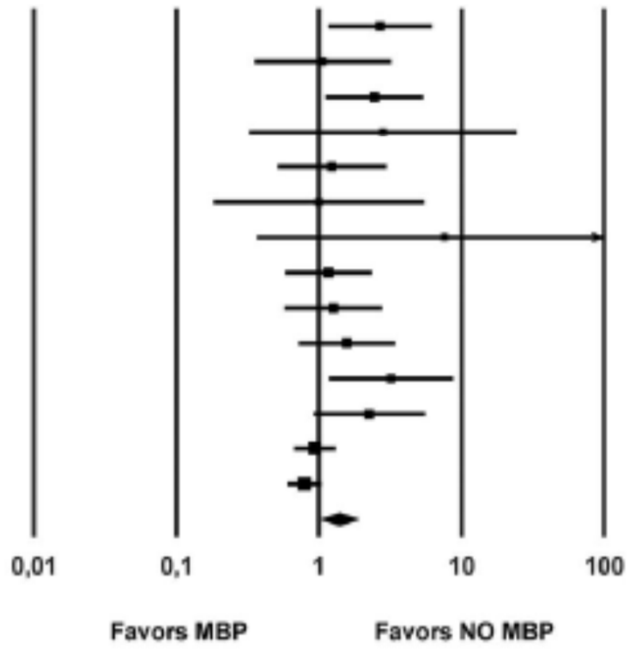
Scher KS. Am Surg 1997;63:59-62.

Mechanical Bowel Prep?

- Should we give?
- Just bowel prep?
  - Risk of anastamotic leak?
- Bowel prep + PO antibiotics?

MBP (no PO abx) and SSI

Study name	Events / Total		Statistics for each study				Relative weight
	MBP	NO MBP	Odds ratio	Lower limit	Upper limit	p-Value	
Brownson 1992	21 / 86	10 / 93	2,682	1,181	6,089	0,018	7,33
Burke 1994	7 / 82	7 / 87	1,067	0,357	3,185	0,908	5,00
Santos 1994	24 / 72	13 / 77	2,462	1,138	5,326	0,022	7,88
Kale1997	8 / 62	1 / 20	2,815	0,330	24,010	0,344	1,63
Miettinen 2000	13 / 138	10 / 129	1,238	0,523	2,930	0,628	6,90
Fillmann 2001	3 / 30	3 / 30	1,000	0,185	5,403	1,000	2,49
Young-Tabusso 2002	3 / 24	0 / 23	7,651	0,373	156,840	0,187	0,86
Zmora 2003	19 / 187	17 / 193	1,171	0,589	2,329	0,653	8,93
Fa-Si-Oen 2005	16 / 125	13 / 125	1,265	0,581	2,753	0,554	7,80
Ram 2005	18 / 164	12 / 165	1,572	0,732	3,377	0,246	7,96
Bucher 2005	17 / 78	6 / 75	3,205	1,188	8,646	0,021	5,73
Pena 2007	19 / 48	11 / 49	2,263	0,933	5,489	0,071	6,67
Jung 2007	82 / 686	83 / 657	0,939	0,678	1,301	0,704	14,84
Contant 2007	135 / 670	165 / 684	0,794	0,614	1,027	0,079	15,99
			1,403	1,054	1,869	0,020	



Test for heterogeneity p = 0.016, I^2 = 50.4

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Slim et al. Ann Surg 2009;249:203-9

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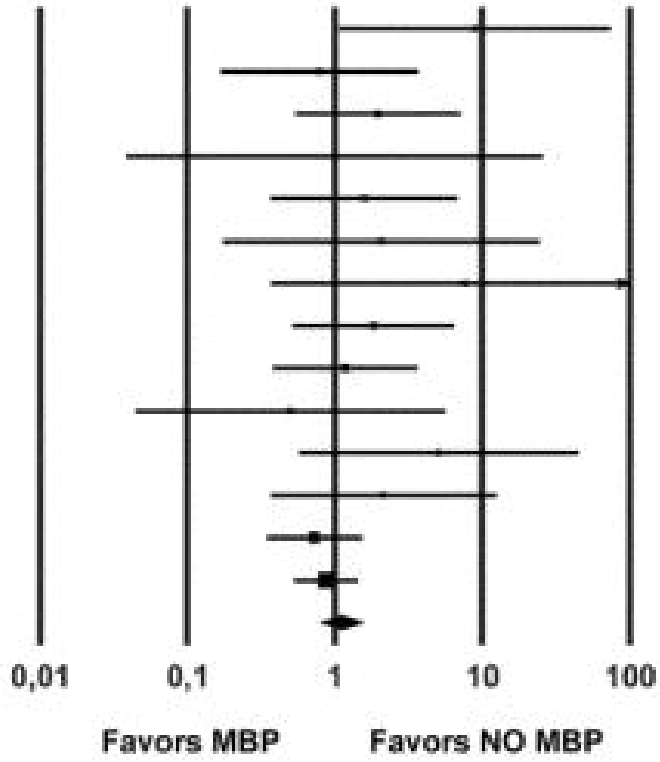
MBP and Harm? Anastamotic Leak

Study name	Events / Total		Statistics for each study			Relative weight
	MBP	NO MBP	Odds ratio	Lower limit	Upper limit	
Brownson 1992	8 / 67	1 / 67	8,949	1,087	73,690	2,17
Burke 1994	3 / 82	4 / 87	0,788	0,171	3,633	4,12
Santos 1994	7 / 72	4 / 77	1,965	0,550	7,020	5,94
Kale1998	1 / 62	0 / 20	1,000	0,039	25,519	0,92
Miettinen 2000	5 / 138	3 / 129	1,579	0,370	6,744	4,57
Fillmann 2001	2 / 30	1 / 30	2,071	0,178	24,148	1,60
Young-Tabusso 2002	3 / 24	0 / 23	7,651	0,373	156,840	1,06
Zmora 2003	7 / 187	4 / 193	1,838	0,529	6,384	6,21
Fa-Si-Oen 2005	7 / 125	6 / 125	1,177	0,384	3,605	7,68
Ram 2005	1 / 164	2 / 165	0,500	0,045	5,568	1,66
Bucher 2005	5 / 78	1 / 75	5,068	0,578	44,446	2,04
Pena 2007	4 / 48	2 / 49	2,136	0,373	12,251	3,16
Jung 2007	13 / 686	17 / 657	0,727	0,350	1,509	18,06
Contant 2007	32 / 670	37 / 684	0,877	0,540	1,425	40,83
			1,124	0,824	1,532	



Test for heterogeneity $p = 0.492$, $I^2 = 0$

Slim et al. Ann Surg 2009;249:203-9

Oral + IV Antibiotics?

- Reviewed 182 RCTs comparing different prophylactic regimens
  - Elective and emergency procedures included
- 13 trials met criteria to compare combined oral and intravenous antibiotic vs. IV alone

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Nelson et al. Cochrane Database Syst Rev 2009; 21:CD001181

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Oral + IV Antibiotics?

- Revi … rent prop…
  - El… luded
- 13 t… com… biotic vs. I…

Analysis 6.1. Comparison 6 Combined oral and intravenous versus oral or intravenous alone, Outcome 1 Surgical wound infection: oral + iv versus iv alone.

Review: Antimicrobial prophylaxis for colorectal surgery

Comparison: 6 Combined oral and intravenous versus oral or intravenous alone

Outcome: 1 Surgical wound infection: oral + iv versus iv alone

Study or subgroup	Combined Oral % IV n/N	IV Alone n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Coppa 1988	9/169	15/141		10.5 %	0.50 [0.23, 1.11]
Espin-Basany 2005	15/200	6/100		8.5 %	1.25 [0.50, 3.12]
Ishida 2001	8/72	17/71		11.0 %	0.46 [0.21, 1.01]
Kaiser 1983	2/63	7/56		3.5 %	0.25 [0.06, 1.17]
Khubchandani 1989	5/55	14/47		8.0 %	0.31 [0.12, 0.78]
Lau 1988	3/65	5/67		4.1 %	0.62 [0.15, 2.48]
Lazorthes 1982	1/30	7/30		2.0 %	0.14 [0.02, 1.09]
Lewis 2002	5/104	17/104		7.8 %	0.29 [0.11, 0.77]
McArdle 1995	8/62	20/87		11.4 %	0.56 [0.26, 1.19]
Peruzzo 1987	4/39	0/41		1.0 %	9.45 [0.53, 169.95]
Reynolds 1989	9/107	26/223		12.1 %	0.72 [0.35, 1.49]
Stoltzfo 1990	3/51	2/51		2.7 %	1.50 [0.26, 8.60]
Taylor 1994	17/159	30/168		17.2 %	0.60 [0.34, 1.04]
Total (95% CI)	**1176**	**1186**		**100.0 %**	**0.55 [0.41, 0.74]**

Total events: 89 (Combined Oral % IV), 166 (IV Alone)

Heterogeneity: $Tau^2 = 0.05$; $Chi^2 = 14.78$, df = 12 (P = 0.25); $I^2 = 19\%$

Test for overall effect: Z = 3.93 (P = 0.000084)

0.1 0.2 0.5 1 2 5 10

Favours treatment Favours control

Nelson et al. Cochrane Database Syst Rev 2009; 21:CD001181

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Consensus Recommendation

- Now three of the four major guidelines recommend the use of MBP + oral antibiotics for colorectal procedures
  - SHEA/IDSA
  - WHO
  - ACS/SIS
  - (not discussed in CDC/HICPAC)

Basic Practices – Beyond SCIP

- Oxygenation
- Skin prep
- Use of plastic wound protectors
- WHO checklist

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Oxygen and SSI: Basic Science

- O_2 is important for wound healing
- O_2 correlated with collagen deposition
- Tissue hypoxia is a risk factor for wound infection and dehiscence
- Superoxide production by leukocytes proportional to P_{O2}
- Many antibiotics require oxygen to exert lethal effects on bacteria

Hunt and Pai. Surg Gynecol Obstet. 1972;135:561-7.
Hartmann et al. Eur J Surg. 1992;158:521-6.
Hopf et al. *Arch Surg.* 1997;132:997-1004.
Allen et al. Arch Surg 1997;132:997-1005. Kohanski et al. Cell 2007;130:797-810.

High Inspired O_2 Fraction

- Recent meta-analysis reviewed 5 RCTs
  - Variation in methods noted
    - 3 included nitrous oxide mixture
    - 1 provided O2 for 6 hours
    - 3 colorectal
    - Antibiotic prophylaxis not controlled for in all
- By fixed-effects method, data supports use of 80% FiO2 for prevention of SSI

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Qadan et al. Arch Surg 2009;144:359-66.
Napolitano L. Arch Surg 2009;144:366-67.

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High Inspired O_2 Fraction

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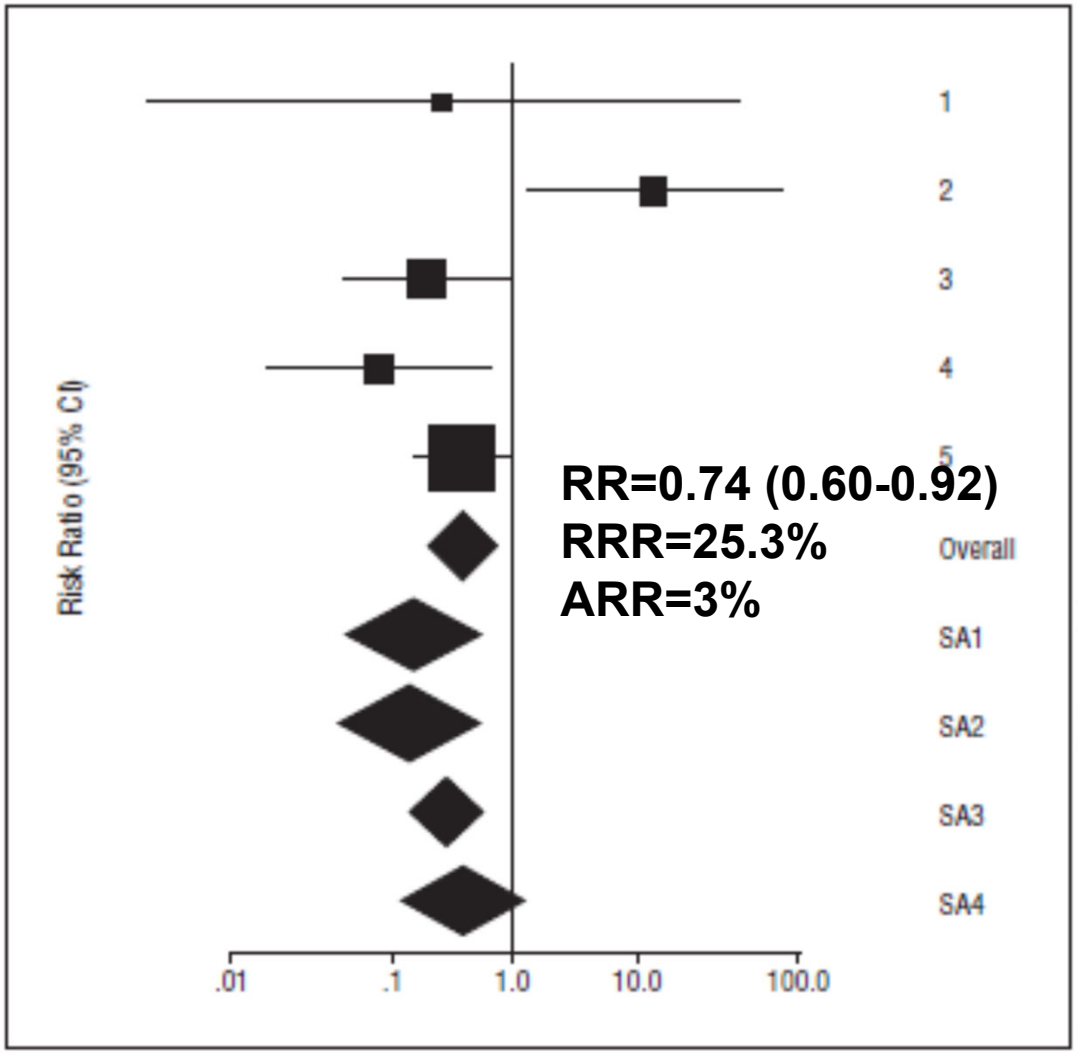

or in all

pports

SSI

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Qadan et al. Arch Surg 2009;144:359-66.
Napolitano L. Arch Surg 2009;144:366-67.

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Harm?

- PROXI Trial
  - n=1400 patients undergoing acute or elective laparotomy
  - Randomized to 80% v. 30% FiO_2
  - SSI dx in 14 days
- No difference in rates of SSI for two groups
  - Approx 20% for each group
  - Adjusted RR=0.91 (0.69 to 1.20)
- No difference in adverse outcomes between two groups

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Meyhoff et al. JAMA 2009;302:1543-50.
Hunt and Hopf. JAMA 2009;302:1588-9.

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Implementation?

- Not easy
- Reasonable chance being given high FiO_2 *during* procedure
- Difficult to develop process to continue high FiO_2 *after* procedure

Skin Prep

- Use alcohol-containing skin prep (when possible)
- Add a disinfectant
  - CHG likely superior to PI

CHG Uses in Infection Control

Application	*Evidence*
Skin antisepsis	
CVC site preparation	50% better than povidone-iodine (catheter colonization)
Surgical hand scrub	86-92% reduction in flora
Source control in ICUs	Reduction in skin flora; reduce risk of CLABSI 6-fold
Preoperative scrub	Superior to other antiseptics in reducing skin flora at surgical site
Impregnated devices	
Vascular catheter dressings	Reduction in catheter colonization (40-50%); decrease rate of CLABSI
Vascular catheters	Reduction in catheter colonization (55%); in BSI (40%) in high-risk groups

Milstone et al, *Clin Infect Dis* 2008; 46:274–81.
Bleasdale et al, *Arch Intern Med* 2007; 167:2073-9.
Timsit et al. JAMA 2009; 301:1231-41.

CHG v. PI?

- Finally, RCT comparing CHG-ETOH vs. PI-ETOH
- 1,147 women undergoing CSEC
- Rate of SSI lower with CHG/EtOH (p=0.02)
  - CHG/EtOH – SSI rate=3.0
  - PI/EtOH – SSI rate=4.9

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Tuuli et al. NEJM 2016;374:647.

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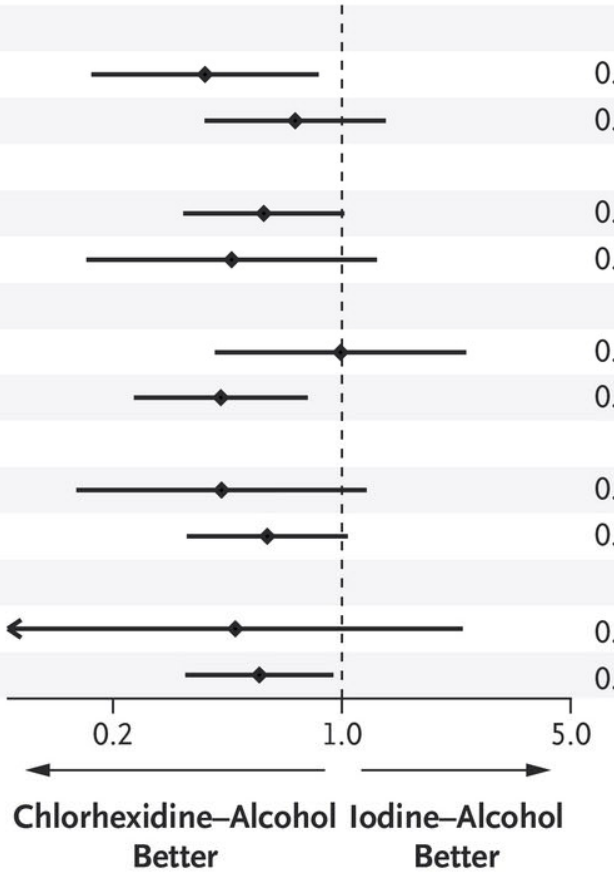
CHG v. PI?

Subgroup	Chlorhexidine–Alcohol	Iodine–Alcohol	Relative Risk (95% CI)	P Value for Interaction
	no. of events/total no.			
Type of cesarean delivery				0.22
Scheduled	8/334	21/335	0.38 (0.17–0.85)	
Unscheduled	15/238	21/240	0.72 (0.38–1.36)	
Obese				0.70
Yes	18/402	30/387	0.58 (0.33–1.02)	
No	5/170	12/188	0.46 (0.17–1.28)	
Skin-closure type				0.12
Staples	9/108	9/107	0.99 (0.41–2.40)	
Suture	14/464	33/467	0.43 (0.23–0.79)	
Chronic medical condition				0.59
Yes	5/107	11/101	0.43 (0.15–1.19)	
No	18/465	31/474	0.59 (0.34–1.04)	
Diabetes				0.84
Yes	2/55	5/65	0.47 (0.10–2.34)	
No	21/517	37/510	0.56 (0.33–0.94)	



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Tuuli et al. NEJM 2016;374:647.

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FDA Warning: CHG

- FDA released a Safety Communication warning about potential for rare but serious allergic reactions to CHG
- Data
  - 1969-2015: 52 cases of anaphylaxis (2 deaths)
  - Big increase since 2010
- While need to monitor for these important reactions, this issue does not change recommendations about CHG

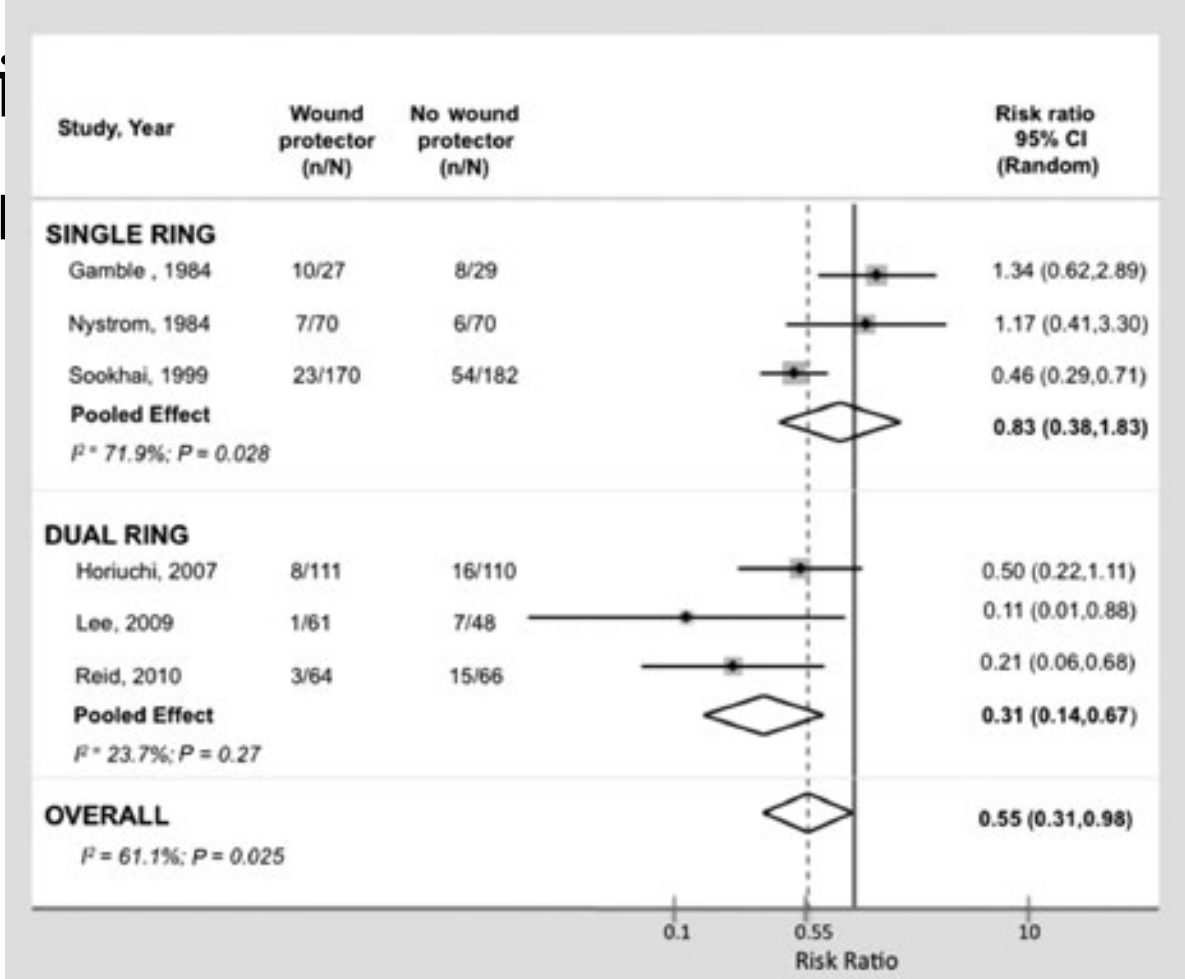
Impervious Plastic Wound Protectors

- Plastic sheath that facilitates retraction
- Theoretically improves health of tissue
- GI and biliary tract procedures

Edwards et al. Ann Surg 2012; 256:53-59.

Impervious Plastic Wound Protectors

- Plasti ction
- Theor sue
- GI an



Edwards et al. Ann Surg 2012; 256:53-59.

Surgical Safety Checklist

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Surgical Safety Checklist

- Checklists
  - Proven method for prevention of complications
    - Change system AND individual behavior
  - CLABSI
- New checklist for surgical care
  - 19 item surgical safety checklist
    - Sign in, Time out, Sign out
  - 8 institutions throughout world
  - Prospective, quasi-experimental study of patients before (n=3733) and after (n=3955) implementation
  - Non-cardiac surgery
  - During “Time-Out,” OR team had to confirm that prophylactic antibiotics have been administered ≤60 min before incision is made or that antibiotics are not indicated

Pronovost et al. N Engl J Med 2006;355:2725-32.
Haynes et al. N Engl J Med 2009;360:491-9.

Surgical Safety Checklist

Table 2. Characteristics of Participating Hospitals.

Site	Location	No. of Beds	No. of Operating Rooms	Type
Prince Hamzah Hospital	Amman, Jordan	500	13	Public, urban
St. Stephen's Hospital	New Delhi, India	733	15	Charity, urban
University of Washington Medical Center	Seattle, Washington	410	24	Public, urban
St. Francis Designated District Hospital	Ifakara, Tanzania	371	3	District, rural
Philippine General Hospital	Manila, Philippines	1800	39	Public, urban
Toronto General Hospital	Toronto, Canada	744	19	Public, urban
St. Mary's Hospital*	London, England	541	16	Public, urban
Auckland City Hospital	Auckland, New Zealand	710	31	Public, urban

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Haynes et al. N Engl J Med 2009;360:491-9.

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Surgical Safety Checklist

Site No.	No. of Patients Enrolled		Surgical-Site Infection		Prophylactic Antibiotics Given Appropriately (N=6802)		Death		Any Complication	
	Before	After	Before	After	Before	After	Before	After	Before	After
					percent					
1	524	598	**4.0**	**2.0**	98.1	96.9	**1.0**	**0.0**	**11.6**	**7.0**
2	357	351	2.0	1.7	56.9	76.9	1.1	0.3	7.8	6.3
3	497	486	5.8	4.3	83.8	87.7	0.8	1.4	13.5	9.7
4	520	545	3.1	2.6	80.0	81.8	1.0	0.6	7.5	5.5
5	370	330	**20.5**	**3.6**	29.8	96.2	**1.4**	**0.0**	**21.4**	**5.5**
6	496	476	4.0	4.0	25.4	50.6	3.6	1.7	10.1	9.7
7	525	585	**9.5**	**5.8**	42.5	91.7	2.1	1.7	**12.4**	**8.0**
8	444	584	4.1	2.4	18.2	77.6	1.4	0.3	6.1	3.6
Total	3733	3955	**6.2**	**3.4**	56.1	82.6	**1.5**	**0.8**	**11.0**	**7.0**
P value			<0.001		<0.001		0.003		<0.001	

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Haynes et al. N Engl J Med 2009;360:491-9.

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Other Interventions

- Maintain normothermia
  - Devices make easier
  - Only in procedures with general anesthesia
- Surveillance
  - Use automated data
  - Feedback data to surgeons/surgical personnel
  - Provide education to surgeons and patients

Special Strategies – To Do or Not?

- "Duke" colorectal bundle
  - Glove change for closure?
- Screening and decolonization for *S. aureus*
- Antimicrobial sutures

The Duke Colorectal Bundle

- High adverse outcomes following colorectal procedures (>20%)
  - ACS-NSQIP data
- Created and implemented a “bundle” of evidence-based and “common sense” interventions
  - Multidisciplinary
  - Monthly review meetings
  - Items included on a “checklist”

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Keenan et al. JAMA Surg 2014;149:1045.

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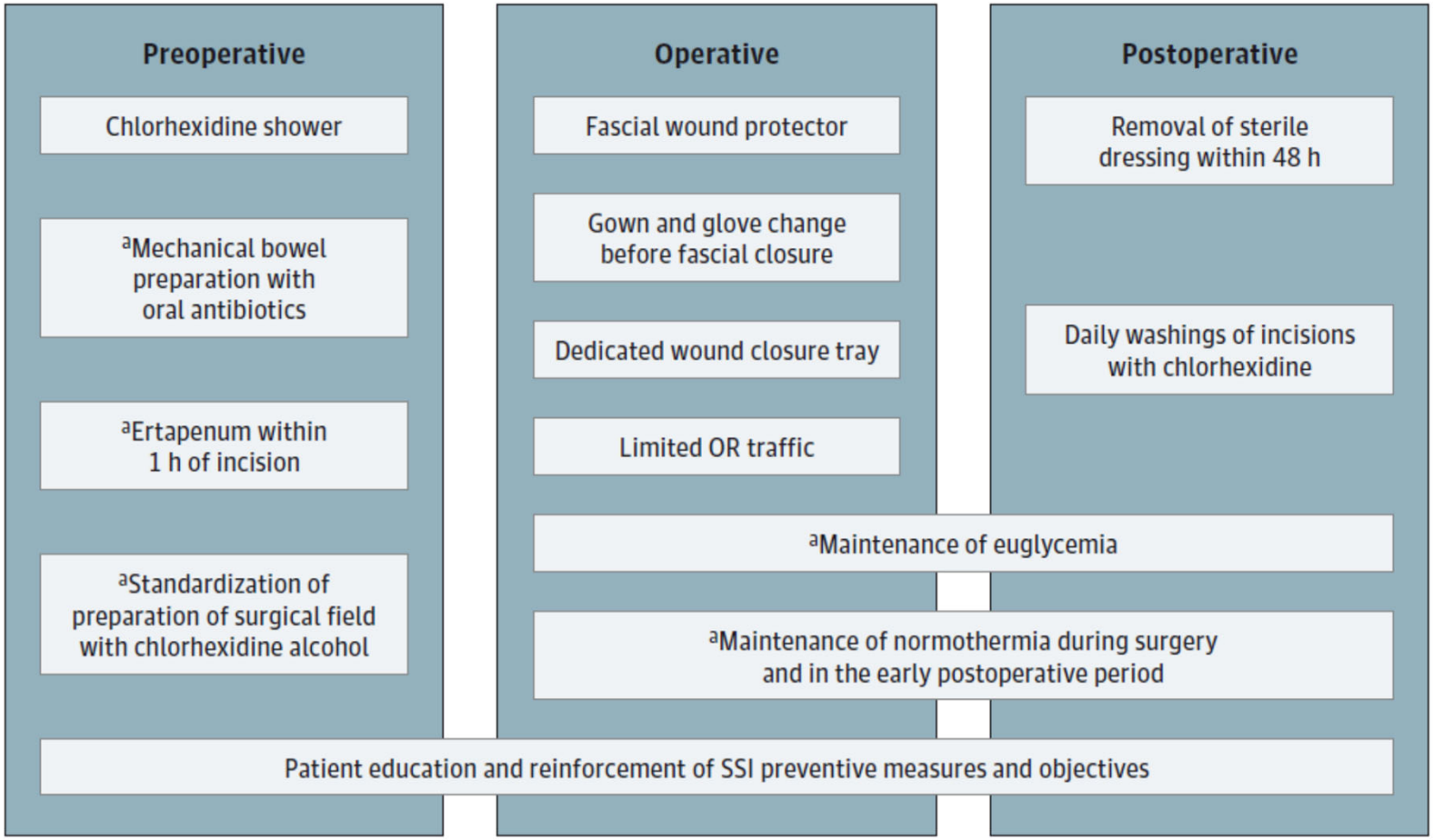
Bundle Components



Keenan et al. JAMA Surg 2014;149:1045.

Results

- Retrospective analysis of 559 randomly selected patients from 2008 through 2012
  - Propensity matched on multiple potential confounders (age, sex, BMI, DM, chemo, XRT, total op time, lap approach, rectal)
  - 212 patients in each group
    - No major differences in patient characteristics

Results

	Prebundle (n=212)	Postbundle (n=212)	p-value
Superficial-incisional SSI	41 (19.3)	12 (5.7)	<0.001
Deep-incisional SSI	3 (1.4)	0	0.25
Organ-Space SSI	11 (5.2)	6 (2.8)	0.32
Wound disruption	5 (2.4)	3 (1.4)	0.72
Postop sepsis	18 (8.5)	5 (2.4)	0.009
LOS – med (IQR)	5.5 (4-8)	5.0 (3-7)	0.05
30-d readmit	32 (15.1)	19 (9.0)	0.14

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Keenan et al. JAMA Surg 2014;149:1045.

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Successes/Challenges

- Bundle considered a success
  - Increased adherence to evidence-based and systematic practices
  - Key “implementation” components:
    - Multidisciplinary
    - Monthly review, open discussion
- Limitations
  - Retrospective, quasi-experimental
  - Elective procedures only
  - Bundle component vs. all?
- Challenges
  - What components to include?
  - Scheduling
  - Prioritization
  - Must have a surgeon “champion”

Glove/Instrument Change

- ACS/SIS recommended changing gloves and instruments for closure in colorectal surgery
- Based on expert concensus
- Frankly, not a bad idea

SA Screening/Decolonization

- If known to be colonized, should decolonize
  - ASHP, WHO, ACS, SHEA
- BUT
  - Should you screen??

- Controversial!

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SA Screening/Decolonization

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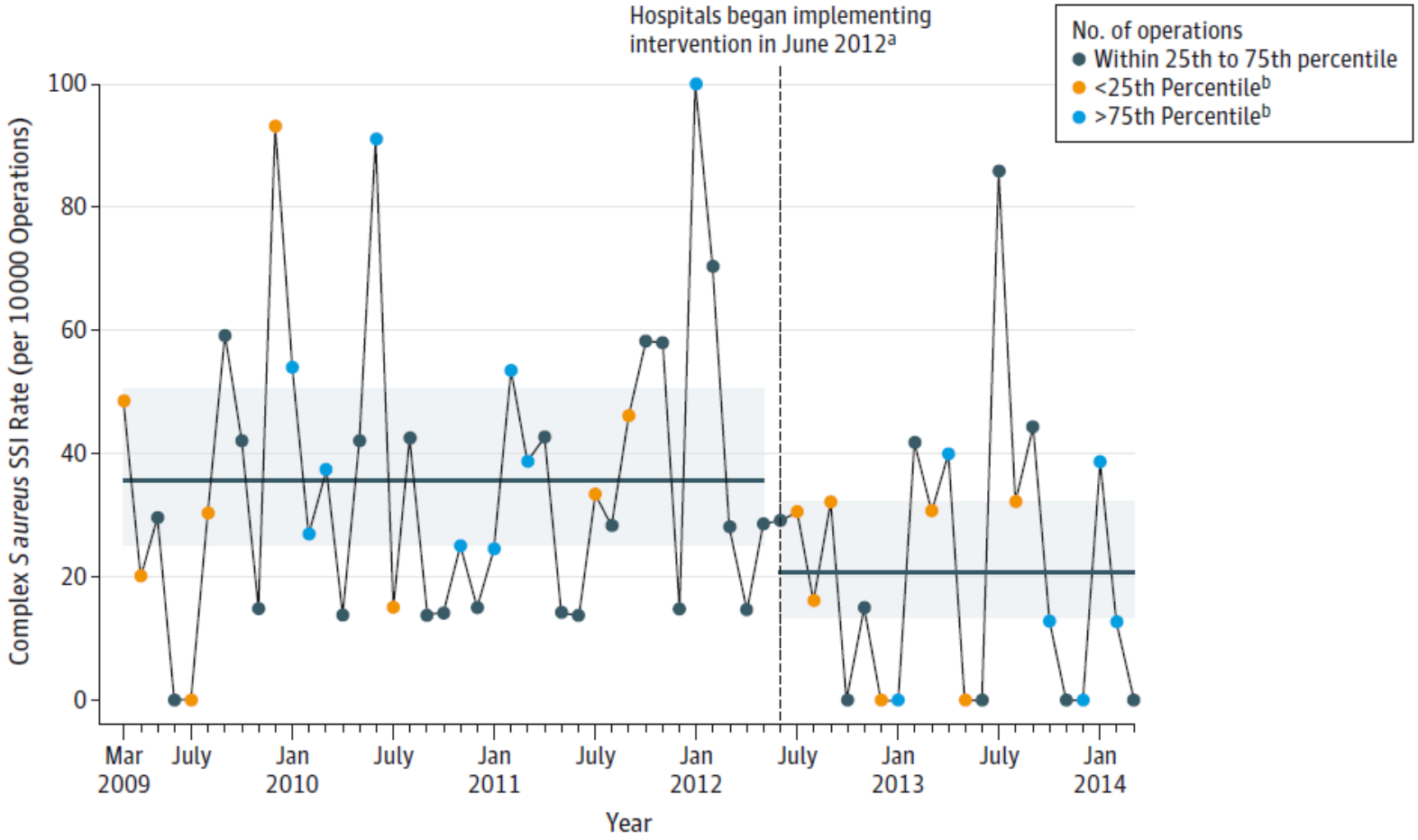


Schweizer et al. JAMA 2015;313:2162.

SA Screening/Decolonization

- Many factors to consider
  - Baseline rate of *S. aureus* SSI
  - Adherence to basic practices
  - Ability to follow up protocol
  - Resources to implement protocol
  - How to screen? How to decolonize?
- Currently recommended as a “Special Approach”

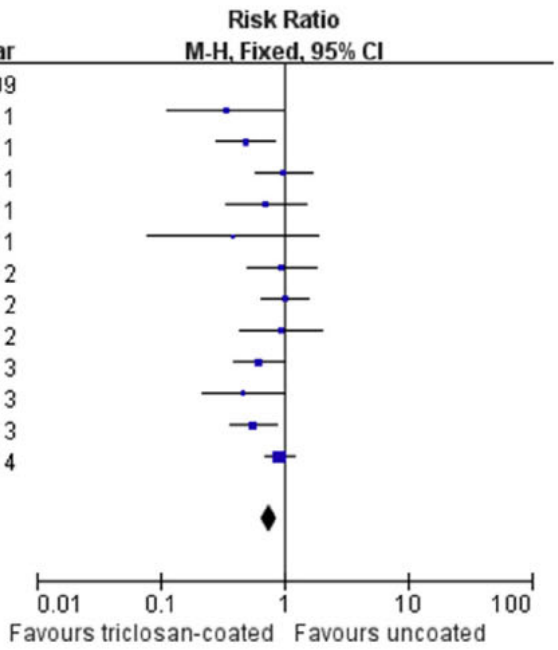
Antimicrobial Sutures

- Important:
  - Foreign devices increase the risk of SSI
    - Presence of sutures decreases inoculum required for SSI
      - 10^6 to 10^2
- SHEA/IDSA guidelines – not recommended
- WHO and ACS guidelines – recommended for clean and clean-contaminated abdominal cases
  - Meta-analysis published in 2016 that included 6 additional RCTs

Antimicrobial Sutures

Study or Subgroup	Triclosan-coated Events	Total	Uncoated Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI	Year
Deliaert 2009	0	26	0	26		Not estimable	2009
Rasic 2011	4	91	12	93	3.4%	0.34 [0.11, 1.02]	2011
Galal 2011	17	230	33	220	9.7%	0.49 [0.28, 0.86]	2011
Baracs 2011	23	188	24	197	6.8%	1.00 [0.59, 1.72]	2011
Williams 2011	10	75	14	75	4.0%	0.71 [0.34, 1.51]	2011
Zhang 2011	2	51	5	50	1.5%	0.39 [0.08, 1.93]	2011
Seim 2012	16	160	17	163	4.9%	0.96 [0.50, 1.83]	2012
Turtiainen 2012	31	139	30	137	8.7%	1.02 [0.65, 1.59]	2012
Isik 2012	9	170	19	340	3.7%	0.95 [0.44, 2.05]	2012
Thimour-Bergstrom 2013	23	184	38	190	10.8%	0.63 [0.39, 1.01]	2013
Nakamura 2013	9	206	19	204	5.5%	0.47 [0.22, 1.01]	2013
Justinger 2013	31	485	42	371	13.7%	0.56 [0.36, 0.88]	2013
Diener 2014	87	587	96	598	27.4%	0.92 [0.71, 1.21]	2014
Total (95% CI)		**2592**		**2664**	**100.0%**	**0.76 [0.65, 0.88]**	
Total events	262		349				

Heterogeneity: Chi² = 14.57, df = 11 (P = 0.20); I² = 25%
Test for overall effect: Z = 3.69 (P = 0.0002)



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Guo et al. J Surg Research 2016;201:105

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Unresolved

- CHG baths before surgery
- Intranasal CHG
- Antibiotic-impregnated, implantable sponges
  - Gentamicin

One Last Thought about Interventions

- SCIP SSI measures have been largely removed
- Cynical view
  - All the gain in best practices via SCIP will gradually degrade
- So…
  - Need to remain vigilant for increases in SSI during and after transition
  - Can SCIP measures still be tracked??

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Implementation

- Based on 4 Es
  - Engage
    - Clear communication about why important
      - Ex: physician champions
  - Educate
    - The “what to do/not do”
      - Ex: Education for patients/family
  - Execute
    - Reduce barriers and improve adherence
      - Ex: QI methodology (six sigma, etc.)
  - Evaluate
    - Measurement
      - Ex: Longitudinal evaluation of outcomes and process

Role of IP in Implementation

- Engage
  - Involve hospital leadership
  - Identify physician champions
  - Identify multidisciplinary teams
  - Evidence-based practices
  - Foster a culture of safety
- Educate
  - Patients, surgeons, leadership

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Role of IP in Implementation

- Execute
  - Quality improvement strategies
  - Maximize IT
  - Participate in a network/collaborative
  - Order sets
  - Protocols
  - Act on problems once identified!!
- Evaluate
  - Surveillance

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Take Home Points

- SSI is the most common and most costly HAI
- Many different strategies are required to reduce SSI risk to lowest extent possible
- IPs play a critical role
- Not every hospital needs to approach SSI prevention the same way
  - But all hospitals need to at least use the basic strategies

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Questions?

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