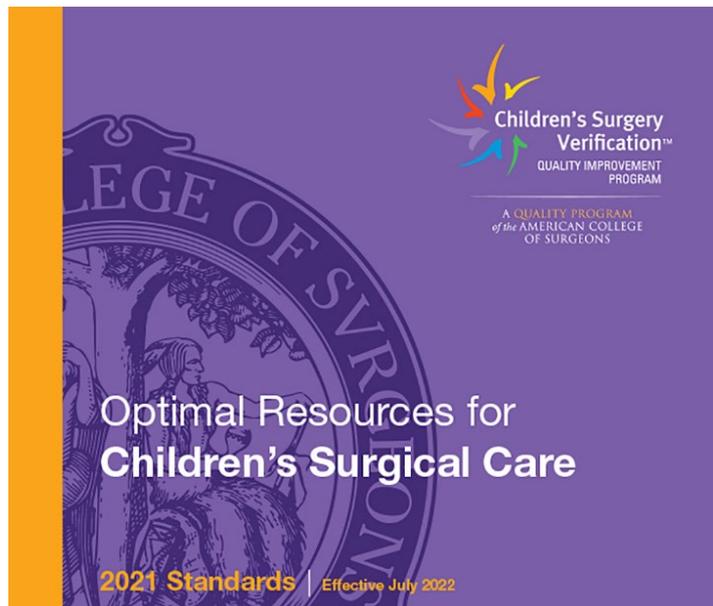


Addressing Surgical Antimicrobial Overuse through Benchmarking, Accountability, and Prioritization of Stewardship Efforts



Shawn J. Rangel, MD, MSCE

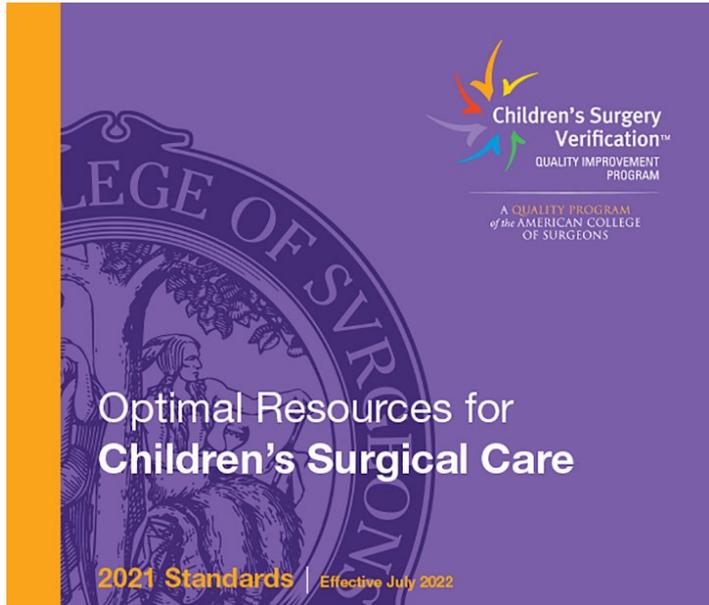
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Surgical Antimicrobial Prophylaxis Measurement & Stewardship Collaborative

Disclosures

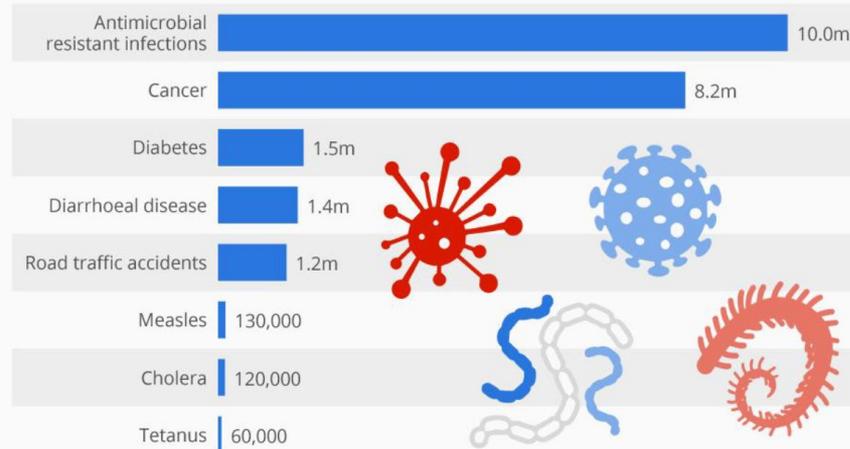


I am a paid site reviewer for
the ACS Children's Surgery
Verification Program

Ever Increasing Public Health Implications of Antimicrobial Resistance...

Deaths From Drug-Resistant Infections Set To Skyrocket *

Deaths from antimicrobial resistant infections and other causes in 2050 *



6 of the 18 most alarming **antibiotic resistance threats** cost the U.S. more than **\$4.6 billion annually**



Vancomycin-resistant *Enterococcus* (VRE)



Carbapenem-resistant *Acinetobacter* species (CRAsp)



Methicillin-resistant *Staphylococcus aureus* (MRSA)



Carbapenem-resistant *Enterobacteriales* (CRE)



Extended-spectrum cephalosporin resistance in *Enterobacteriales* suggestive of extended-spectrum beta-lactamase (ESBL) production



Multidrug-resistant (MDR) *Pseudomonas aeruginosa*

www.cdc.gov/DrugResistance

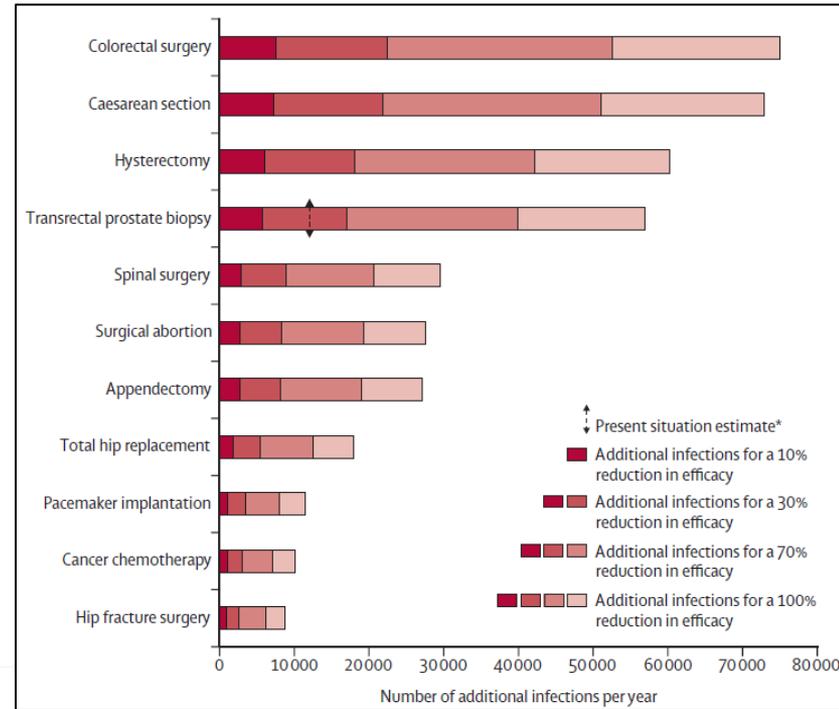


U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

*UK Government (2015). O'Neill J. Health matters: antimicrobial resistance. 2015

Antimicrobial Resistance in Surgical Patients Predicted to Increase over Time* ...

	Standard prophylactic antibiotic	Main infecting organisms (proportions of total infections)	Proportion of infections caused by pathogens resistant to standard prophylactic antibiotics
Caesarean section, hysterectomy	Cefazolin	<i>Staphylococcus aureus</i> (19.7%), <i>Escherichia coli</i> (12.9%), coagulase-negative staphylococci (7.1%), <i>Enterococcus faecalis</i> (8.3%), <i>Streptococcus</i> spp (7.6%)	38.7%
Transrectal prostate biopsy	Fluoroquinolone	<i>E coli</i> (91.0%), <i>Pseudomonas aeruginosa</i> (9.0%) [†]	Clinical isolates: 50.0-90.0%; pre-biopsy rectal cultures: 20.5%
Spinal surgery, total hip replacement, hip fracture surgery	Cefazolin	<i>S aureus</i> (47.1%), coagulase-negative staphylococci (11.0%), <i>Streptococcus</i> spp (5.6%), <i>E faecalis</i> (4.6%), <i>P aeruginosa</i> (4.4%)	47.7%
Pacemaker implantation	Cefazolin	<i>S aureus</i> (30.7%), coagulase-negative staphylococci (13.4%), <i>P aeruginosa</i> (7.9%), <i>E coli</i> (6.4%), <i>Klebsiella pneumoniae</i> / <i>Klebsiella oxytoca</i> (5.9%)	50.9%
Appendectomy, colorectal surgery	Cefazolin and metronidazole	<i>E coli</i> (18.6%), <i>S aureus</i> (11.5%), <i>E faecalis</i> (9.3%), <i>Enterococcus</i> spp (5.9%), <i>P aeruginosa</i> (5.6%)	43.2%
Cancer chemotherapy	Fluoroquinolone	Meticillin-resistant <i>S aureus</i> (11.3%), multidrug-resistant <i>E coli</i> (8.0%), vancomycin-resistant enterococci (4.2%), multidrug-resistant <i>P aeruginosa</i> (3.3%)	26.8%



*Teillant et al. Lancet Infect Dis 2015;15:1429-37.

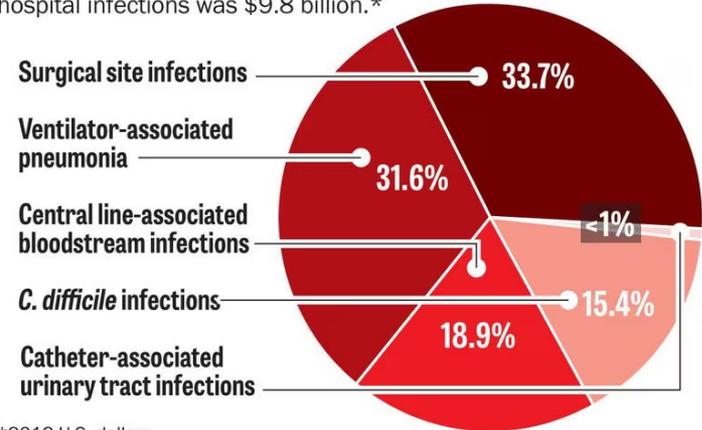
Ever Increasing Public Health Implications of Surgical Site Infections...

Inpatient surgery patients who develop an SSI:	2% to 5%
Number of SSIs that occur in the U.S. each year:	160 to 300K
Increase in average length of stay as a result of an SSI:	7 to 11 days
Increase in chance of death associated with SSIs:	2 to 11X greater
Estimated percentage of preventable SSIs:	Up to 60%

Sources: *Infect Control Hosp Epidemiol* 2014;35(6):605-627;
World J Emerg Surg 2019;14:50.

TOTAL ANNUAL COSTS

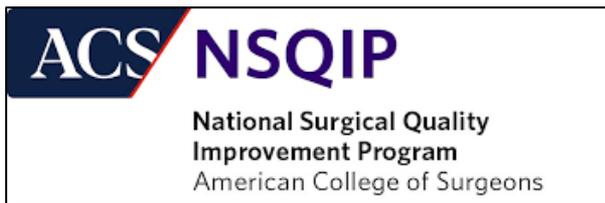
The annual cost nationally for the five major hospital infections was \$9.8 billion.*



*2012 U.S. dollars

*Zimlichman et al. *JAMA Intern Med.* 2013

Improving Stewardship through the American College of Surgeons Quality Measurement & Verification Programs



Program Goals: Quality & Outcomes Benchmarking

- 157 hospitals currently participate in the pediatric program
- 1,500 cases/year audited across 6 surgical specialties
- Adverse events (including SSI) are collected by nurse-level clinical reviewers
- Risk-adjusted “report cards” sent out semi-annually
- **Measures of appropriate surgical antimicrobial prophylaxis utilization added in 2021 (mandatory for all sites)**



Program Goals: Provide verification as a “Children’s Surgery Center” based on a hospital’s resources, infrastructure & dedication to continuous quality improvement

- 57 hospitals are currently verified by the program
- Site visit/review required to maintain verification every 3 years
- **Requires participation in NSQIP**
- **Standards for antimicrobial stewardship added in 2021**

ACS-NSQIP Surgical Antimicrobial Prophylaxis & SSI Semiannual Report



A QUALITY PROGRAM
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OF SURGEONS

ACS NSQIP Pediatric Surgical Antibiotic Prophylaxis (SAP) Semiannual Report (SAR)

Boston Children's Hospital

Released: August 2023

Dates of Surgery:
January 1, 2022 – December 31, 2022



August 2023 report cohort:

- 65,112 procedures from 151 hospitals
- 6 pediatric surgical specialties

Overview of SAP utilization (all patients):

- **21.0% overall overutilization rate****
 - **40.0% postoperative use (9.2% > 24 hours postop!)**
 - **7.5% use of overly broad spectrum agents**
 - **70.7% use in low-risk clean procedures**

Hospital-specific data/resources

- Report card comparing case-mix and comorbidity-adjusted rates of **SAP mis-utilization and SSI rates**
- Detailed report of case-level misutilization for all procedures performed



Variation in hospital-level procedure and risk-adjusted SAP overutilization and SSI rates



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Boston Children's Hospital

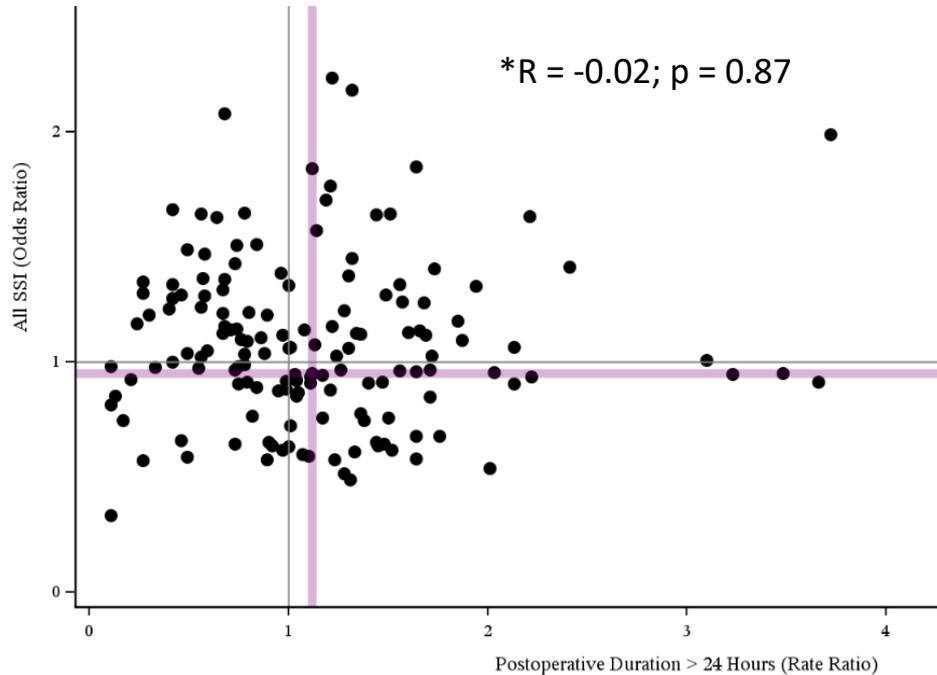
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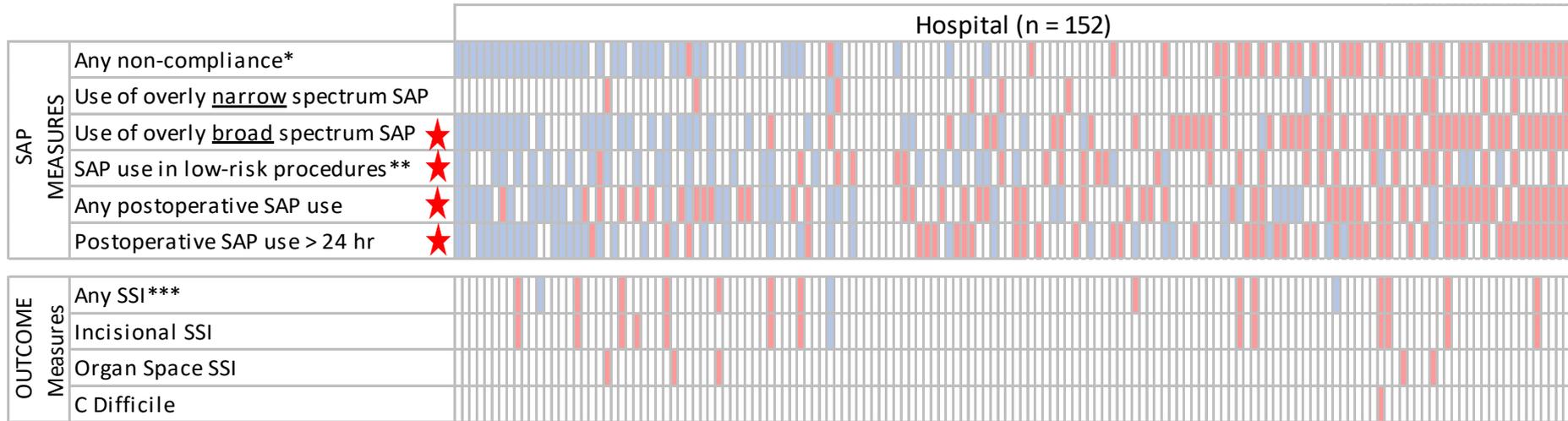
Peds Models	Sites Included	Total Cases (n)	Measure Rate (%)	Low Outliers (n)	High Outliers (n)
SAP MEASURES					
Overall Prophylaxis Misutilization	151	65112	33.65%	42	30
Overall Prophylaxis Overutilization***	151	65112	21.97%	40	38
Overall Prophylaxis Underutilization***	151	65112	12.63%	35	33
Non-compliance: Timing Guidelines	151	36346	5.18%	10	24
Non-compliance: Spectrum Guidelines	151	48053	8.66%	31	26
Inappropriate Spectrum: Narrow	151	48053	1.13%	3	11
Use of Overly Broad Spectrum Agents	151	48053	7.53%	29	39
Prophylaxis Use in Low Risk Clean Procedures	151	8416	70.72%	33	21
Omission of SAP in Clean-Contaminated Cases	150	26664	18.03%	29	32
Continuation of Postoperative Prophylaxis	151	56842	40.00%	35	50
Postoperative Duration > 24 Hours	151	56842	9.23%	32	43
OUTCOME MEASURES					
Complication: All SSI	151	65112	2.02%	4	13
Complication: Incisional SSI	151	65112	1.56%	4	10
Complication: Organ space SSI	151	65112	0.46%	0	2
Complication: C.diff Colitis	151	65112	0.07%	0	3

Relationship between hospital-level postoperative SAP utilization >24 hours and SSI rates



Peds Models	Sites Included	Low Outliers (n)	High Outliers (n)
SAP MEASURES			
Overall Prophylaxis Misutilization	151	42	30
Overall Prophylaxis Overutilization***	151	40	38
Overall Prophylaxis Underutilization***	151	35	33
Non-compliance: Timing Guidelines	151	10	24
Non-compliance: Spectrum Guidelines	151	31	26
Inappropriate Spectrum: Narrow	151	3	11
Inappropriate Spectrum: Broad	151	29	39
SAP Use in Low Risk Clean Procedures	151	33	21
Omission in Clean-Contaminated Cases	150	29	32
Postoperative Duration > 0 Hours	151	35	50
Postoperative Duration > 24 Hours	151	32	43
OUTCOME MEASURES			
Complication: All SSI	151	4	13
Complication: Incisional SSI	151	4	10
Complication: Organ space SSI	151	0	2
Complication: C.diff Colitis	151	0	0

Variation in SAP misutilization and SSI outlier status (2021 NSQIP data; 152 hospitals)



- High rate outlier for SAP utilization/Outcome
- Low rate outlier for SAP utilization/Outcome
- As expected SAP utilizer or SSI rate

★ = overutilization measure

Variation in Hospital-Level Postoperative Prophylaxis Utilization & SSI Rates for Spine Cases



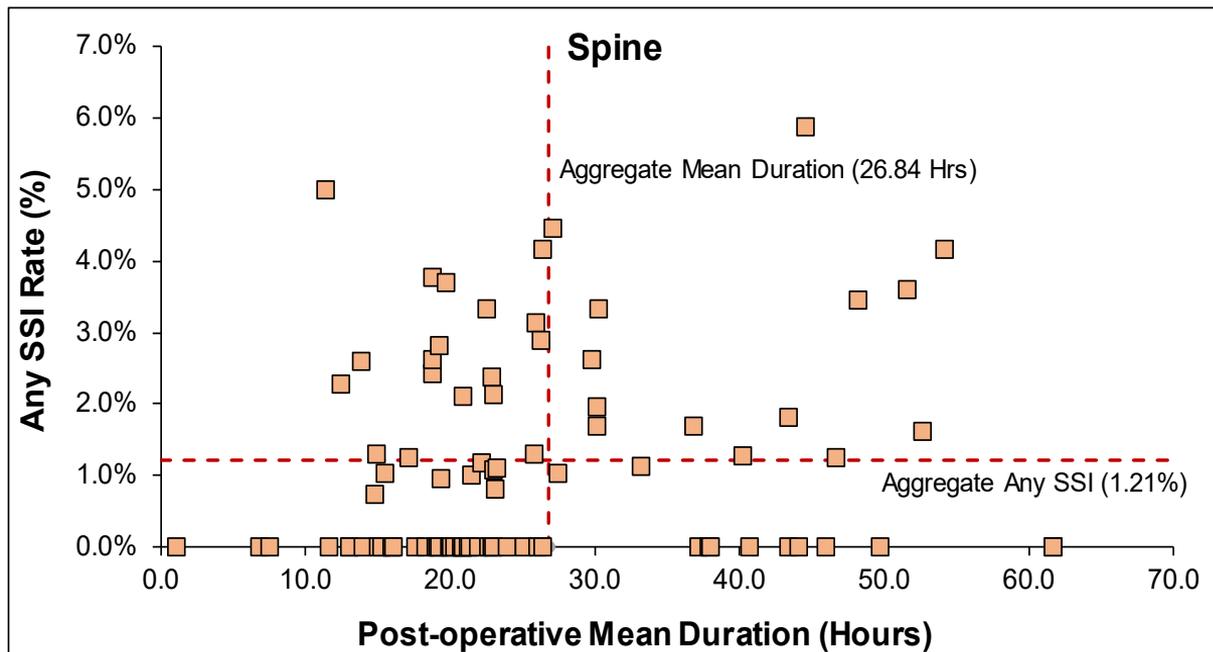
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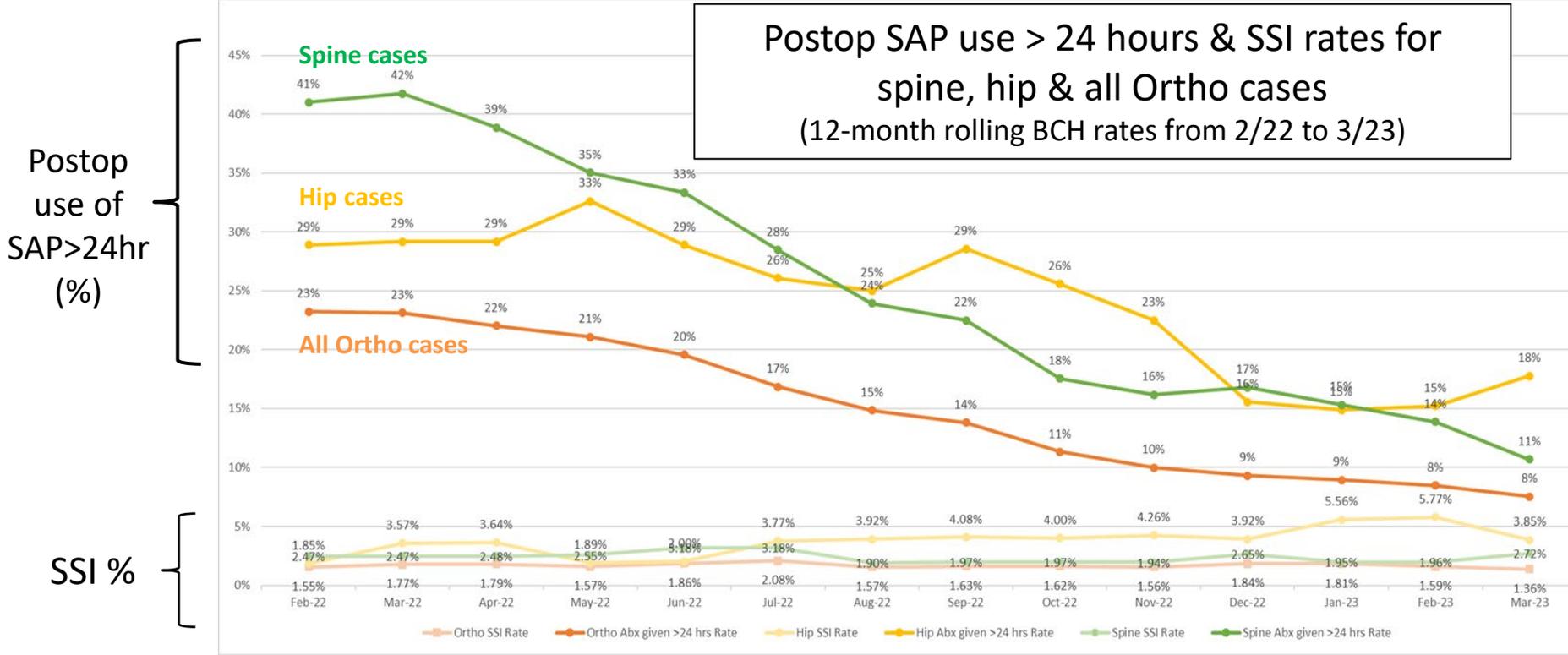


2021 NSQIP-Pediatric SAP Semiannual Report Card for Boston Children's Hospital

ALL SURGERIES

	NSQIP Pediatric	Your Hospital								
	Observed Rate	Total Cases	Observed Rate	Predicted Observed Rate	Expected Rate	Rate Ratio	Odds Ratio	95% C.I.		Outlier
								Lower	Upper	
Non-compliance with appropriate timing	5.68%	392	4.08%	4.16%	4.63%	0.90	0.89	0.56	1.43	
Non-compliance with appropriate spectrum	9.20%	716	6.01%	6.08%	9.03%	0.67	0.60	0.42	0.87	Low
Inappropriate Spectrum: Narrow	1.08%	716	0.70%	0.80%	1.08%	0.73	0.70	0.33	1.49	
Inappropriate Spectrum: Broad	8.12%	716	5.31%	5.35%	7.30%	0.73	0.67	0.45	1.00	
Overall prophylaxis utilization*	70.47%	119	75.63%	76.24%	83.08%	0.92	0.52	0.30	0.90	Low
Any postoperative prophylaxis	40.01%	729	50.21%	50.24%	53.66%	0.94	0.81	0.63	1.03	
Postoperative prophylaxis > 24 Hours	9.09%	729	13.99%	13.94%	10.66%	1.31	1.42	1.07	1.88	High
Complication: All SSI	1.95%	764	1.44%	1.54%	1.81%	0.85	0.85	0.51	1.39	
Complication: Incisional SSI	1.49%	764	1.05%	1.16%	1.45%	0.80	0.80	0.46	1.39	
Complication: Organ Space SSI	0.46%	764	0.39%	0.37%	0.34%	1.09	1.09	0.46	2.59	
Complication: C Difficile	0.07%	764	0.13%	0.06%	0.03%	1.78	1.78	0.31	10.27	

Reduction of postoperative SAP utilization at Boston Children's Hospital



2023 NSQIP-Pediatric SAP Semiannual Report Card for Boston Children's Hospital

ALL SURGERIES

	NSQIP Pediatric	Your Hospital									
		Observed Rate	Total Cases	Observed Rate	Predicted Observed Rate	Expected Rate	Rate Ratio	Odds Ratio	95% C.I.		Outlier
									Lower	Upper	
Overall Prophylaxis Misutilization	30.68%	827	15.11%	15.45%	25.65%	0.60	0.44	0.35	0.56	Low	
Overall Prophylaxis Overutilization	19.11%	827	13.18%	13.34%	20.10%	0.66	0.52	0.40	0.67	Low	
Overall Prophylaxis Underutilization	11.93%	827	2.06%	2.22%	4.57%	0.49	0.45	0.28	0.72	Low	
Non-Compliance: Timing Guidelines	4.29%	438	2.28%	2.46%	3.49%	0.71	0.70	0.40	1.22		
Non-Compliance: Spectrum Guidelines	9.48%	732	6.56%	6.60%	8.34%	0.79	0.69	0.46	1.02		
Inappropriate Spectrum: Narrow	1.13%	732	0.82%	0.87%	0.98%	0.89	0.88	0.44	1.73		
Inappropriate Spectrum: Broad	8.35%	732	5.74%	5.77%	7.15%	0.81	0.74	0.50	1.10		
Prophylaxis Use in Low Risk Clean Procedures	66.50%	63	58.73%	59.32%	67.69%	0.88	0.66	0.38	1.15		
Omission in Clean-Contaminated + High Risk Clean Procedures	4.68%	369	0.27%	0.63%	2.01%	0.31	0.30	0.10	0.89	Low	
Any Postoperative Antibiotic Use	39.65%	787	36.98%	37.12%	50.69%	0.73	0.41	0.33	0.51	Low	
Postoperative Duration > 24 Hours	7.94%	787	5.34%	5.42%	9.10%	0.60	0.55	0.38	0.78	Low	
Complication: All SSI	1.95%	827	1.81%	1.82%	1.85%	0.98	0.98	0.62	1.56		
Complication: Incisional SSI	1.53%	827	1.57%	1.56%	1.53%	1.02	1.02	0.62	1.68		
Complication: Organ Space SSI	0.42%	827	0.24%	0.27%	0.29%	0.94	0.94	0.41	2.14		
Complication: C.diff Colitis	0.06%	827	0.24%	0.12%	0.04%	2.90	2.91	0.54	15.59		

Mandating Stewardship Accountability through the ACS Children's Surgery Verification Program (CSVP)

The American College of Surgeons (ACS) Children's Surgery Verification Program



The image shows the cover of a report titled "Optimal Resources for Children's Surgical Care 2015" from the American College of Surgeons. The cover features a photograph of a young child in a hospital gown. To the right of the cover is the logo for the Children's Surgery Verification Quality Improvement Program, which includes a stylized graphic of colorful arrows pointing outwards. Below the logo is the text "A QUALITY PROGRAM of the AMERICAN COLLEGE OF SURGEONS".

Children's Surgery Verification
QUALITY IMPROVEMENT PROGRAM

A QUALITY PROGRAM
of the AMERICAN COLLEGE
OF SURGEONS

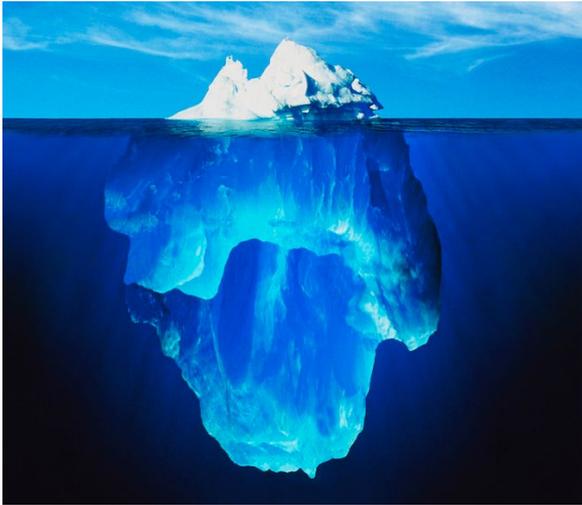
"Hospitals seeking level 1 and 2 status must participate in NSQIP-Pediatric and demonstrate how their NSQIP data was used for driving process improvement..."

CSV v. 2.0 Level I & II hospital standards for surgical antimicrobial stewardship efforts

Hospitals will need to provide evidence of:

- ***A formal antimicrobial stewardship program (ASP) with active involvement of perioperative services***
- ***Dissemination of NSQIP prophylaxis benchmarking reports to surgical departments and your hospital's ASP***
- ***Ongoing PI efforts to address areas of antimicrobial overuse identified from the benchmarking report***

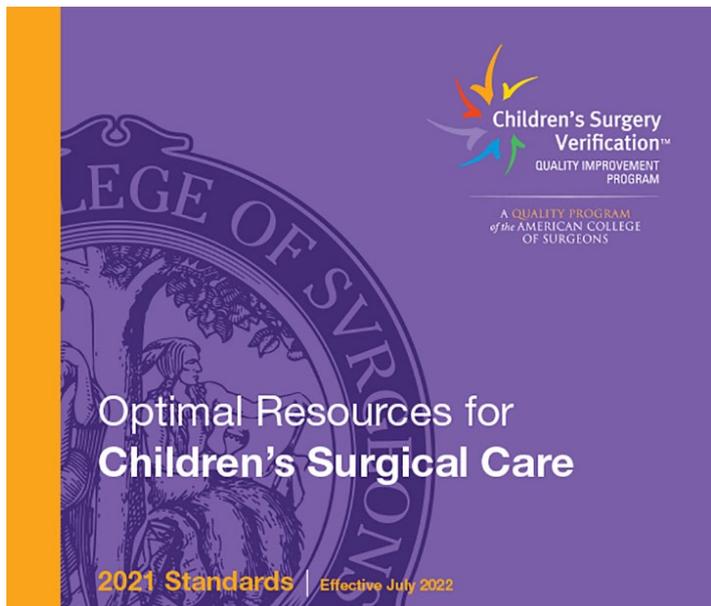
Surgical Prophylaxis is Just One of Many Areas where Comparative Benchmarking can Facilitate Stewardship



Other areas of antimicrobial overutilization and practice variation that can be targeted:

- Treatment of established surgical and non-surgical infections
- Use of antimicrobial Prophylaxis for medical conditions

Addressing Surgical Antimicrobial Overuse through Benchmarking, Accountability, and Prioritization of Stewardship Efforts



Thank you for your attention!

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