



Complications Associated With Surgical Antibiotic Prophylaxis Practice Patterns

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Background

SSI are the **leading cause of health care infections** in surgical patients¹.

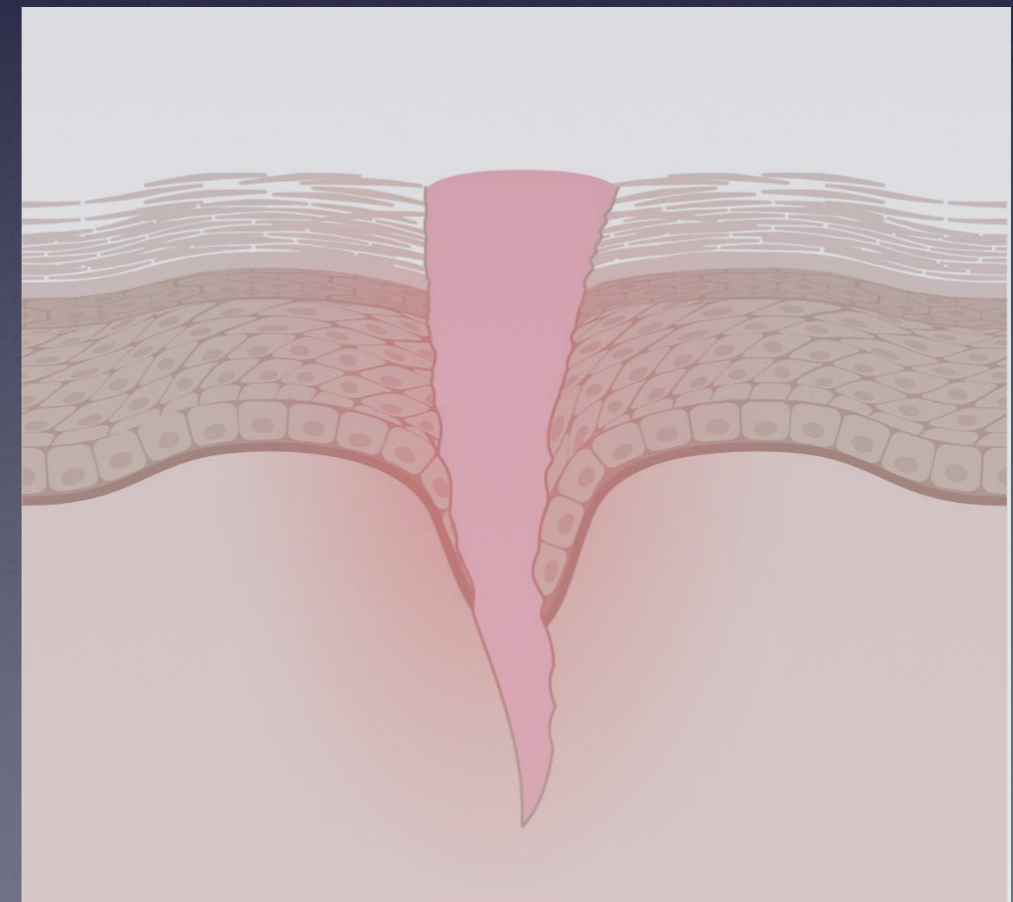
Accounts for about 1.6 billion in health care related costs².

Estimated incidence³: 2-5%


1. Anderson DJ et al. Infect Control Hosp Epidemiol. 2014;35(6):605-27.

2. Bratzler DW et al. Clin Infect Dis 2004;38:1706-15


3. de Lissovoy G et al. Am J Infect Control 2009;37:387-97.



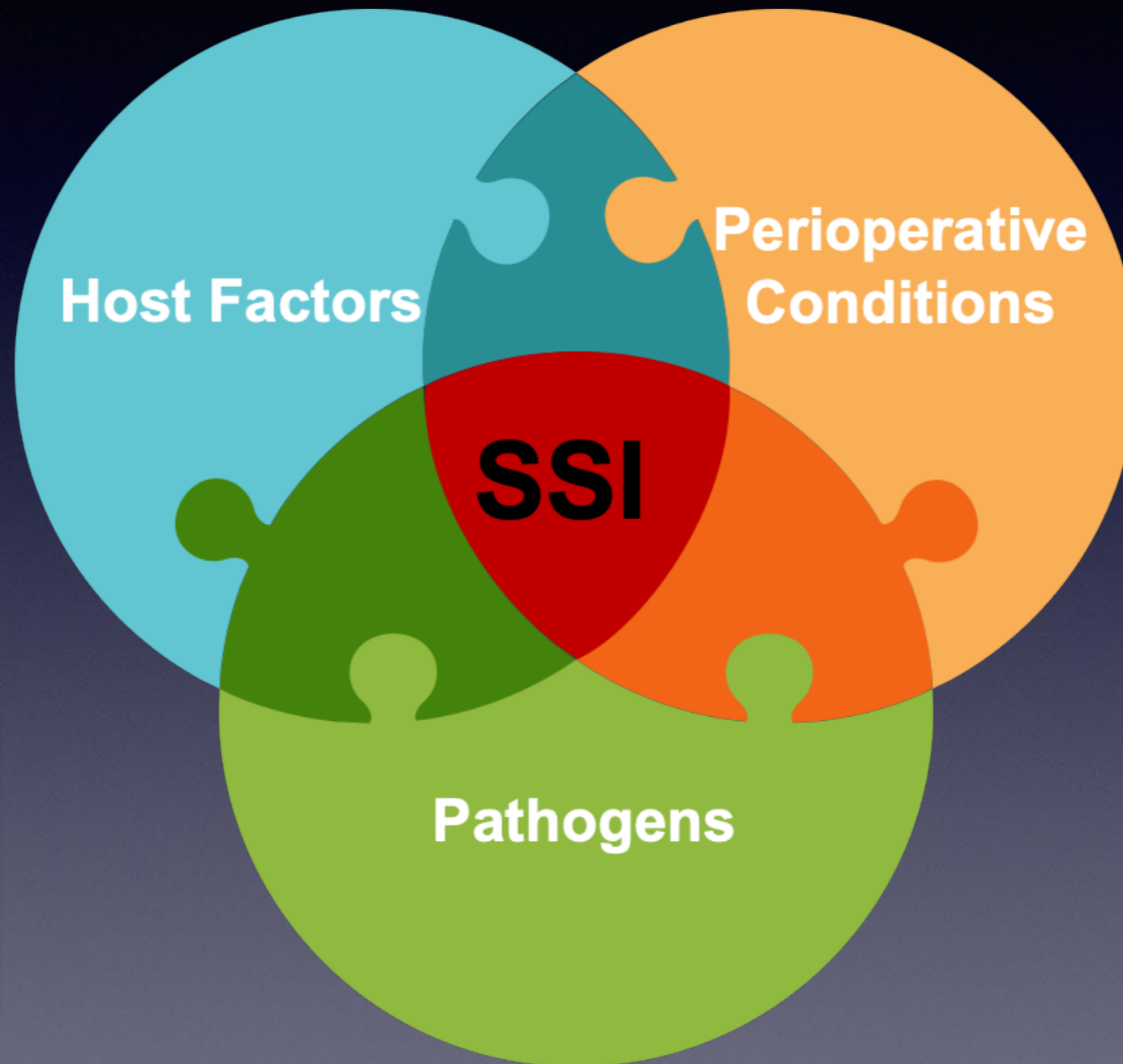
Surgical Site Infections (SSI)


Host factors 

Demographics
Comorbid conditions
Pre-existing conditions
Host Defense

Pathogens 

Virulence
Inoculum
Type



Perioperative Conditions 

Surgical Characteristics
Urgency
Duration
Decontamination
Perioperative Antibiotics
Temperature Control
Glycemic Control
Others

Study Design

Linking of two perioperative registries



MPOG

- Antibiotic Administration Details
- Intraoperative Details
- Patient Demographics

NSQIP

- Surgical Site Infections (SSIs)
- Postoperative outcomes
- Procedure details

Inclusion Criteria

Patients \geq 18 years of age who underwent non-cardiac procedures involving a skin incision from 01/01/2014 to 08/31/2022.

Exclusion Criteria

- Preexisting infection
- Transplant Surgeries, Cardiac surgeries
- ASA 6
- Missing / Unknown antibiotic administration metrics
- Missing CPT
- Missing Weight

Exposure Variable

Non-adherence to the following antibiotic administration

metrics:

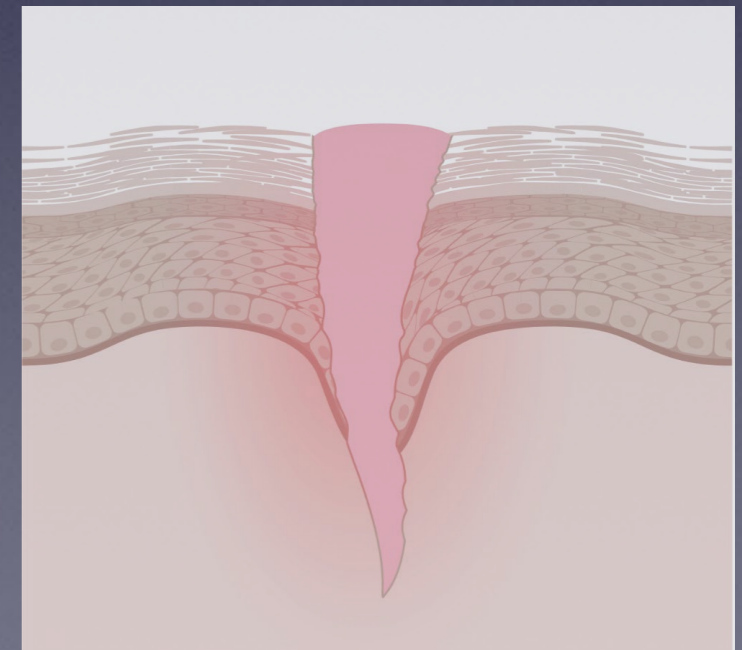
- Timing
- Dosing
- Choice (based on CPTs)
- Re-dosing (if the case qualifies)



Primary Outcome:

NSQIP adjudicated surgical site infection:

Any superficial, deep tissue, or organ space infections as recorded in the NSQIP registry within 30-days postoperatively.



Substudy

Vancomycin as the sole antibiotic

- Dosing is mg/kg based
- Need for prolonged infusion
- Associated with higher incidence of SSIs

Primary Analyses

A hierarchical generalized linear mixed model using Poisson regression with surgical patients nested within MPOG institutions was performed, aiming to investigate possible associations between the non-adherence metrics and SSI. Models involved adjusting for patient, provider, institutional, and surgical characteristics.

Results

A total of **119,236** unique cases met the inclusion criteria.

The incidence of SSI was **4.4%** in the cohort.

Non-adherence to guideline-based antibiotic was common with non-adherence to at least one metric in **26.1%** cases.

Non adherent **choice**, **dosing**, **timing** and **redosing** was **13.3%**, **9.0%**, **3.0%** and **13.9%** respectively.

Multivariate Regression: Overall Non-adherence

Variable	Relative Risk (95% CI)	p-Value
Any non-adherence	1.34 (1.26, 1.43)	<0.001
Age (in years)	0.99 (0.99, 0.99)	<0.001
Sex, Male vs Female	0.99 (0.93, 1.05)	0.615
BMI (kg/m ²)	1.01 (1.01, 1.02)	<0.001
Hispanic vs. Non-Hispanic	0.91 (0.74, 1.12)	0.365
Race		
Black	0.84 (0.76, 0.93)	0.001
Others	0.99 (0.87, 1.14)	0.941
Unknown	0.94 (0.85, 1.05)	0.289
White	Ref	
Surgical Specialty		
Gynecology	0.73 (0.65, 0.82)	<0.001
Neurosurgery	0.36 (0.29, 0.44)	<0.001
OMFS/Plastics	0.87 (0.69, 1.09)	0.231
Orthopedics	0.62 (0.54, 0.71)	<0.001
Thoracic Surgery	0.44 (0.35, 0.55)	<0.001
Urology	0.52 (0.44, 0.61)	<0.001
Vascular Surgery	0.66 (0.58, 0.76)	<0.001
General Surgery	Ref	
ASA class		
5	3.00 (1.90, 4.71)	<0.001
4	2.83 (2.17, 3.70)	<0.001
3	2.55 (2.00, 3.30)	<0.001
2	1.77 (1.39, 2.26)	<0.001
1	Ref	
Van Walraven Comorbidity Index	1.03 (1.02, 1.03)	<0.001
Smoking Status (ref. No)	1.21 (1.07, 1.37)	0.002
Diabetes	1.01 (0.94, 1.10)	0.743
Cerebrovascular Disease	0.99 (0.83, 1.20)	0.921
Institution, Academic vs. Community	1.54 (1.20, 1.97)	0.001
Year of Surgery	1.01 (0.99, 1.03)	0.190
Emergency case	1.44 (1.28, 1.61)	<0.001
Off-hours Cases (Starting between 5PM and 6:30AM)	1.28 (1.13, 1.45)	<0.001
Anesthetic Duration (minutes)	1.00 (1.00, 1.00)	<0.001
Hyperglycemia (>180 mg/dl)	1.17 (1.08, 1.26)	<0.001
Blood products given	1.16 (1.05, 1.29)	0.006
MAP <55	1.00 (1.00, 1.00)	1.00

Guideline Non-adherence was significantly associated with a higher relative risk of SSIs.

Multivariate Regression: Individual Metrics

Variable	Relative Risk (95% CI)	p-Value
Non-adherent choice	1.43 (1.33, 1.53)	<0.001
Non-adherent dosing	1.10 (0.99-1.22)	0.068
Non-adherent timing	1.13 (0.98-1.31)	0.087
Non-adherent re-dosing	1.12 (1.02-1.24)	0.020
Age (in years)	0.99 (0.99, 0.99)	<0.001
Sex, Male vs Female	0.98 (0.93, 1.05)	0.604
BMI (kg/m ²)	1.01 (1.01, 1.02)	<0.001
Hispanic vs. Non-Hispanic	0.91 (0.74, 1.11)	0.348
Race		
Black	0.84 (0.76, 0.94)	0.001
Others	0.99 (0.87, 1.14)	0.938
Unknown	0.94 (0.84, 1.05)	0.258
White	Ref	
Surgical Specialty		
Gynecology	0.74 (0.67, 0.83)	<0.001
Neurosurgery	0.38 (0.30, 0.46)	<0.001
OMFS/Plastics	0.90 (0.71, 1.13)	0.348
Orthopedics	0.63 (0.55, 0.72)	<0.001
Thoracic Surgery	0.44 (0.35, 0.56)	<0.001
Urology	0.52 (0.44, 0.61)	<0.001
Vascular Surgery	0.67 (0.59, 0.77)	<0.001
General Surgery	Ref	
ASA class		
5	3.01 (1.91, 4.74)	<0.001
4	2.86 (2.19, 3.73)	<0.001
3	2.57 (2.02, 3.29)	<0.001
2	1.79 (1.41, 2.28)	<0.001
1	Ref	
Van Walraven Comorbidity Index	1.03 (1.02, 1.03)	<0.001
Smoking Status (ref. No)	1.20 (1.06, 1.36)	0.003
Diabetes	1.01 (0.94, 1.10)	0.766
Cerebrovascular Disease	1.00 (0.84, 1.20)	0.977
Institution, Academic vs. Community	1.54 (1.20, 1.97)	0.001
Year of Surgery	1.01 (0.99, 1.03)	0.335
Emergency case	1.40 (1.25, 1.58)	<0.001
Off-hours Cases (Starting between 5PM and 6:30AM)	1.26 (1.11, 1.43)	<0.001
Anesthetic Duration (minutes)	1.00 (1.00, 1.00)	<0.001
Hyperglycemia (>180 mg/dl)	1.16 (1.07, 1.26)	<0.001
Blood products given	1.17 (1.05, 1.30)	0.005
MAP <55	1.00 (1.00, 1.00)	0.924

Non adherent **choice** and **redosing** were significantly associated with a higher relative risk of SSIs.

Vancomycin Sub-study

Vancomycin Sub-study

Results:

A total of **5542** unique cases met the inclusion criteria.

The incidence of SSI was **5.6%** in the cohort.

Non-adherence to guideline-based antibiotic **choice**, **dosing** and **timing** was 705 (**12.7%**), 59 (**1.1%**) and 197 (**3.6%**) respectively.

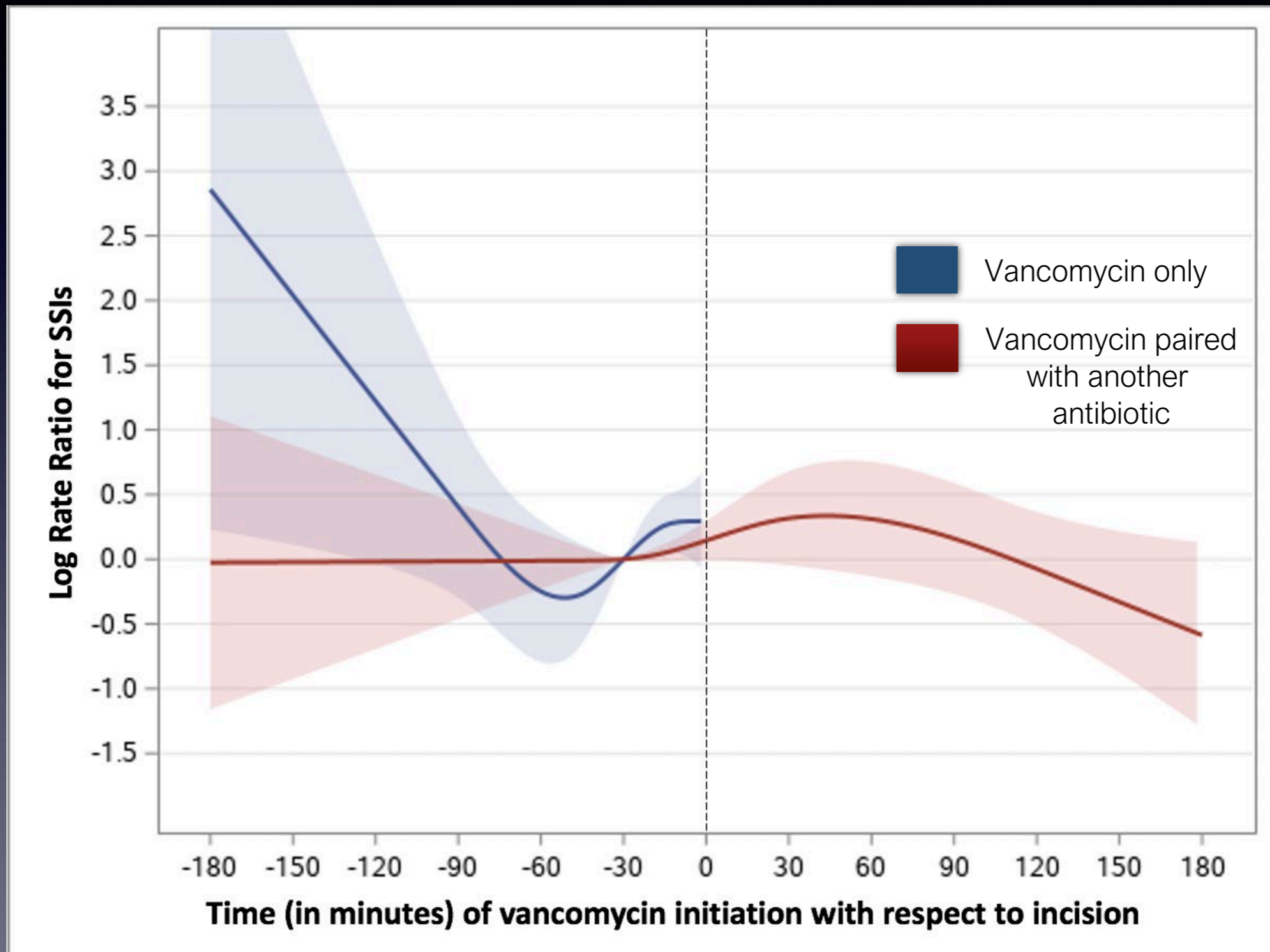
Multivariable analysis evaluating the SSI association with demographic and perioperative factors and non-adherent Vancomycin usage with respect to choice, dose and timing.

Variable	Relative Risk (95% CI)	p-Value ²
Choice non-adherence	1.64 (1.17, 2.31)	0.004
Dose non-adherence	0.89 (0.22, 3.59)	0.863
Timing non-adherence	1.56 (1.01, 2.40)	0.043
Age ³	0.76 (0.59, 0.98)	0.032
Sex, Male vs Female	0.93 (0.74, 1.18)	0.570
BMI		
Obese (>29.9)	1.17 (0.87, 1.56)	0.300
Overweight (25.0 -29.9)	1.02 (0.74, 1.41)	0.894
Normal (18.5- 24.9)	Ref	
Hispanic vs. Non-Hispanic	1.65 (0.40, 6.69)	0.487
Race		
Black	0.90 (0.63, 1.29)	0.561
Others	1.33 (0.72, 2.48)	0.366
Unknown	1.03 (0.63, 1.69)	0.904
White	Ref	
Surgical Specialty		
Gynecology	0.98 (0.36, 2.71)	0.971
Orthopedics	0.58 (0.39, 0.86)	0.007
Urology	0.71 (0.39, 1.31)	0.271
Others	0.40 (0.26, 0.62)	<.001
General Surgery	Ref	
ASA class		
4-5	1.51 (0.95, 2.39)	0.084
3	1.33 (0.97, 1.83)	0.072
1-2		
Van Walraven Comorbidity Index	1.02 (1.00, 1.03)	0.008
Smoking Status (ref. No)	1.08 (0.51, 2.29)	0.840
Diabetes	1.19 (0.89, 1.59)	0.250
Cerebrovascular Disease	0.67 (0.38, 1.17)	0.160
Institution, Academic vs. Community	1.92 (0.72, 5.11)	0.193
Year of Surgery		
2020-2022	1.27 (0.84, 1.93)	0.252
2017- 2019	0.96 (0.65, 1.40)	0.820
2014-2017	Ref	
Emergency case	1.09 (0.66, 1.80)	0.730
Off-hours Cases (Starting between 5PM and 6:30AM)	1.19 (0.69, 2.05)	0.530
Anesthetic Duration ⁴	1.01 (1.00, 1.02)	0.130
Hyperglycemia ⁵	1.22 (0.89, 1.67)	0.210
Blood products given	1.65 (1.16, 2.36)	0.005

1. RR (95% CI) rounded to two decimal point; 2. p-values rounded to 3 decimal points; 3. Unit = 10 years; 4. Unit= 10 minutes; 5. Hyperglycemia: Intraoperative blood glucose ≥ 180 mg/dl; ref = reference

Non adherent **choice** and **timing** were associated with a significantly higher relative risk of SSIs.

Association of Vancomycin timing and Surgical Site Infections.



Limitations:

Observational study design

MRSA status not known

Nutritional status not known

No data on local decontamination practices

Thank you