

Consideration of Minimum Inhibitory Concentration to Reduce Surgical Site Infections

Bonita Conner, DNP, RN, CPHQ, CPAN, CAPA, NE-BC
Amy Holloway, MBA, BSN, RN, CNOR, NE-BC
Christina Anderson, BSN, RN
Erin Howard, BSN, RN, CIC

Introduction

Atlantic General Hospital’s mission is to achieve high reliability and organizational excellence through zero harm (Atlantic General Hospital, 2024). This is demonstrated through continuous quality improvement utilizing rapid cycle change. This opportunity lies in the alignment of preoperative antibiotic administration timing to achieve minimum tissue perfusion required to prevent postoperative bacterial growth before the surgical incision (Baseel et al., 2022).

Problem Description

- Organizational increase in the rate of surgical site infections (SSIs) over the previous fiscal year was noted by both the infection prevention team and surgical services leadership.
- SSIs were predominantly affecting patients that had total joint replacement surgery performed.
- Secondary postoperative infections were leading to increased ED returns and readmissions for joint replacement patients.
- Patients with postoperative infections reported dissatisfaction with quality of life and inability to return to active lifestyle.
- Prophylactic antibiotic process inconsistent and not nurse driven.
- Minimum inhibitory concentration when administering prophylactic antibiotics in the preoperative setting was not a consideration by Perianesthesia nursing team.

Literature Review

Surgical Site Infection Prevention

- Multimodal means of prophylaxis crucial to SSI prevention.
- Risk factors for negative outcomes including SSI should be considered preoperatively.
- ERAS protocols should include time, duration, and dosage of antibiotics

Minimum inhibitory concentration (MIC)

- Crucial to consider the lowest concentration of a prophylactic antibiotic needed to prevent surgical site infection.
- Consideration of MIC time most effective measure to determine the effectiveness of prophylactic antibiotics.
- MIC times varies between antibiotics.
- Ancef MIC time < 60 minutes prior to incision time with > 15 minutes from end of administration time to incision time.

Specific Aims

- Reduce rate of SSIs.
- Standardize administration of prophylactic antibiotics in the preoperative setting.
- Prevent secondary negative patient outcomes – ED visits/readmissions.
- Ensure recommended minimum inhibitory concentration time is met when prophylactic IV antibiotics are utilized.

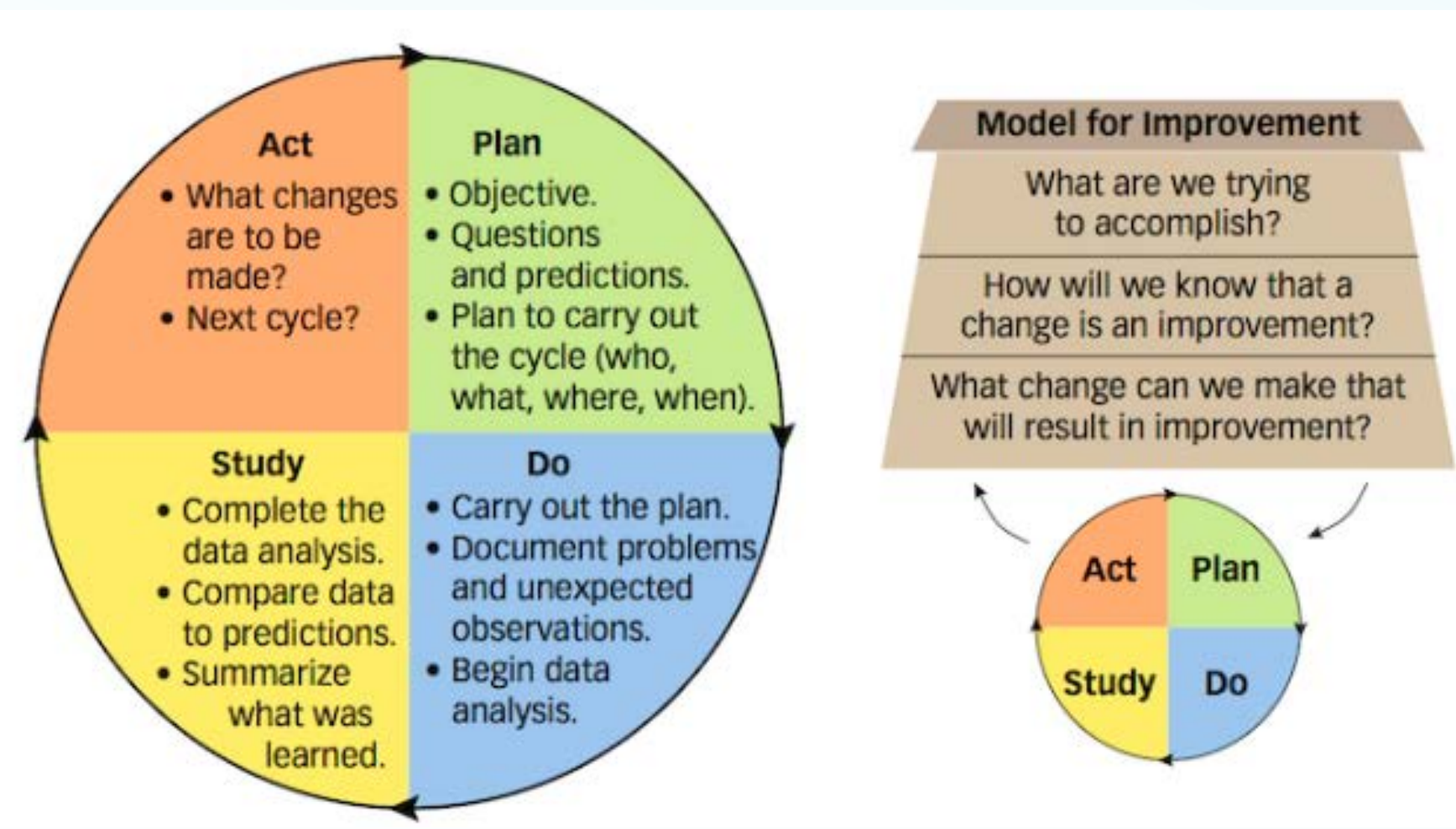
PICOT

In surgical patients, how does consideration of MIC timing in prophylactic antibiotic administration compared to inconsistent administration timing affect SSI rates over one fiscal year?

Theoretical Framework

Advancing Research and Clinical Practice through Close Collaboration Model (ARCC)

- Assesses organizational culture for EBP readiness
- Develops and utilizes EBP mentors
- Increases EBP implementation in healthcare organizations



Interventions

- Development of an Infection Prevention interdisciplinary subcommittee to review SSI cases, prophylactic antibiotic usage and administration, and Enhanced Recovery After Surgery (ERAS) protocols.
- Conducted antibiotic pilot study of most utilized preoperative prophylactic IV antibiotic – Cefazolin (Ancef)
- Reviewed data related to the administration and documentation of Cefazolin timing
- Collaborated with Clinical Pharmacist to gain an understanding of the minimum inhibitory concentration time – end of administration to incision time
- Responsibility and IV prophylactic antibiotic administration transferred from anesthesia providers to Perianesthesia nursing team.
- Gemba walked preoperative patient care processes with nursing, infection prevention, and pharmacy team
- Revised process of preoperative antibiotic administration from IVPB to IVP
- Responsibility and IV prophylactic antibiotic administration altered again to ensure MIC
- Rapid-cycle changes through PDSA continued with data review of administration and incision timing to ensure continued MIC compliance

Results

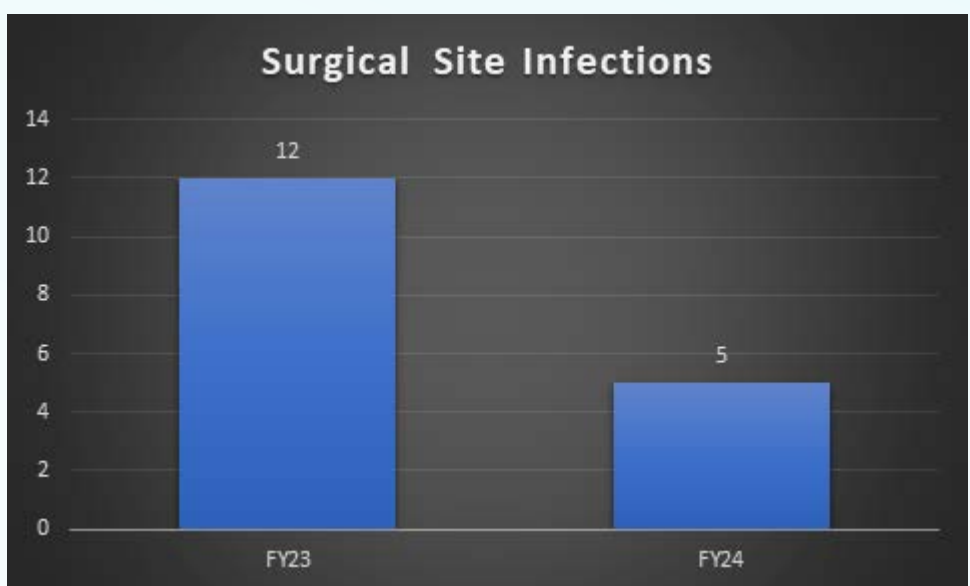
In FY24, a 64% decrease in SSIs was noticed from FY23. Antibiotic costs were reduced by \$4.37 per patient dose. The MIC compliance increased by 41% in CY24



Antibiotic administration compliance – January 2024 – **47%**
December 2024 – **86%**

FY23 – **12** total surgical site infection

FY24 – **5** total SSIs



Sustainability

- Ongoing engagement by surgical site subcommittee members
- 100% Cefazolin utilization for preoperative prophylaxis chart audits
- Expansion of project to include additional prophylactic antibiotics.
- Compliance reporting to OR Executive Committee, Department of Surgery, Anesthesia Committee, and the Infection Prevention Committee
- Continued collaboration with Clinical Pharmacist

Implications for Nursing Practice

- Collaboration with multidisciplinary team
- Partnership with PharmD to gain understanding of MIC times
- Developing workflows based on pharmacodynamics
- Understanding MIC times dependent upon antibiotic choice
- Inclusion of multiple factors in SSI prophylaxis- antibiotic timing and cut time
- Consideration of surgery length time when considering the need for redosing
- Awareness of patient flow and preparation of surgery in antibiotic dose timing
- SSI reduction is dependent upon multiple preventative measures

Conclusion

The improvement in patient outcomes created through this PI project was a direct result of the interdisciplinary collaboration and implementation of evidence-based practices related to prophylactic antibiotic timing. Consideration of MIC, as opposed to attention only to nurse workflow and patient throughput, is accredited with the project’s success.

References

- Baseel, D., Kim, J., Mohammed, S., Lowe, A., & Siddiqi, J. (2022). The ideal time to administer pre-operative antibiotics: Current and future practices. *Cureus*, 14(5). <https://doi.org/10.7759/cureus.24979>
- Costa, A. C. D., Santa-Cruz, F., & Ferraz, Á. A. B. (2021). What’s new in infection on surgical site and antibiotic prophylaxis in surgery? *Brazilian archives of digestive surgery*, 33(4).
- Kowalska-Krochmal, B., & Dudek-Wicher, R. (2021). The minimum inhibitory concentration of antibiotics: Methods, interpretation, clinical relevance. *Pathogens (Basel, Switzerland)*, 10(2), 165. <https://doi.org/10.3390/pathogens10020165>.