Executive Summary: Timing of Pre-operative Antibiotics in Cardiac Surgery Patients

Alexander Lee, PA-C, 1/23/16

A full report is attached, which describes project activities step-by-step and results in more detail.

Introduction. Cardiac surgery patients receive prophylactic antibiotics to reduce the risk of post-operative wound infections. However, these patients sometimes do not receive the recommended antibiotics within the time period that maximizes their effectiveness. Physician assistants working on the adult cardiac surgery service determined that only 49% of patients received antibiotics within the recommended time period prior to surgery. The physicians assistants worked with other personnel on the service with a goal of increasing the administration of antibiotics within the recommended time frame to > 90% of patients.

Methods. This project has performed two linked PDCA cycles of data-guided quality improvement.

Design. A repeated pre/post-intervention design had baseline data for 5/1-31/15, data review and intervention initiation during 6/1-30/15, post-intervention data for 7/1-31/15, data review and adjustments during 8/1-9/30/15, post-adjustment data for, 10/1-31/15, and data review 11/1-12/2/15.

Population. All adult patients who have cardiac surgery at the CVC, e.g., heart surgery involving sternotomy or thoracotomy, endovascular procedures such as Transcatheter Aortic Valve Replacement.

Measures. Appropriate timing of antibiotic administration was measured for four sets of drugs, relative to time of incision. The measures for cephalosporin & penicillins and for gentamicin were pre-procedure administration in minutes: early > 70, a little early 61-70, appropriate 30-60, a little late 20-29, late < 20. The measures for vancomycin and for levofloxacin were: early > 130, a little early 121-130, appropriate 60-120, a little late 50-59, late < 50.

Data collection. The department's data analyst collected data from patient's records in Centricity.

Root causes and related interventions. The physician assistants initiated discussions of underlying causes and possible interventions, expanding discussions to include the anesthesia team and operating room nurses. Across the two cycles the primary root causes and their related interventions were:

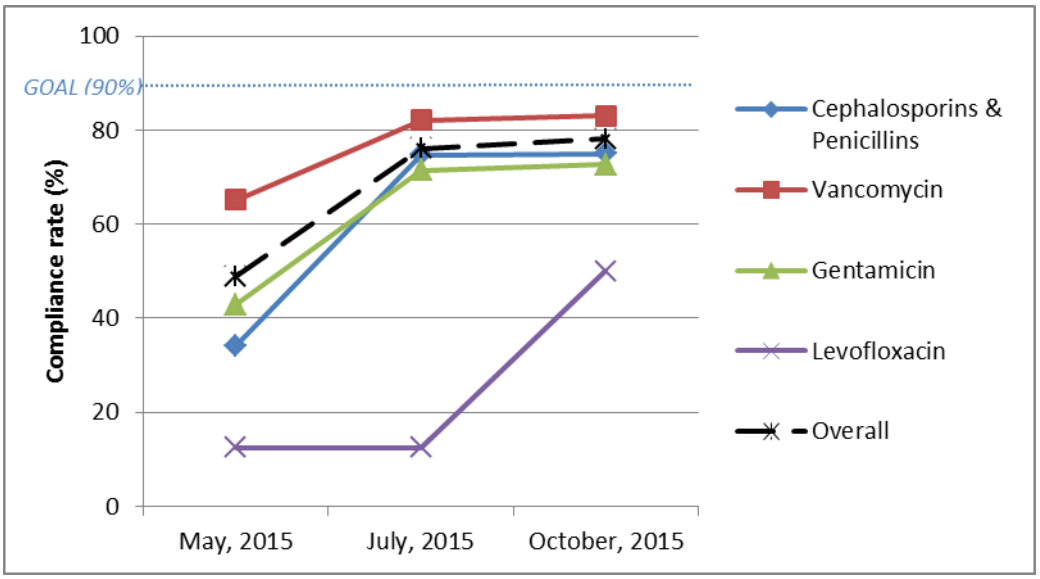
- Individual staff members misinformed about antibiotic timing: education about guidelines and underlying evidence; ongoing feedback about actual performance.
- Individual staff variation on cue to administer: standard points for administration identified in work flow.
- Inappropriate initial orders: "pre-induction verification" expanded to check and correct antibiotic order.
- Information about surgery start time uncertain or incorrect: reminders to communicate information.
- Staff unfamiliar with levofloxacin timing (infrequently administered): special reminder for levofloxacin.
- Skin incision made assuming antibiotic appropriately administered: added pre-incision check.

Results. Appropriate timing of antibiotics increased substantially from 49% at baseline to 76% post-intervention ($p < .001$) and then only marginally to 78% post-adjustment (p = NS). See the Figure (next page) for a summary of results by drug and overall across drugs. Other noteworthy results include:

- Late administration is the major problem: at post-adjustment, 29% patients (11% a little late, 8% late).
- Appropriate timing varies by drug, but the difference narrowed. Appropriateness at baseline ranged from 13% to 65% (55 %age points) and at post-adjustment ranged from 50% to 83% (33 %age points).

Future plans. Performance is still 13 percentage points below our goal of > 90% of patients receiving antibiotics within the recommended time period. We will perform additional improvement cycles aimed at achieving this goal. In particular, systemic causes for late administration in current cases need to be understood, including a pattern for this to occur later in the day. For example, if a group of patients is identified for whom lead-time within the OR will be insufficient for appropriate administration of prophylactic antibiotics, a solution could be shifting standardized start times to earlier stages of pre-operative preparation.

Figure. Percent of Cardiac Surgery Patients with the Administration of Prophylactic Antibiotics Appropriately Timed



Baseline = May, 2015; Post-Intervention = July, 2015; Post-Adjustment = October 2015.

Report on a QI Project Eligible for Part IV MOC

Timing of Pre-operative Antibiotics in Cardiac Surgery Patient

Instructions

Determine eligibility. Before starting to complete this report, go to the UMHS MOC website [ocpd.med.umich.edu], click on "Part IV Credit Designation," and review sections 1 and 2. Complete and submit a "QI Project Preliminary Worksheet for Part IV Eligibility." Staff from the UMHS Part IV MOC Program will review the worksheet with you to explain any adjustments needed to be eligible. (The approved Worksheet provides an outline to complete this report.)

Completing the report. The report documents completion of each phase of the QI project. Final confirmation of Part IV MOC for a project occurs when the full report is submitted and approved.

An option for preliminary review (recommended) is to complete a description of activities through the intervention phase and submit the partially completed report. (Complete at least items 1-16 and 27a-b.) Staff from the UMHS Part IV MOC Program will provide a preliminary review, checking that the information is sufficiently clear, but not overly detailed. This simplifies completion and review of descriptions of remaining activities.

Questions are in bold font and answers should be in regular font (generally immediately below the questions). To check boxes electronically, either put an "X" in front of a box or copy and paste "☒" over the blank box.

For further information and to submit completed applications, contact either:
Grant Greenberg, MD, UMHS Part IV Program Lead, 763-232-6222, ggreenbe@med.umich.edu
R. Van Harrison, PhD, UMHS Part IV Program Co-Lead, 734-763-1425, rvh@umich.edu
Ellen Patrick, UMHS Part IV Program Administrator, 734-936-9771, partivmoc@umich.edu

Report Outline

Section		Items
A.	**Introduction**	1-6. Current date, title, time frame, project leader, specialties/subspecialties involved, funding
B.	**Plan**	7-10. General goal, patient population, IOM quality dimensions addressed, experimental design 11-12. Baseline measures of performance, specific performance objectives 13. Data review and identifying underlying (root) causes
C.	**Do**	14-16. Intervention(s), who is involved, initiated when
D.	**Check**	17-18. Post-intervention performance measurement, data collection, performance level
E.	**Adjust – Replan**	19. Review, continuing/new underlying causes,
F.	**Redo**	20-21. Second intervention
G.	**Recheck**	22-23. Post-adjustment performance measurement, data collection, performance level
H.	**Readjust plan**	24. Review, continuing/new underlying causes to address
I.	**Future plans**	25-28. Subsequent PDCA cycles, standardize processes, "spread" to other areas
J.	**Physician involvement**	29-31. Physician's role, requirements, reports, reflections, participation, number
K.	**Sharing results**	32. Plans for report, presentation, publication
L.	**Project Organization**	33. Part of larger initiative, organizational structure, resources, oversight, Part IV opportunity

QI Project Report for Part IV MOC Eligibility

A. Introduction

1. Date *(this version of the report):*
01/11/2016

2. Title of QI project:
Timing of Pre-operative Antibiotics in Cardiac Surgery Patients

3. Time frame
a. Date physicians begin participating (may be in design phase): 05/01/2015
b. End date: 12/02/15

4. Key individuals

a. QI project leader *[also responsible for attesting to the participation of physicians in the project]*
Name: Alexander Lee, PA-C
Title: Physician Assistant
Organizational unit: Adult Cardiac Surgery
Phone number: 269-317-0559
Email address: alextlee@med.umich.edu
Mailing address: Frankel Cardiovascular Center,1500 E. Medical Center Dr. Room 5348.

a. Clinical leader to whom the project leader reports regarding the project *[responsible for overseeing/"sponsoring" the project within the specific clinical setting]*
Name: Richard Prager, MD
Title: Head, Department of Adult Cardiac Surgery
Organizational unit: Adult Cardiac Surgery
Phone number: 888-287-1082
Email address: rprager@umich.edu
Mailing address: Frankel Cardiovascular Center, 1500 E. Medical Center Dr. Floor 3

5. Approximately how many providers were involved in this project categorized by specialty and/or subspecialty?
Cardiac surgery operating room physician assistants (7): Thuy Le, Jeff Schneider, Eric Smith, Joe Allgeyer, Robert Cutsinger, Tim McElmurry, Alexander Lee.

6. Will the funding and resources for the project come only from internal UMHS sources?
☒ Yes, only internal UMHS sources
☐ No, funding and/or resources will come in part from sources outside UMHS,
which are: _____

The Multi-Specialty Part IV MOC Program requires that projects engage in change efforts over time, including at least three cycles of data collection with feedback to physicians and review of project results. Some projects may have only three cycles while others, particularly those involving rapid cycle improvement, may have several more cycles. The items below are intended to provide some flexibility in describing project methods. If the items do not allow you to reasonably describe the methods of your specific project, please contact the UMHS Part IV MOC Program office.

B. Plan

7. General goal

a. Problem/need. What is the "gap" in quality that resulted in the development of this project? Why is this project being undertaken?

Cardiac surgical patients sometimes do not receive the recommended regimen of prophylactic antibiotics within the time period that maximizes their effectiveness in reducing the risk of post-operative wound infections. At the University of Michigan Health System Cardiovascular Center, guidelines for the optimal timing to administering antibiotics are established by the Infection Control/Antibiotic committee, based on recommendations from the Society of Thoracic Surgeons (STS).

b. Physician Assistant's role. What is the physician assistant's role related to this problem?

Among other responsibilities in the immediate pre-operative period, cardiac surgery physician assistants are involved with antibiotic selection and verification as well as antibiotic start times based on anticipated time of incision.

c. Project goal. What general outcome regarding the problem should result from this project?

(Specific aims/targets are addressed in #12b.)

The goal of this project is to improve the frequency of appropriately timed antibiotic administration, thereby reducing the risk of post-operative wound infections.

8. Patient population. What patient population does this project address?

The project includes adult cardiac surgical patients who have procedures at the Cardiovascular Center. These cases include traditional heart surgery such as through a sternotomy or thoracotomy incision as well as endovascular procedures such as Transcatheter Aortic Valve Replacement or Thoracic Endovascular Aortic Repair.

9. Which Institute of Medicine Quality Dimensions are addressed? *[Check all that apply.]*

☒ Effectiveness	☐ Equity	☒ Safety
☐ Efficiency	☒ Patient-Centeredness	☒ Timeliness

10. What is the experimental design for the project?

☒ Pre-post comparisons (baseline period plus two or more follow-up measurement periods)
☐ Pre-post comparisons with control group
☐ Other: _____

11. Baseline measures of performance:

a. What measures of quality are used? If rate or %, what are the denominator and numerator?

The appropriate timing of antibiotic administration will be measured separately for four types of antibiotics and combined across all four types. For each measure, each case will be categorized into one of five aspects of performance: late, a little late, appropriate, a little early, and early.

Cephalosporin and penicillins administration timing:

- Denominator for all five categories: number of patients receiving a pre-procedure prophylactic cephalosporin or penicillin.
- Numerators, antibiotic administered:
  - Early: >70 minutes pre-procedure
  - A little early: 61-70 minutes pre-procedure
  - Appropriately: 30-60 minutes pre-procedure
  - A little late: 20-29 minutes pre-procedure
  - Late: < 20 minutes pre-procedure

Gentamicin administration timing:

- Denominator for all five categories: number of patients receiving a pre-procedure prophylactic gentamicin.
- Numerators, antibiotic administered:
  - Early: >70 minutes pre-procedure
  - A little early: 61-70 minutes pre-procedure
  - Appropriately: 30-60 minutes pre-procedure
  - A little late: 20-29 minutes pre-procedure
  - Late: < 20 minutes pre-procedure

Vancomycin administration timing:

- Denominator for all five categories: number of patients receiving a pre-procedure prophylactic vancomycin.
- Numerators, antibiotic administered:
  - Early: > 130 minutes pre-procedure
  - A little early: 121-130 minutes pre-procedure
  - Appropriately: 60-120 minutes pre-procedure
  - A little late: 50-59 minutes pre-procedure
  - Late: < 50 minutes pre-procedure

Levofloxacin administration timing:

- Denominator for all five categories: number of patients receiving a pre-procedure prophylactic levofloxacin.
- Numerators, antibiotic administered:
  - Early: > 130 minutes pre-procedure
  - A little early: 121-130 minutes pre-procedure
  - Appropriately: 60-120 minutes pre-procedure
  - A little late: 50-59 minutes pre-procedure
  - Late: < 50 minutes pre-procedure

Administration timing across the four types of antibiotics:

- Denominator for all five categories: number of patients receiving one of the four types of antibiotics prophylactically pre-procedure.
- Numerators, antibiotic administered (as classified above for the type of antibiotic):
  - Early
  - A little early
  - Appropriately
  - A little late
  - Late

b. Are the measures nationally endorsed? If not, why were they chosen?
No. Although guidelines for pre-operative timing of antibiotic administration are commonly based on STS recommendations, guideline details vary by institution.

c. What is the source of data for the measure (e.g., medical records, billings, patient surveys)?
Electronic health record: Centricity.

d. What methods were used to collect the data (e.g., abstraction, data analyst)?
Our department's Database Analyst pulled raw data from Centricity in Excel form.

e. For what time period was the sample collected for baseline data?
May 1 – May 31, 2015.

12. Specific performance objectives

a. What was the overall performance level(s) at baseline? *(E.g., for each measure: number of observations or denominator, numerator, percent. Can display in a data table, bar graph, run chart, or other method. Can show here or refer to attachment with data.)*

The percentage of doses that were administered within the appropriate time frame:

- Cephalosporins and penicillins compliance rate: 34%
- Gentamicin compliance rate: 43%
- Vancomycin compliance rate: 65%
- Levofloxacin compliance rate: 13%

- Overall compliance rate: 49%

These values are shown on the left side of the run chart (Figure) on the next-to-last page of the report.

For values of non-compliant doses (Early, A little early, A little late, and Late), see the baseline data in the Table on the last page of the report.

b. Specific aim: What was the target for performance on the measure(s) and the timeframe for achieving the target?
>90% compliance by October, 2015

c. How were the performance targets determined, e.g., regional or national benchmarks?
Discussion among our group of physician assistants as well as the Cardiac Workgroup resulted in this target. Of course we strive for 100% compliance, but it must be recognized that a portion of cardiac surgeries are emergent and may not afford the luxury of time needed for compliance.

13. Data review and identifying underlying (root) causes.

a. Who was involved in reviewing the baseline data, identifying underlying (root) causes of the problem(s), and considering possible interventions ("countermeasures") to address the causes? Briefly describe:

- **Who was involved?**

Cardiac surgery physician assistants.

- **How?** *(e.g., in a meeting of clinic staff)*

The project was discussed at an office meeting, and further conversation was held via group email.

- **When?**

June, 2015.

b. What were the primary underlying/root causes for the problem(s) that the project can address?
(Causes may be aspects of people, processes, information infrastructure, equipment, environment, etc. List each primary cause separately.)

A. Individual's misinformation regarding the appropriate timing of antibiotics. Individuals may not have been aware of the appropriate timing for a specific type of antibiotic or they may have incorrectly presumed that timing for one type of antibiotic applied to another.

B. Inappropriate initial orders. Inappropriate orders resulted in last minute changes to the type of antibiotic ordered. Patients generally arrived to the operating room with antibiotics which had been selected by providers tasked with pre-operative care. Occasionally, inappropriate antibiotics were ordered, which required anesthesia to write orders for the appropriate ones, and obtain them from the pharmacy. This process was cumbersome and often resulted in a delay of starting the doses.

C. Uncertainty or incorrect information about surgery start time. Communications regarding the specifics of timing events in the OR were uncertain or incorrect among the anesthesia team (which administers antibiotics) and surgeons, physician assistants, and operating room (OR) nurses (who position and prep the patient as well as make the incision) regarding the specifics

of timing events in the OR. As an example, the PA may be aware of the fact that the surgeon plans to scrub early to get a case started sooner. This would be valuable information for anesthesia, who may decide to start the antibiotic sooner.

C. Do

14. Intervention(s). Describe the interventions implemented as part of the project.

Individual's misinformation addressed by:

- Review of existing guidelines. The "UMHS SURGICAL ANTIMICROBIAL PROPHYLAXIS GUIDELINES", Revision 9/23/14, was disseminated to the physician assistants and anesthesia team with key take-home points emphasizing timing.
- Ongoing feedback on performance. A program was designed to interface with Centricity data and allow PAs to log comments alongside each case. The program gives prompt feedback as to whether antibiotics are appropriately timed and allows PAs to quickly identify inappropriately timed doses.

Inappropriate orders addressed by:

- Promptly identifying inappropriately ordered antibiotics and getting the appropriate ones from pharmacy. This step was added to the "pre-induction verification", and PAs were asked to facilitate this process.

Uncertainty or incorrect information about surgery start time addressed by:

- Reminders for better communication. To help accommodate case-to-case variability, anesthesia and surgical staff were reminded to better communicate information regarding timing of incision.

15. Who was involved in carrying out the intervention(s) and what were their roles?

The project lead was responsible for:

- Disseminating the guidelines,
- Designing the program with the help of the Cardiac Surgery Department's Database Analyst, and
- Reviewing data and presenting it to the PAs and the Cardiac workgroup

The physician assistants were responsible for:

- Learning the guidelines and implementing them to the best of their abilities,
- Logging into the database after each case to input data relevant to antibiotic timing,
- Verifying correct antibiotics were available in a timely fashion (before patient induction),
- Communicating case-specific information regarding the speed of pre-operative tasks - with anesthesia

The anesthesia team was responsible for learning the guidelines

Operating room nurses were responsible for initiating conversation about which antibiotics were ordered during the pre-induction verification.

The clinical leader ran a meeting in which the data were presented and facilitated communication between the individuals involved with this project and those in administration.

16. When was the intervention initiated? (For multiple interventions, initiation date for each.)

- Interventions began July 1, 2015.

D. Check

17. Post-intervention performance measurement. Did this data collection follow the same procedures as the initial collection of data described in #11: population, measure(s), and data source(s)?

☒ Yes ☐ No – If no, describe how this data collection

18. Performance following the intervention.

a. The collection of the sample of performance data following the intervention occurred for the time period:
July 1 – July 31, 2015.

b. What was post-intervention performance level? *(E.g., for each measure: number of observations or denominator, numerator, percent. Can display in a data table, bar graph, run chart, or other method. Can show here or refer to attachment with data.)*

The percentage of doses that were administered within the appropriate time:

- Cephalosporins and penicillins compliance rate: 75%
- Gentamicin compliance rate: 71%
- Vancomycin compliance rate: 82%
- Levofloxacin compliance rate: 13%

- Overall compliance rate: 76%.

These values are shown in the middle of the run chart (Figure) on the next-to-last page of the report.

For values for non-compliant doses (ex: Early, A little early, A little late, and Late), see the post-intervention data in the Table in the last page of the report.

c. Did the intervention produce the expected improvement toward meeting the project's specific aim (item 12.b)?

- Yes, the overall compliance rate improved from 49% in May, 2015 to 76% in July, 2015. This was more than half way to the goal of 90%.
- The compliance rate for three of the categories of antibiotics improved meaningfully following the interventions. Levofloxacin improved only slightly.

E. Adjust – Replan

19. Review of post-intervention data and identifying continuing/new underlying causes.

a. Who was involved in reviewing the post-intervention data, identifying underlying (root) causes of the continuing/new problem(s), and considering possible adjustments to interventions ("countermeasures") to address the causes? Briefly describe:

- **Who was involved?**

Cardiac surgery physician assistants.

- **How?** *(e.g., in a meeting of clinic staff)*

The project was discussed at an office meeting, and further conversation was held via group email.

- **When?**

August, 2015

b. What were the primary underlying/root causes for the continuing/new problem(s) that the project can address? *(Causes may be aspects of people, processes, information infrastructure, equipment, environment, etc. List each primary cause separately.)*

A. Relative unfamiliarity with levofloxacin. This antibiotic stood out as an outlier both of non-compliance as well as relatively infrequent usage.

B. Uncertainty or incorrect information about surgery start time. As before, this continued to be a persistent issue.

C. Assuming that antibiotic timing was appropriate when making incision. Once a patient was prepped and draped, a skin incision would be made assuming that the antibiotics had been circulating for the recommended amount of time.

F. Redo

20. Second intervention. What additional interventions/changes were implemented?

Relative unfamiliarity with levofloxacin was addressed by:

- Reminders for levofloxacin guidelines. A reminder was sent to all PAs that levofloxacin should be timed as vancomycin – that is, started upon patient arrival to the OR.

Uncertainty or incorrect information about surgery start time was addressed by:

- Standardization of administration. Antibiotics that must start 60-120 minutes pre-incision (vancomycin, levofloxacin) were started upon patient arrival to the OR. Antibiotics that must start 30-60 minutes pre-incision (cephalosporins, penicillins, and gentamicin) were started once the PAs began tucking the patients' arms and positioning them.

Assuming that antibiotic timing was appropriate when making incision was addressed by:

- A final check of timing. Before a skin incision is made, PAs pause to ask the anesthesia team what time antibiotics were given. They then must assess whether to make an incision or wait until the antibiotics are in compliance.

21. The second intervention was initiated when? (For multiple interventions, initiation date for each.)
September, 2015

G. Recheck

22. Post-second intervention performance measurement. Did this data collection follow the same procedures as the initial collection of data described in #11: population, measure(s), and data source(s)?

☒ Yes ☐ No – If no, describe how this data collection

23. Performance following the second intervention.

a. The collection of the sample of performance data following the intervention(s) occurred for the time period:
October 1 – October 31, 2015

b. What was the performance level? *(E.g., for each measure: number of observations or denominator, numerator, percent. Can display in a data table, bar graph, run chart, or other method. Can show here or refer to attachment with data.)*

The percentage of doses that were administered within the appropriate time:

- Cephalosporins and penicillins compliance rate: 75%
- Gentamicin compliance rate: 73%

- Vancomycin compliance rate: 83%
- Levofloxacin compliance rate: 50%

- Overall compliance rate: 78%

These values are shown on the right side of the run chart (Figure) on the next-to-last page of the report.

For values for non-compliant doses (ex: Early, A little early, A little late, and Late), see the post-intervention data in the Table in the last page of the report.

c. Did the second intervention produce the expected improvement toward meeting the project's specific aim (item 12.b)?

- The second round of intervention produced only a little improvement over the first round. Our overall compliance rate increased from 76% in July to 78% in October. Overall compliance is still 12 percentage points below the compliance goal (90%).
- Meaningful improvement was seen in levofloxacin compliance, which was a specific target for this round of interventions.

H. Readjust

24. Review of post-second intervention data and identifying continuing/new underlying causes.

a. Who was involved in reviewing the data, identifying underlying (root) causes of the continuing/new problem(s), and considering additional possible adjustments to interventions ("countermeasures") to address the causes? Briefly describe:

- **Who was involved?**

Cardiac surgery physician assistants, cardiac workgroup meeting attendees, surgical site infection committee members.

- **How?** *(e.g., in a meeting of clinic staff)*
  - Conversation among physician assistants.
  - A presentation was given to the cardiac workgroup as well as surgical site infection committee regarding the status of this project.
- **When?**
  - Conversation: November, 2015
  - Cardiac workgroup meeting: November 11, 2015
  - Surgical Site Infection Committee meeting: December 02, 2015

b. What were the primary underlying/root causes for the continuing/new problem(s) that the project can address? *(Causes may be aspects of people, processes, information infrastructure, equipment, environment, etc. List each primary cause separately.)*

A. Antibiotics tend to be started too late. A sizeable portion of doses are administered "a little late". Late doses are a greater concern than early doses because IV drugs require time to reach adequate therapeutic levels. For early doses intra-operative re-dosing can occur, but no corrective option is available if doses are late. The cause for the trend in late doses being "a little late" needs to be studied to develop appropriate countermeasures.

If lack of adequate time in the OR is a cause for this trend, the standardized start times may need to be shifted to an earlier landmark during pre-operative preparation. For example, instead of starting vancomycin and levofloxacin upon entry to the OR, we may consider starting them immediately before transporting the patient from the pre-operative holding area.

B. Problem with cases starting later in the day. Cases that start later in the day are more likely to be non-compliant. The cause for this trend needs to be studied to develop appropriate countermeasures. A potential cause is that for patients later in the day, central lines and arterial lines are more likely to be in place before the patient arrives to the OR (unlikely for morning cases). This shortens the preparation time in the OR and the opportunity to administer antibiotics in the appropriate time frame.

If no additional cycles of adjustment are to be documented for the project for Part IV credit, go to item #25.
If a few additional cycles of adjustments, data collection, and review are to be documented as part of the project to be documented, document items #20 – #24 for each subsequent cycle. Copy the set of items #20 – #24 and paste them following the last item #24 and provide the information. When the project to be documented for Part IV credit has no additional adjustment cycles, go to item #25.
If several more cycles are included in the project for Part IV credit, contact the UM Part IV MOC Program to determine how the project can be documented most practically.

I. Future Plans

25. How many subsequent PDCA cycles are to occur, but will not be documented as part of the "project" for which Part IV credit is designated?
This project has been adopted by the group of physician assistants as well as the two committees listed above (Cardiac workgroup and Surgical Site Infection Committee) and will likely become an ongoing project for the department, with multiple cycles of intervention to follow.

26. How will the project sustain processes to maintain improvements?
At least for the foreseeable future, the project lead will continue to present data to the committees above. Together, with the cardiac surgery PAs, interventions will be devised and implemented until our goal of 90% compliance is met and sustained.

27. Do other parts of the organization(s) face a similar problem? If so, how will the project be conducted so that improvement processes can be communicated to others for "spread" across applicable areas?
Yes, all surgical services face the problem of surgical site infections. We intend to write up a summary of this project and our progress, which will be available for all who are interested.

28. What lessons (positive or negative) were learned through the improvement effort that can be used to prevent future failures and mishaps or reinforce a positive result??

- It has been impressive to see people from several backgrounds coming together to support this project. Anyone interested is a potential ally in a project like this.
- Some interventions are better than others. It seems that persistence will be vital in devising new interventions and garnering support for them.
- Interventions such as the standardized start times for antibiotics will likely take some trial and error to refine.

J. Participant Involvement

Note: To receive Part IV MOC a physician must both:
a. Be actively involved in the QI effort, including at a minimum:
- *Work with care team members to plan and implement interventions*
- *Interpret performance data to assess the impact of the interventions*
- *Make appropriate course corrections in the improvement project*

b. Be active in the project for the minimum duration required by the project

29. Participant's role. What were the minimum requirements for participants to be actively involved in this QI effort? *(What were participants to do to meet each of the basic requirements listed below? If this project had additional requirements for participation, also list those requirements and what physicians had to do to meet them.)*

a. Interpreting baseline data, considering underlying causes, and planning intervention. *(As appropriate, use or modify the following response.)*
Participants had to participate as described in item #13a.

b. Implementing intervention. *(As appropriate, use or modify the following response.)*
Participants had to participate as described in items #14, #15, and #16.

c. Interpreting post-intervention data, considering underlying causes, and planning changes. *(As appropriate, use or modify the following response.)*
Participants had to participate as described in item #24a.

d. Implementing further intervention/adjustments. *(As appropriate, use or modify the following response.)*
Participants had to participate as described in items #20 and #21.

e. Interpreting post-adjustment data, considering underlying causes, and planning changes. *(As appropriate, use or modify the following response.)*
Participants had to participate as described in item #24a.

30. How were reflections of individual participants about the project utilized to improve the overall project?

- The interventions listed above are a direct product of the comments left by PAs in the case log database.

31. How did the project ensure meaningful participation by participants who subsequently request credit for Part IV MOC participation?

- Monitoring input to the database, attendance of the group meetings, and email responses to reminders.

K. Sharing Results

32. Are you planning to present this QI project and its results in a:

☒ Yes ☐ No Formal report to clinical leaders?

☒ Yes ☐ No Presentation (verbal or poster) at a regional or national meeting?

☒ Yes ☐ No Manuscript for publication?

L. Project Organizational Role and Structure

33. UMHS QI/Part IV MOC oversight – this project occurs within:

☒ **University of Michigan Health System**

• Overseen by what UMHS Unit/Group?

Adult Cardiac Surgery

• Is the activity part of a larger UMHS institutional or departmental initiative?

☒ No ☐ Yes – the initiative is:

Although not initially part of an institution or department initiative, as data have been presented to the Cardiac Workgroup, the Department of Cardiac Surgery has become interested in this project. Also, the Office of Clinical Affairs has become interested and we intend to present our findings at that level.

☐ **Veterans Administration Ann Arbor Healthcare System**

- **Overseen by what AAVA Unit/Group?**

- **Is the activity part of a larger AAVA institutional or departmental initiative?**

☐ No ☐ Yes – the initiative is:

☐ **An organization affiliated with UMHS to improve clinical care**

- **The organization is:**

- **The type of affiliation with UMHS is:**

☐ **Accountable Care Organization type** *(specify which):*

☐ **BCBSM funded, UMHS lead state-wide Collaborative Quality Initiative** *(specify which):*

☐ **Other** *(specify):*

Figure. Run Chart for Rate of Appropriate Antibiotic Compliance Over Time

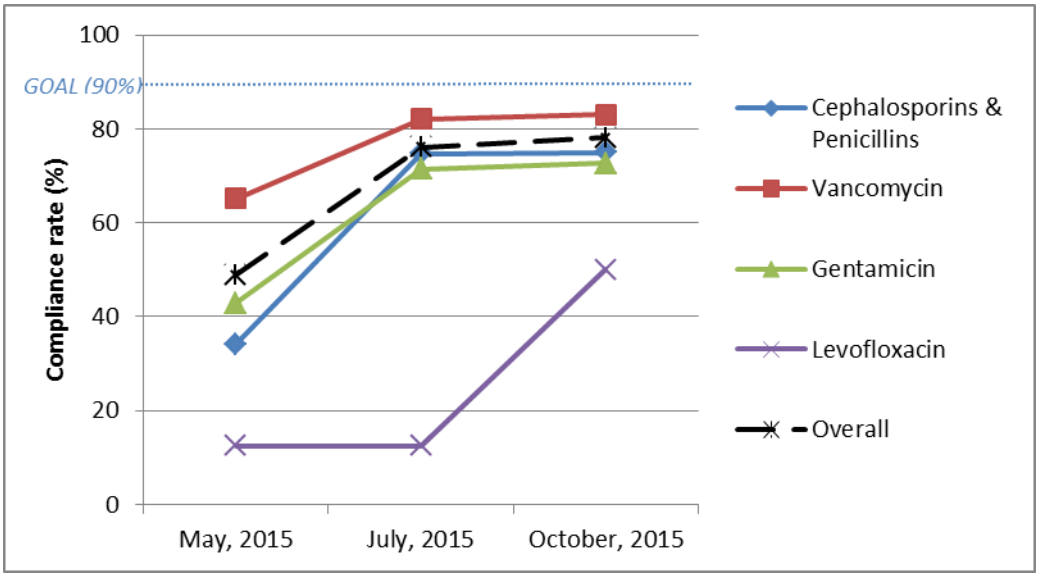


Table. Timing of Administration of Antibiotic by Type of Antibiotic and Time Period

Antibiotic Type	Baseline (5/1-31/15)	Post-Intervention (7/1-31/15)	Post-second Intervention (10/1-31/15)	Goal
Cephalosproins & Penicillins				
n doses	76	95	84	
% Early (> 70 min)	1%	0%	0%	
% A little early (61-71 min)	1%	2%	2%	
% Appropriate (30-60 min)	**34%**	**75%**	**75%**	**> 90%**
% A little late (20-29 min)	25%	17%	17%	
% Late (< 20 min)	38%	6%	6%	
Gentamicin				
n doses	14	14	11	
% Early (> 70 min)	0%	0%	9%	
% A little early (61-71 min)	0%	0%	0%	
% Appropriate (30-60 min)	**43%**	**71%**	**73%**	**> 90%**
% A little late (20-29 min)	21%	14%	9%	
% Late (< 20 min)	36%	14%	9%	
Vancomycin				
n doses	92	117	100	
% Early (> 130 min)	1%	1%	1%	
% A little early (121-130 min)	1%	0%	2%	
% Appropriate (60-120 min)	**65%**	**82%**	**83%**	**> 90%**
% A little late (50-59 min)	8%	5%	6%	
% Late (< 50 min)	25%	12%	8%	
Levofloxacin				
n doses	8	8	6	
% Early (> 130 min)	0%	0%	0%	
% A little early (121-130 min)	0%	0%	0%	
% Appropriate (60-120 min)	**13%**	**13%**	**50%**	**> 90%**
% A little late (50-59 min)	13%	25%	17%	
% Late (< 50 min)	75%	63%	33%	
Total across the four types				
n doses	190	234	201	
% Early	1%	0%	1%	
% A little early	1%	1%	2%	
% Appropriate	**49%**	**76%**	**78%**	**> 90%**
% A little late	16%	11%	11%	
% Late	33%	12%	8%	