MSH + UHN

ASP ANTIMICROBIAL STEWARDSHIP PROGRAM

Q4 AND END-OF-YEAR REPORT

FISCAL YEAR 2010 | 2011

MOUNT SINAI HOSPITAL
Joseph and Wolf Lebovic Health Complex

University Health Network
Toronto General Hospital | Toronto Western Hospital | Princess Margaret Hospital

"Getting patients the right antibiotics, when they need them"

EXECUTIVE SUMMARY

The Antimicrobial Stewardship Program (ASP) has been active at Mount Sinai Hospital (MSH) since February 2009, and at University Health Network (UHN) since December 2009. The MSH-UHN ASP uses a collaborative and evidence-based approach to improve the quality of antimicrobial use by getting patients the right antibiotics, when they need them. The ASP follows PDSA (Plan-Do-Study-Act) quality improvement methodology to pursue the best possible clinical outcomes for its patients, relying heavily on patient-centred data.

The MSH-UHN ASP uses research and education (facilitated by Pfizer Canada's financial support), alongside clinical care, to take a leadership role in increasing antimicrobial stewardship capacity and improving the quality of health care.

Highlights of this quarterly report:

- **Antimicrobial Consumption**: Antimicrobial stewardship activities at MSH and UHN have **avoided almost 9000 doses of antimicrobials** over the past fiscal year.
- **Antimicrobial Costs**: Direct pharmacy cost savings associated with antimicrobial stewardship throughout the MSH and UHN hospitals in the past fiscal year is estimated at **$298 651**.
- **Patient Safety**: All three medical-surgical ICUs where there is ASP involvement (MSH, TGH, and TWH) have seen a reduction in crude mortality since the introduction of the ASP.
- **Antimicrobial Resistance**: In the Mount Sinai Hospital ICU, antimicrobial resistance (as measured for *Pseudomonas* species) is the lowest it has been in over 6 years, with dramatic improvements in ciprofloxacin, ceftazidime and meropenem resistance. Similarly, in the TWH ICU (where the ASP has been working for just over 1 year), antimicrobial resistance is

also at historic levels, with a dramatic improvement in ciprofloxacin susceptibility. We have not seen improvements in resistance in the TGH ICU after 6 months.

- **Patient Safety**: The OPAT clinic remains active, with approximately 20-30 referrals/month, providing safe, continuous outpatient care to patients who require parenteral antimicrobial therapy.
- **Research**: The ASP received peer-reviewed funding for a prospective evaluation of the effectiveness of ASP in intensive care units (Physicians' Services Inc.) and for developing measures for evaluating interventions and outcomes of antimicrobial stewardship programs using a modified Delphi process (Canadian Institute for Health Research).
- **Education**: The ASP held its first course, "Antimicrobial Stewardship: Taking it to the Next Level" from June 2-4 in Toronto. Sixty healthcare providers from throughout Canada attended this course, the first of its kind in Canada. Attendees learned how to develop and implement stewardship programs in healthcare institutions from MSH-UHN ASP team members and other expert faculty.
- **Personnel Changes**: The ASP welcomed back **Dr. Amita Woods**, pharmacist, after an undoubtedly busy but rewarding parental leave. **Ron Fung**, who filled in for Dr. Woods, will be missed as he returns back to the inpatient wards at Princess Margaret Hospital. Additionally, the ASP is thrilled to have the opportunity to be joined by **Kevin Duplisea**, a pharmacist who will be sharing his time with both the TWH ICU and the ASP.
- **Partnerships**: The MSH ASP enters its third year partnering with Pfizer Canada. With the Antimicrobial Stewardship Course, growth in research productivity, and a website slated to go online in the fall of this 2011, Pfizer Canada's commitment to antimicrobial stewardship is truly enabling stewardship growth throughout Canada.

The following table summarizes the activities of the MSH-UHN ASP, recognizing that the ASP has had the benefit of collaborating with numerous colleagues:

MSH + UHN ASP ANTIMICROBIAL STEWARDSHIP PROGRAM

SUMMARY OF CURRENT ASP ACTIVITIES AND RESULTS

LOCATION/ STAKEHOLDERS	METHODS	START DATE	HIGHLIGHTS
MSH Intensive Care Unit	Prospective audit and feedback	February 2009	ASP has been working with the ICU team for over two years. FY 10/11 antimicrobial costs per 100 patient days has decreased 41.1% and antimicrobial usage has decreased 21.8% compared to before ASP started in the ICU. Pseudomonas susceptibility has continued to improve over the past 2 years, as mortality has dropped.
MSH Obstetrical Program	Quality initiative study	November 2009	The study of infections after c-section has been completed. The infection rate in this study was 6.6%. An audit in February 2011 indicated 25% of antibiotics were administered less than 15 min prior to surgery compared to last year during the study (46%) and 51% administered 16-30 min prior to surgery compared to last year (40%).
MSH General Surgery	Prospective audit and feedback	March 2010	Antimicrobial consumption has been reduced since the introduction of the ASP by 24.7% and antimicrobial costs per patient day by 20.9% when comparing FY 10/11 to FY 09/10.
Outpatient Parental Antimicrobial Therapy (OPAT) Program	Capture-and-follow	December 2009	The OPAT team welcomes the return of Dr. Amita Woods from her maternity leave and would like to thank Mr. Ron Fung for his excellent work over the past year. The OPAT program continues its expansion, providing outpatient care to an increasing number of patients at TGH and TWH. A recently completed survey shows a high degree of healthcare provider satisfaction.
PMH 14A & 15B/ Leukemia and Immunocompro-mised Host Service	Prospective audit and feedback	February 2010	Comparing FY 09-10 vs. FY 10-11, Antimicrobial consumption has been reduced by approximately 8%. This has been accompanied by a 7% reduction in antimicrobial costs (resulting in approximately $130K in savings).
TWH Intensive Care Unit	Prospective audit and feedback	December 2009	Comparing FY 09-10 vs. FY 10-11, Antimicrobial consumption has been reduced by approximately 10%. This has been accompanied by a less than 1% reduction in antimicrobial costs. Dr. Kevin Duplisea, a 0.25 FTE ASP pharmacist, joined the Toronto Western staff in May.

TGH Intensive Care Unit	Prospective audit and feedback	October 2010	Antimicrobial consumption has been reduced since the introduction of the ASP by approximately 25%. This has been accompanied by a 21% reduction in antimicrobial costs.
ASP Working Groups	Best practice collaboration	January 2011	The ASP has formed an inter-disciplinary working group with clinical colleagues at MSH and UHN to develop best practices regarding the diagnosing and treatment of VAP. Draft guidelines are to be discussed at the upcoming VAP Working Group meeting in June 2011. The ASP is also participating in the Effective and Efficient Utilization Committee regarding a process to treat Sepsis/Septic Shock.
Greater Toronto Area/ Toronto Central LHIN, Teaching Hospitals,	Quarterly meetings; electronic communication	January 2010	There are now 13 hospitals that are members of the Toronto Antimicrobial Stewardship Corridor (TASC), chaired by members Andrew Morris and Sandra Nelson. This group has also created a TASC Research Sub-Committee, to advance the research scope of antimicrobial stewardship within TASC.
Hospital for Sick Children, MSH, St. Michael's, Sunnybrook Health Sciences Centre, UHN	Research collaboration	September 2010	The *Staphylococcus aureus* bacteremia (SAB) research study collaborative among TASC members is underway. This study will retrospectively analyze clinical features, diagnostic methods, clinical outcomes and resource utilization among over 1000 patients diagnosed with SAB. Its data will be used to plan for clinical trials and/or quality improvement projects in the future. An ASP in the ICU project will analyze the efficacy of an ASP in improving antimicrobial use and patient care among the MSH, TGH and TWH ICUs.
Expert Delphi Consensus Panel	Research/ Education Collaboration	June 2011	The MSH-UHN ASP held a successful Expert Delphi Consensus Panel on June 1st, 2011, funded by the Canadian Institutes of Health Research (CIHR).
Toronto/ Healthcare professionals throughout Canada	Education Course on Antimicrobial Stewardship	June 2011	The 1st Toronto Course on Antimicrobial Stewardship was successfully held by the MSH-UHN ASP on June 2-4 2011. This course was an intensive 3-days of interactive education consisting of small-group case-based learning, dynamic lectures and keynote addresses. This course was accredited by University of Toronto's Continuing Education and Professional Development (CEPD). Attendees included ID physicians, pharmacists, IC practitioners and hospital directors from across Canada.

LOOKING FORWARD

CLINICAL

Moving forward into FY 2011/12 we hope to strengthen and expand our relationships with clinical services at MSH, PMH, TGH, and TWH as we plan to expand prospective audit-and-feedback to more medical and surgical services. A new focus of the MSH-UHN ASP will be to further develop and establish best practices for common clinical syndromes. The first steps in developing best practices have been working with our ICU partners to develop a protocol for diagnosing and treating ventilator-associated pneumonia, as well as working with a variety of stakeholders to optimize the investigation and management of sepsis and septic shock.

The ongoing resource challenge is a consideration in the ability to maintain and expand prospective audit-and-feedback to other services in the 4 hospitals. This includes both human resources (physician and pharmacist) and database development for readily accessible patient-specific information, which forms the basis for our audit-and-feedback interventions.

RESEARCH

Chart reviews for the *S. aureus* bacteremia project are underway and will continue over the next 3-6 months. This study promises to be the largest study of *S. aureus* bacteremia ever undertaken.

Using a stepped wedge design (whereby the same intervention is introduced sequentially at different sites), a research study will analyze the efficacy of an ASP in improving antimicrobial use and patient care among the MSH, TGH and TWH ICUs. Dr. Brian Minnema has received a resident research grant from Physicians' Services Incorporated to support this work.

In the coming months, the MSH-UHN ASP will look to hire a research coordinator to advance the research agenda.

Finally, there are new and ongoing student and resident research projects this summer, involving PMH, OPAT program, the ICU, the acute leukemia population, and renal transplant recipients.

EDUCATION

The 1st Toronto Course on Antimicrobial Stewardship was developed by the MSH-UHN ASP and was successfully held on June 2-4, 2011. Workshop case study discussions will be collated and shared with attendees. All members of the ASP are involved in other various aspects of education, and will continue to do so.

ASP continues to use Huddle for sharing of information and best practice guidelines. An ASP website is in the developmental stages, which will result in an online resource for physicians, pharmacists and other healthcare providers and administrators both nationally and internationally.

MOUNT SINAI HOSPITAL (SUPPORTED BY PFIZER CANADA INC.)

INTENSIVE CARE UNIT

The Antimicrobial Stewardship Program (ASP) began working in the MSH ICU in February 2009. In FY 10/11 Q4, the ASP further reduced rounding to 3 days a week (M/W/F).

Full results on data collected are in the Appendix, but are summarized below:

- Fiscal Year (FY) 2010/11 antimicrobial usage per quarter (using defined daily doses (DDDs) per 100 patient days) has decreased by 21.8% compared to before the ASP started in the ICU. The decrease in usage was most substantial with systemic antibacterials, where the usage/100 patient days decreased by 25.2%. This translates to approximately **1851 avoided doses over the past year** compared to baseline.

- Antimicrobial costs per 100 patient days have also continued to decrease since beginning the program and for FY 10/11 have decreased by 41.1% compared to before the ASP was introduced in the ICU. Substantial decreases were seen with both systemic antifungals and systemic antibacterials, whereby the costs per patient day decreased by 42.3% and 47.6%, respectively. This translates to **savings of $134 505** this past fiscal year compared to baseline.

- Antimicrobial costs for patients originating from PMH patients continues to be monitored, and remains high: Despite a reduction in antimicrobial costs (of approximately 25%) for these patients, the **proportion of antimicrobial costs in the MSH ICU attributable to patients originating from PMH is now 59%** of the total ICU costs.

- The number of cases of yeast isolated in blood in FY 10-11 has been 12, which is an increase over FY 09-10's number of 8. None have been resistant to fluconazole. (There has not been a case of Fluconazole resistant yeast isolated from blood since FY 07-08 (1 case of *Candida krusei*). **Use of antifungal agents other than fluconazole for empiric treatment of yeast in the MSH ICU is currently unnecessary based on this data.**

- Since the introduction of the ASP in the MSH ICU, **crude mortality has dropped from 19.9% in FY 2008/9**, to 17.5% in 2009/10 and **16.3% 2010/11**.

- *Pseudomonas aeruginosa* susceptibilities for FY 10/11 Q3-Q4 were (with FY 08/09 Q3-Q4 shown in parentheses, which is before the ASP began working in the MSH ICU):

  ceftazidime 90% (78%)
  ciprofloxacin 75% (49%)
  meropenem 89% (70%)
  piperacillin-tazobactam 96% (92%)
  tobramycin 89% (89%)

  This represents **the best antimicrobial susceptibility profile in over 6 years**.

CESAREAN SECTIONS

The ASP began working with Obstetrical Team at MSH in the fall of 2009 to change the timing of antibiotic prophylaxis for c-sections from post cord-clamping to pre-incision. Please refer to prior Quarterly Reports for more details. Results from the quality improvement study indicate that the infection rate is 6.6%. After

meeting with the stakeholders to discuss the results, an audit of timing of antibiotics was undertaken in February 2011 by Sandra Nelson. It was found that 24.5% of antibiotics were administered < 15 minutes prior to incision and 51% were given 16-30 minutes prior. The obstetrical group has a goal to further decrease infection rates to 5% in 2011. This summer, Infection Control will perform another audit of infections in this population.

GENERAL SURGERY (14TH FLOOR)

The ASP began working with the General Surgery Teams at MSH in March 2010. Sandra Nelson performs prospective audit and feedback, and meets with or phones one or more surgical residents from each surgical team 2-3 times a week.

Outcome data are available in the Appendix, but are summarized below:

- 14th floor FY 10/11 antimicrobial usage (using defined daily doses (DDDs) per 100 patient days) has dropped by 24.7% compared to FY 09/10, and is now at 47 DDD/100 patient-days. This has resulted in an estimated **2800 avoided doses of antimicrobials**.
- 14th floor FY 10/11 antimicrobial costs per patient day have decreased 20.9% compared to FY 09/10. Systemic antibacterial showed the significant decreases in costs per patient day, however, systemic antifungal costs per patient day increased slightly when compared to last year. This has resulted in an estimated **annual cost savings of $17 728**.
- The number of cases of yeast in the blood remains low at 3 episodes in FY 10/11, all of which are fluconazole susceptible *Candida albicans*. Of note, similar to the MSH ICU, not since FY 07-08 has there been fluconazole-resistant yeast grown in the blood on 14th floor (*Candida krusei*).

SURGICAL PROPHYLAXIS

The ASP at MSH has been working with Monique Pitre and Dr. Camille Lemieux at UHN to develop and harmonize surgical prophylaxis guidelines. At MSH, cefazolin for surgical prophylaxis will be changing from 1g to 2g pre-operatively. This is being done to avoid the risk of under-dosing patients (particularly in patients with a large Body Mass Index (BMI). The change is expected to occur in July 2011. Sandra Nelson will be leading the educational component required to institute the change.

OUTPATIENT PARENTERAL ANTIMICROBIAL THERAPY (OPAT) PROGRAM

The OPAT service continues to consistently accrue patients at the rate of 20-30 per month since May 2010. As of March 31, 2011, OPAT had accrued 305 patients and was actively following 30. A follow up survey of healthcare providers regarding the OPAT program have been overwhelmingly positive. OPAT makes critical contributions to continuity of patient care. A case control study showed an important trend toward improved efficiency with slightly better outcomes, but needs to be extended to demonstrate statistical significance. Review of the database shows that OPAT improves communication from patients and the home bedside nurses to physicians allowing earlier intervention in response to clinical problems. In addition the excellent safety record with regard to administration of toxic antibiotics such as Vancomycin continues. The medical diagnoses and services using OPAT are similar to the last report and are shown graphically in the Appendix.

The OPAT team welcomes the return of **Dr. Amita Woods** from her maternity leave on April 26th and would like to thank **Mr. Ron Fung** for his excellent work over the past year. Mr. Fung will return to his previous position at PMH.

Ms. Lopa Naik continues to increase the efficiencies of the OPAT MS Access database and to provide regular / "as needed" database training and support. The OPAT team has noticed a time savings with respect to improved efficiencies caused by reduced data entry. The new database has also served as a more user friendly communication tool with various family and attending physicians in terms of generating follow-up letters. Furthermore, it has enabled easier and faster data analysis for reporting, continuous improvement, and research purposes.

PATIENT CARE ACTIVITIES

CASE CONTROL STUDY OF OPAT IMPACT

A matched case-control study of OPAT patients with non-OPAT patients matched for 4 criteria. 21 OPAT patients were match and these patients had a 30 day readmission rate 50% less than the controls, ALOS of 3 days less with improved cure rate 61% vs 57%. Thus there was an important trend to improved efficiency with at least equivalent outcome. The study was underpowered and needs to be extended to demonstrate statistical significance. The study was hampered by the fact that until the advent of OPAT there was no way of identifying patients discharged from UHN on intravenous antibiotics.

PATIENT SAFETY

Intravenous Vancomycin
Between Dec 2009 and Jan 2011, 123 patients were referred to the OPAT program for treatment with intravenous Vancomycin, for a total of 2076 Vancomycin days. The median duration of therapy for each patient was 20days. In total 103 dose or medication changes were made in response to changes in renal function or Vancomycin levels. Critical results (vancomycin levels >30mg/L) were reported in 12 patients and Vancomycin was discontinued in 27 cases. Only 2 patients had to be readmitted for nephrotoxicity and no patient required dialysis. To our knowledge all patients discharged on Vancomycin or aminoglycoside therapy during this time were referred to OPAT for follow up.

IV antibiotic complications in NON-OPAT patients In the same time we are aware of 2 patients NOT followed by OPAT. One developed cloxacillin-induced interstitial nephritis requiring one week dialysis and the other developed ceftriaxone agranulocytosis requiring readmission and treatment with GCSF.

What else does OPAT contribute to patient care?

Review of OPAT shows that in addition to safe delivery of intravenous antibiotic therapy OPAT makes other important contributions to patient care including:

Improved communication with home bedside nurse.

- In general we noted poor communication from the bedside to physician and a tendency for a band-aid rather than problem-solving approach to home care nursing
- Correction of misinterpreted orders or orders that failed to be implemented.
- Resolution of PICC line problems especially blockage with incomplete administration of dose. E.g. endocarditis patient receiving less than 50% of prescribe dose due to partial PICC line blockage.
- Closer follow up of wound and other clinical parameters than provided by the usual follow up schedule. We intervened early when improvement was not occurring.
- Failure to start antibiotics on Friday afternoon when ordered for a septic patient.

Improved patient communication and follow up:

OPAT was instrumental in improving patient follow-up by resolving issues:

- Patient acceptance of treatment
- Could be monitored patient safely
- Could be found to book clinic appointment
- Identified critical events requiring ER visit or readmission
- Identifying need for and facilitating checks and insertion of central venous access devices.

A patient satisfaction survey conducted in the summer of 2010 demonstrated very high patient acceptance
A recent comment received by UHN Patient Relations stated: “during this time, as well as in a follow up appointment, my care was detailed and thorough. I wanted to make sure to thank the medical staff involved in my treatment and dealing with my case in a caring and proficient manner”

Communication with Ontario Drug Program:

Intervention with Ontario Drug Program for special access antibiotics allowing discharge from hospital or preventing admission.

Improving OPAT efficiency:

OPAT was originally assigned 0.5 FTE physician, 0.75 FTE pharmacist and the services of the project manager and database manager/analyst. It has become clear that the vast majority of the time is for clerical work:

- Filling and faxing laboratory requisitions
- Follow up with 3 different private laboratories to get timely results for drug blood levels
- Entering the results into an Access database that was developed for outpatient management
- Faxing prescriptions
- Communicating with patients and nurses at home to identify problems
- Scheduling clinic appointments

Personnel:

Currently most of this clerical work is being done by the pharmacist. We propose that a half time medical secretary could perform the clerical work more efficiently and would allow the pharmacist to focus on functions that they alone can perform. This would allow the reduction of pharmacist time to 0.5. The physician/medical secretary should also do more of the patient contact functions.

Laboratory data retrieval:

Currently this is very inefficient and time-consuming and would benefit from an electronic solution such as the EPR being implemented in the UHN Family Practice Unit.

Patient Information

Ms. Brittany Weber, a pharmacy co-op student from the University of Waterloo, supervised by **Mr. Fung**, has created an OPAT Patient Information Handout. This document has been approved by members of the UHN ASP, and has been reviewed by the Patient Education Network (PEN) at TGH. PEN will assist with the printing and translation of the handout. It is our goal that this handout will serve to enhance communication(s) with our very diverse and multilingual patient population at UHN, and with community service providers. We expect to print and disseminate this handout by the middle of July.

Ms. Pauline Feng, a current Grade 11 honours high school student will commence her summer volunteer position with the OPAT program in July.

DATABASE

Led by **Ms. Naik,** with input from **Dr. Brunton**, **Mr. Fung**, and **Mr. Thung**, a new and improved MS Access-based database has been successfully created and is currently utilized by the OPAT team.

Ms. Lopa Naik continues to increase the efficiencies of the OPAT MS Access database and to provide regular / "as needed" database training and support. She is currently investigating the possibility of changing the database platform from MS Access to Oracle® to minimize the number of connections required to directly extract the patient data and to improve its overall robustness in terms of data, outcome analysis, and performance.

USER SATISFACTION SURVEYS

UHN professional staff:

May 2011 Survey

From 40 healthcare professionals (Physicians, Nurses, Pharmacists, Fellows, Residents)

82% – Think that quality of patient care would be poorer if the OPAT service was discontinued
73% – Think the OPAT service has improved patient safety
80% – Think the OPAT service has improved patient care
83% – Stated that OPAT service improved their confidence that antibiotics will be delivered safely
43% – OPAT service helped to allow earlier discharge

Testimonials:

Unedited healthcare professionals' testimonials (showing high degree of satisfaction with the OPAT program) are shared in the **APPENDIX.**

PRINCESS MARGARET HOSPITAL

LEUKAEMIA SERVICE

The Antimicrobial Stewardship Program (ASP) re-introduced thrice-weekly (Mon, Wed, Fri) rounds with the **clinical associates** and **other key members of the Leukemia service (attending physicians, pharmacists,** and **nursing unit administrators)** to review patients not being followed by the Immunocompromised Host Infectious Diseases Consultation Service on December 6, 2010. The chief of service, **Dr. Andre Schuh**, also attends regularly.

Based on microbiological data, the empiric regimen for febrile patients with chemotherapy-induced neutropenia has been switched to piperacillin-tazobactam and gentamicin. The ASP has also worked with the Immunocompromised Host Service (**Drs. Coleman Rotstein and Shahid Husain**) to identify areas for standardization. This has included avoiding unnecessary metronidazole (if a patient is already on an antibacterial with anaerobic activity), and treating Gram-negative infections with single agents once susceptibilities are known.

In the coming months, the ASP hopes to continue improving the process of care, including standardizing current practices such as blood cultures (which have an impact on antimicrobial utilization), and use of antifungal agents.

Over the past fiscal year, there has been a **7% reduction in antimicrobial consumption** (primarily due to a 13% reduction in antibacterial use), corresponding with a 7.7% reduction in antimicrobial costs/patient day (reflecting a **savings of almost $130K**).

For the next Quarterly Report, we will present patient-related outcomes such as mortality, transfers to the ICU and length of stay.

TORONTO WESTERN HOSPITAL

MEDICAL-SURGICAL INTENSIVE CARE UNIT

The ASP group continues to round with the ICU team on a regular basis. Audit-and-feedback with the TWH ICU started December 2009 and rounding times were reduced this quarter to four days per week.) UHN recently hired Dr. Kevin Duplisea. Dr. Duplisea's appointment includes 25% of his time to be dedicated to antimicrobial stewardship activities, and will enable Dr. Dresser to focus her attention to other clinical areas.

Full results are in the Appendix, but are summarized below:

- In the past fiscal year, there has been a **10% reduction in antimicrobial consumption** from 87.6 DDD/100 patient-days to 79.2 DDD/100 patient-days, representing **approximately 800 avoided doses**.

- Antimicrobial costs were just 0.5% less than the prior fiscal year year due to a considerable increase in antifungal expenses coupled , which offset these reductions. Nevertheless, there **was $19 739 cost savings** compared to baseline.

- *Pseudomonas* susceptibility to ciprofloxacin has increased considerably since the introduction of the ASP, and is the highest it has been in over 6 years. Susceptibility to other antimicrobials remains excellent.

- ICU crude mortality is down 1.8% (from 19.9% to 18.1%) this fiscal year.

TORONTO GENERAL HOSPITAL

MEDICAL-SURGICAL INTENSIVE CARE UNIT

The ASP started collaborating with the TGH Medical-Surgical ICU in October 2010. Dr. Dresser continues to round with the ICU team on weekday mornings, starting at 9:00, with Dr. Morris attending approximately twice per week. Full results are in the Appendix, but are summarized below. (Note that we report year-over-year results for fiscal quarters 3 and 4 (i.e. October to March)):

- There has been a **25% reduction in antimicrobial consumption**, from 262 DDD/100 patient-days to 196 DDD/100 patient-days, representing **2541 doses avoided over the 6-month period**.
- There has been an **antimicrobial cost reduction of 29%**, representing a 6-month savings **of $107 856**.
- Pseudomonas susceptibility has dropped for piperacillin-tazobactam, but has otherwise remained largely unchanged.
- Crude ICU mortality is 1% lower at 15.9%.

ASP WORKING GROUPS

In addition to prospective audit and feedback, the ASP believes that reducing variation in practice when there is no clear clinical or evidence-based explanation for the variation will improve patient outcomes. Accordingly, the ASP has begun collaborations with various stakeholders to develop working groups to improve care by reducing variation. The first such working group is the Ventilator-Associated Pneumonia (VAP) Working Group, which includes Pharmacists, Physicians, and Respiratory Therapists. This group has begun working together to develop a standardized approach to the investigation and management of VAP. Working on a tight time-schedule, this group has reviewed evidence, discussed feasibility of different approaches, and has been using Huddle to do some of the collaboration on-line using wikis to supplement in-person meetings.

TORONTO ANTIMICROBIAL STEWARDSHIP CORRIDOR

The Toronto Antimicrobial Stewardship Corridor (TASC) is a collaboration between the ASP and like-minded individuals in and around the Greater Toronto Area, and had its one year anniversary in December 2010. The group currently includes antimicrobial stewardship representatives from 13 hospitals, including: Credit Vally Hospital, Mount Sinai Hospital, Hospital for Sick Children, North York General Hospital, St. John's Rehab, St. Joseph's Health Centre, St. Michael's, Sunnybrook Health Sciences Centre, The Scarborough Hospital, Toronto East General Hospital, Trillium Health Centre, William Osler Health Centre, University Health Network.

The TASC group continues to use Huddle™ to share documents/resources and collaborate online. The Huddle™ solution was purchased with a portion of the generous donation from Pfizer Canada.

TASC has been working with the Best Practice In General Surgery (BPIGS) group to develop guidelines for antimicrobial use in intra-abdominal sepsis. These collaborative guidelines will be released this summer.

ANTIMICROBIAL STEWARDSHIP PROGRAM RESEARCH

From the time the ASP was initiated, it has pursued the model that all of its activities should be based on the best available evidence, should be studies to observe real-world outcomes, and should contribute to modern medical practice with knowledge translation. Some of this research has been listed above.

ANTIMICROBIAL STEWARDSHIP IN THE ICU

The first research project will be using the data accrued from the clinical activities of the ASP. Supervised by **Dr. Morris**, Infectious Diseases and Critical Care fellow **Dr. Brian Minnema** has received a resident research grant from Physicians' Services Incorporated and will be looking at clinical, microbiological and antimicrobial utilization outcomes in a "step-wedge" trial design. Much of the data has already been collected, although the study will be looking at data from all ICUs as far back as 2007, and following it forward to 2012. The study is expected to be completed June 2012.

STAPHYLOCOCCUS AUREUS BACTERAEMIA

The second such project involves examining the management and outcomes of patients with S. *aureus* bacteraemia at several TASC member hospitals. It is an ambitious project hoping to capture approximately 1000 episodes of S. *aureus* bacteraemia at the teaching hospitals. It will look at how patients are investigated and managed (including resource utilization such as echocardiography and length of stay), and will also be examining outcomes. Because S. *aureus* bacteraemia is such an important disease, the ASP hopes to use this study to springboard clinical trials and quality improvement projects into the best management of S. *aureus* bacteraemia. The study is anticipated to take 15-18 months to complete. An infectious diseases fellow **(Dr. Dan Ricciuto)** and two medical residents **(Drs. Bryan Coburn and Adrienne Showler) have contributed significantly in the development of this project. In addition, they** will each be conducting sub-projects as their major research projects for their 2010-11 residency research blocks. **Lopa Naik** has been instrumental in the development of the electronic database to support this project.

The study protocol and data collection forms have been submitted to the respective Research Ethics Boards for approval, and Drs. Coburn (Supervisor: **Dr. Matt Muller,** St. Michael's) and Showler (Supervisor: Dr. Andrew Morris) have had their research blocks approved for this coming academic year.

DELPHI PANEL

The MSH-UHN ASP held a successful an Expert Delphi Consensus Panel on June 1st, 2011 focused on defining indicators for antimicrobial stewardship in acute care settings, funded by a Canadian Institutes of Health Research (CIHR) Meeting Grant. Stakeholders included experts from across North America, representing the Centres for Disease Control, the Infectious Diseases Society of America, the Association of Medical Microbiology and Infectious Diseases Canada, Accreditation Canada, and the BC Centres for Disease Control. We anticipate that the knowledge generated during this process will be shared with Accreditation Canada, Ontario Ministry of Health and Long-Term Care, ISMP Canada, AMMI Canada and Public Health Agency of Canada.

SEPSIS

Dr. Christine McDonald, a resident in Internal Medicine (Supervisor: Dr. Morris), will be collaborating with Drs. Stephen Lapinsky and Dave Dushenski, and MSH Quality and Safety Consultant, to study sepsis and septic shock investigation and management as a first step to quality improvement in the care of patients with these conditions.

CASE CONTROL STUDY OF OPAT IMPACT

A matched case-control study of OPAT patients with non-OPAT patients matched for 4 criteria. 21 OPAT patients were match and these patients had a 30 day readmission rate 50% less than the controls, ALOS of 3 days less with improved cure rate 61% vs 57%. Thus there was an important trend to improved efficiency with at least equivalent outcome. The study was underpowered and needs to be extended to demonstrate statistical significance. The study was hampered by the fact that until the advent of OPAT there is no was of identifying patients discharged on antibiotics from UHN.

Background: The study was performed by Ms. Anjie Yang, a UHN Pharmacy Resident supervised by **Mr. Fung** with valuable input from other members of the MSH-UHN ASP team (primarily **Drs. Brunton** and **Dresser**). This was a retrospective cohort study with matched historical controls for the OPAT group. We focused on surgical patients as these are the most prevalent users of the OPAT program. Due to the stringent matching criteria, only 21 OPAT patients were able to be matched out of 108 that were eligible for matching.

Analysis: Although this study was underpowered (the most conservative estimate would have required 66 patients per group for a total of 132 patients), and the study only had 9 months of data due to constraints in project time, the primary endpoints of cure rate, length of hospitalization and 30-day re-hospitalization are all trending in the right direction. Reducing length of hospitalization and 30-day re-hospitalization could translate into potential cost savings for the hospital without compromising patient safety. In particular, the OPAT program can help prevent re-hospitalization due to device related complications. The one patient in the control group was re-hospitalized due to a PICC line change secondary to onset of fever, which can now be managed in the OPAT clinic as a day-time appointment through radiology.

Primary Endpoint	Control group	OPAT group	p-value
Clinical status (no., %)			
Cure	12 (57.1)	13 (61.9)	>0.10
Control/improved	6 (28.6)	7 (33.3)	
Failure	3 (19.1)	1 (4.8)	
Due to drug	0 (0.0)	1 (4.8)	
Due to source control / other reasons	3 (19.1)	0 (0.0)	
Length of hospitalization (days)	13.9 (14.8)	10.7 (6.8)	0.36
Rehospitalization* (no., %)			
Unexpected	6 (28.6)	3 (14.3)	> 0.10
Due to adverse drug reactions	1	0	
Due to device-related complications	1	0	
Therapeutic failure (drug or other)	2	1	
Other (not related to infection)	1	1	
Planned	1	1	
Primary source control			

Secondary Endpoint	Control group	OPAT group	p-value
Patients with reported adverse drug reactions (no., %)	5 (23.8)	5 (23.8)	>0.10
Allergic reaction (no.)	2	1	
Hematological (no.)	0	1	
Renal/liver toxicity (no.)	1	1	
GI (no.)	0	1	
Neurological (no.)	1	0	
Abnormal drug level (no.)	0	2	

Other (no.)	1	0	
Total reported adverse drug reactions (no.)	5	6	
Patients with therapy stopped / switched due to ADR (no., %)	3 (60.0)	1 (20.0)	0.26
Device related complications (no., %)	2 (9.5)	2 (9.5)	>0.10

Summary: Out of 108 OPAT patients eligible for matching, 21 patients were able to be matched to the control group on all four criteria. For this cohort, the OPAT program was not associated with significantly improved cure rates (OPAT 61.7% vs control 57.1%, p>0.10), reduction in rehospitalisation (14.3% vs. 28.6%, p>0.10) or length of stay (10.7 vs. 13.9 days, p=0.36) compared to the control group although there was a trend towards significance.

Conclusion: For this cohort of surgery patients, the OPAT program does not seem to significantly improve outcomes although there is trending towards benefit. Since this study was underpowered, the OPAT program at UHN needs to be further evaluated in a larger trial to determine its full benefit to patients and the health care system.

ANTIMICROBIAL STEWARDSHIP PROGRAM EDUCATION

One of the ASP's mandates is to increase the antimicrobial stewardship capacity locally, provincially, and nationally. All of the clinical members of the ASP play a role in stewardship education, giving one-on-one advice to healthcare providers, having teaching sessions within the hospitals, supervising trainees, giving rounds to colleagues at other institutions, or developing educational curricula.

TORONTO COURSE ON ANTIMICROBIAL STEWARDSHIP "TAKING IT TO THE NEXT LEVEL"

The 1st Toronto Course on Antimicrobial Stewardship was successfully held by the MSH-UHN ASP on June 2-4, 2011. This course was an intense 3-days of interactive education consisting of small group case-based learning, dynamic lectures and keynote addresses. This course was accredited by University of Toronto's Continuing Education and Professional Development (CEPD). Attendees included ID physicians and pharmacists from across Canada. Speakers and Facilitators for this course came from across North America, although definitely showcased the MSH-UHN ASP.

Initial feedback has been very positive from attendees. Evaluation forms have been collected and will be analyzed for future improvements.

ACKNOWLEDGEMENTS

We would like to thank the following individuals for their help in making this report possible: Patrick Cheng, Dr. Michael Gardam, Dr. Susy Hota, Yelena Katsaga, Donna Lowe, Dr. Allison McGeer, Karen Ong, Monique Pitre, Dr. Susan Poutanen, and many others (omissions unintentional).

NEXT QUARTERLY REPORT

The next quarterly report, for FY 11/12 Q1 is expected in the fall.

APPENDIX

MOUNT SINAI HOSPITAL ICU

Mount Sinai Hospital ICU Antimicrobial Cost and Usage

Note: Defined Daily Dose (DDD) is an internationally accepted method to measure and compare antimicrobial usage, although it does have limitations. Example of a DDD: the DDD for cefazolin is 3 g since the standard daily dose is 1 g IV q8h.

Key Performance Indicator	FY 08/09	FY 09/10	FY 10/11	% Change (10/11) Compared to Same Period Last Year (FY 09/10)	% Change (10/11) Compared to before ASP in ICU (FY 08/09)
Antimicrobial Usage and Costs					
Total Antimicrobial DDDs*/100 Patient Days	180	164	140.8	-14.1%	-21.8%
Systemic Antibacterial DDDs/100 Patient Days	145	126	108.4	-14.0%	-25.2%
Systemic Antifungal DDDs/100 Patient Days	31	28	24.3	-13.2%	-21.6%
Total Antimicrobial Costs	$332,731	$285,931	$193,085	-32.5%	-
Total Antimicrobial Costs/100 Patient Days	$6,939	$5,922	$4,090	-30.9%	-41.1%
Systemic Antibacterial Costs	$173,082	$140,022	$89,226	-36.3%	-
Systemic Antibacterial Costs/Patient Day	$36.10	$29.00	$18.90	-34.8%	-47.6%
Systemic Antifungal Costs	$143,019	$132,475	$81,243	-38.7%	-
Systemic Antifungal Costs/Patient Day	$29.83	$27.44	$17.21	-37.3%	-42.3%
Patient Care Indicators					
ICU Average Length of Stay (days)	5.81	5.57	5.65	1.4%	-2.8%
ICU Mortality Rate	19.9%	17.5%	16.3%	-7.2%	-18.5%
ICU Readmission Rate	3.2%	2.9%	2.7%	-6.8%	-15.2%
ICU Ventilator Days	N/A	3285	2941	-10.5%	N/A

*DDD = Defined Daily Dose

*Total Antimicrobial DDDs is the sum of systemic antibacterial DDDs + systemic antifungal DDDs + systemic antivirals; non-systemic antimicrobials are excluded

MSH ICU	Pre-ASP (Apr 08 to Mar 09)	Post-ASP (Apr 10 to Mar 11)
Actual Antimicrobial Costs	$332,731	$193,085
Patient Days	4795	4721
Actual Antimicrobial Costs/Patient Day	$69.39	$40.90

Post-ASP savings FY 10/11 (adjusted for altered bed utilization)
= [(Pre-ASP cost/patient day) x (Post-ASP patient days)] - Actual cost Post-ASP
= ($69.39 x 4721) - $193,085
= $134,505

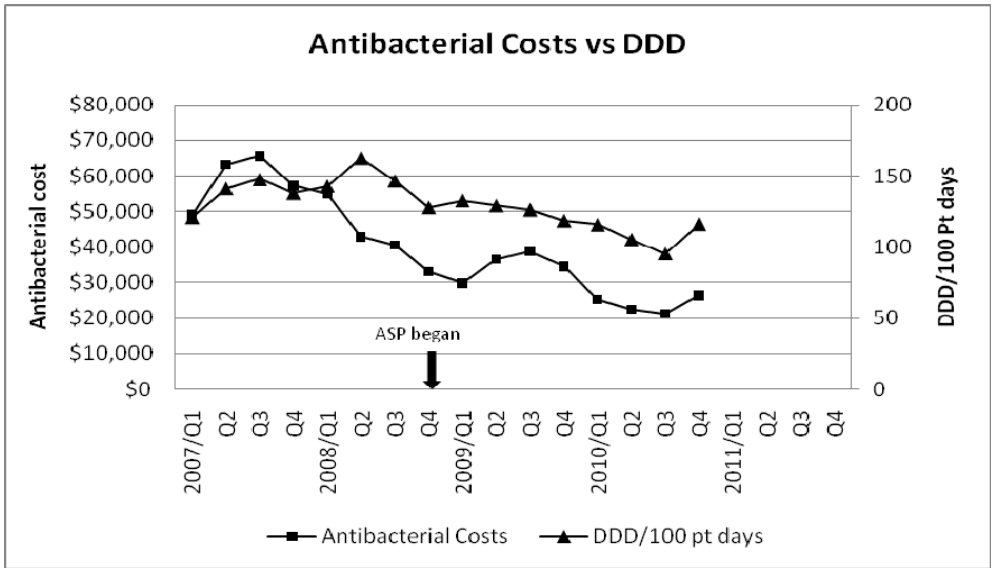
Antimicrobial Costs in MSH ICU FY 09/10 vs FY 10/11, according to PMH or non-PMH origin* (preliminary data for FY 2010)

	FY 2009-10	FY 2010-11	% Change 10/11 vs 09/10	$ Change 10/11 vs 09/10
Total Antibacterial Costs	$140,022	$95,770	-31.60%	-$44,252
Non-PMH Patients	$76,678	$56,992	-25.67%	-$19,687
PMH Patients	$63,344	$38,779	-38.78%	-$24,565
Total Antifungal Costs	$132,475	$88,964	-32.84%	-$43,511
Non-PMH Patients	$83,137	$69,230	-16.73%	-$13,907
PMH Patients	$49,338	$19,734	-60.00%	-$29,604
Total All Antimicrobial Costs (antibacterial + antifungal + antiviral)	$285,931	$193,091	-32.47%	-$92,840
Non-PMH Patients	$132,969	$78,699	-40.81%	-$54,269
PMH Patients	$152,963	$114,392	-25.22%	-$38,571

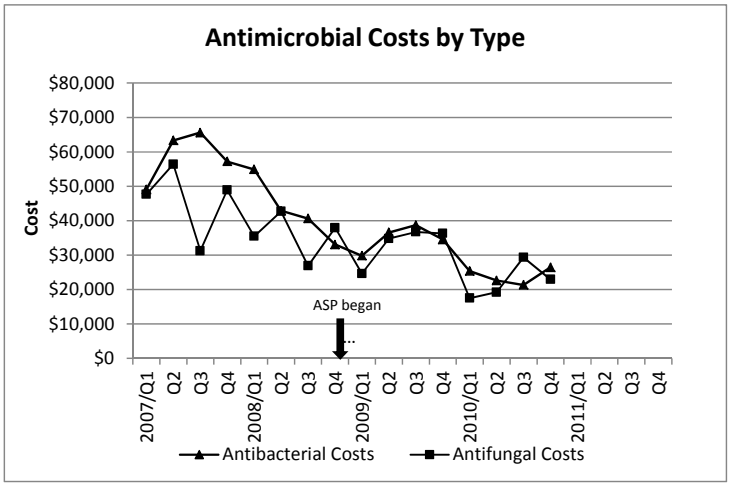
Note: Overall total antimicrobial cost differs slightly from that reported key performance indicator table above due to data run at different times on an open year.

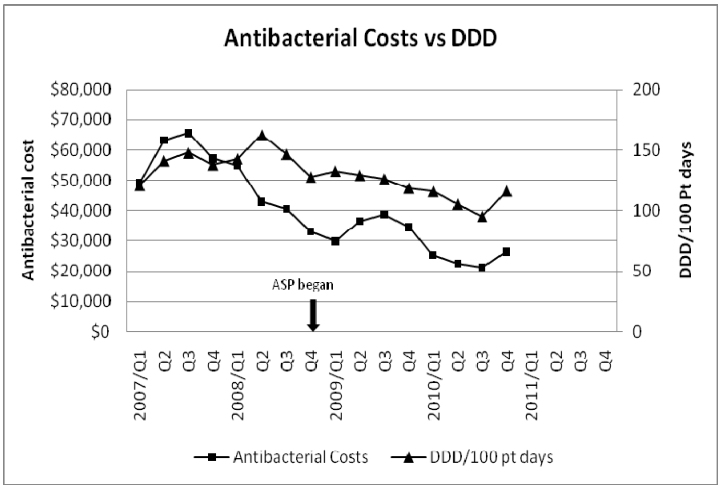
*March Inpatient Discharge Abstract Database not complete at time of reporting therefore identification of PMH patients not finalized, therefore totals subject to change.

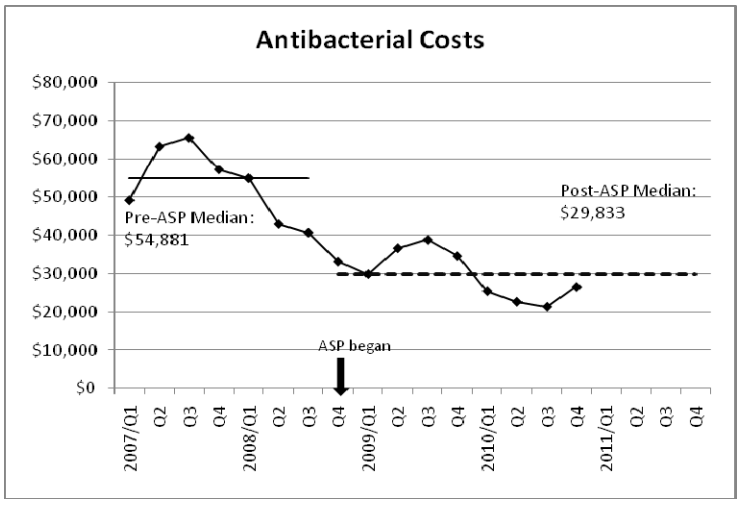
MSH ICU Antimicrobial Costs and Usage

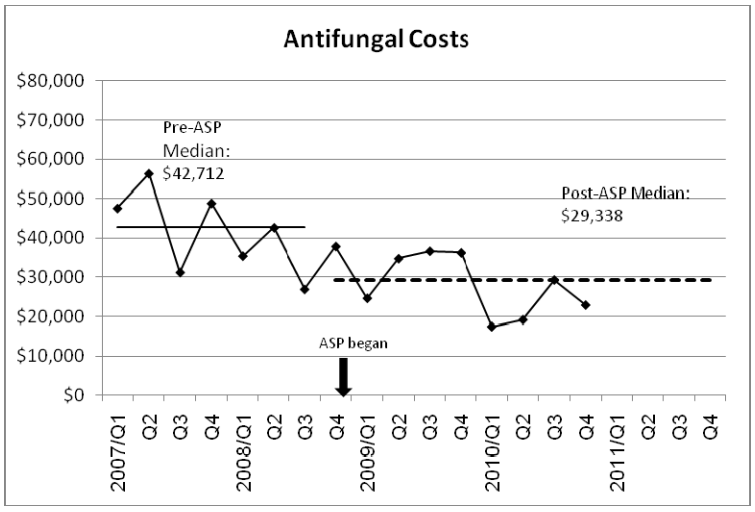


MSH ICU Antimicrobial Costs and Usage cont.









MSH ICU Antimicrobial Costs and Usage cont.

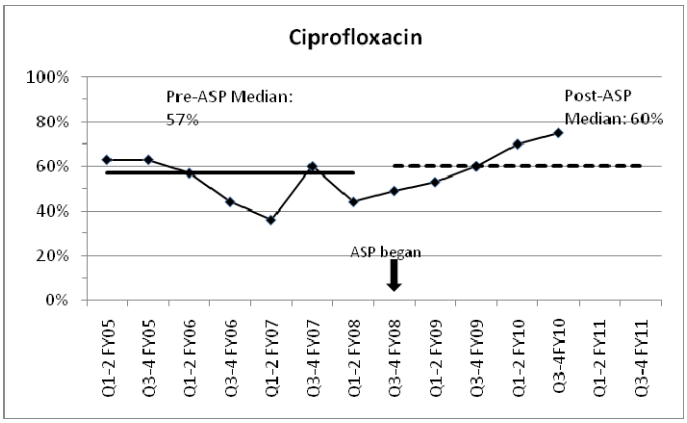
Top 10 Antimicrobials by DDD and Cost for FY 10/11

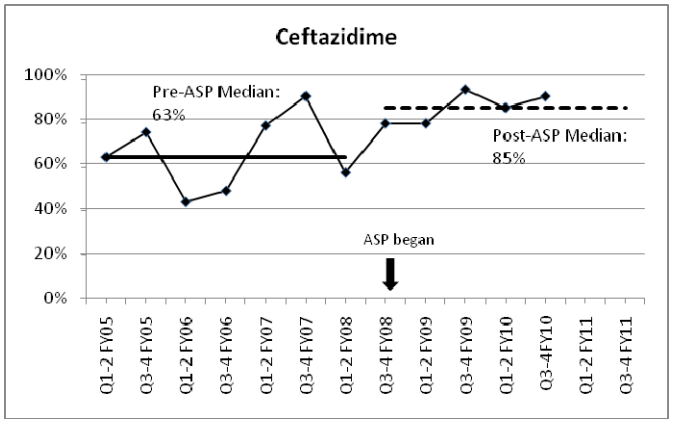
	Top 10 Antimicrobials by DDD for FY 10/11	DDD	DDD/100 Pt Days
1	piperacillin-tazobactam IV	568.6	12.04
2	meropenem IV	536.0	11.35
3	vancomycin IV	419.3	8.88
4	fluconazole IV	417.0	8.83
5	cefazolin IV	390.0	8.26
6	ciprofloxacin IV	374.4	7.93
7	ceftriaxone IV	358.0	7.58
8	cloxacillin IV	344.0	7.29
9	ampicillin IV	271.0	5.74
10	penicillin G IV	261.6	5.54
	Total	**3939.8**	
	% of Total Antimicrobial DDDs	**59.28%**	

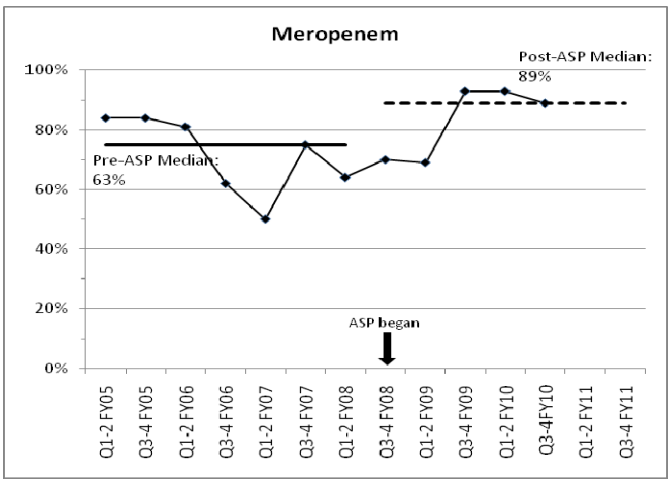
	Top 10 Antimicrobials by Cost for FY 10/11	Cost	Cost/Pt Day
1	meropenem IV	$ 51,857	$ 10.98
2	caspofungin IV	$ 43,736	$ 9.26
3	amphotericin B IV	$ 16,883	$ 3.58
4	piperacillin-tazobactam IV	$ 15,882	$ 3.36
5	voriconazole IV	$ 12,887	$ 2.73
6	posaconazole PO	$ 11,668	$ 2.47
7	vancomycin IV	$ 7,287	$ 1.54
8	ribavirin IV	$ 4,016	$ 0.85
9	ceftazidime IV	$ 2,603	$ 0.55
10	fluconazole IV	$ 2,590	$ 0.55
	Total	**$ 169,408**	
	% of Total Antimicrobial Costs	**87.74%**	

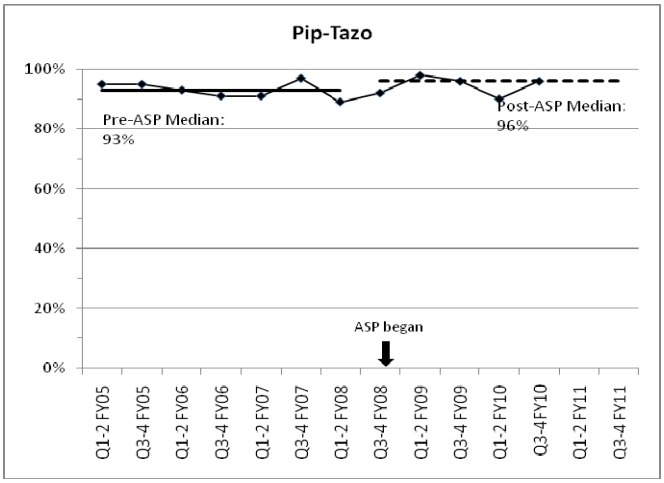
Antimicrobial Susceptibility and Pathogen Surveillance

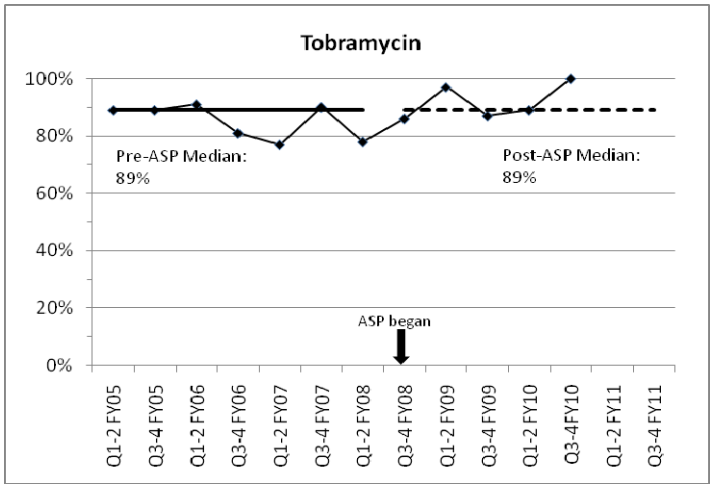
Pseudomonas Susceptibility – MSH ICU



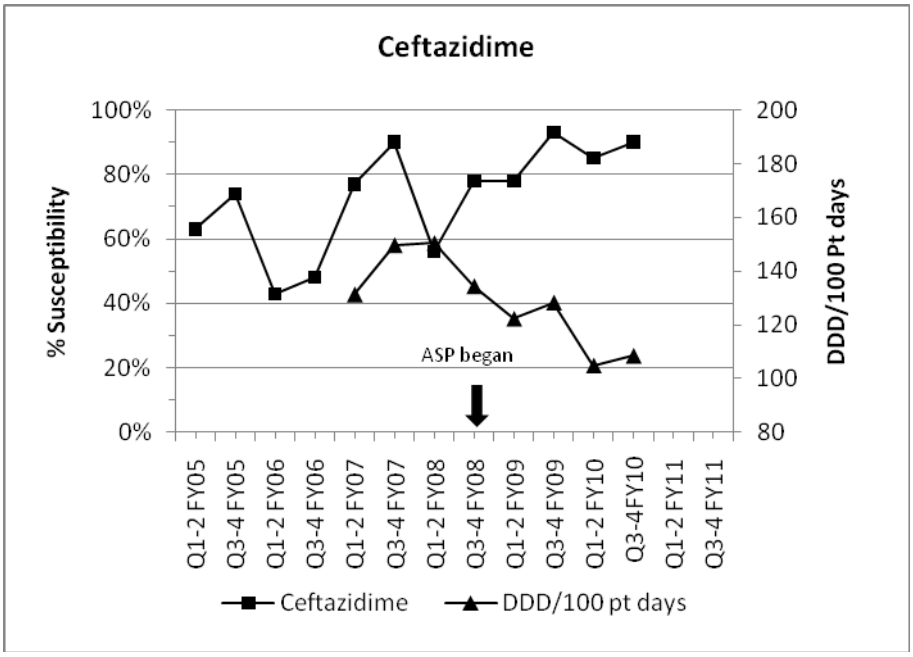


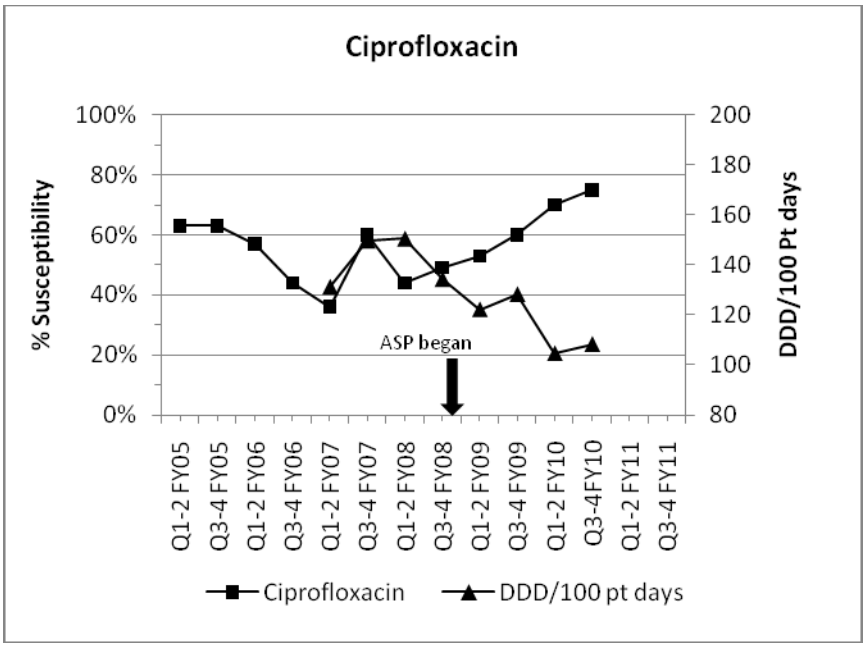




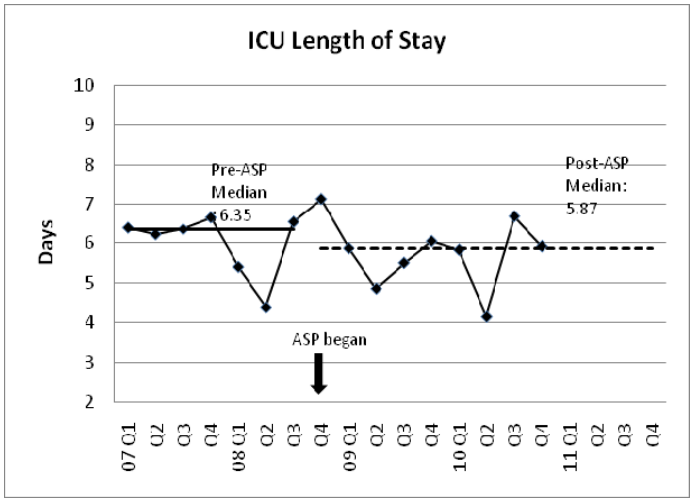


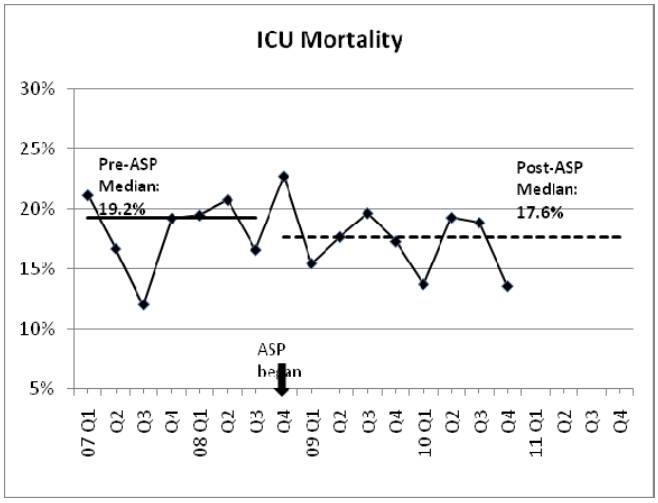
Pseudomonas Susceptibility Further Analysis: Compared with DDD per 100 Patient days – MSH ICU

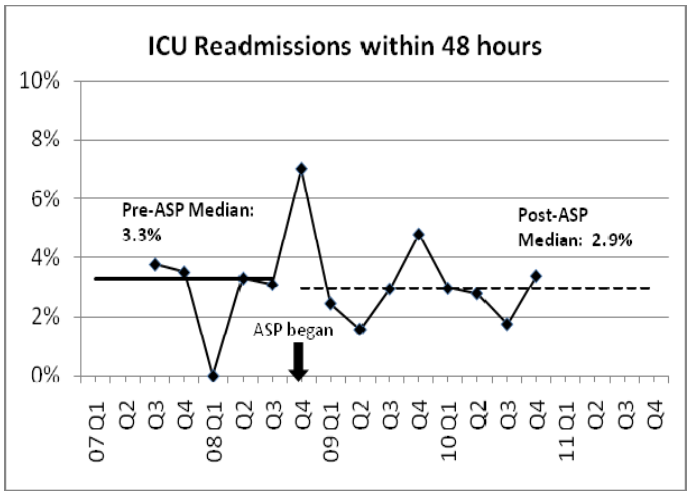


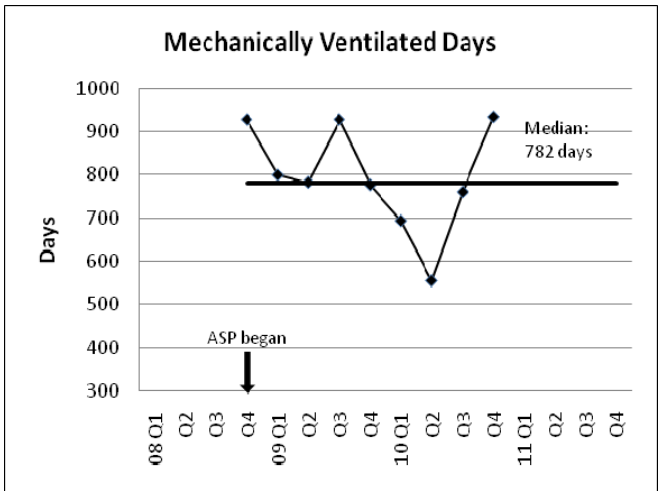


Patient Care Indicators – MSH ICU



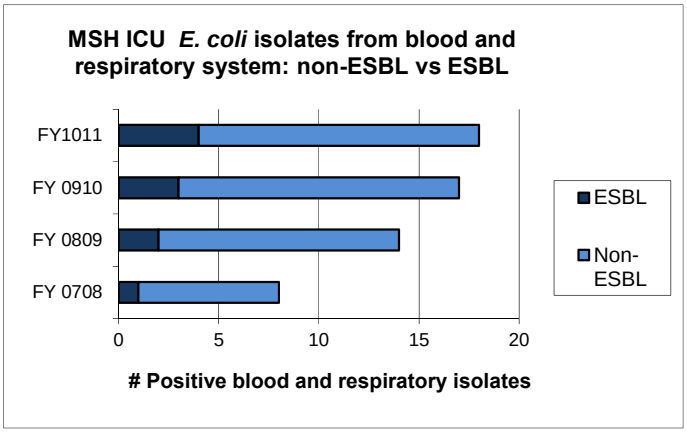


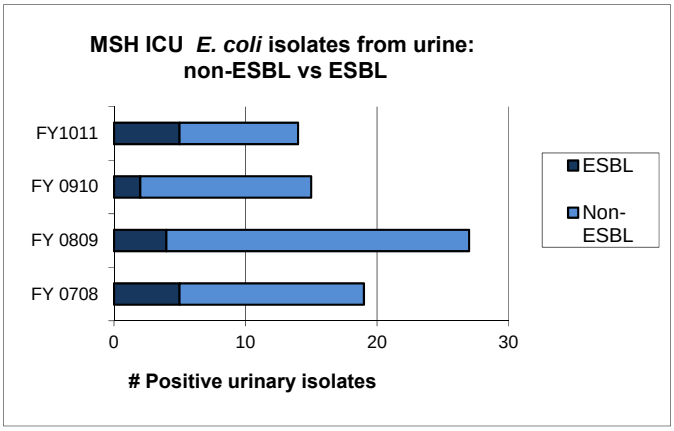




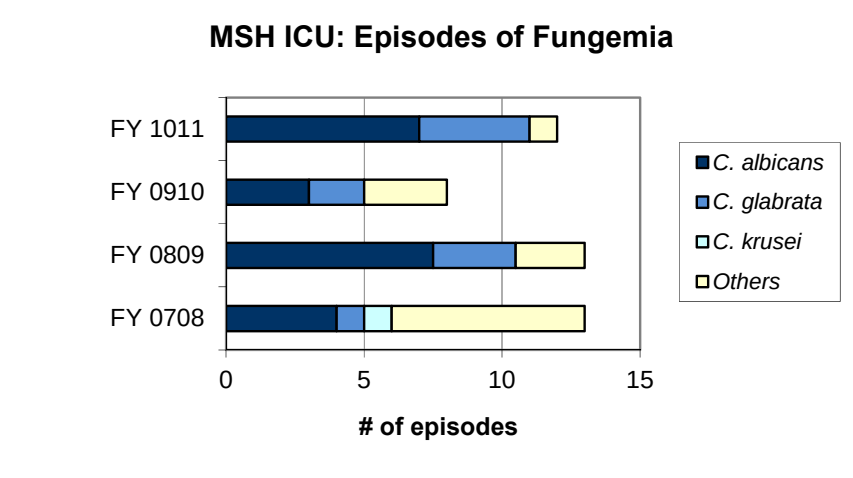
Antimicrobial Susceptibility and Pathogen Surveillance cont.

E.Coli isolates: Blood, Respiratory, Urine





Yeast Species Isolated in Blood – MSH ICU



MSH + UHN ASP ANTIMICROBIAL STEWARDSHIP PROGRAM

14th Floor

Mount Sinai Hospital 14th Floor Antimicrobial Usage and Costs

Key Performance Indicator	FY 09/10	FY 10/11	% Change (10/11)	
			Compared to Same Period Last Year	Compared to before ASP started on 14** (FY 09/10)
Antimicrobial Usage and Costs				
Total Antimicrobial DDDs*/100 Patient Days	62.0	46.7	-24.7%	-
Systemic Antibacterial DDDs/100 Patient Days	59.9	42.0	-29.9%	-
Systemic Antifungal DDDs/100 Patient Days	1.1	1.7	48.4%	-
Total Antimicrobial Costs	$89,053	$67,986	-23.7%	-
Total Antimicrobial Costs/Patient Day	$4.69	$3.72	-20.9%	-
Systemic Antibacterial Costs	$83,359	$63,727	-23.6%	-
Systemic Antibacterial Costs/Patient Day	$4.39	$3.48	-20.8%	-
Systemic Antifungal Costs	$3,853	$3,862	0.2%	-
Systemic Antifungal Costs/Patient Day	$0.20	$0.21	3.9%	-
Patient Care Indicators				
14th floor Average Length of Stay (days)	6.4	6.4	0.0%	-
14th floor Mortality Rate	0.7%	0.6%	-14.3%	-
14th floor Readmission Rate	3.1%	3.1%	0.0%	-
14th floor Isolation Days per 100 pt days	8.6	10.1	17.4%	-

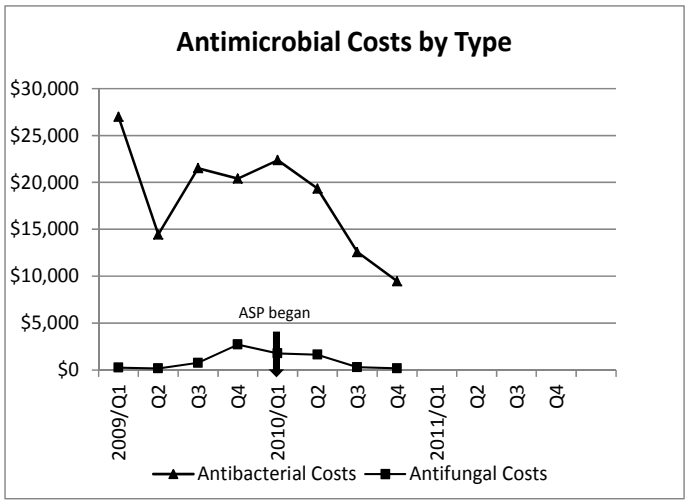
Total Antimicrobials is the sum of systemic antibacterial + systemic antifungal + systemic antivirals; non-systemic antimicrobials are excluded
*DDD = Defined Daily Dose
** ASP started on 14th level in March 2010; data will be populated for this indicator beginning Q1 2011/12
Note: for FY 10/11, one patient accounted for nearly all antifungal costs ($1554) for the month of April, contributing significantly to the 200% increase for Q1-Q3 vs. same period last year.

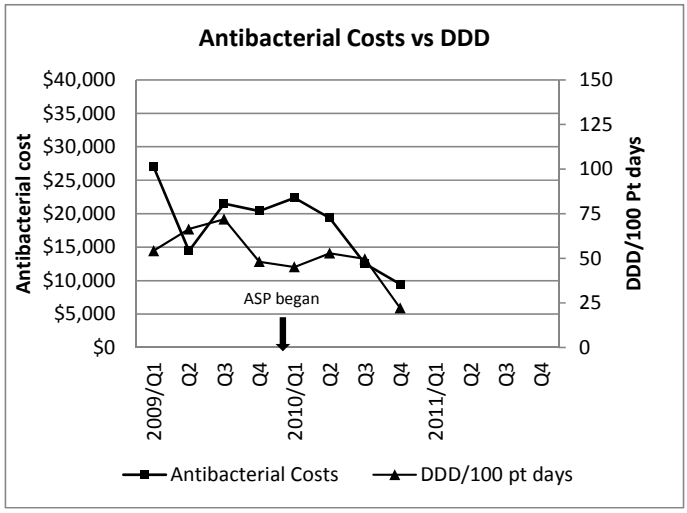
MSH 14th Level	Pre-ASP (Apr 09 to Mar 10)	Post-ASP (Apr 10 to Mar 11)
Actual Antimicrobial Costs	$89,053	$67,986
Patient Days	18,988	18,276
Actual Antimicrobial Costs/Patient Day	$4.69	$3.72

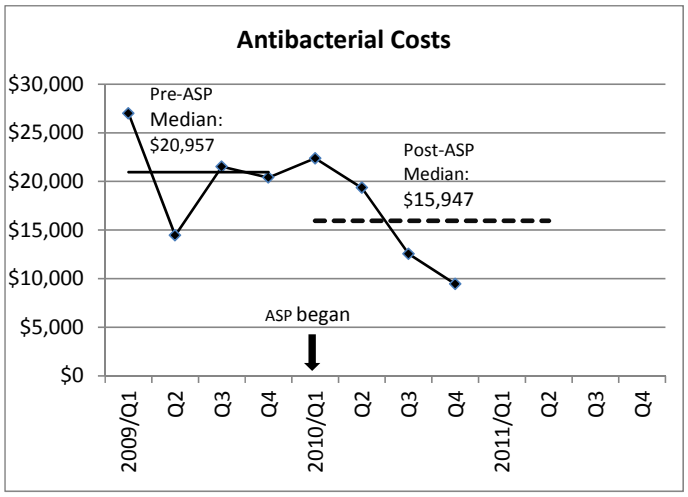
Post-ASP savings FY 10/11 (adjusted for altered bed utilization)
= [(Pre-ASP cost/patient day) x (Post-ASP patient days)] - Actual cost Post-ASP
= ($4.69 x 18,276) - $67,986
= $17,728

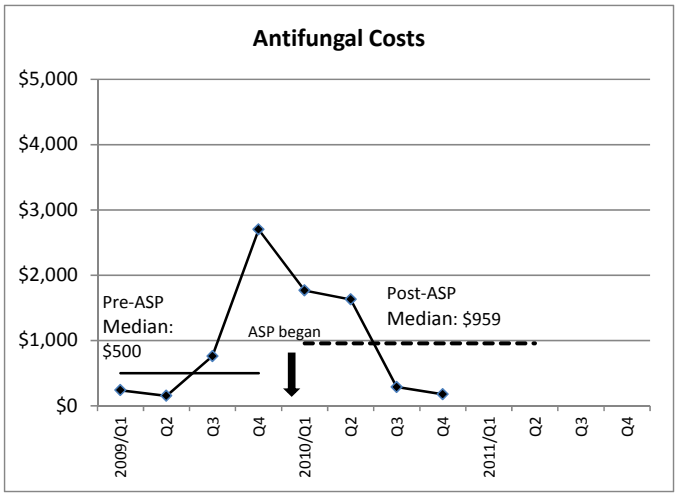
MOUNT SINAI HOSPITAL Joseph and Wolf Lebovic Health Complex
University Health Network

Mount Sinai Hospital 14th Floor Antimicrobial Usage and Costs cont.









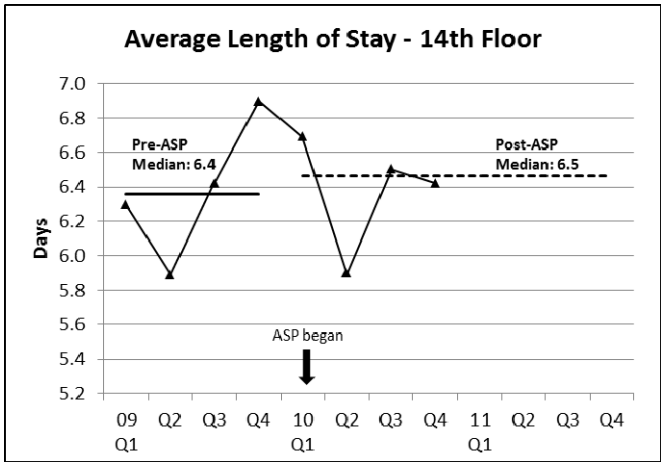
Mount Sinai Hospital 14th Floor Antimicrobial Usage and Costs cont.

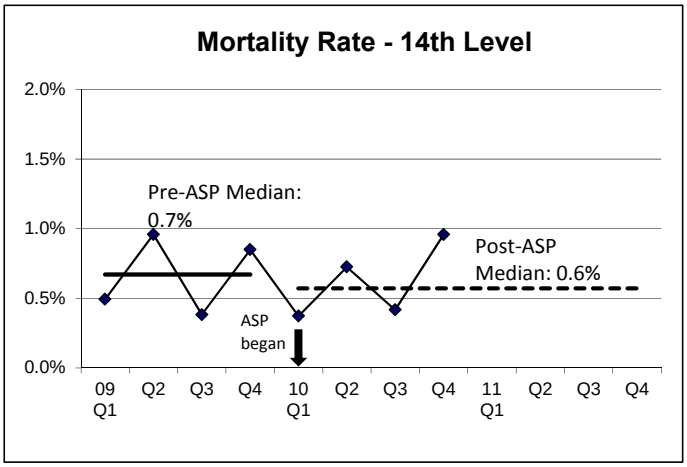
Top 10 Antimicrobials by DDD and Cost for FY 10/11

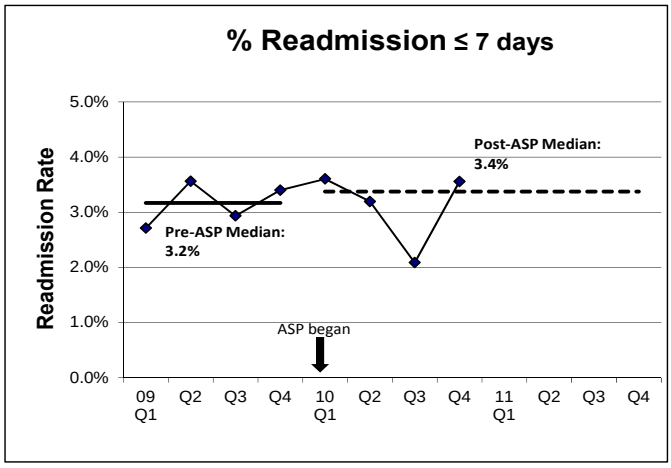
	Top 10 Antimicrobials by DDD	DDD	DDD/100 Pt Days
1	ciprofloxacin IV	1521.6	8.3
2	ciprofloxacin PO	1071.0	5.9
3	metronidazole IV	984.5	5.4
4	valganciclovir PO	500.0	2.7
5	cefazolin IV	481.3	2.6
6	cefTRIAXone IV	410.0	2.2
7	ampicillin IV	391.0	2.1
8	metronidazole PO	273.8	1.5
9	piperacillin-tazobactam IV	258.4	1.4
10	meropenem IV	251.5	1.4
	Total	**6143.0**	
	% of Total	**71.90%**	

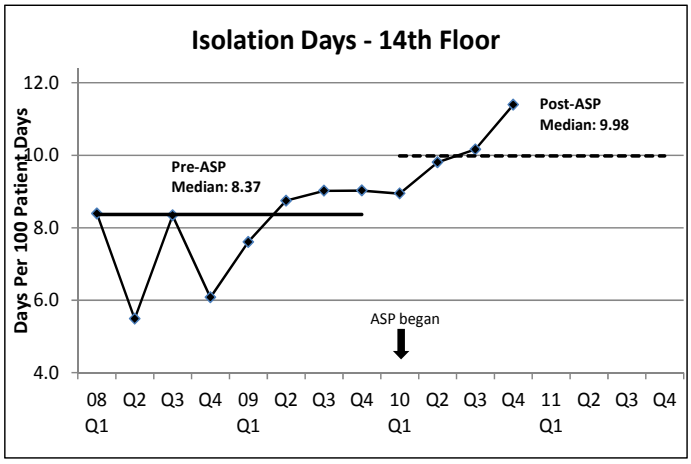
	Top 10 Antimicrobials by Cost	Cost	Cost/Pt Day
1	meropenem IV	$24,489.00	$1.34
2	piperacillin-tazobactam IV	$8,228.85	$0.45
3	ciprofloxacin IV	$5,326.07	$0.29
4	metronidazole IV	$5,041.05	$0.28
5	ertapenem IV	$3,740.76	$0.20
6	vancomycin IV	$3,459.97	$0.19
7	moxifloxacin IV	$1,932.00	$0.11
8	ceftriaxone IV	$1,677.33	$0.09
9	fluconazole IV	$1,605.33	$0.09
10	clindamycin IV	$1,547.70	$0.08
	Total	**$57,048.06**	
	% of Total	**83.91%**	

Patient Care Indicators – MSH 14th Level



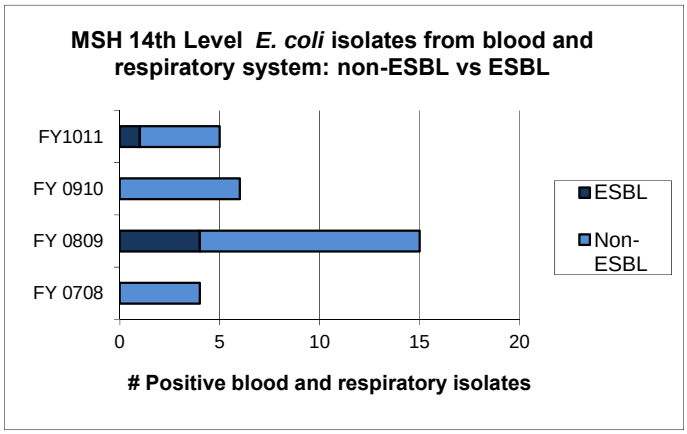


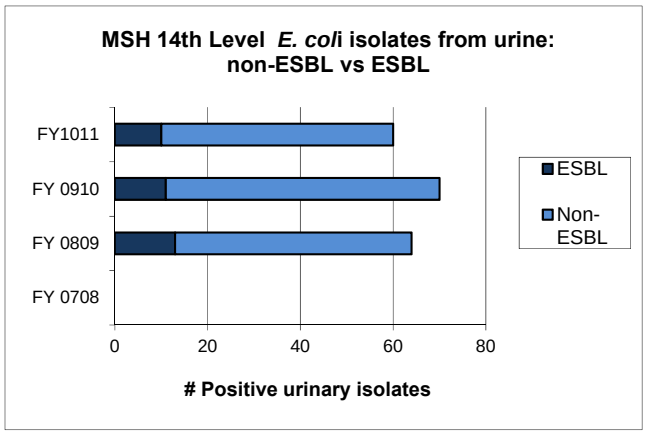




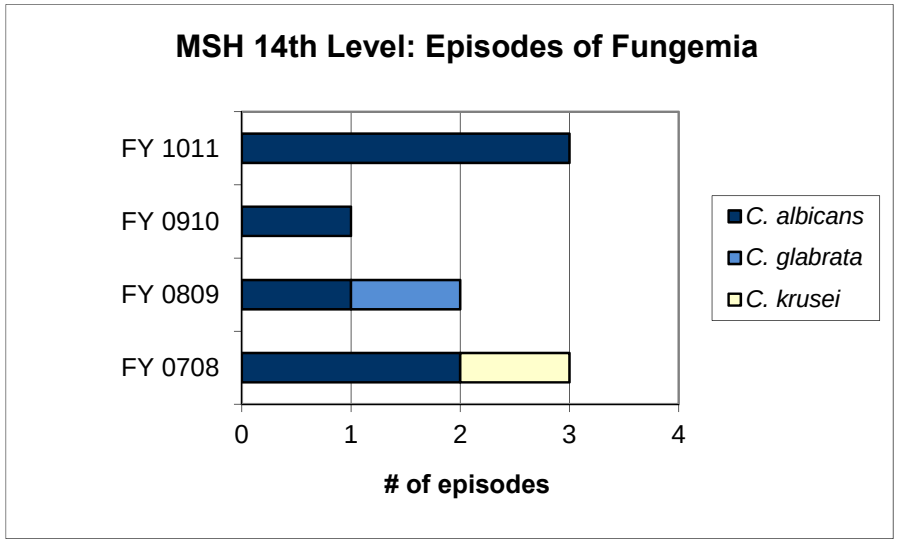
Antimicrobial Susceptibility and Pathogen Surveillance cont.

E.Coli isolates: Blood, Respiratory, Urine





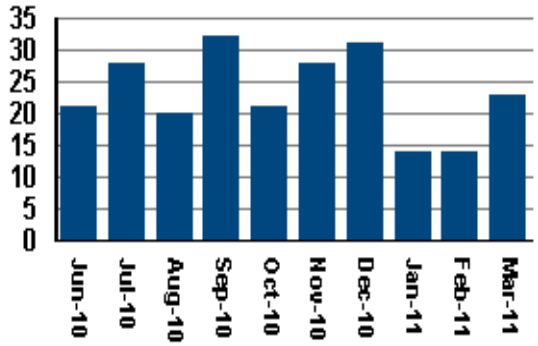
Yeast Species Isolated in Blood – MSH 14th Level



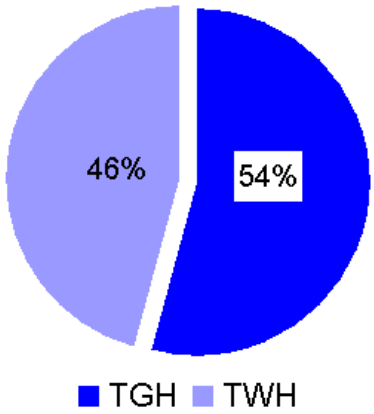
MSH + UHN ASP ANTIMICROBIAL STEWARDSHIP PROGRAM

Outpatient Parenteral Antimicrobial Therapy (OPAT) Program

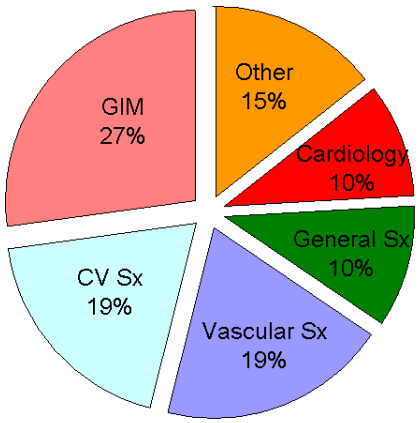
New Referrals to OPAT, by Month



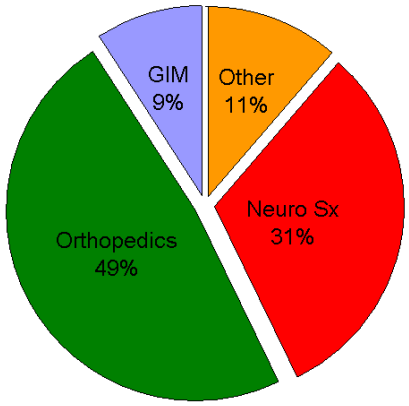
Patient Distribution



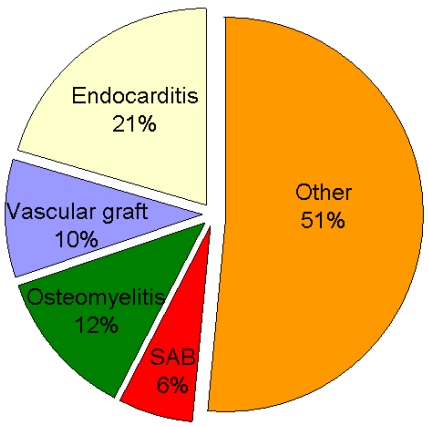
Referring Service, TGH



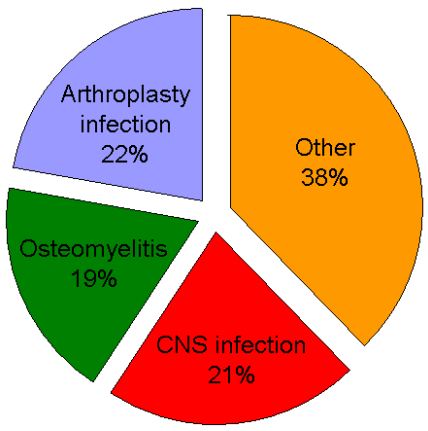
Referring Service, TWH



OPAT Diagnosis, TGH



OPAT Diagnosis, TWH



MOUNT SINAI HOSPITAL Joseph and Wolf Lebovic Health Complex
University Health Network

Outpatient Parenteral Antimicrobial Therapy (OPAT) Program

Patient readmissions rates within 30 and 60 days of OPAT consultation

Date Range: January 1, 2011 to March 31, 2011

	% Yes	% No
Readmissions Within 30 days	**23.53%**	**76.47%**
Readmissions Within 60 days	**11.76%**	**88.24%**

PICC Line Information

Date Range: January 1, 2011 to March 31, 2011

	# days
Average Delay to Insertion of PICC line	**1.49**
Average Time from PICC line Insertion to Actual Discharge	**5.00**

Outpatient Parenteral Antimicrobial Therapy (OPAT) Program

USER SATISFACTION SURVEYS

UHN professional staff (May 2011 Survey)

Testimonials:

1) Our pts on vancomycin would not be safe to leave hospital therefore our length of stay would increase for many pts OPAT has helped to access special antibiotics for pts that are not covered to help them return home with very complex planning f/u is tailored to pts and this is very pt centered as they are often seen together with the referring service and this saves them a visit. the pt has a contact person if they have issues of line access blood work is done in the community for pts we may not have followed please keep this service going-its the only way to help some our pts. The OPAT team has also been a pleasure to work with. They also make suggestions/changes to the pts regime so that they can be on po meds. It's an amazing program and I feel comfortable that my pts are safe++++++

2) The service has been useful in allowing us to discharge patients from hospital sooner, with confidence that they will receive their antibiotic course as prescribed. It is difficult to determine how effective the program has been because we rarely see these patients in follow-up to assess the outcomes.

3) I think this is a fabulous program. We don't D/C patients from our service home on IV antibiotics very often but your service is invaluable to us and we know that our patients will be followed up in the community. This is an important safety initiative.

4) Discontinued service would lead to a gap in patient care and potential adverse consequences.

5) This is an essential service! Please continue.

6) Raise media awareness of OPAT success like recent article in the Toronto Star on the Virtual Ward.

7) Helpful to continue the service. Follow up of patients to enhance clinical care was excellent.

8) If OPAT would be discontinued who would f/u on antibiotic orders, especially the once which need monitoring?

9) Extremely valuable service. Makes preparation for discharge home and reliable monitoring much easier and allows patients to leave hospital sooner knowing that they will be safely monitored.

10) The safe administration of outpatient antibiotics is necessarily a time-consuming process for physicians and the OPAT service accepts this burden and instills confidence that patients will be treated safely.

11) A formal antibiotic outpatient supervision program is an essential service for a large complicated institution such as ours. Safe outpatient antibiotic care; particularly where drug monitoring is required, is poorly done if not centralized. This service should receive more funding, more staffing, and should be expanded to include the Mount Sinai Hospital with a tighter integration with the ID consultation service in hospital.

12) This is a great service and I think it is really important for my patients being d/c'd home on IV antibiotics, especially ones which require close monitoring such as vancomycin and aminoglycosides.

13) It is a wonderful service that helps to prevent adverse effects such as renal failure.

PMH I4A & 15B Antimicrobial Usage and Costs

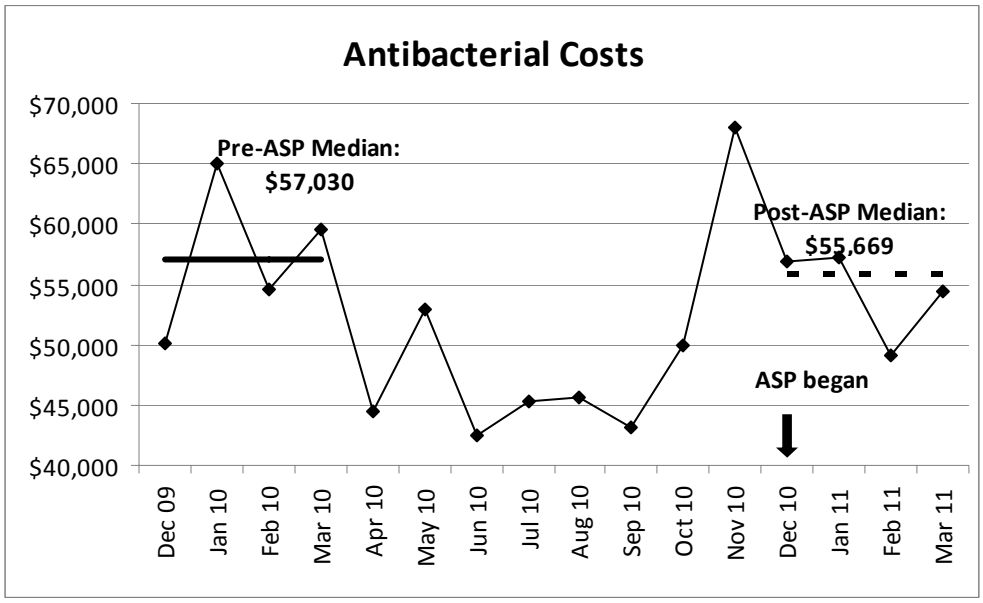
Key Performance Indicator	FY 09/10 (Apr - Mar)	FY 10/11 (Apr - Mar)	Difference	
			% Change	Numerical Change
Antimicrobial Usage and Costs				
Total Antimicrobial DDDs*/100 Patient Days	295.2	274.3	-7.1%	-20.9
Systemic Antibacterial DDDs/100 Patient Days	190.8	166.8	-12.6%	-24.0
Systemic Antifungal DDDs/100 Patient Days	104.4	107.4	2.9%	3.0
Total Antimicrobial Costs	$1,768,317	$1,641,331	-7.2%	-$126,987
Total Antimicrobial Costs/Patient Day	$167.12	$154.32	-7.7%	-$12.80
Systemic Antibacterial Costs	$659,034	$609,747	-7.5%	-$49,287
Systemic Antibacterial Costs/Patient Day	$62.28	$57.33	-8.0%	-$4.96
Systemic Antifungal Costs	$1,109,283	$1,031,584	-7.0%	-$77,700
Systemic Antifungal Costs/Patient Day	$104.84	$96.99	-7.5%	-$7.85

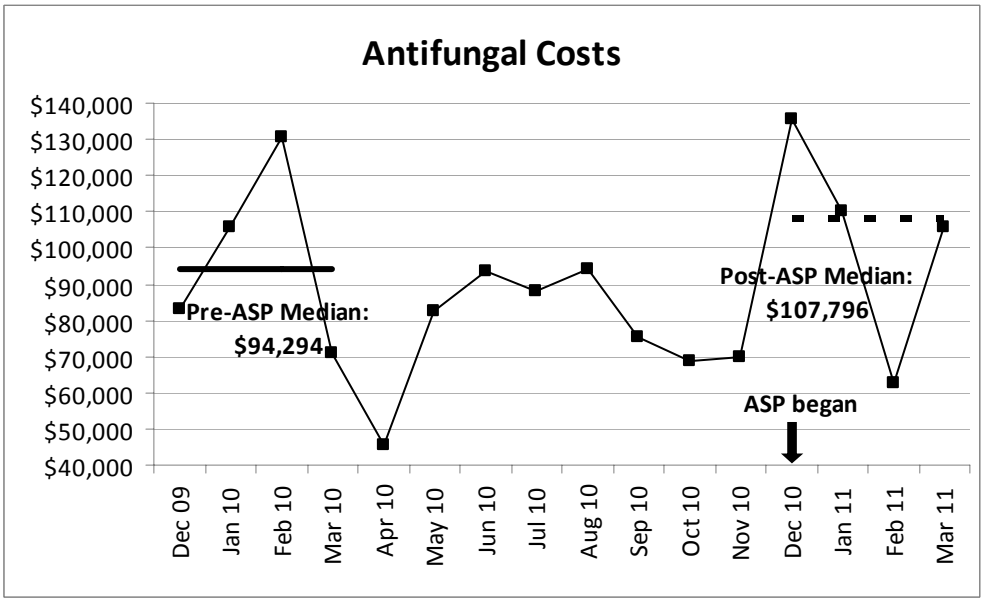
Note:
* DDD = Defined Daily Dose
** ASP restarted at PMH 14A & 15B in December 2010

PMH 14A & 15B	Pre-ASP (Dec 09 to Mar 10)	Post-ASP (Dec 10 to Mar 11)
Actual Antimicrobial Costs	$619,417	$631,813
Patient Days	3491	3667
Actual Antimicrobial Costs/Patient Day	$177.43	$172.30

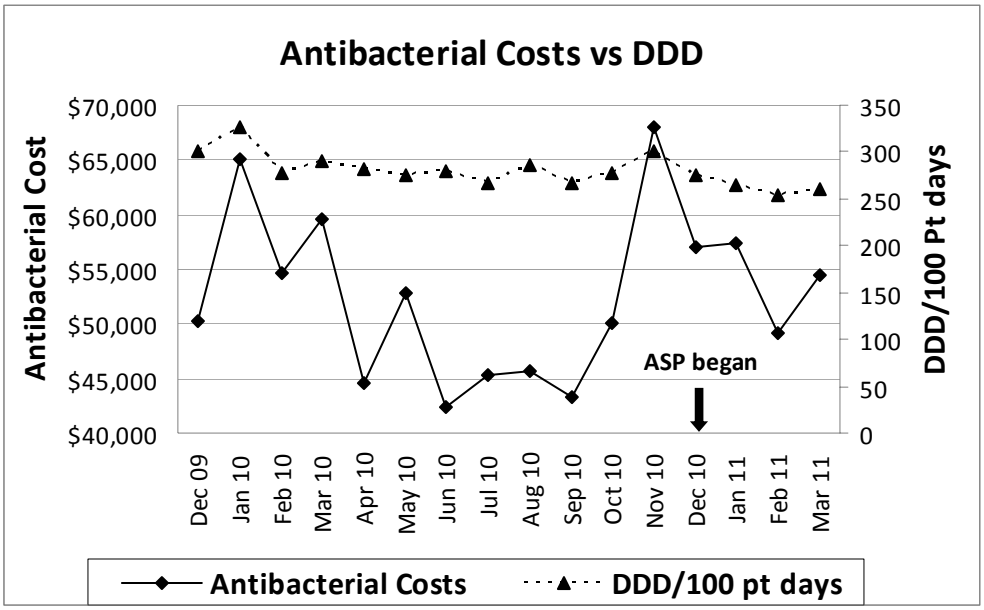
Post-ASP savings FY 10/11 (adjusted for altered bed utilization)
= [(Pre-ASP cost/patient day) x (Post-ASP patient days)] - Actual cost Post-ASP
= ($177.43 x 3667) - $631,813
= $18,823

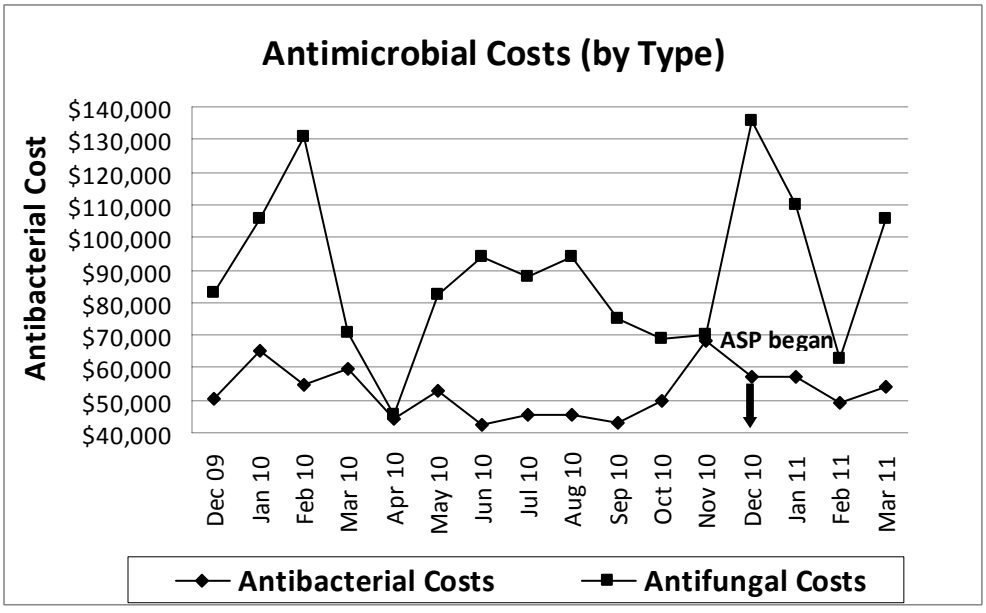
PMH I4A & 15B Antimicrobial Usage and Costs





PMH I4A & 15B Antimicrobial Usage and Costs





PMH I4A & 15B Antimicrobial Usage and Costs

FY 10/11	Top 10 Antimicrobials by DDD	DDD	DDD/100 Pt Days
1	Fluconazole	5865.8	55.15
2	Piperacillin Sod-Tazobactam	3911.1	36.77
3	Meropenem	3517.8	33.07
4	Ciprofloxacin	2527.0	23.76
5	Vancomycin Hcl	2133.1	20.06
6	Voriconazole	1738.8	16.35
7	Caspofungin Acetate	1561.8	14.68
8	Tobramycin Sulfate	1126.5	10.59
9	Moxifloxacin	726.0	6.83
10	Gentamicin Sulfate	710.9	6.68
	Total	**23818.6**	
	% of Total	**81.66%**	

FY 10/11	Top 10 Antimicrobials by Cost	Cost	Cost/Pt Day
1	Amphotericin B Liposomal	$430,994	$40.52
2	Meropenem	$342,629	$32.21
3	Caspofungin Acetate	$226,461	$21.29
4	Voriconazole	$185,533	$17.44
5	Piperacillin Sod-Tazobactam	$139,044	$13.07
6	Micafungin Sodium	$61,000	$5.74
7	Posaconazole	$60,950	$5.73
8	Vancomycin Hcl	$48,231	$4.53
9	Linezolid	$41,550	$3.91
10	Amphotericin B	$34,377	$3.23
	Total	**$1,570,768**	
	% of Total	**95.70%**	

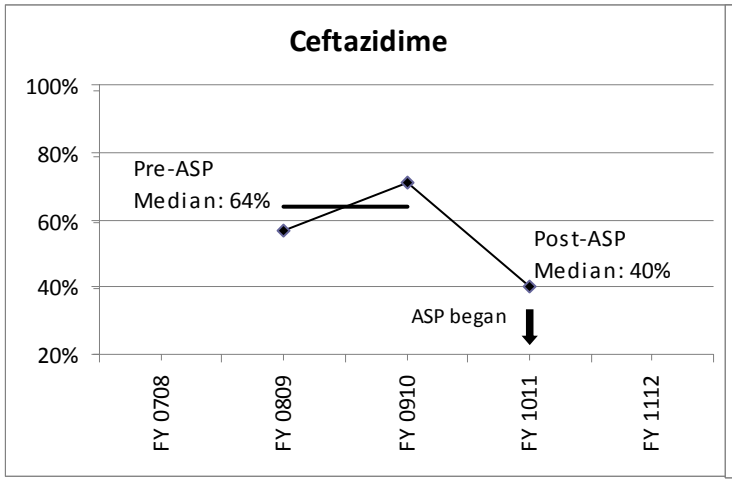
PMH I4A & 15B Antimicrobial Usage and Costs

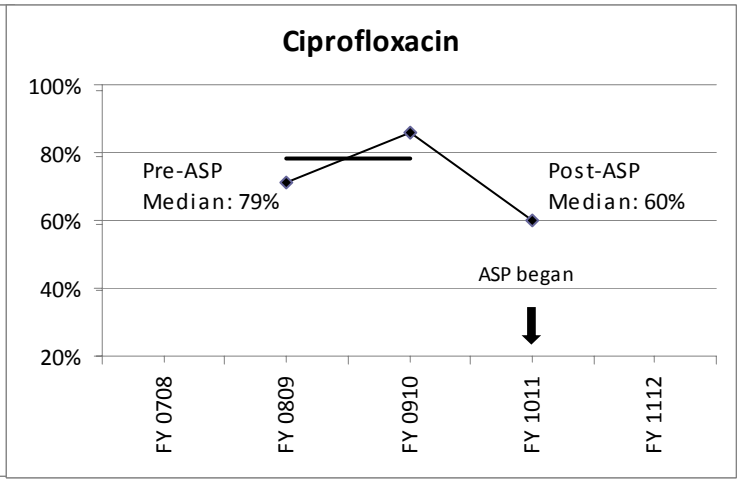
Comparison Table

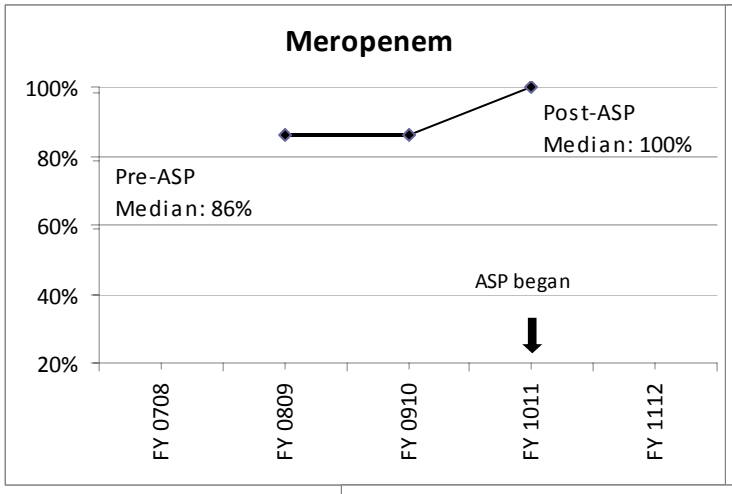
14 A + 15 B	Current	"Year-over-year"	No ASP	ASP "part 1"
	December 2010 to April 2011	December 2009 to April 2010	July 2010 to November 2010	March 2010 to June 2010
Total Cost	$702,310	$709,457	$675,928	$491,961
Cost / Month	$140,462	$141,891	$135,186	$122,990
Total DDD	9893	12874	14203	9747
# patient days	4584	4360	4407	3466
Total DDD / 100 pt days	216	295	322	281

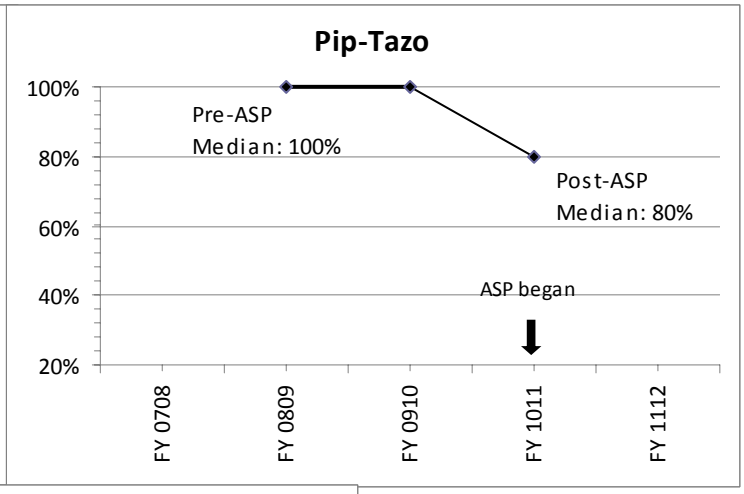
Antimicrobial Susceptibility and Pathogen Surveillance

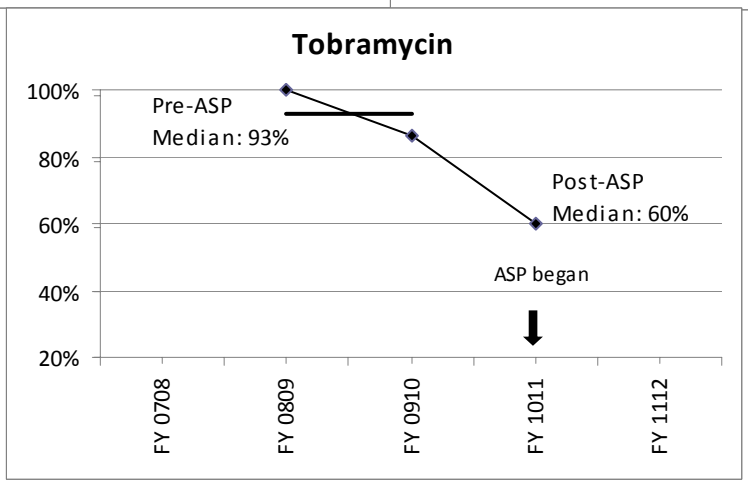
Pseudomonas Susceptibility - PMH I4A & 15B





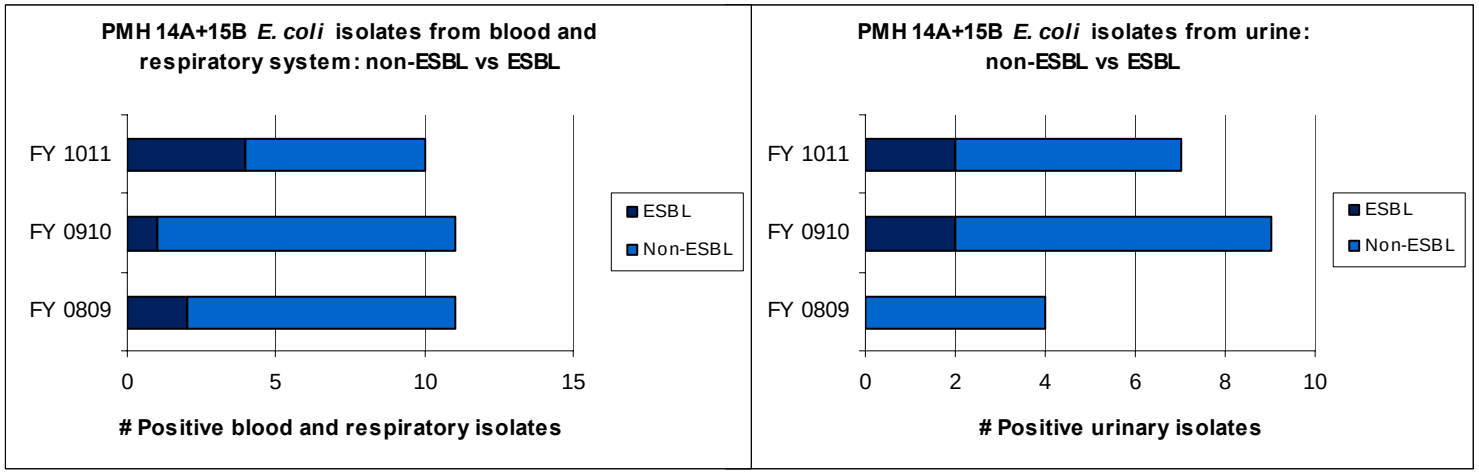




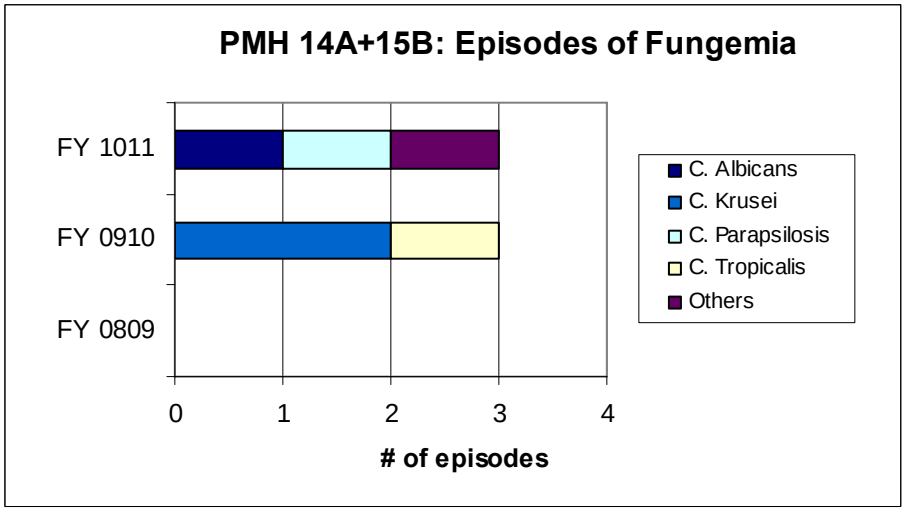


Antimicrobial Susceptibility and Pathogen Surveillance cont.

E.Coli isolates: Blood, Respiratory, Urine



Yeast Species Isolated in Blood – PMH I4A & 15B



TGH ICU Antimicrobial Usage and Costs

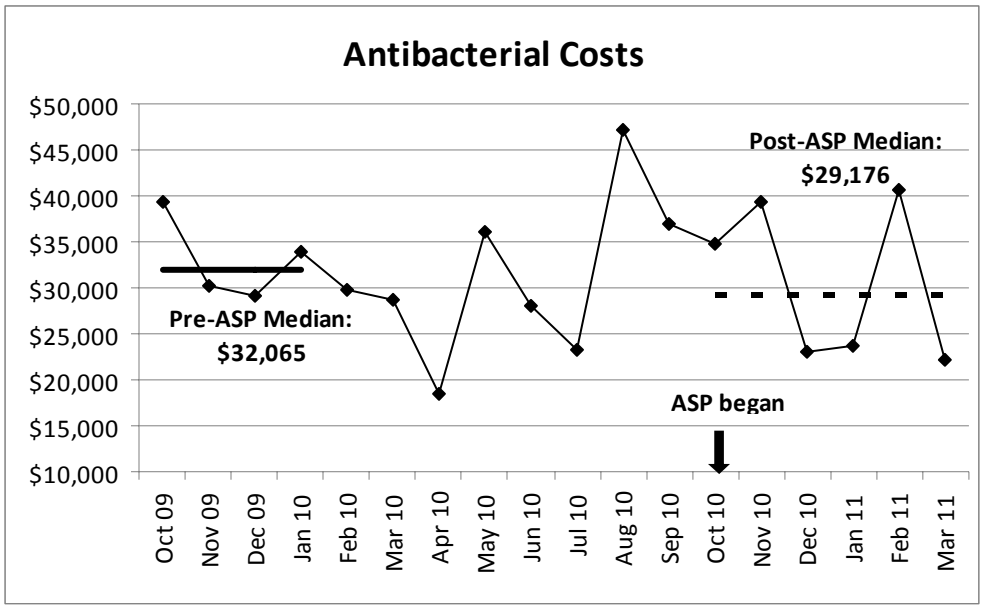
Key Performance Indicator	FY 09/10 (Oct - Mar)	FY 10/11 (Oct - Mar)	Difference	
			% Change	Numerical Change
Antimicrobial Usage and Costs				
Total Antimicrobial DDDs*/100 Patient Days	261.8	196.0	-25.1%	-65.8
Systemic Antibacterial DDDs/100 Patient Days	183.9	151.6	-17.6%	-32.3
Systemic Antifungal DDDs/100 Patient Days	78.0	44.4	-43.0%	-33.5
Total Antimicrobial Costs	$335,850	$266,391	-20.7%	-$69,458
Total Antimicrobial Costs/Patient Day	$96.93	$69.00	-28.8%	-$27.93
Systemic Antibacterial Costs	$190,958	$183,569	-3.9%	-$7,389
Systemic Antibacterial Costs/Patient Day	$55.11	$47.54	-13.7%	-$7.57
Systemic Antifungal Costs	$144,891	$82,822	-42.8%	-$62,069
Systemic Antifungal Costs/Patient Day	$41.82	$21.45	-48.7%	-$20.36
Patient Care Indicators				
TGH ICU Average Length of Stay (days)	9.35	9.53	1.9%	0.2
TGH ICU Mortality Rate	16.9%	15.9%	-5.8%	-1.0%
TGH ICU Bed Occupancy	19.01	21.16	11.3%	2.2
TGH ICU Vent Days	2769	3422	23.6%	653

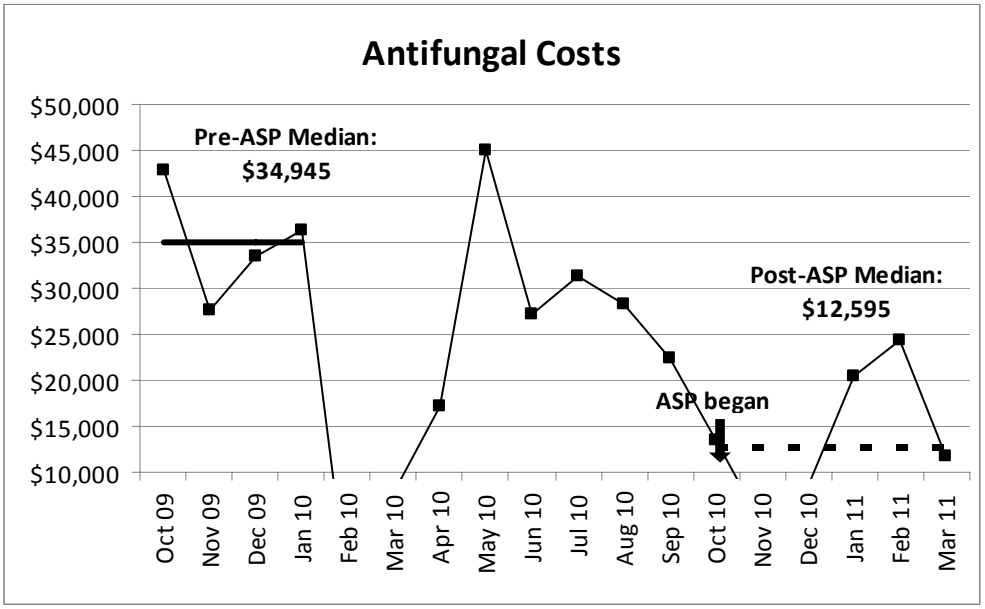
Note:
* DDD = Defined Daily Dose
** ASP started at TGH ICU in October 2010

TGH ICU	Pre-ASP (Oct 09 to Mar 10)	Post-ASP (Oct 10 to Mar 11)
Actual Antimicrobial Costs	$335,850	$266,391
Patient Days	3465	3861
Actual Antimicrobial Costs/Patient Day	$96.93	$69.00

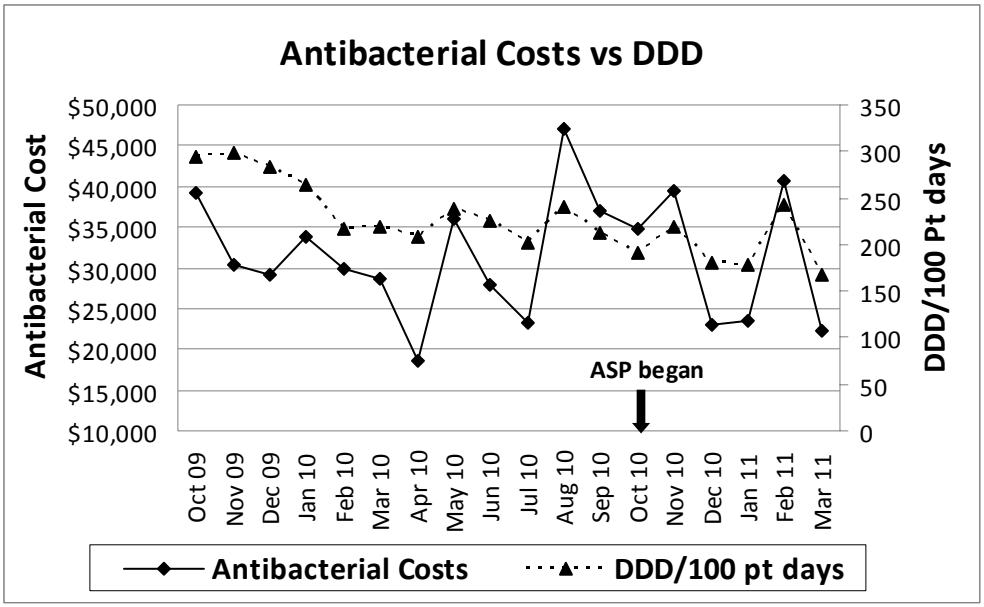
Post-ASP savings (adjusted for altered bed utilization)
= [(Pre-ASP cost/patient day) x (Post-ASP patient days)] - Actual cost Post-ASP
= ($96.93 x 3861) - $266,391
= $107,856

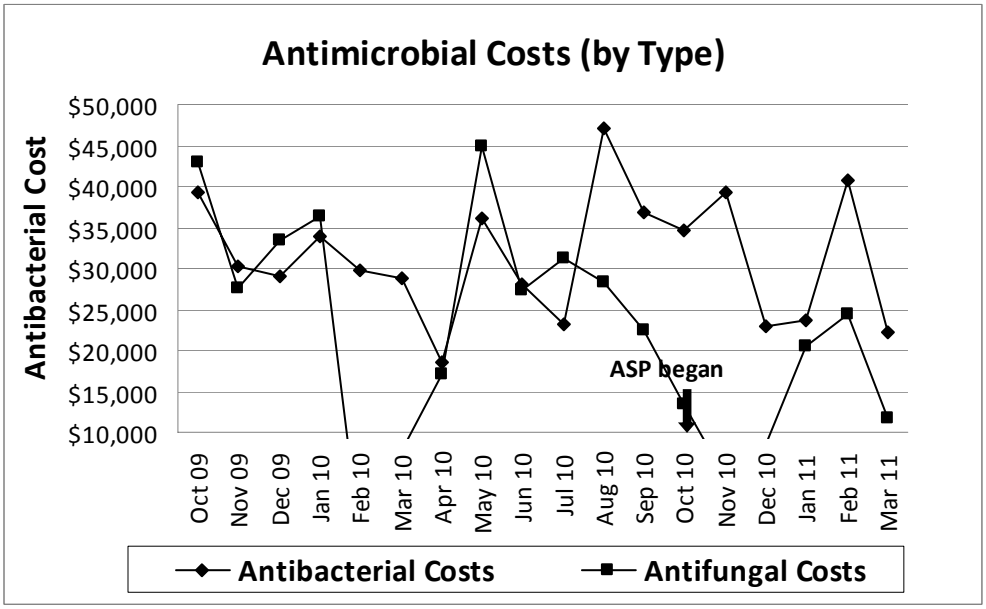
TGH ICU Antimicrobial Usage and Costs





TGH ICU Antimicrobial Usage and Costs





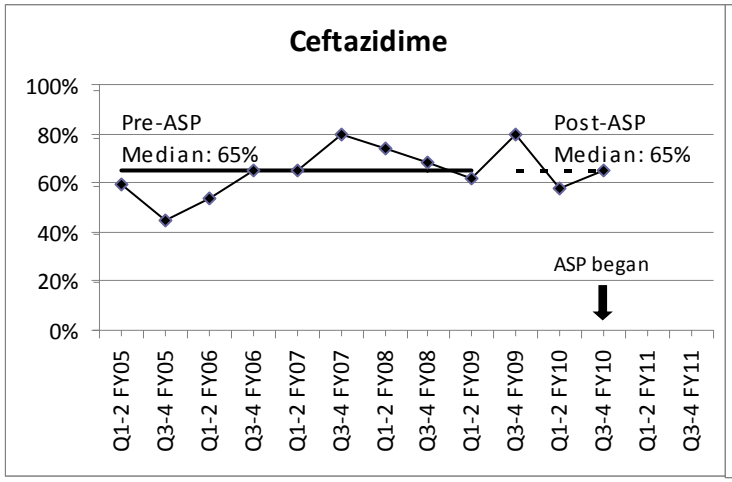
TGH ICU Antimicrobial Usage and Costs

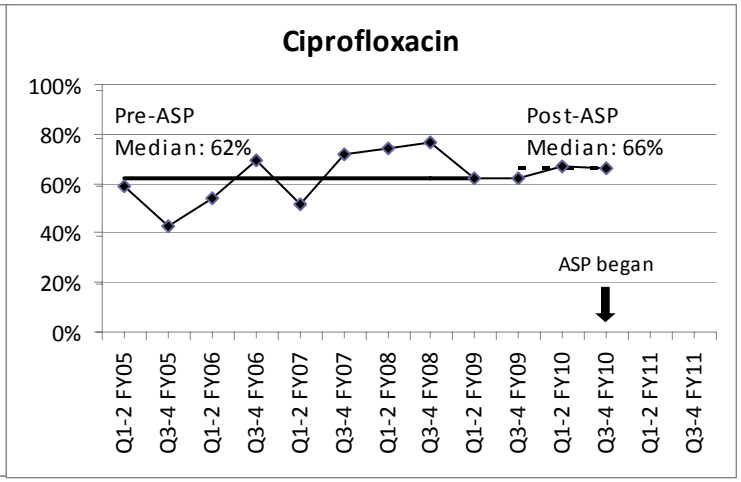
FY 10/11	Top 10 Antimicrobials by DDD	DDD	DDD/100 Pt Days
1	Meropenem	2006.3	26.79
2	Nystatin	1510.9	20.18
3	Fluconazole	1288.5	17.21
4	Piperacillin Sod-Tazobactam	1257.4	16.79
5	Ciprofloxacin	970.1	12.95
6	Cloxacillin Sodium	932.8	12.46
7	Vancomycin Hcl	833.1	11.13
8	Cotrimoxazole	767.5	10.25
9	Voriconazole	685.0	9.15
10	Azithromycin	570.3	7.62
	Total	**10821.9**	
	% of Total	**69.41%**	

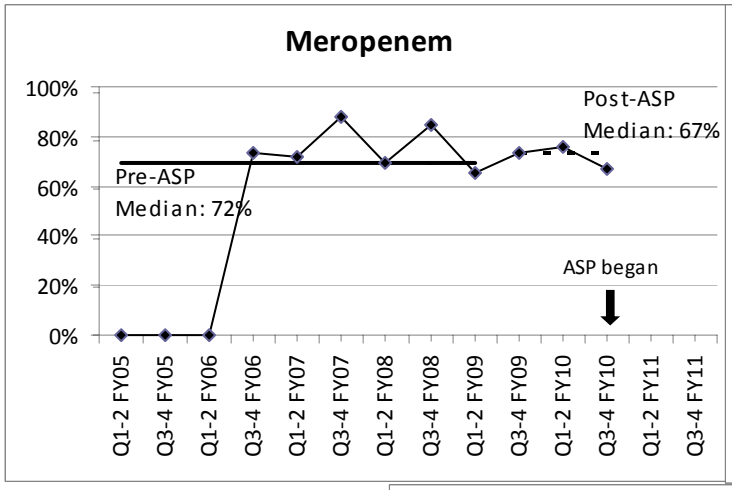
FY 10/11	Top 10 Antimicrobials by Cost	Cost	Cost/Pt Day
1	Meropenem	$195,409	$26.10
2	Voriconazole	$121,963	$16.29
3	Amphotericin B Liposomal	$59,241	$7.91
4	Piperacillin Sod-Tazobactam	$45,317	$6.05
5	Caspofungin Acetate	$29,928	$4.00
6	Linezolid	$29,856	$3.99
7	Tigecycline	$22,230	$2.97
8	Micafungin Sodium	$19,300	$2.58
9	Fluconazole	$13,962	$1.86
10	Vancomycin Hcl	$13,066	$1.74
	Total	**$550,272**	
	% of Total	**87.69%**	

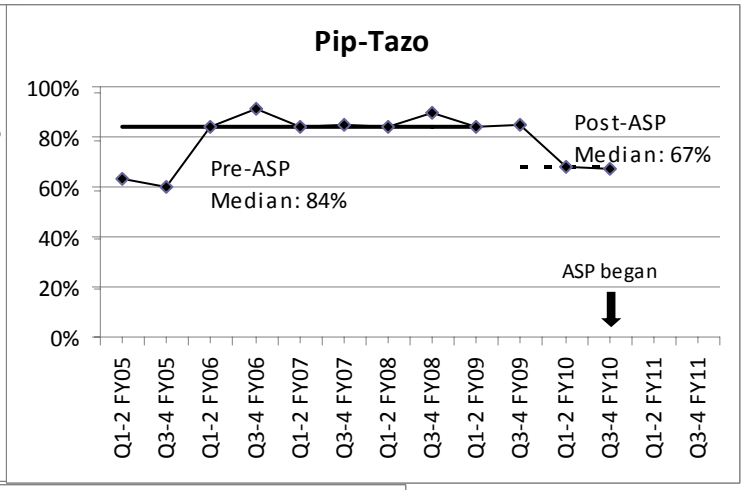
Antimicrobial Susceptibility and Pathogen Surveillance

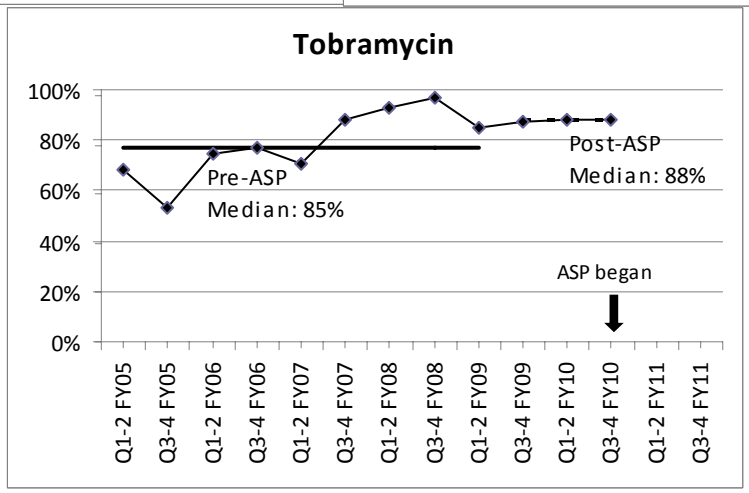
Pseudomonas Susceptibility – TGH ICU



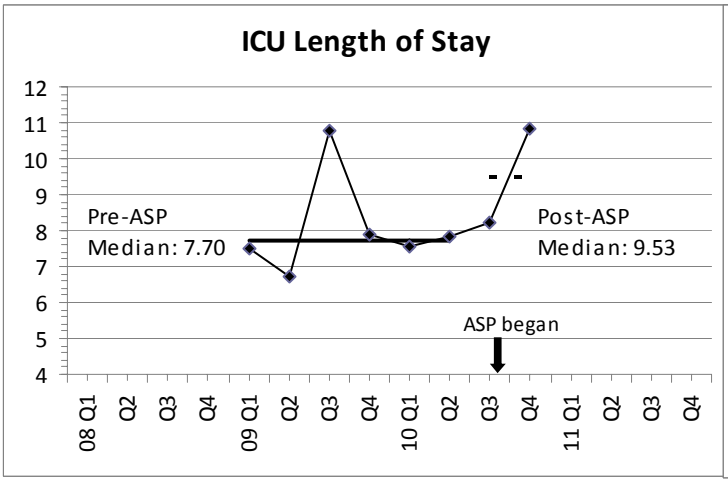


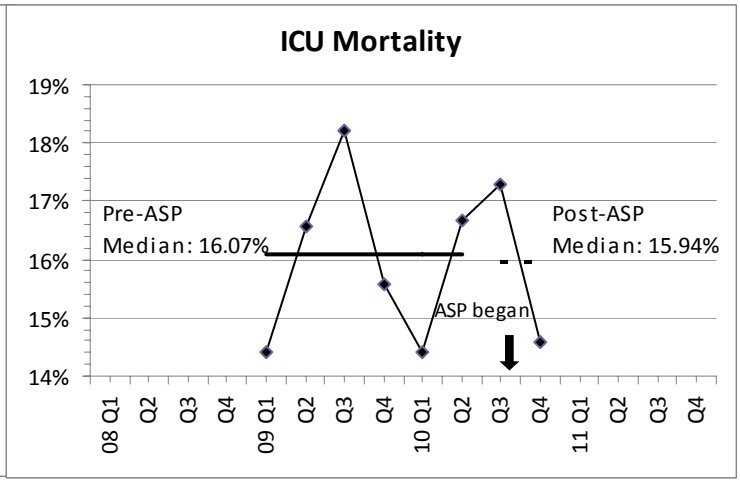


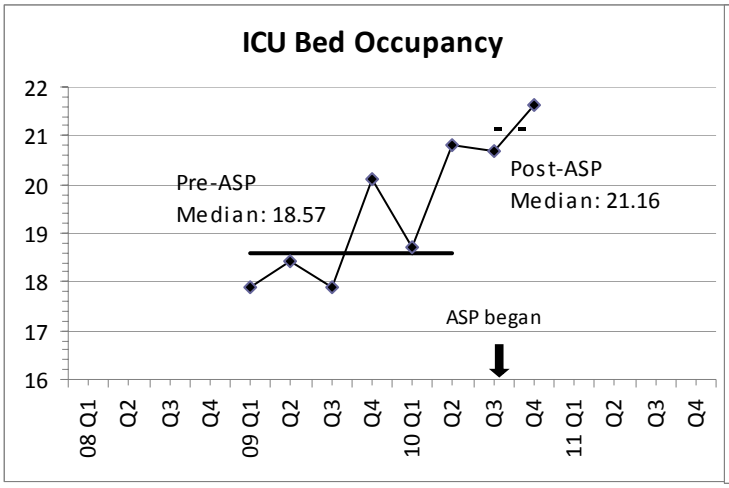


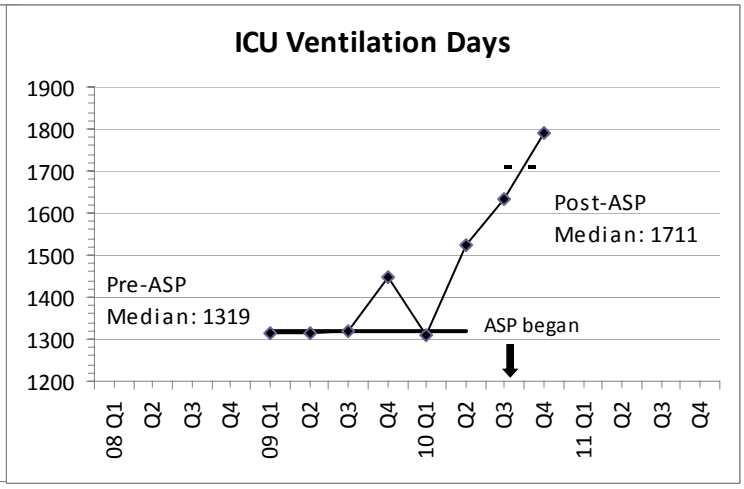


Patient Care Indicators - TGH ICU



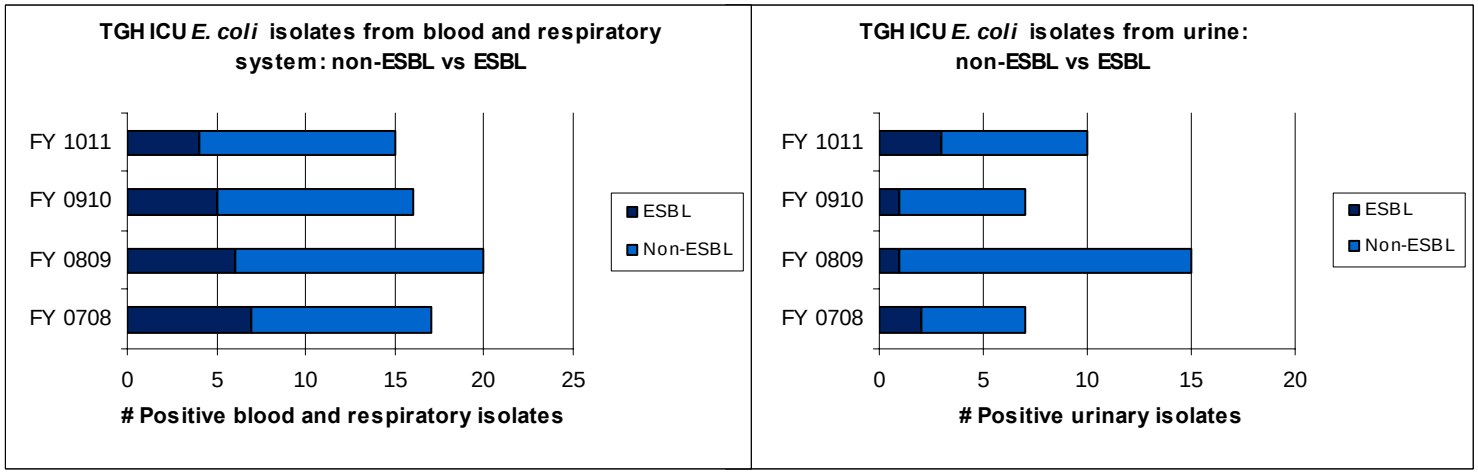




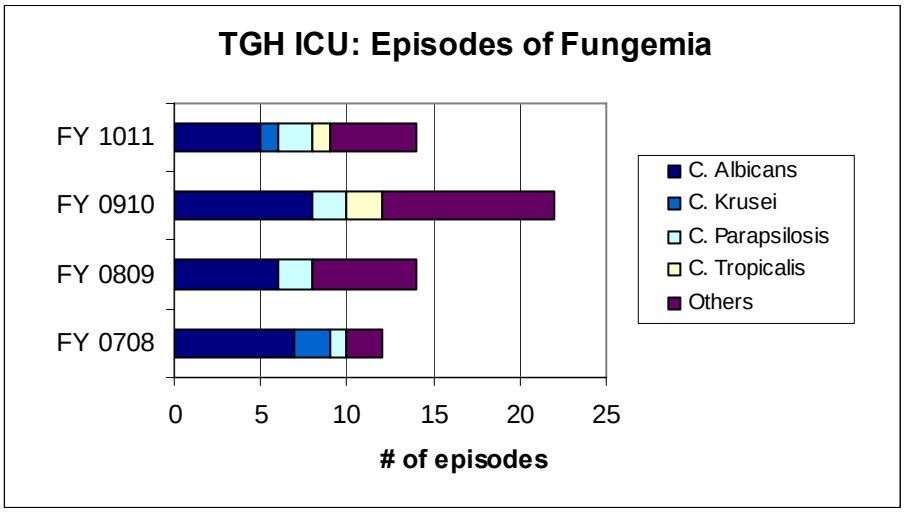


Antimicrobial Susceptibility and Pathogen Surveillance cont.

E.Coli isolates: Blood, Respiratory, Urine



Yeast Species Isolated in Blood – TGH ICU



TWH ICU Antimicrobial Usage and Costs

Key Performance Indicator	FY 09/10	FY 10/11	Difference	
			% Change	Numerical Change
Antimicrobial Usage and Costs				
Total Antimicrobial DDDs*/100 Patient Days	87.6	79.2	-9.6%	-8.4
Systemic Antibacterial DDDs/100 Patient Days	77.8	73.5	-5.6%	-4.3
Systemic Antifungal DDDs/100 Patient Days	9.8	5.7	-41.7%	-4.1
Total Antimicrobial Costs	$100,408	$101,191	0.8%	$783
Total Antimicrobial Costs/Patient Day	$13.24	$13.17	-0.5%	-$0.06
Systemic Antibacterial Costs	$87,445	$79,280	-9.3%	-$8,165
Systemic Antibacterial Costs/Patient Day	$11.53	$10.32	-10.5%	-$1.21
Systemic Antifungal Costs	$12,963	$21,911	69.0%	$8,947
Systemic Antifungal Costs/Patient Day	$1.71	$2.85	66.9%	$1.14
Patient Care Indicators				
TWH ICU Average Length of Stay (days)	7.44	10.68	43.5%	3.24
TWH ICU Mortality Rate	19.9%	18.1%	-9.2%	-1.8%
TWH ICU Readmissions within 48 hours	4.7%	4.9%	4.9%	0.2%
TWH ICU Ventilation Days	6305	5960	-5.5%	-345

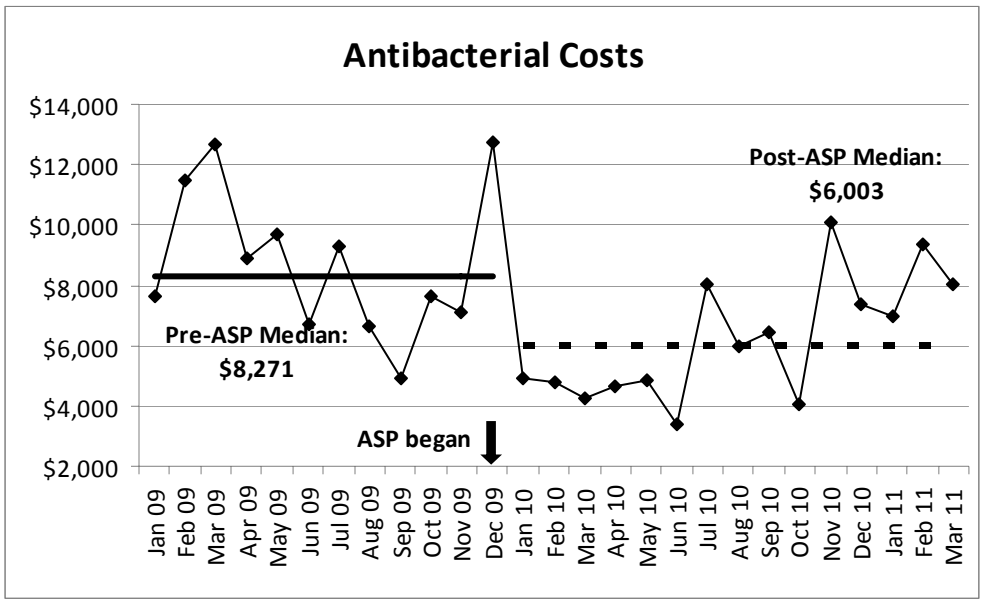
Note:
* DDD = Defined Daily Dose
** ASP started at TWH ICU in December 2009

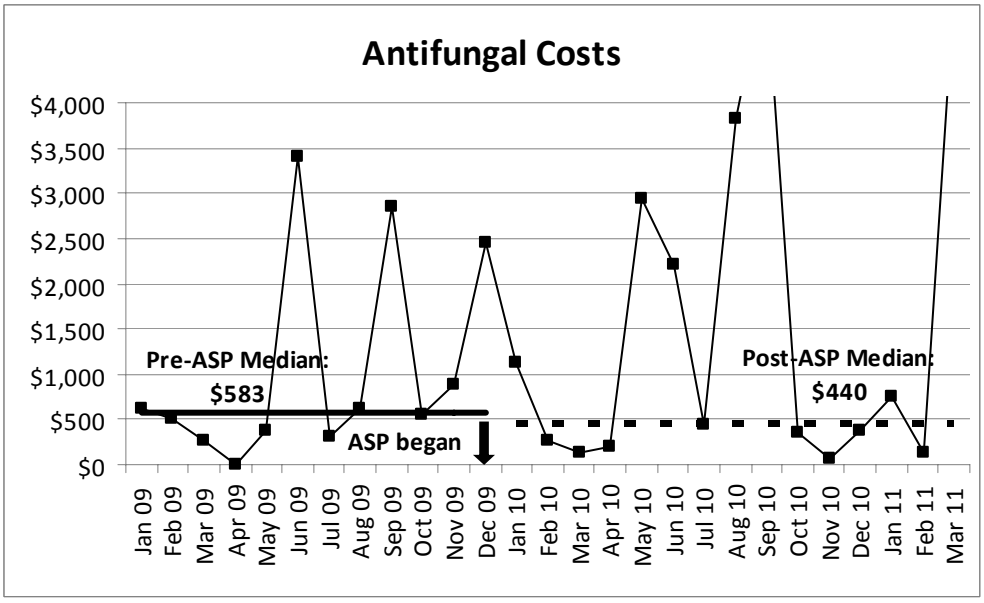
TWH ICU	Pre-ASP (Jan 09 to Dec 09)	Post-ASP (Jan 10 to Mar 11)
Actual Antimicrobial Costs	$118,257	$116,586
Actual Antimicrobial Costs / Month	$9,855	$7,772
Patient Days	7512	9570
Patient Days / Month	626	638
Actual Antimicrobial Costs / Patient Day	$15.74	$12.18

Post-ASP savings (adjusted for altered bed utilization)
= [(Pre-ASP cost/patient day) x (Post-ASP patient days)] - Actual cost Post-ASP
= ($15.74 x 9570) - $116,586
= $34,046

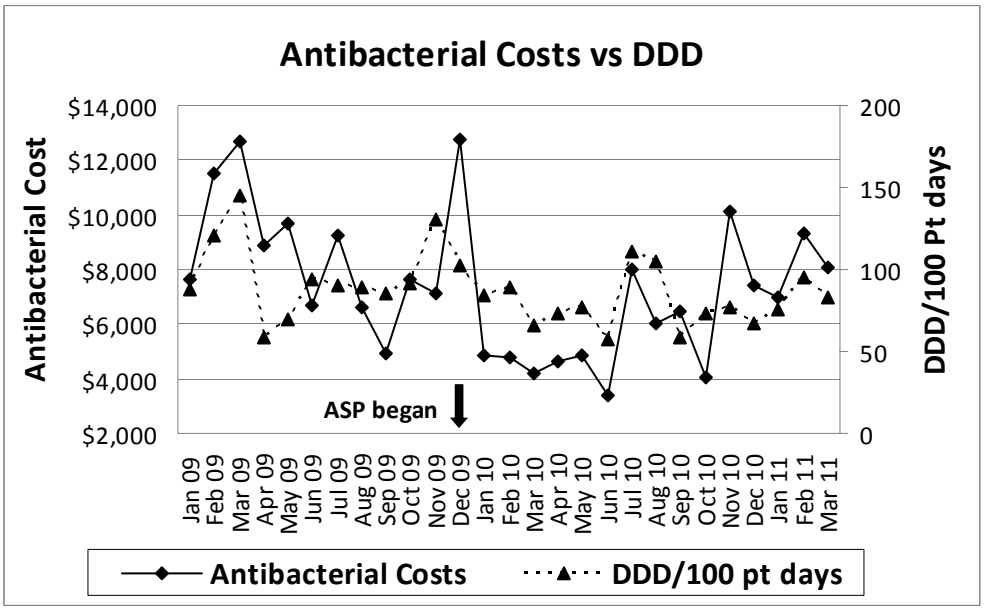
Post-ASP savings FY 10/11
= [(Pre-ASP cost/patient day) x (Post-ASP patient days)] - Actual cost Post-ASP
= ($15.74 x 7683) - $101 191
= $19,739

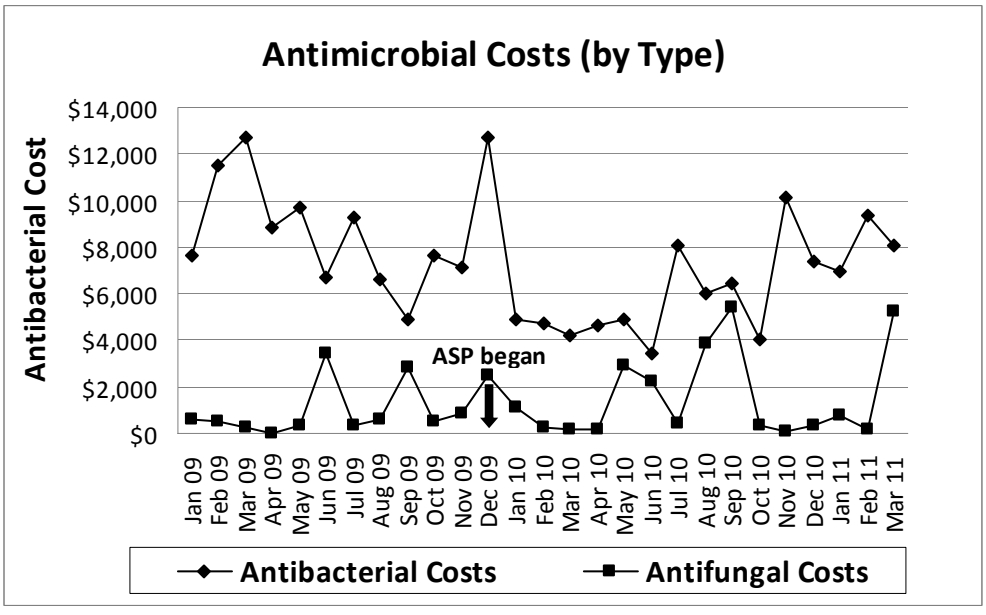
TWH ICU Antimicrobial Usage and Costs





TWH ICU Antimicrobial Usage and Costs





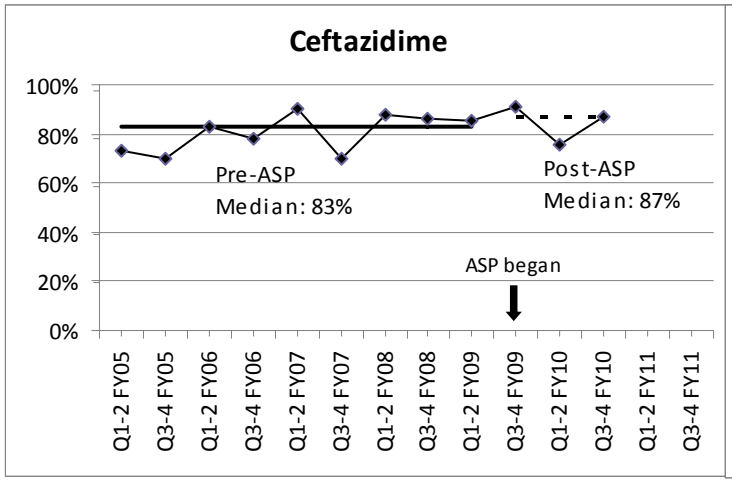
TWH ICU Antimicrobial Usage and Costs

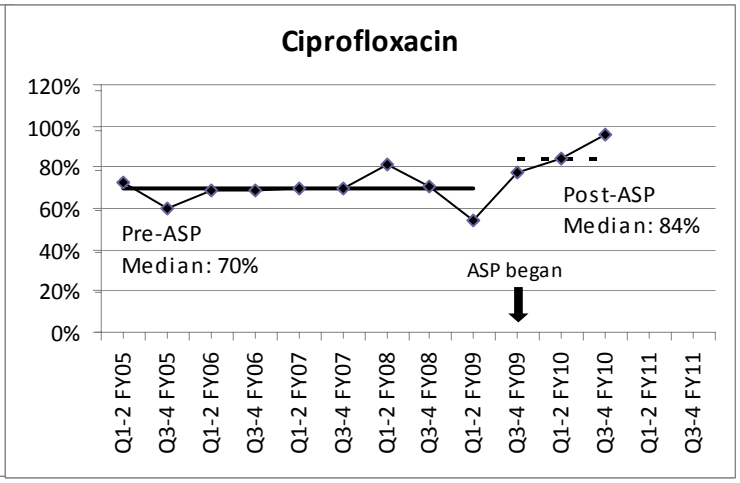
FY 10/11	Top 10 Antimicrobials by DDD	DDD	DDD/100 Pt Days
1	Cloxacillin Sodium	1299.7	16.92
2	Piperacillin Sod-Tazobactam	532.3	6.93
3	Vancomycin Hcl	497.4	6.48
4	Ciprofloxacin	399.0	5.19
5	Ampicillin	362.5	4.72
6	Ceftriaxone Sodium	358.7	4.67
7	Cefazolin Sodium	334.8	4.36
8	Meropenem	311.3	4.05
9	Fluconazole	286.3	3.73
10	Cotrimoxazole	249.0	3.24
	Total	**4630.9**	
	% of Total	**76.13%**	

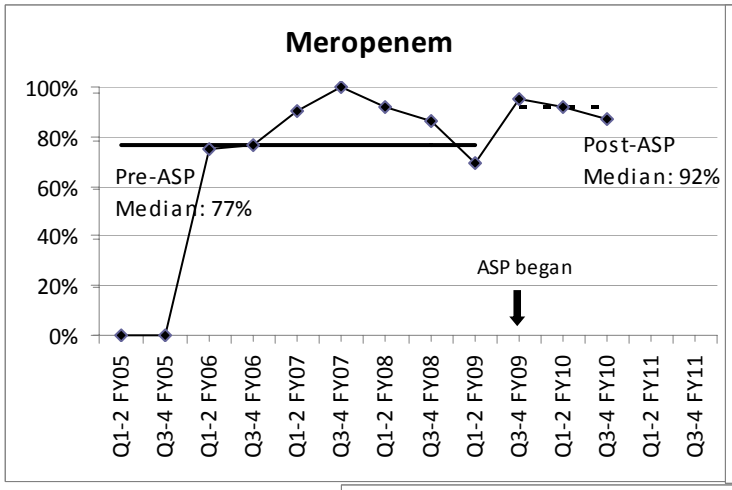
FY 10/11	Top 10 Antimicrobials by Cost	Cost	Cost/Pt Day
1	Meropenem	$30,097	$3.92
2	Piperacillin Sod-Tazobactam	$12,992	$1.69
3	Amphotericin B Liposomal	$9,975	$1.30
4	Vancomycin Hcl	$7,570	$0.99
5	Cloxacillin Sodium	$6,928	$0.90
6	Caspofungin Acetate	$4,321	$0.56
7	Linezolid	$3,780	$0.49
8	Cotrimoxazole	$3,463	$0.45
9	Fluconazole	$2,954	$0.38
10	Voriconazole	$2,660	$0.35
	Total	**$84,739**	
	% of Total	**83.74%**	

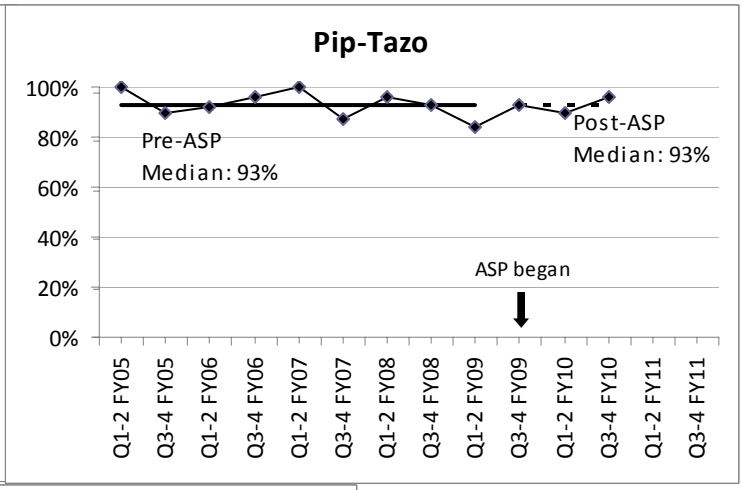
Antimicrobial Susceptibility and Pathogen Surveillance

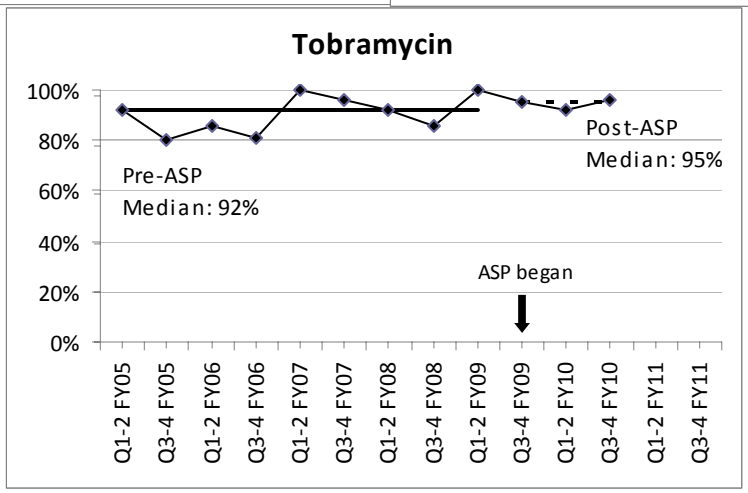
Pseudomonas Susceptibility – TWH ICU



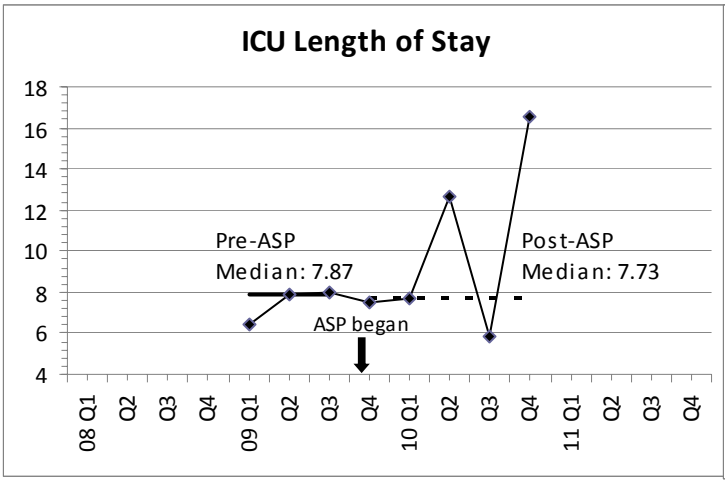


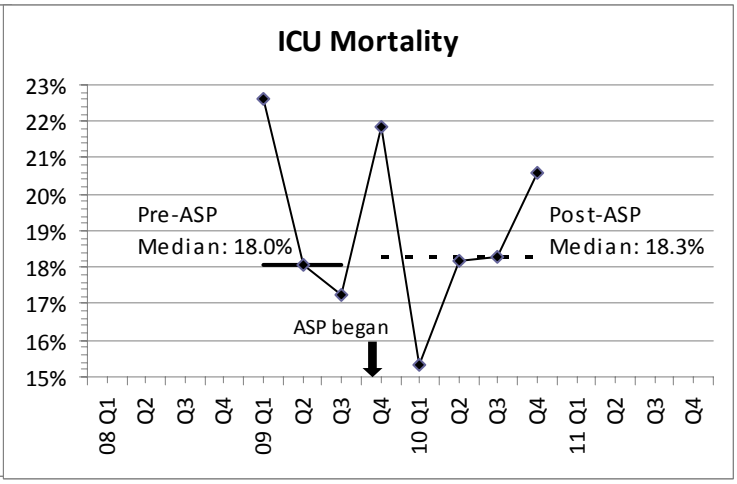


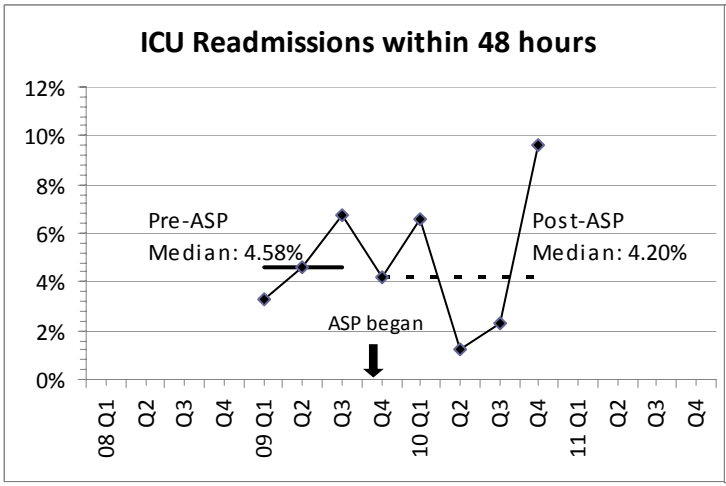


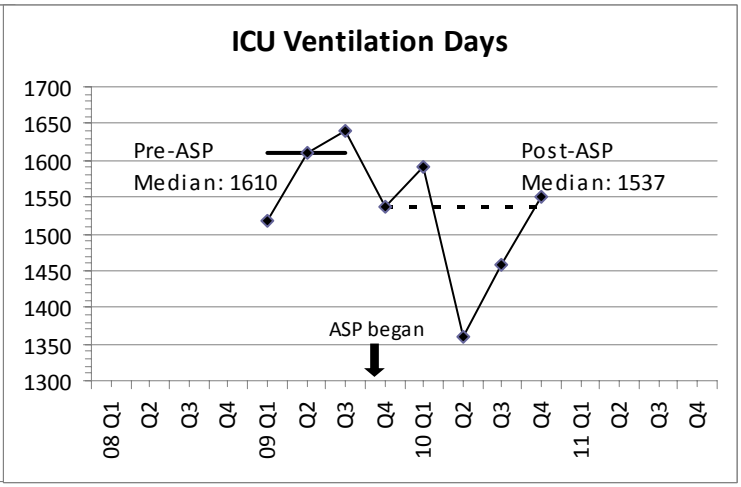


Patient Care Indicators - TWH ICU



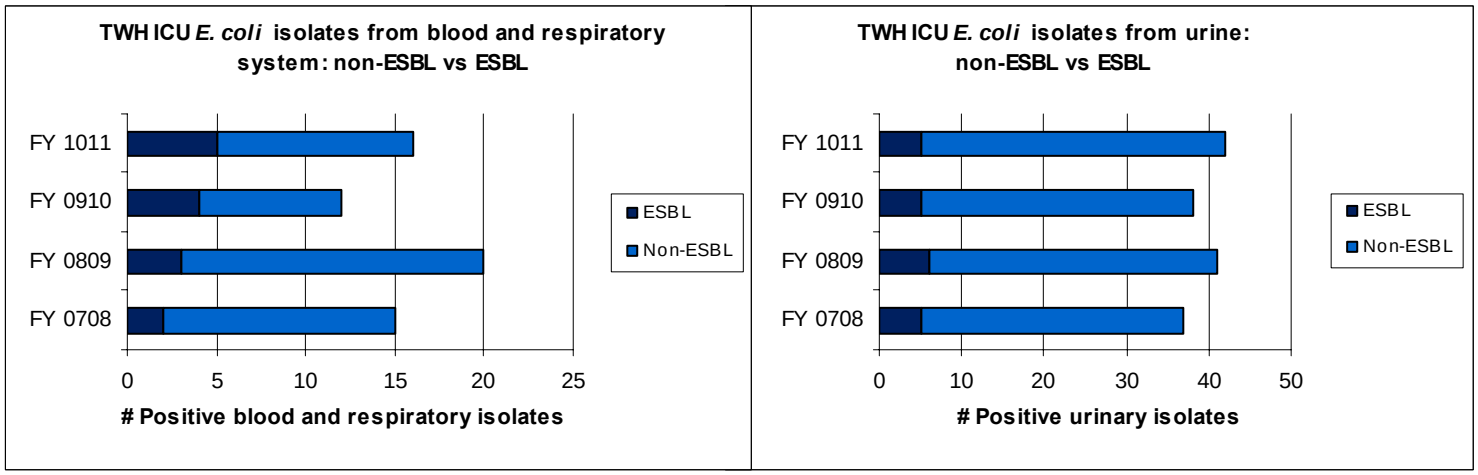






Antimicrobial Susceptibility and Pathogen Surveillance cont.

E.Coli isolates: Blood, Respiratory, Urine



Yeast Species Isolated in Blood – TWH ICU