

April 21, 2010

## MSH-UHN Antimicrobial Stewardship Program (ASP)

Quarterly Report FY 09/10 Q4

Prepared For: Antimicrobial Stewardship Program Oversight Committee

Prepared By: MSH-UHN Antimicrobial Stewardship Program Team

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### Executive Summary

The Antimicrobial Stewardship Program (ASP) at University Health Network (UHN) began clinical activities in December 2009, making the ASP a truly collaborative program between UHN and Mount Sinai Hospital (MSH), whose ASP started in February 2009. Led by Dr. Andrew Morris, ASP teams at UHN and MSH work across their own hospitals as well as on many joint ventures, leading the way antibiotics are prescribed and used. The MSH-UHN ASP is making great strides to impact clinical practice, while enhancing its research and education scope to “ensure patients receive the right antibiotics, when they need them”.

The MSH-UHN ASP team uses innovative evidence-based practice in transforming the way antibiotics are prescribed and used in the hospital. Antimicrobial stewardship at MSH and UHN focuses on three interdependent factors associated with antimicrobial use:

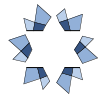


This quarterly report captures the work that the ASP performs collaboratively with many colleagues throughout MSH and UHN (and beyond) to improve antimicrobial use and patient care. Although all ASP projects and reports strive to focus on patient outcomes and antimicrobial utilization, some of the data presented—for example at PMH or on the 14<sup>th</sup> floor at MSH—reflect only antimicrobial costs (which looks at only a small aspect of improving antimicrobial use). We hope to provide more complete information for these areas (i.e. similar to the intensive care units’ data) with the next quarterly report in July 2010.

The ASP academic mission has been greatly enhanced by a transformation \$1 million grant (over three years) from Pfizer Canada to support the work of the ASP. The funds will be used, primarily, to further education and research into antimicrobial stewardship, and allow the ASP to educate healthcare providers provincially and nationally with regard to the appropriate use of antimicrobials.

#### *Clinical*

*At Mount Sinai:*



Dr. Sandra Howie has introduced prospective audit and feedback of antimicrobial prescribing with the three General Surgery teams. Dr. Howie and the surgical teams have together developed a hybrid schedule of face-to-face contact along with written feedback.

Surgical site infection prevention for caesarean sections has been dramatically changed. The ASP has worked with the Obstetrics and Neonatology teams to change the timing of antibiotic prophylaxis to pre-incision (whereas it was previously given at the time of cord-clamping). Evidenced-based caesarean section guidelines and an allergy assessment were also developed to facilitate antibiotic prophylaxis prescription for the obstetrical staff. Clinical outcome data (including surgical site infections and neonatal sepsis) is not yet available.

Based on antimicrobial resistance data, patients allergic to  $\beta$ -lactams requiring surgical prophylaxis now receive vancomycin instead of clindamycin. Because vancomycin requires a prolonged infusion, Dr. Howie worked with Nursing, Pharmacy and Anæsthesia to ensure that the necessary systems changes were in place prior to this high-risk implementation.

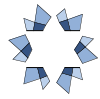
Prospective audit and feedback of antimicrobial prescribing with the Critical Care team continues. Feedback received from the Critical Care team regarding daily antibiotic review remains positive and the ASP's support is found to be valuable. Based on feedback, the ASP team now meets with the Critical Care team 4 days a week, rather than the previous 5 days a week (Mon-Fri). Working together, the ASP and the MSH Critical Care team have reduced antimicrobial use and costs in the Intensive Care Unit (ICU) by 14% and 17%, respectively. This has coincided with reduced antimicrobial resistance, improved clinical outcomes, and the first quarter in 2 years without an ICU-acquired case of *C. difficile* infection. The ASP, however, has been unable to reduce overall microbiology laboratory utilization (which was a stated objective from the outset), despite reduction in laboratory utilization for *C. difficile* and antimicrobial resistance testing.

*At UHN:*

The Outpatient Parenteral Antibiotic Therapy (OPAT) program officially launched at both TGH (General) and TWH (Western) on January 15, 2010. The OPAT team, under the direction of Drs. Jim Brunton and Amita Woods, follows patients referred to this service who will be discharged from hospital receiving intravenous antibiotics. Implementation required a new "OPAT consultation" order through EPR to be developed and deployed. To date, 42 patients have been managed through the OPAT program, most have been referred from specialty services (i.e. Orthopedics, Neurosurgery, Vascular Surgery and Cardiovascular Surgery). Almost 50% have been prescribed vancomycin, which requires close monitoring for renal toxicity followed by dose adjustment. Close follow up of lab test results together with clinical follow up by telephone and clinic visits is a keystone of the program and has allowed early identification and resolution of problems such as failure to respond to therapy, medication side effects and need to adjust medication dose or change antibiotics altogether. Finally it has also identified other critical medical problems that need resolution. There is currently a heavy load of unsupported clerical tasks (e.g. faxing orders to CCAC) which jeopardize the sustainability of this program as it continues to grow. The program has excellent acceptance from patients. Formal satisfaction surveys and audits are underway.

On the inpatient side, Drs. Andrew Morris and Linda Dresser commenced prospective audit and feedback with the TWH Critical Care team at the end of November 2009. Dr. Dresser meets daily with the ICU team, with Dr. Morris attending twice weekly, to discuss and optimize antimicrobial care. An anonymous survey to TWH critical care staff physicians, pharmacists, residents, and fellows and has received very positive feedback, with 93% reporting that "the antibiotic rounds were useful to their practice" and "were appropriately focused on patient care", and 100% reporting that their autonomy has not been negatively affected. Working together, the ASP and the TWH Critical Care team have reduced antimicrobial use and costs in the ICU by 33% and 54%, respectively.

Drs. Dresser and Morris commenced prospective audit and feedback with the 3 Clinical Associate physicians on the Leukæmia Service on February 15, 2010. They meet with each Clinical Associate once per week. Looking at very preliminary data (which therefore might reflect random variation), it would appear that there is a fairly dramatic reduction in antimicrobial costs on the Leukæmia wards (14A and 15B): looking at the



first 14 weeks of 2009 and 2010, the most recent 4 weeks of 2010 have had weekly cost reductions approximately \$13 000 less than the prior year. Further, the two lowest cost weeks over these 28 weeks occurred in April 2010. There is no accompanying clinical outcome data available.

Work is evolving on how to develop and implement best clinical practices on the Leukæmia service based on evidence-based medicine.

### *Research*

#### *At Mount Sinai:*

Amanda Israel, a summer university student presented an abstract at the 7<sup>th</sup> Annual Canadian Critical Care Conference titled “Impact of an antimicrobial stewardship program on treatment of critically ill patients with Gram-positive bloodstream infections.” She showed that the introduction of the ASP resulted in a dramatically less frequent use of vancomycin and linezolid despite no appreciable change in the incidence of bloodstream isolates growing Gram-positive bacteria.

Christina Katsios, a medical student at McMaster University, examined ICU patient data before and after the implementation of the ASP, and found that antibiotic treatment was significantly more likely to target the result of sterile site (rather than non-sterile site) cultures following the introduction of an ASP. Further, she found that clinical documentation changed dramatically, with approximately 75% of progress notes documenting antimicrobial management, whereas only 25% of such notes documented antimicrobial management prior to the introduction of the ASP.

A Pharmacy resident, Jennifer Teng is prospectively studying the outcomes of the C-section antibiotic prophylaxis project as her Resident Project. Recruiting of patients started in January 2010.

Adrienne Showler (PGY-1, General Medicine) and Christine Stephen (Clinical Fellow, Critical Care) have started projects retrospectively examining the investigation and management of *Staphylococcus aureus* bacteræmia (SAB) at MSH and UHN. (Adrienne has been granted a two-month elective block next year for this project.) They will be forming part of a larger collaborative investigation of SAB, involving teams at St. Michael’s Hospital, Sunnybrook Hospital, and the Hospital for Sick Children.

Dr. Lisa Burry, a Critical Care pharmacist at MSH, has been able to join the ASP as a 0.6 FTE research pharmacist using the funds generously donated by Pfizer Canada to support the Antimicrobial Stewardship Program, and will be involved in several research initiatives with the ASP team and other researchers from Toronto academic hospitals.

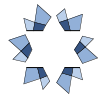
#### *At UHN:*

During the month of January 2010, a PharmD student from University of Toronto, Derek Lee, reviewed antimicrobial prescribing practice in TGH MSICU to establish baseline characteristics and identify areas for improvement.

Dr. Chaim Bell, a clinician-scientist from St. Michael’s Hospital who holds the CIHR/CPSI Chair in Patient Safety & Continuity of Care, is being supported by the funds the MSH ASP received from Pfizer Canada to work with the MSH-UHN ASP on joint research initiatives in an effort to expand the ASP’s research portfolio. This includes ICU research among MSH, TWH and TGH sites, as well as understanding post-hospital care process to evaluate the OPAT program.

### *Education*

#### *At Mount Sinai & UHN:*



Members of the ASP have been involved in education, at both a local and national level, using a combination of internal rounds for residents and new trainees, electronic media, speaking engagements at local, provincial and national levels, and academic/scientific publications.

A BSc. Pharmacy student from Memorial University, Newfoundland, Danielle Stacey, completed one of her experiential training periods with Drs. Dresser and Woods between February and April 2010.

### *Opportunities for Improvement and Growth*

Although considerable strides have been made with the Informatics Team at MSH, the ASP's lack of a durable, cohesive information technology strategy—particularly at UHN—remains an obstacle for further growth. Hopefully, the recent hiring of Lopa Naik, a highly qualified data analyst, will help overcome this challenge. Nevertheless, Ms. Naik cannot address the requirements of a cross-site database—combining data elements from MSH and UHN—alone.

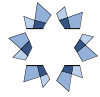
The OPAT fills a hole in patient care: the management of patients who require (or are unnecessarily discharged on) parenteral antibiotics. As the OPAT clinic continues to grow, the clinic's operational demands will outstrip the abilities of the healthcare providers (i.e. physician and pharmacist) to play clerical roles.

As this report demonstrates, there is considerable work to be done beyond the modest early achievements of the ASP: prospective audit and feedback will need to be performed in all critical care areas at TGH (i.e. the medical-surgical ICU, the cardiovascular ICU, and the coronary care unit); more attention and time should be paid to the high-utilization areas at PMH; medical teams at MSH, TGH and TWH should all be targeted for prospective audit and feedback, as should the surgical teams at TGH and TWH; etc. However, there are currently only 2 ASP pharmacists with infectious diseases/antimicrobial expertise suited to perform these tasks at present. (Ron Fung, who is replacing Amita Woods, will primarily be involved in the OPAT clinic, but may become involved in more inpatient-related ASP activities over time.) Dr. Morris has approximately 0.5 FTE set aside for all ASP-related activities.

The somewhat disappointing results regarding microbiology laboratory utilization for the MSH ICU is another tremendous opportunity for growth. Improving microbiology laboratory utilization is akin to improving appropriate antimicrobial use: it should result in improved care, reduce costs, and hopefully improve the overall patient experience. The ASP plans to work with all three intensive care units—including Infection (Prevention and) Control, Nursing, Pharmacy, Critical Care Medicine, and Respiratory Therapy—to develop best practices that will improve microbiology laboratory lab utilization.

### Quarterly Report Contents

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- MSH-UHN Joint Initiatives
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## Antimicrobial Stewardship Program: Mount Sinai Hospital

The Antimicrobial Stewardship Program (ASP) Team at Mount Sinai Hospital (MSH) has been working with clinicians across the hospital for over a year, beginning in February 2009, and continues to use teamwork and evidence-based practice in transforming the way antibiotics are prescribed and used in the hospital. The ASP team started prospective audit and feedback with clinical teams in General Surgery. A change in timing of antibiotic prophylaxis for caesarean sections was implemented, and the ASP continues to provide support to the MSH ICU. For surgical prophylaxis hospital-wide, a change was instituted so that vancomycin is used instead of clindamycin for beta-lactam allergic patients. The MSH ASP team was recently awarded the Karen McGibbon Award of Excellence – Seymour Schulich Honorarium for 2009.

The ASP is committed to being transparent regarding data collected and used for comparison as this program moves forward. Findings related to antimicrobial susceptibility, patient outcomes and other antibiotic measures are appended at the end of the quarterly report.

### 1. Achievements

#### *Clinical*

- Prospective audit and feedback on 14<sup>th</sup> level, Mount Sinai Hospital:

A study looking at appropriateness of antibiotic use on medical and surgical floors identified the surgical wards on the 14<sup>th</sup> floor surgical area as appropriate opportunities to collaborate with prospective audit and feedback. Using a 3-day point prevalence, Dr. Howie (with 2 other ASP collaborators) identified 44 courses of antibiotics where the patient was not being followed by the infectious diseases service. Only 45% of these courses were felt to be appropriate by 3 different assessors.

Meetings were held with Dr. Carol Swallow (Head of General Surgery) to provide this information, and then to discuss implementing the audit and feedback process with the General Surgery teams. The ASP was introduced at General Surgery Rounds and at the beginning of March, Dr. Howie started performing prospective audit and feedback: meeting with the General Surgery teams on 14<sup>th</sup> level 2-3 times per week in-person, and once through written recommendations on their scut board (which is regularly reviewed by the residents and fellows on the clinical teams). At the time of this report, only cost data is available for the last quarter of the fiscal year, and so this neither reflects the impact of the ASP on antimicrobial utilization, nor does it reflect clinical or microbiological outcomes.

- A change to the second-line antibiotic for surgical prophylaxis in patients with beta-lactam allergies was implemented on April 19. Rather than using clindamycin for these allergic patients, the antibiotic of choice to cover gram positive organism for surgical prophylaxis is vancomycin. This is a result of the finding that ~ 25% of *Staphylococcus aureus* at MSH are resistant to clindamycin, and another ~20% of Group A streptococci are resistant to clindamycin. This change was implemented after 3 months of working with the Nursing Unit Administrators, Surgeons, Anæsthetists, Anæsthesia assistants and Pharmacists to develop an appropriate process for the change. Meetings have begun with of the applicable surgical groups, nurses and pharmacists to educate them about the change and on beta-lactam allergies and assessment.
- A change in timing for antibiotic prophylaxis from post-cord clamping to prior to incision for c-sections was implemented in November using evidenced-based guidelines. Key clinical stakeholders reviewed and accepted the guidelines, including: OB/GYN leaders (Drs. Gareth Seaward, Matthew Sermer and Lisa Allen), Director of OB-Anaesthesia (Dr. Jose Carvalho), Nursing leaders (Debbie Yorke, Karen Meadwell and Deborah Goldman) and Neonatologist-in-Chief (Dr. Shoo Lee). An Allergy



Assessment was also created and implemented to facilitate antibiotic prophylaxis prescription for the Obstetrical staff.

A Pharmacy Resident at Mount Sinai, Jennifer Teng, has chosen to work with the ASP team to perform a prospective study to measure outcomes of the C-section antibiotic prophylaxis project as her Resident Project. See *Research* below.

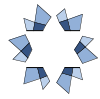
- Antibiotic prospective audit and feedback with the ICU team continues after bedside rounds. Further feedback was received from the ICU team. Feedback received remains very positive and they find the ASP's support valuable. Based on feedback from Intensivists, audit and feedback has been reduced to 4 days a week, rather than the previous 5 days a week (Mon-Fri) to minimize impact on their schedules while still maintaining adequate face time for the ASP and ICU team to review antibiotics.
- Working together with Microbiology, an antibiogram for the ICU is in the final development stages. Updating the antibiogram quarterly will enable the ASP program to provide up-to-date antibiotic sensitivity data to clinicians to facilitate appropriate antibiotic prescribing. Dr. Stephen Lapinsky (Director, ICU) has recommended that a hard copy of the antibiogram be available for use on the ICU rounding cart as well as an electronic copy available as a resource on the intranet.
- Monthly evaluation of drug use costs of the antibiotics used in Mount Sinai's ICU continue. A look at one-year data (Feb 2009-Jan 2010) post-implementation of the ASP shows that there has been a 28% decrease in costs, with a total savings of \$53, 595. With the apparently durable change in prescribing behaviour, ongoing cost reductions from antimicrobial use are expected to be less dramatic (and difficult to achieve at all).

ICU Antibiotic Costs	FY 08/09	FY 09/10	Difference	
	(Apr 08 - Mar 09)	(Apr 09 - Mar 10)	\$	%
Mean Quarterly Costs	\$42,950	\$35,655	\$7,295	17%
Total Annual Costs	\$171,801	\$142,618	\$29,183	

ICU Antibiotic DDD per 100 bed days	FY 08/09	FY 09/10	Difference	
	(Apr 08 - Mar 09)	(Apr 09 - Mar 10)	#	%
Mean Quarterly DDD per 100 bed days	143.9	123.6	20.3	14%

- Other comparison data regarding antimicrobial susceptibility and patient outcomes related to the ASP has been collected from various sources and are attached at the end of this report.
- One of the guiding principles of the ASP is improving appropriate laboratory utilization as they pertain to the diagnosis and management of infectious diseases. One component of this is microbiology laboratory utilization. As can be seen below, microbiology lab utilization in the ICU has not been reduced appreciably in the year since the ASP started working with the Critical Care team. Although there have been the expected reductions in C. difficile testing and costs for sensitivity testing of multidrug-resistant organisms (because resistance has been reduced), use of the lab remains unchanged.

Below are summary test numbers, productivity and costs for selected service types as well as totals. All data is microbiology data for the MSH ICU. Time periods include one year prior to the ASP starting in the



MSH ICU (Feb 2008-Jan 2009) and one year post ASP working with the ICU Team (Feb 2009-Jan 2010).

Note: The difference (%) is the percent increase/decrease between the two periods (positive difference % indicates an increase; negative % indicates a decrease)

Select Service Type	Time Period	Tests		Productivity		Costs	
		Total (#)	Difference (%)	Total (UV)	Difference (%)	Total Cost (\$)	Difference (%)
Blood Cultures	Feb 08-Jan 09	1,736	-	52,080	-	\$32,984	-
	Feb 09-Jan10	1,799	↑ 3.6%	53,970	↑ 3.6%	\$37,779	↑ 14.5%
Urine Cultures	Feb 08-Jan 09	891	-	17,820	-	\$17,820	-
	Feb 09-Jan10	952	↑ 6.8%	19,040	↑ 6.8%	\$20,944	↑ 17.5%
Sputum Cultures	Feb 08-Jan 09	710	-	15,620	-	\$19,880	-
	Feb 09-Jan10	724	↑ 2.0%	15,928	↑ 2.0%	\$22,444	↑ 12.9%
Swabs	Feb 08-Jan 09	21	-	525	-	\$693	-
	Feb 09-Jan10	35	↑ 66.7%	875	↑ 66.7%	\$1,295	↑ 86.9%

Testing Type	Time Period	Tests		Productivity		Costs	
		Total (#)	Difference (%)	Total (UV)	Difference (%)	Total Cost (\$)	Difference (%)
C Difficile testing	Feb 08-Jan 09	246	-	2,952	-	\$7,380	-
	Feb 09-Jan10	241	↓ -2.0%	2,892	↓ -2.0%	\$6,507	↓ -11.8%
Sensitivity/Vitek	Feb 08-Jan 09	2,229	-	26,748	-	Costs embedded in overhead of other tests	
	Feb 09-Jan10	1,964	↓ -11.9%	23,568	↓ -11.9%	Costs embedded in overhead of other tests	

Overall	Time Period	Tests		Productivity		Costs	
		Total (#)	Difference (%)	Total (UV)	Difference (%)	Total Cost (\$)	Difference (%)
Total Microbiology for MSH ICU	Feb 08-Jan 09	12,096	-	267,389	-	\$226,658	-
	Feb 09-Jan10 (excl H1N1)	12,234	↑ 1.1%	277,062	↑ 3.6%	\$234,767	↑ 3.6%
	Feb 09-Jan10 (incl H1N1)	12,814	↑ 5.9%	285,466	↑ 6.8%	\$287,149	↑ 26.7%

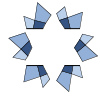
↑↓Indicates increase or decrease in difference between time periods

**Notes:**

- Costs for 8HBC2 & 8HCA2 (Serology Tests) are not included in the total, awaiting to be confirmed by Microbiology
- Preliminary data provided by Microbiology, awaiting for data to be vetted by Microbiology

**Research**

- Pfizer Canada generously donated \$1 million to the ASP at MSH over three years. The ASP is grateful for Pfizer's transformative philanthropic contribution, which will enable the ASP to achieve its 3 missions: clinical care, education and research (interfaced with knowledge translation). Plans discussed with Pfizer included to have an Antimicrobial Stewardship Training Program event in the future (potential date: May 2011), and development of a web-based portal of stewardship-related information which they will help us develop to serve to advertise our program and disseminate educational materials and facilitate stewardship networking. A portion of these funds has allowed the ASP to hire a research pharmacist (Lisa Burry, PharmD) and clinician-scientist (Dr. Chaim Bell) with an interest in patient safety and knowledge translation, each on a part-time basis. Pfizer's grant is hoped to enable other research grants to support the mission of research, education and clinical work. One-year objectives include: publishing data already generated from the ASP; spearheading a citywide study on *Staphylococcus aureus* bacteræmia; and translating MSH and TWH ICU pilot data into a research agency-funded multi-site prospective study of the role of ASPs in the ICU.
- Amanda Israel, a summer university student now a medical student at the University of British Columbia, presented an abstract at the 7<sup>th</sup> Annual Canadian Critical Care Conference, in Whistler, BC, titled "Impact of an antimicrobial stewardship program on treatment of critically ill patients with Gram-positive bloodstream infections." She showed that the introduction of the ASP resulted in a 43% relative reduction in the duration of vancomycin and linezolid despite no appreciable change in the incidence of bloodstream isolates growing Gram-positive bacteria.
- A McMaster University Medical Student, Christina Katsios, evaluated the choice of antibiotic regimens in ICU patients on the basis of sterile vs. non-sterile site cultures, utilizing retrospective microbiology and patient demographic data to explain descriptive epidemiology of bacteria in the ICU setting before and after the ASP implementation. Initial results based on April-May 2008 vs. April-May 2009 results demonstrate 5% fewer patients receiving any antibiotics, and a 25% absolute reduction in the



treatment of non-sterile site cultures, with a statistically significant year-over-year reduction. Qualitative differences include patient charts including more detail regarding antimicrobial choice, progress notes more likely to document antibiotic day number, culture data documented, regimens frequently reassessed/tailored and a higher number of ID consults. Seventy-five percent of progress notes addressed antimicrobial therapy, versus 25% prior to the introduction of the ASP. She plans to present her research at a scientific conference later this year, and to submit it for publication.

### *Education*

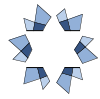
- Dr. Morris continues to be scheduled as part of the education sessions for incoming ICU residents and fellows at the beginning of their rotation, ensuring housestaff starting their ICU rotation will understand VAP protocols and will follow safe and prudent antibiotic practices when treating patients.
- The ASP will be featured in an upcoming Sinai Scene article showcasing the work of several clinical teams across the hospital and their involvement with the ASP team.
- Dr. Morris maintains a Blog ([www.IDologist.com/Blog](http://www.IDologist.com/Blog)) that covers the evidence surrounding common clinical questions as they pertain to antimicrobial stewardship.
- The team has been actively presenting the ASP at local and national conferences, including the Canadian Society of Hospital Pharmacists' National Professional Practice Conference in January 2010 and the Canadian Patient Safety Institute Forum in April 2010.

## 2. Work in Progress

### *Clinical*

- Together with the Obstetricians, work has started on modifying to the pre-printed order form for prescribing antibiotic prophylaxis for caesarean sections. This will help ease the process and help standardize antibiotics ordered for prophylaxis.
- Initial meetings have been held with Gynaecology leaders, including Dr. Lisa Allen, as the ASP team develops evidence based surgical prophylaxis guidelines (i.e. hysterectomy, TA, etc.). Initial data regarding antibiotic resistance and isolates have been received by MSH Microbiology and the Ontario Agency for Health Protection and Promotion (OAHPP).
- Evidence-based draft guidelines for surgical prophylaxis have been developed and shared with surgeons from various divisions (primarily General Surgery, Orthopedics and Plastics). An Allergy Assessment has also been distributed with the prophylaxis guidelines. Developing these guidelines involved working with surgeons to obtain agreement on the proposed guidelines and discuss distribution methods.
- The process to develop Best Practice Guidelines for the ICU has begun.
- The antibiogram being finalized for the ICU will be updated quarterly and similar antibiograms for other clinical areas will start being developed.
- Work continues with Informatics on phase two of developing an access database for general surgery, similar to the one for ICU. A larger, more comprehensive database is also being developed that would allow pharmacists, physicians, infection control practitioners and other health care professionals' access important information from a variety of sources to best meet patient care needs





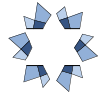
regarding antibiotics. The database connects data from 5 separate source: the paper chart, PowerChart, LIS (the Microbiology Laboratory Information System), PharmNet and Infection Control.

### *Research*

- MSH Pharmacy Resident, Jennifer Teng, has successfully recruited 281 patients and 106 respondents (target is 280 respondents) to measure outcomes of the c-section antibiotic prophylaxis as her Resident Project. Data collected in the survey include whether they have been diagnosed with a surgical site infection or experienced signs or symptoms of infection.
- Dr. Chaim Bell, clinician-scientist from St. Michael's Hospital and Dr. Lisa Burry are working with the MSH-UHN ASP on joint research initiatives. This includes ICU research among MSH, TWH and TGH sites. See *MSH-UHN Joint Initiatives* section.

### *Education*

- See *UHN-MSH Joint Initiatives* section.



## Antimicrobial Stewardship Program (ASP): University Health Network

The Antimicrobial Stewardship Program (ASP) Team at University Health Network (UHN) continues to use teamwork and evidence-based practice in transforming the way antibiotics are prescribed and used in the hospital. The ASP team has shown the ability (backed by results) to improve patient care (through OPAT), reduce costs (TWH ICU), and reduce the usage of antimicrobials (TWH ICU). As well, the ASP continues to provide support to the TWH ICU.

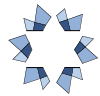
The ASP is committed to being transparent regarding data collected and used for comparison as this program moves forward. The UHN ICU report and other antibiotic measures that compare findings from February 2009 - March 2010 with 2008 and 2007 data are appended at the end of the quarterly report.

### 1. Achievements

#### *Clinical*

#### OPAT

- The OPAT program has been officially launched at both TGH (General) and TWH (Western) on January 15, 2010. The OPAT team under the direction of Drs. Jim Brunton and Amita Woods, has started seeing patients and is continuously aiming to improve patients care at both TGH and TWH.
- A new procedure in EPR is now available for physicians and nurses to order "OPAT consultation" directly through EPR. The OPAT team worked closely with the PCMS (Patient Care Management Systems) team (Cindy Lin, Karen Feng, Trevor Godfrey) to ensure that the new "OPAT consultation" procedure in EPR will have a smooth and error free implementation as well as buy-in from users. Feedbacks from users have been very positive thus far.
- A database has been developed to follow patients in the OPAT program. While this has been very helpful it will need to be migrated to a more robust platform and to interact with the EPR and UHN Data Warehouse to improve efficiency
- To date we have followed patients during 42 courses of OPAT. Most patients have been referred from specialty services - orthopedics (11), neurosurgery (8), vascular surgery (6) and cardiovascular surgery (7) while (8) were referred from General Internal medicine and (2) from other surgical services.
- Almost 50% have been prescribed vancomycin which requires close monitoring for renal toxicity followed by dose adjustment. Dose adjustment or changing the antibiotic altogether has been necessary in 80% of vancomycin courses, likely because the majority of patients have diabetes complicated by renal and vascular disease.
- The keystones of the program close follow up of lab test results together with clinical follow up by telephone and clinic visits. These activities have identified several problems in the home care system including:
  - Prolonged turnaround times for vancomycin level tests in certain private labs and in certain specific regions of Ontario
  - Tendency of home care nurses NOT to spontaneously report failure to improve or worsening of condition
  - Misinterpretation of orders with potential adverse effects
  - Significant differences in CCAC services and care standards in the GTA and around the province



- Our policy of close follow up has allowed early identification and resolution of problems such as failure to respond to therapy, medication side effects and need to adjust medication dose or change antibiotics altogether. It has also identified other critical medical problems that need resolution.
- There is a heavy load of (currently unsupported) clerical tasks such as faxing orders to CCAC and communication with patients, home care nurses, family physicians. The program has excellent acceptance from patients. Formal satisfaction surveys and audits are underway.
- Some specimens from the operating room are being processed as if they were superficial wound swabs. Microbiology is reviewing one such incident to determine how the process can be made failsafe.
- Dr. Amita Woods is currently on her maternity leave and is being replaced by Ron Fung, effective April 21, 2010.

TWH

- Drs. Andrew Morris and Linda Dresser commenced audit and feedback rounds with the TWH ICU team at the end of November 2009. Dr. Dresser meets daily with the ICU team, with Andrew attending twice weekly as well, to discuss and optimize antimicrobial care.
- The ASP team conducted a “blind” survey (i.e. using Survey Monkey) to TWH ICU staff physicians, pharmacists, residents, and fellows and has received very positive feedback.
  - 92.9% said that “the review sessions were useful to their practice”
  - 92.9% said that “the antibiotic rounds were appropriately focused on patient care”
  - 100% said that “the ASP team has not affected their autonomy in a manner that they feel is negative”
- Savings at TWH:

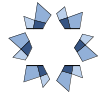
ICU Antibiotic Costs	FY 08/09 (Jan 09 - Mar 09)	FY 09/10 (Jan 10 - Mar 10)	Difference	
			\$	%
Total Costs	\$33,244	\$15,395	\$17,849	54%

ICU Antibiotic DDD per 100 bed days	FY 08/09 (Jan 09 - Mar 09)	FY 09/10 (Jan 10 - Mar 10)	Difference	
			#	%
	355.2	239.2	116.0	33%

Note: DDD/100 Pt-Days = Antibiotic Daily Dose Definition (DDD) per 100 patient days

PMH

- The ASP team conducted an official introductory meeting on February 9, 2010 with the clinical associates and the hæmatologists from the Leukæmia service.
- Drs. Dresser and Morris started weekly audit and feedback rounds with the 3 clinical associate physicians (Drs. Andrzej Lutynski, Anna Rydlewski, and Ken Peckham), PMH clinical pharmacists and the attending physicians ((Joe Brandwein, Mark Minden, Aaron Schimmer, Andre Schuh, Karen Yee, Vikas Gupta) the week of February 22, 2010.



- Dr. Morris had initiated a working group exploring the diagnosis and management of pulmonary infiltrates in leukæmic patients. Dr. Coleman Rotstein will now be chairing this committee, which will evolve into a “Best Antimicrobial Practices Subcommittee at PMH. This committee will report to the ASP.

### *Research*

- Dr. Dresser has been a core member of the ISMP Canada - Ontario Antimicrobial Stewardship Project since its inception in 2007. This project, commissioned by the Ontario Ministry of Health and Long-Term Care in partnership with the Ontario Agency for Health Protection and Promotion, is currently developing a protocol to implement antimicrobial stewardship activities in a number of Ontario hospitals as pilot programs. Drs. Howie and Morris are part of the working group.
- *Work in Progress* below

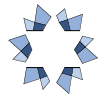
### *Education*

#### OPAT (Outpatient Parenteral Antibiotic Therapy) Program

- Drs. Jim Brunton and Amita Woods conducted an “OPAT FYI” presentations to the following committees:
  - EHR CAC (Electronic Health Record Clinical Advisory Committee) on Thursday, Feb 18<sup>th</sup>
  - CBPIT (Clinical Best Practices in Information Technology ) on Friday, Feb 19<sup>th</sup>
- A 1-page summary of the OPAT program as well as instructors on how to order “OPAT consultation” service from EPR has been produced and distributed. “Hands-on” live demonstrations on how to order “OPAT consultation” from EPR have been (and still currently being) offered and delivered to various interested groups.

#### ASP (Antimicrobial Stewardship Program)

- Dr. Andrew Morris conducted an “ASP FYI” presentation to the EHR CAC (Electronic Health Record Clinical Advisory Committee) on Thursday, Feb 18<sup>th</sup>.
- Dr. Morris is scheduled as part of the education sessions for incoming ICU residents and fellows at the beginning of their rotation, ensuring house staff starting their ICU rotation will understand VAP protocols and will follow safe and prudent antibiotic practices when treating patients.
- Dr. Morris maintains a Blog ([www.IDologist.com/Blog](http://www.IDologist.com/Blog)) that covers the evidence surrounding common clinical questions as they pertain to antimicrobial stewardship.
- Dr. Morris spoke on antimicrobial stewardship at the Ontario Hospital Association Conference on Antimicrobial Stewardship, the 5th Annual Infectious Diseases/Critical Care, the Critical Care Canada Forum, and was a visiting professor at the University of British Columbia, Department of Pharmacology and Therapeutics.
- Drs. Dresser and Woods presented Clinical Foundations “the UHN Antimicrobial Stewardship Program” to the UHN pharmacy department.
- Dr. Dresser provides weekly informal educational sessions to the TWH ICU team on a topic of the team’s choice related to the best use of antimicrobials.



## 2. Work in Progress

### *Clinical*

#### OPAT

- Continues to refine current processes and procedures in order to improve patient care.
- Immediately we need to improve our database and automate more data entry using EPR or Data Warehouse downloads. This will be the task of the new Data Analyst at UHN.
- We will work with the Centre for Innovation in Complex Care to try to make communication with CCAC and Calea pharmacy more efficient.
- The OPAT program serves as a good platform to monitor long-term outcomes of common surgical problems and complications. The long term goal will be to establish best practice for management of complications in collaboration with surgical subspecialties and the Infectious Diseases consultation service, potentially starting with inpatient antibiotic stewardship for the Vascular and Cardiovascular, Orthopedic and Neurosurgical programs.
- We will look into expanding to help clinic patients and Emergency department patients.

#### ASP

- Continues to work closely with Informatics towards developing a database that would allow pharmacists, physicians, infection control practitioners and other health care professionals' access important information from a variety of sources to best meet patient care needs regarding antibiotics.

#### TWH

- Continues to meet daily with the ICU team at the Toronto Western Hospital (TWH) to discuss and optimize antimicrobial care.
- The ASP team to develop and formalize "best practices" for TWH.

#### PMH

- Continues weekly audit and feedback rounds with the 3 clinical associate physicians (Andrzej Lutynski, Anna Rydlewski, Ken Peckham), PMH clinical pharmacists and the attending physicians ((Joe Brandwein, Mark Minden, Aaron Schimmer, Andre Schuh, Karen Yee, Vikas Gupta).

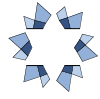
### *Research*

#### ASP

- An ID fellow, Brian Minnema, will commence his research project at the Toronto General Hospital (TGH) in October 2010.

### *Education*

- The ASP team, working together with the UHN Intranet team, has developed a unique ASP intranet website, where information related to ASP and OPAT will be posted and updated on a regular basis.
  - ASP: <http://intranet.uhn.ca/departments/asp/>
  - OPAT: <http://intranet.uhn.ca/departments/clinics/opat.asp>



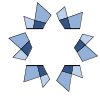
## Antimicrobial Stewardship Program (ASP): MSH & UHN Collaboration

### MSH-UHN ASP Joint Initiatives

- A MSH-UHN ASP Terms of Reference document is being developed to house the vision, objectives and roles/responsibilities of the MSH-UHN ASP. Several key aspects also included in the document are: recommendations by CMPA regarding documentation, relationship with other committees/departments and scope of the program. As the MSH-UHN ASP expands to working with clinicians across many disciplines, this document will serve as a guide to ensure consistent messaging regarding information about the program.
- ASP teams at MSH and UHN are working together to create an Antimicrobial Stewardship Training Course. This is guided by the principles:
  - Increase ID pharmacist/stewardship capacity
  - Develop training materials which will position MSH/UHN as the leaders in antimicrobial stewardship
  - Work to develop a stewardship network for all to benefit from each others experiences
  - Increase stewardship research capacity

An environmental scan and needs assessment was conducted. Next steps involve setting a date and venue as well as planning the sessions that will be offered at the training course.

- As collaboration continues at MSH and UHN, work is underway with lawyers and hospital administrators within the Pharmacy Department in order to provide ASP pharmacists access to databases at both UHN and MSH. This is hoped to be a first initiative (of many more to come) that will help synchronize antimicrobial stewardship at both hospitals.
- A Toronto Antimicrobial Stewardship Corridor has been formed with two initial meetings having been held in December 2009 and April 2010. These meetings were organized and held by MSH's ASP team, bringing together Infectious Diseases Physicians, Pharmacists and Microbiologists involved in similar antimicrobial stewardship initiatives at other Toronto teaching hospitals, including MSH, UHN, St. Michael's Hospital, Sunnybrook Health Sciences Centre and Sick Kids Hospital. Contact lists have been shared and there will be a pharmacist and physician that chair each meeting, on a rotational basis. The current chairs are Drs. Andrew Morris and Sandra Howie. The meetings allow all hospitals to share antimicrobial stewardship work being done at their hospitals as well as the discussion for joint initiatives regarding standardization of best practices and guidelines as well as multi-site research opportunities.
- Dr. Chaim Bell, clinician-scientist from St. Michael's Hospital, is working with the MSH-UHN ASP on joint research initiatives. This includes ICU research among MSH, TWH and TGH sites. Meetings have been held with ICU leadership and a stepped wedge design and time series analysis approach has been developed to assess the various outcomes of the ASP. Initial meetings have been held with community stakeholders for the outpatient program to appropriately understand and evaluate the post-hospital care process. Upcoming: submissions of a research and operating grants to the Patient Safety Institute and other agencies.
- Development of an overall ASP submission form for MSH and UHN Research Ethics Boards (REBs) is underway to aid in cooperative projects among sites, and further expanding the ASP submission for REBs across other hospitals within the Toronto Antimicrobial Stewardship Corridor (membership includes St. Michael's Hospital, Sunnybrook Health Sciences Centre, Sick Kids Hospital, UHN, MSH)



## Opportunities for Improvement and Growth

Although considerable strides have been made with the Informatics Team at MSH (who have recently created a second generation version of the ASP incorporating ICU and 14<sup>th</sup> floor patient-related data), the ASP's lack of a durable, cohesive information technology strategy—particularly at UHN—remains an obstacle for further growth. Hopefully, the recent hiring of Lopa Naik, a highly qualified data analyst, will help overcome this challenge. Nevertheless, Ms. Naik cannot address the requirements of a cross-site database—combining data elements from MSH and UHN—alone.

The OPAT fills a hole in patient care: the management of patients who require (or are unnecessarily discharged on) parenteral antibiotics. As the OPAT clinic continues to grow, the clinic's operational demands will outstrip the abilities of the healthcare providers (i.e. physician and pharmacist) to play clerical roles.

As this report demonstrates, there is considerable work to be done beyond the modest early achievements of the ASP: prospective audit and feedback will need to be performed in all critical care areas at TGH (i.e. the medical-surgical ICU, the cardiovascular ICU, and the coronary care unit); more attention and time should be paid to the high-utilization areas at PMH; medical teams at MSH, TGH and TWH should all be targeted for prospective audit and feedback, as should the surgical teams at TGH and TWH; etc. However, there are currently only 2 ASP pharmacists with infectious diseases/antimicrobial expertise suited to perform these tasks at present. (Ron Fung, who is replacing Amita Woods, will primarily be involved in the OPAT clinic, but may become involved in more inpatient-related ASP activities over time.) Dr. Morris has approximately 0.5 FTE set aside for all ASP-related activities.

The somewhat disappointing results regarding microbiology laboratory utilization for the MSH ICU is another tremendous opportunity for growth. Improving microbiology laboratory utilization is akin to improving appropriate antimicrobial use: it should result in improved care, reduce costs, and hopefully improve the overall patient experience. Because microbiology lab results drive both appropriate and inappropriate antimicrobial use, the ASP is keen to improve the use of these tests. The ASP, therefore, plans to work with all three intensive care units—including Infection (Prevention and) Control, Nursing, Pharmacy, Critical Care Medicine (both staff physicians and housestaff), and Respiratory Therapy—to develop best practices that will improve microbiology laboratory lab utilization. The plan is to develop a working group that will include this broad representation across the sites to arrive at an evidence-based, durable quality improvement plan. (This will represent the first time the ASP will begin work on a second revolution of the Plan-Do-Study-Act cycle.)

## Organizational Issues

The MSH-UHN ASP held their first and second quarterly joint meeting in October 2009 and February 2010 respectively. The ASP teams at both hospitals shared work-to-date and in-progress at each organization. Collaboration, harmonization and standardization in terms of practices and research in antimicrobial stewardship remain key messages shared by the ASP teams. Dr. Chaim Bell, from St. Michael's Hospital with an interest in antimicrobial stewardship, was a guest attendee at the first quarterly meeting.

UHN has successfully hired a Data Analyst, Lopa Naik, to join the UHN ASP Team. She will start on Monday, May 3<sup>rd</sup>. Welcome Lopa!

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The next quarterly report will be distributed in July 2010

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April 21, 2010

Antimicrobial Stewardship Program (ASP): Mount Sinai Hospital  
Findings: FY 09/10  
Data captured up to March 2010

Prepared For: Antimicrobial Stewardship Program Oversight Committee

Please find below the following appended elements:

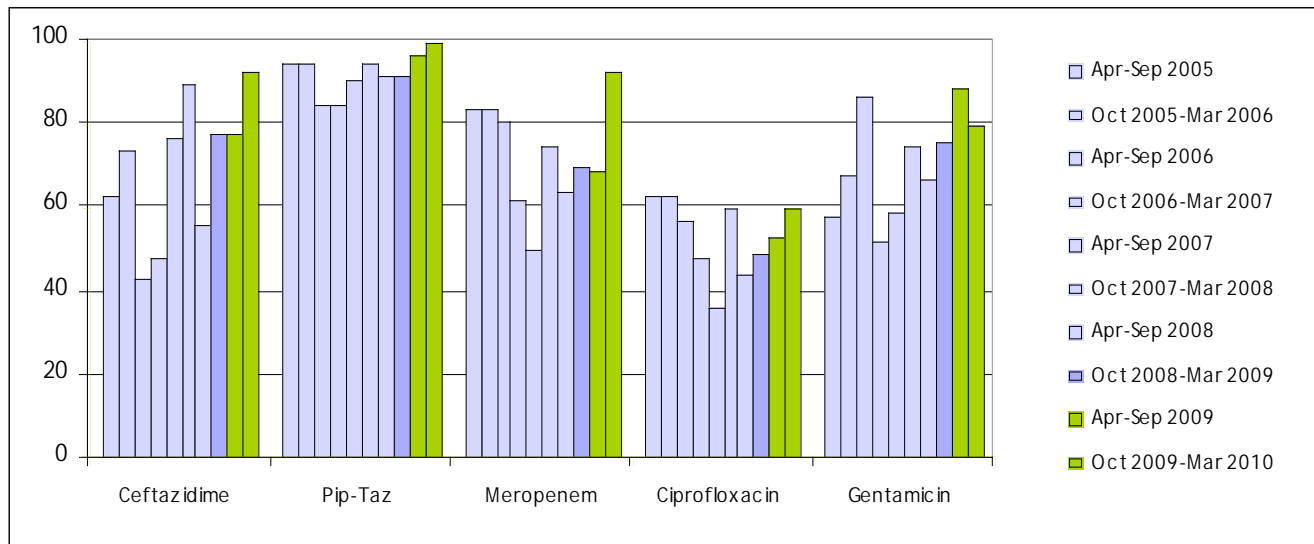
Antimicrobial Stewardship Findings	
1. Antimicrobial Susceptibility Trends in the ICU	1.1. Percent Susceptible Pseudomonas in MSH ICU 2005-2010
2. MSH ICU Report	2.1. ICU Average Length of Stay 2.2. ICU Ventilation as a Percentage of ICU Bed Days 2.3. ICU Mortality Rate 2.4. ICU Readmission Rate 2.5. C. difficile in ICU
3. Antibiotic Data	3.1. Antibacterial Defined Daily Dose (DDD) per 100 patient days in the ICU 3.2. A) Antibiotic Costs in ICU B) Antibiotic Costs per ICU bed days 3.3. Use of Non-Lactose Fermenter (NLF) vs. Lactose Fermenter (LF) Covering Antibiotics 3.4. MRSA vs. MSSA Covering Drug Use 3.5. Antimicrobial costs on 14 <sup>th</sup> Floor (14 North, 14 South, 14 Step-down)

A look at 2008 data (where available) will serve as baseline data for the ASP moving forward. The ASP started in February 2009 (denoted by blue highlight in data tables) and data will continue to be tracked and reported on a quarterly basis.



1.1 RESISTANCE TRENDS IN ICU

1.1 Percent (%) Susceptible Pseudomonas in MSH ICU April 2005 - March 2010  
*One organism visit (unless otherwise specified)*

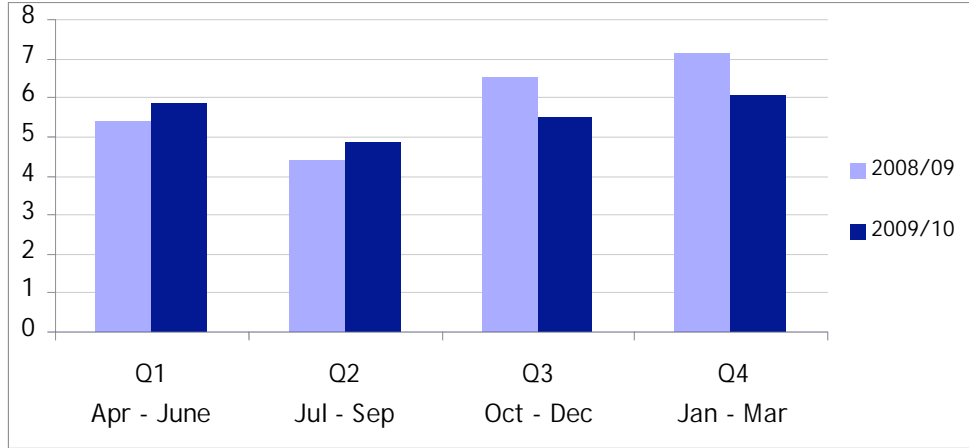


Note: Dark blue bar denotes Antimicrobial Stewardship Program initiated in MSH ICU mid-period (Feb 2009)

	Apr-Sep 2005	Oct 2005-Mar 2006	Apr-Sep 2006	Oct 2006-Mar 2007	Apr-Sep 2007	Oct 2007-Mar 2008	Apr-Sep 2008	Oct 2008-Mar 2009	Apr-Sep 2009	Oct 2009-Mar 2010	
No. of patients colonized/infected	19	19	23	27	22	20	36	38	23	15	
Susceptibility (%)	Ceftazidime	63	74	43	48	77	90	56	78	78	93
	Pip-Taz	95	95	85	85	91	95	92	92	97	100
	Meropenem	84	84	81	62	50	75	64	70	69	93
	Ciprofloxacin	63	63	57	48	36	60	44	49	53	60
	Gentamicin	58	68	87	52	59	75	67	76	89	80

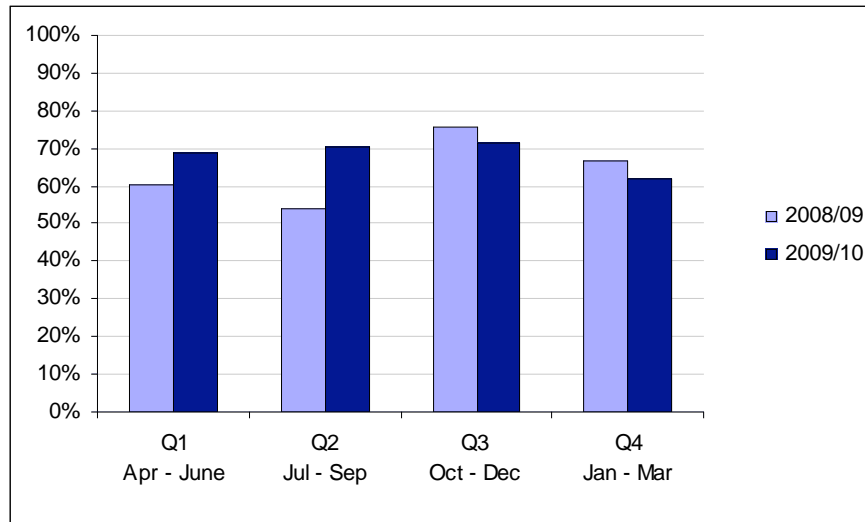
2.1 ICU DATA

2.1 ICU Average Length of Stay (in days)



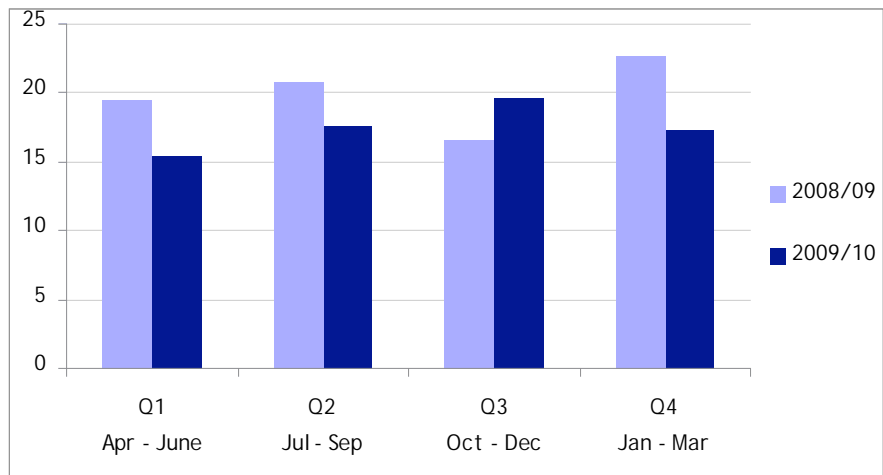
	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar
2008/09	5.4	4.4	6.5	7.1
2009/10	5.9	4.9	5.5	6.1

2.2 ICU Ventilation as a Percentage of ICU Bed Days



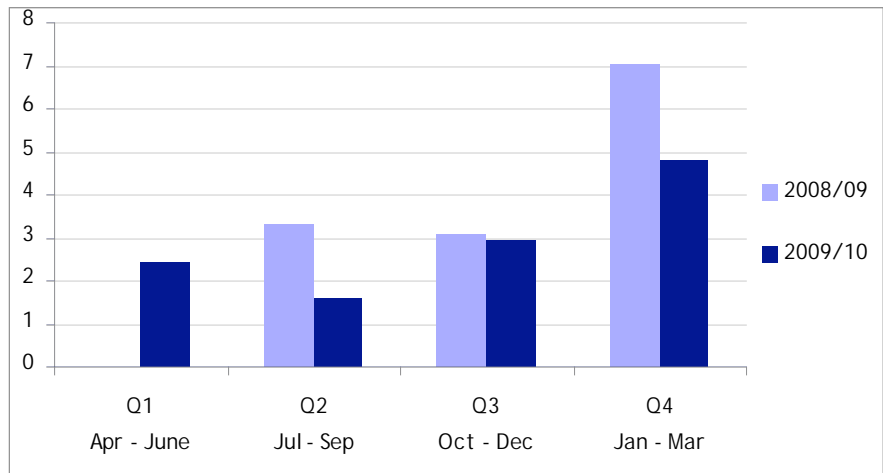
	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar
2008/09	60.1%	54.2%	75.7%	66.5%
2009/10	68.9%	70.2%	71.6%	61.8%

2.3 ICU Mortality Rate (%)



	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar
2008/09	19.5	20.7	16.6	22.7
2009/10	15.4	17.7	19.6	17.3

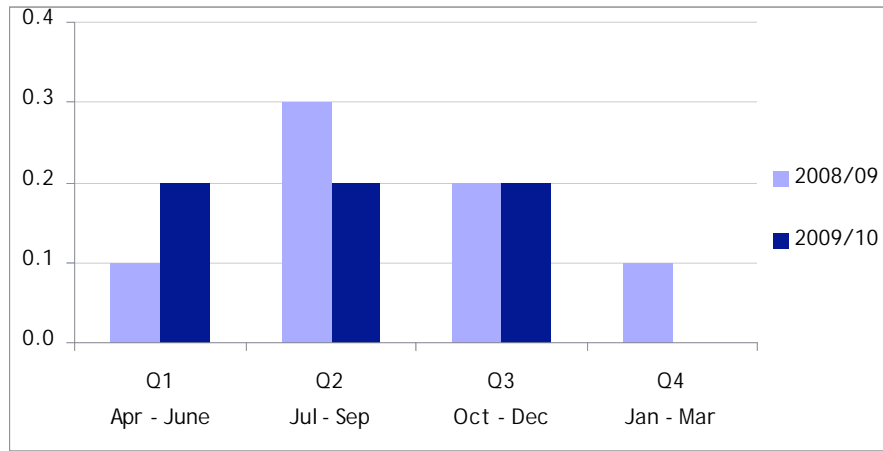
2.4 ICU Readmission Rate (% readmitted < 48 hrs to ICU)



	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar
2008/09	0.0	3.3	3.1	7.0
2009/10	2.4	1.6	2.9	4.8

### 2.5 C. difficile in the ICU

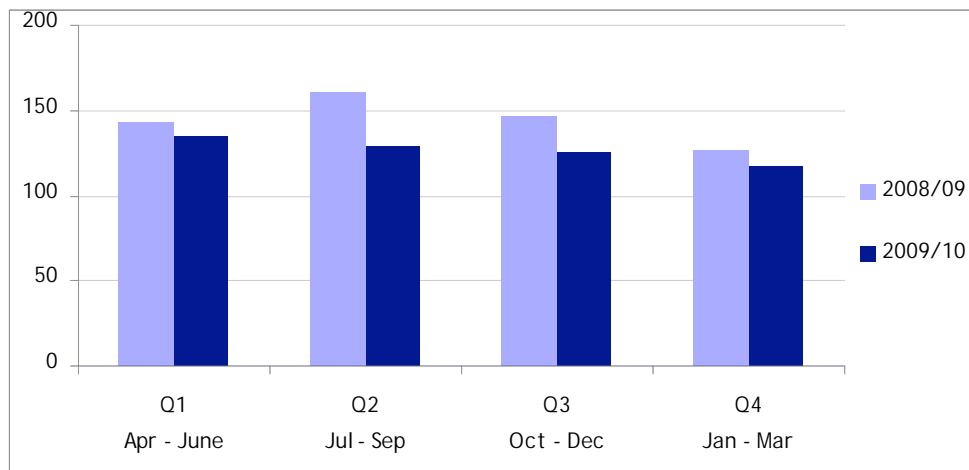
# C. Diff positive patients/100 patient days



	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar
2008/09	0.1	0.3	0.2	0.1
2009/10	0.2	0.2	0.2	0.0

### 3.1 ANTIBIOTIC DATA

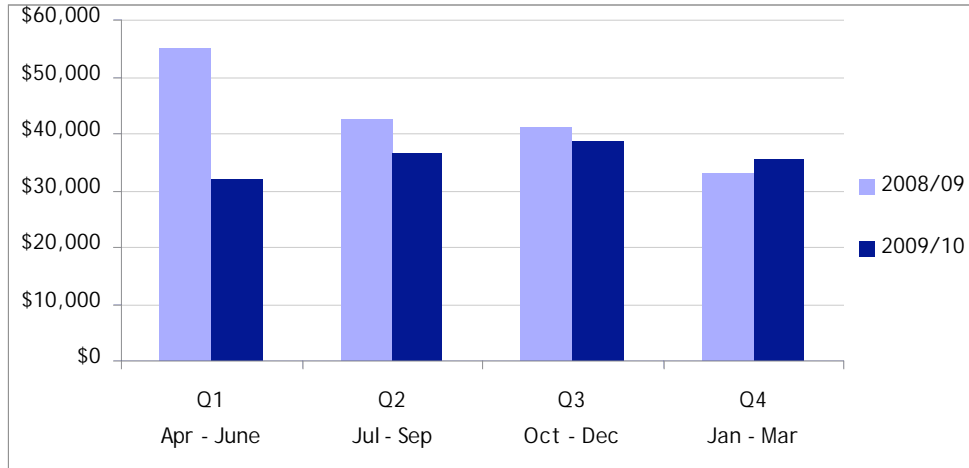
#### 3.1 Antibacterial Defined Daily Dose (DDD) per 100 patient days in the ICU



	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar	Quarterly Mean
2008/09	142.3	160.6	146.2	125.8	143.9
2009/10	134.7	129.2	124.9	117.4	123.6

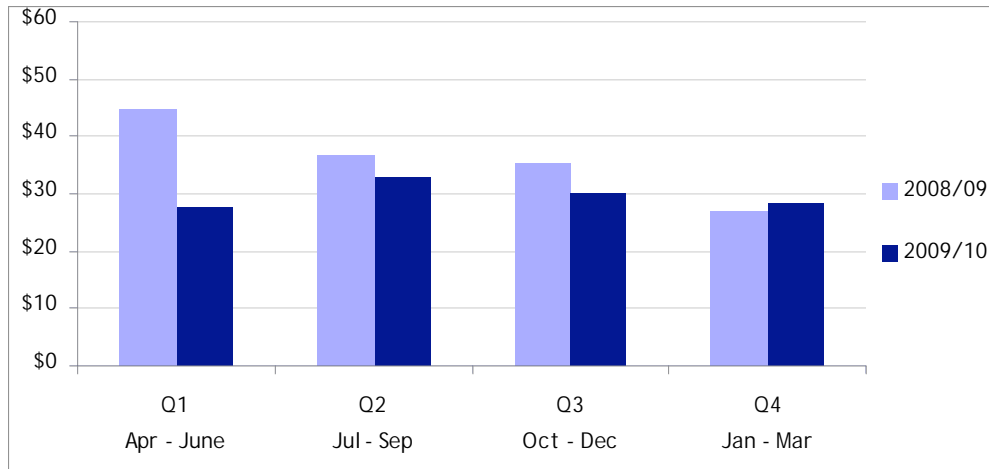


3.2 A. Antibiotic Costs in ICU



	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar	Total	Quarterly Mean
2008/09	\$55,263	\$42,590	\$40,899	\$33,049	\$171,801	\$42,950
2009/10	\$31,808	\$36,579	\$38,703	\$35,528	\$142,618	\$35,655

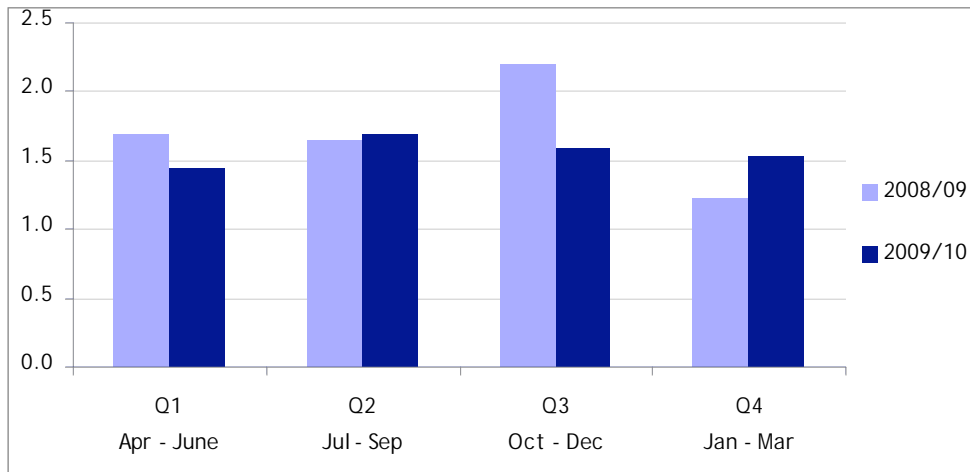
3.2. B. Antibiotic Costs per ICU Bed Days



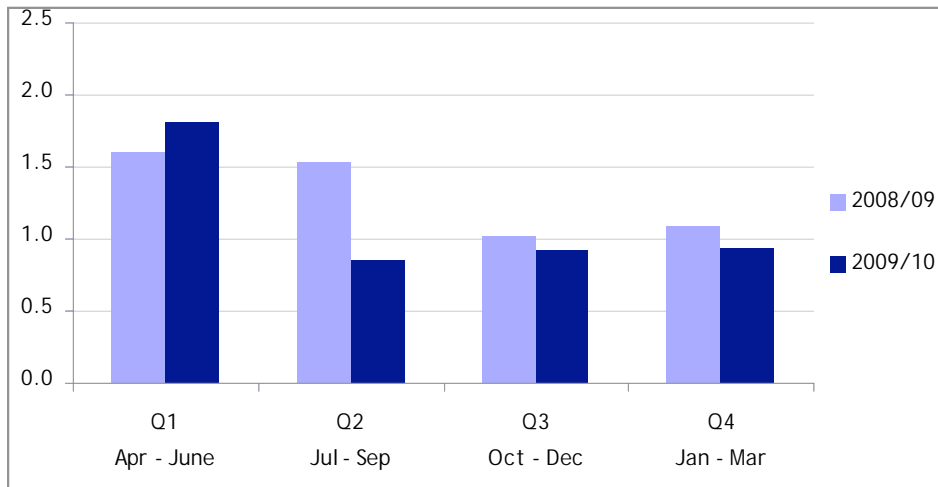
	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar	Quarterly Mean
2008/09	\$44.60	\$36.53	\$35.38	\$26.78	\$48
2009/10	\$27.42	\$32.84	\$29.86	\$28.29	\$39

3.3 Use of Non-Lactose Fermenter (NLF) vs. Lactose Fermenter (LF) Covering Antibiotics (Ratio)

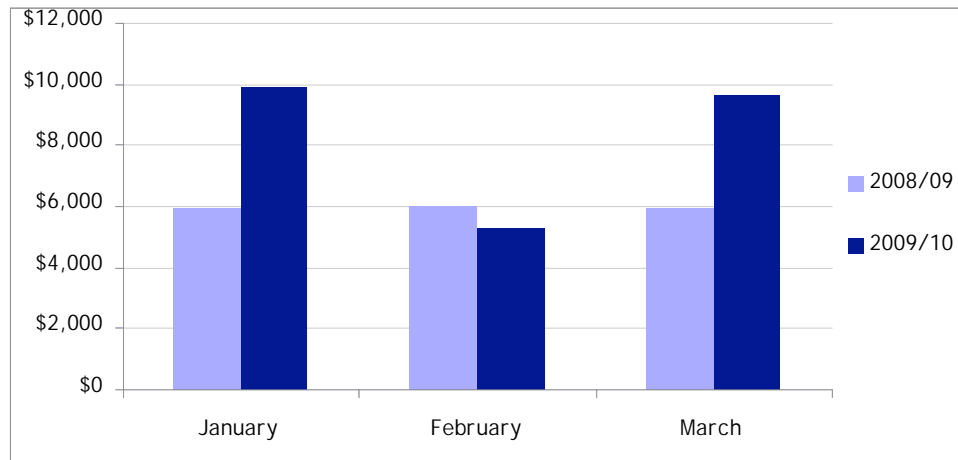
Note: Non-Lactose Fermenter covering antibiotics includes: amikacin, ceftazidime, ciprofloxacin, levofloxacin, meropenem, piperacillin-tazobactam, tobramycin and colistimethate



3.4 MRSA vs. MSSA Covering Drug Use (Ratio)



3.5 Antimicrobial Costs for 14<sup>th</sup> Level (14 South, 14 North, 14 Step-down)



	January	February	March
2008/09	\$5,958	\$6,031	\$5,966
2009/10	\$9,940	\$5,250	\$9,637

April 21, 2010

Antimicrobial Stewardship Program (ASP): University Health Network (UHN)

Findings: FY 09/10 Q4

Data captured up to March 2010

Prepared For: Antimicrobial Stewardship Program Oversight Committee

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Please find below the following appended elements:

Antimicrobial Stewardship Findings	
4. Antimicrobial Susceptibility Trends in the ICU	4.1. Percent Susceptible Pseudomonas in TWH ICU 2008-2010
5. TWH ICU Report	5.1. ICU Average Length of Stay 5.2. ICU Ventilation as a Percentage of ICU Bed Days 5.3. ICU Mortality Rate 5.4. ICU Readmission Rate
6. Antibiotic Data	6.1. Antibacterial Defined Daily Dose (DDD) per 100 patient days in the ICU 6.2. Antibiotic Costs in ICU 6.3. PMH 14A/15B Antibiotic Costs

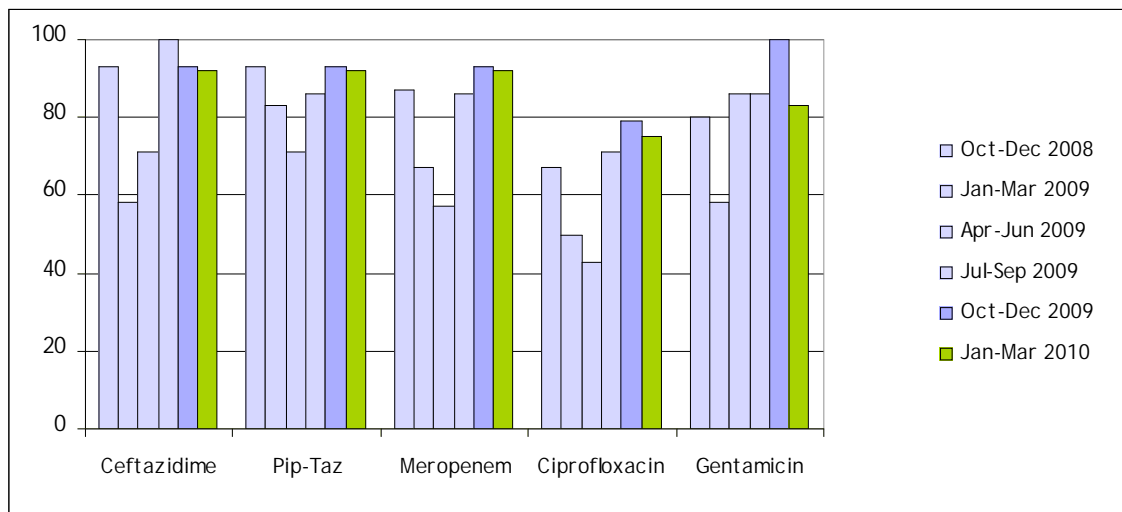
A look at the 2008 and 2009 data will serve as baseline data for the ASP moving forward. The ASP at UHN started in December 2009 and data will continue to be tracked and reported on a quarterly basis.

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4.1 RESISTANCE TRENDS IN ICU

4.1 Percent (%) Susceptible Pseudomonas in TWH ICU October 2008 - March 2010  
*One organism visit (unless otherwise specified)*



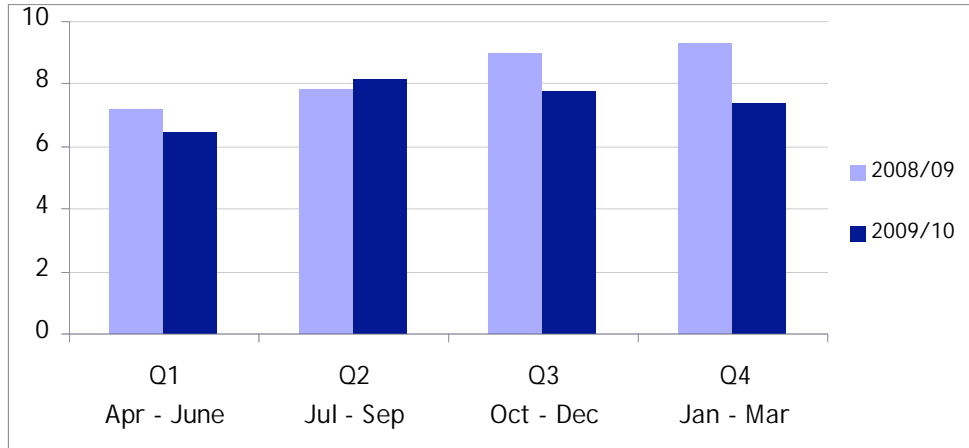
Note: Dark blue bar denotes Antimicrobial Stewardship Program initiated in TWH ICU mid-period (end of Nov 2009)

		Oct-Dec 2008	Jan-Mar 2009	Apr-Jun 2009	Jul-Sep 2009	Oct-Dec 2009	Jan-Mar 2010
Susceptibility (%)	No. of patients colonized/infected	15	12	7	7	14	12
	Ceftazidime	93	58	71	100	93	92
	Pip-Taz	93	83	71	86	93	92
	Meropenem	87	67	57	86	93	92
	Ciprofloxacin	67	50	43	71	79	75
	Gentamicin	80	58	86	86	100	83



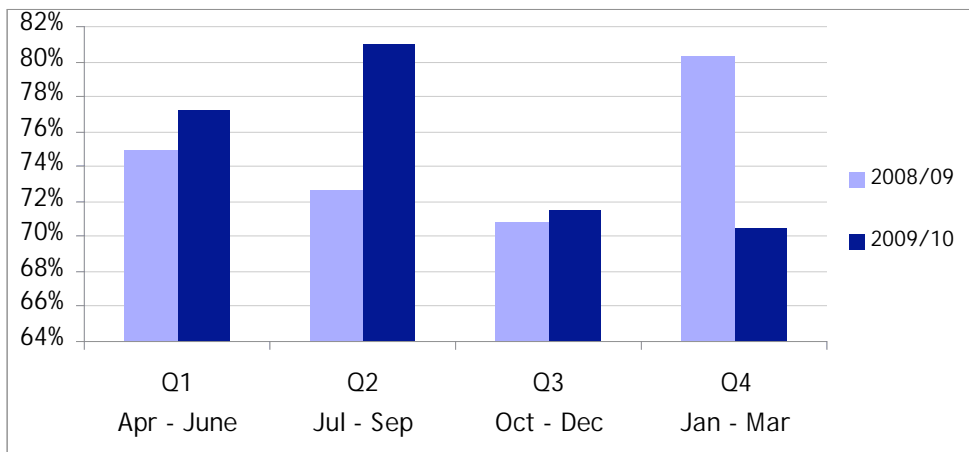
5.1 ICU DATA

5.1 ICU Average Length of Stay (in days)



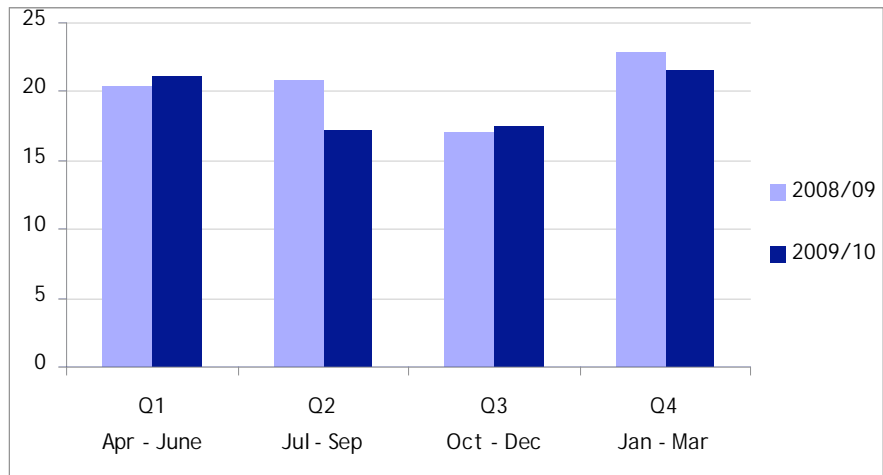
	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar
2008/09	7.2	7.8	9.0	9.3
2009/10	6.4	8.2	7.8	7.4

5.2 ICU Ventilation as a Percentage of ICU Bed Days



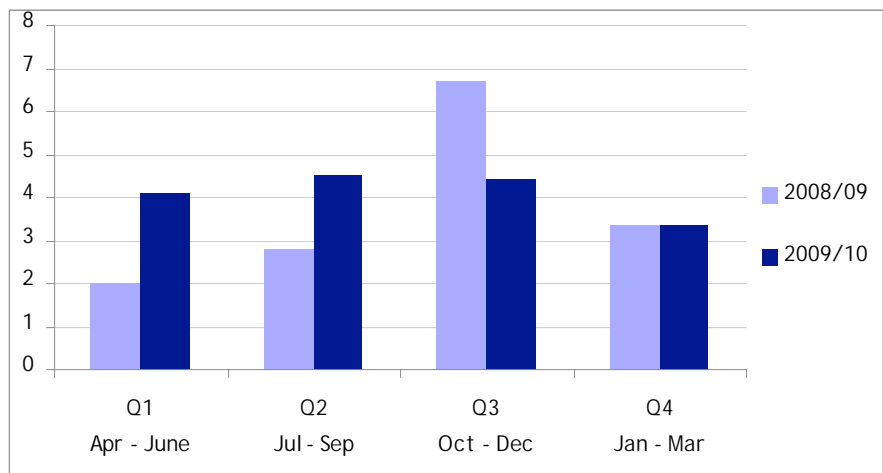
	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar
2008/09	74.9%	72.7%	70.9%	80.3%
2009/10	77.2%	81.0%	71.5%	70.5%

5.3 ICU Mortality Rate (%)



	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar
2008/09	20.4	20.8	17.0	22.9
2009/10	21.1	17.2	17.5	21.6

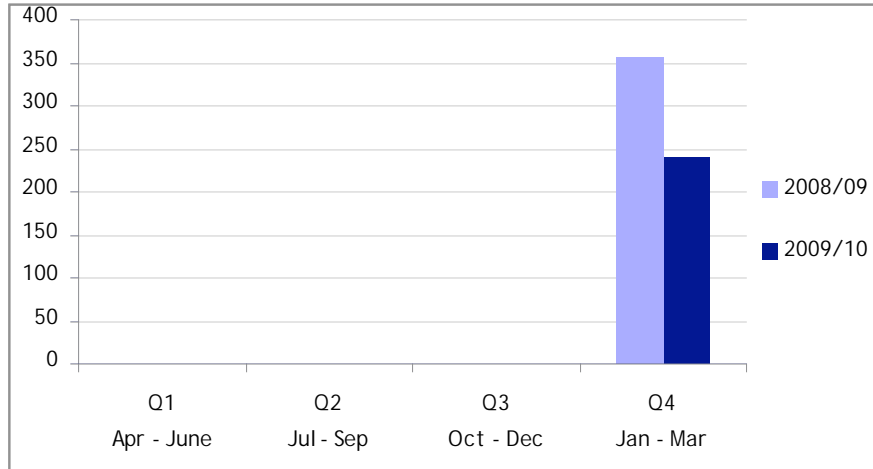
5.4 ICU Readmission Rate (% readmitted < 48 hrs to ICU)



	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar
2008/09	2.0	2.8	6.7	3.4
2009/10	4.1	4.5	4.4	3.3

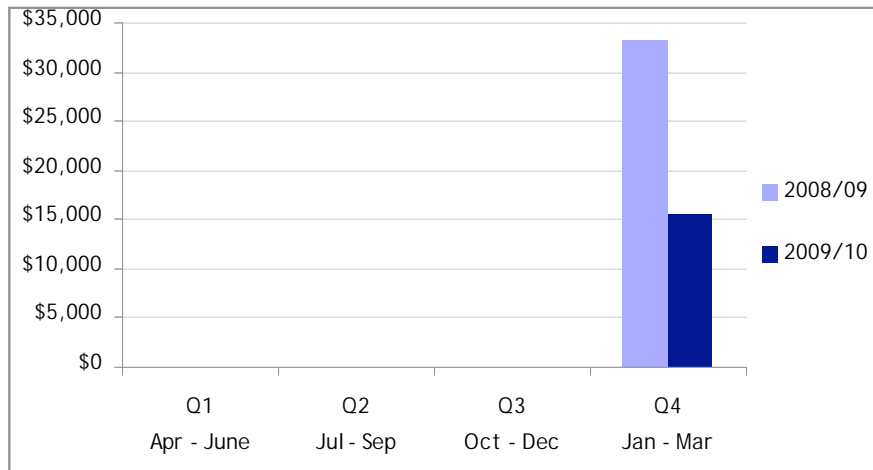
6.1 ANTIBIOTIC DATA

6.1 Antibacterial Defined Daily Dose (DDD) per 100 patient days in the ICU

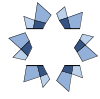


	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar
2008/09	-	-	-	355.2
2009/10	-	-	-	239.2

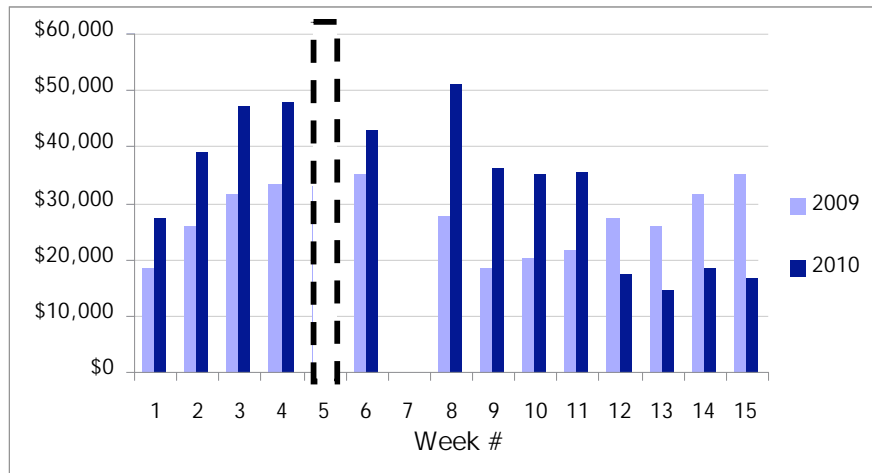
6.2 Antibiotic Costs in ICU



	Q1 Apr - June	Q2 Jul - Sep	Q3 Oct - Dec	Q4 Jan - Mar
2008/09	-	-	-	\$33,244
2009/10	-	-	-	\$15,395



6.3 PMH 14A/15B Antibiotic Costs



Note: Week # 7 → transition week, data is not available