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Antimicrobial Stewardship Profile: Lakeridge Health

Lakeridge Health

Lakeridge Health is a multi-site facility with 630+ beds in Durham Region serving urban and rural communities.
Lakeridge Health offers a broad range of programs and patient services including:

- Cancer Care
- Critical Care
- Dialysis
- Emergency
- Obstetrics and NICU
- Pediatrics
- Psychiatry
- Rehab
- Regional Stroke Centre
- Surgery

Champions (L-R): Tom Oomen, ASP Pharmacist; Dr. Dan Ricciuto, ASP Physician Lead; Justin Chow, ASP Pharmacist.

Why an Antimicrobial Stewardship Program (ASP)?

An important patient quality care initative

Soon after President and Chief Executive Officer Kevin Empey and Executive Vice President and Chief Nursing Executive Lisa Shiozaki joined Lakeridge Health, they identified the need for an ASP. They believed that an ASP would help them achieve the corporate goal of improving the quality of patient care by lowering hospital-acquired infection rates and reducing antimicrobial resistance. In 2011, they began the process by recruiting an infectious diseases physician lead and pharmacist.

Daily ASP rounds

Dr. Dan Ricciuto (infectious diseases physician) and Dr. Tom Oommen (pharmacist) initiated the ASP in November 2011 and first concentrated their efforts in the intensive care unit (ICU) by doing daily ASP rounds with intensivists and residents. They augmented their ASP knowledge by job-shadowing other infectious diseases pharmacists/physicians, conducting literature reviews and attending local stewardship workshops, giving them the confidence to challenge barriers. The team next expanded offsite to the Lakeridge Whitby Rehabilitation Centre by providing daily audit and feedback via phone; this intervention was focused primarily on the management of asymptomatic bacteriuria and cystitis.

A year after its initiation in intensive care, the ASP expanded to two high-risk medical wards in response to a hospital-wide *Clostridium difficile* outbreak. Initially there was resistance on the part of the medical staff to the daily audit and feedback, but with time, staff realized the value of the ASP and their acceptance grew. The program gained momentum and was further expanded in 2013 with the addition of a full-time pharmacist, Justin Chow. Two more medical wards were also targeted, followed by a surgical ward. With the continued success of the program, additional units are expressing interest in expansion to their areas as well.

Collaboration

The infection prevention and control team works collaboratively with the ASP team, focusing efforts on infection prevention, practice reviews and microbiology surveillance. The collaboration has included implementing urinary catheter protocols to reduce catheter days and associated urinary tract infections and reducing urine culture testing to decrease the number of patients with asymptomatic bacteriuria who are taking antibiotics. The infection prevention and control team also reviews blood collection practices to reduce contamination and associated antibiotic use. The collaboration doesn't stop at front-line staff, however. The ASP team has recruited two leads from the information technology department—Kimberly Cooper and Vince Ruttan—who help collect, track, analyze and validate data in the existing electronic system.

To measure the impact of the ASP, the Lakeridge team chose days of therapy (DOT) and antimicrobial cost savings from optimized antimicrobial use as its first metrics. Preliminary results showed evidence of reduced antibiotic use in the intensive care unit, and cost savings within the first few months of unit rounds and discussion of treatment options. Since the program expansion, there has been an overall decrease in antimicrobial use by more than 30 per cent.

Successes

- Expansion of the program from the ICU to medical and surgical wards
- Reduction in antimicrobial use and cost savings
- Development of *C. difficile* treatment protocols, pre-printed orders, and protocols for patients with febrile neutropenia and catheter-related bloodstream infections
- Increased pharmacists' clinical practice on wards awaiting their ASP implementation
- Participation as a Hub Institution in the ARTIC CHILL project

Challenges

- Time management with competing work priorities; balancing roles and tasks outside of ASP
- Communication with physicians about changes or new initiatives
- Multiple small but time consuming barriers when implementing new ASP initiatives

Horizon

- Building ASP capacity for the entire corporation including the small hospital sites
- Implementing methods to simultaneously incorporate additional information into the ASP database such as laboratory culture and clinical results

Lakeridge Health ASP tools and resources

The following resources have been made available by Lakeridge Health and are examples of tools and resources that support its/an antimicrobial stewardship program:

1. Selective Pressure WebApp: an ASP internet resource for Lakeridge healthcare providers, to optimize antimicrobial therapy. Available from: https://selectivepressureapp.wordpress.com/

2. Excerpt from Lakeridge Health Antimicrobial Stewardship Program Annual Report (2012-2014)
3. Lakeridge Health 2013 Antibiogram

The materials and information in this section are not owned by Public Health Ontario. Neither PHO nor Lakeridge Health shall be responsible for the subsequent use of any tools and resources by any third party.

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Citation

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For further information

Antimicrobial Stewardship Program, Infection Prevention and Control, Public Health Ontario.
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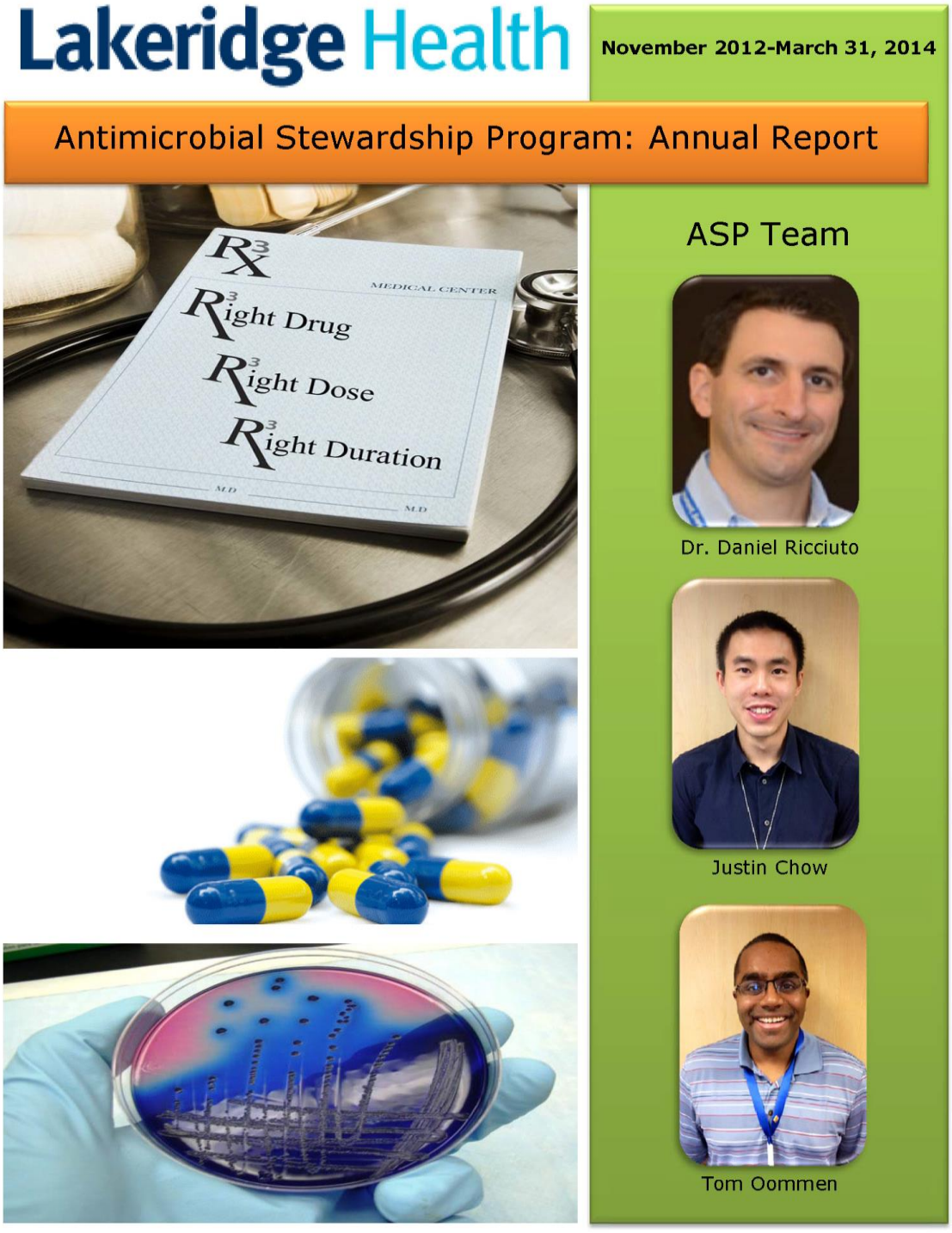
Public Health Ontario acknowledges the financial support of the Ontario Government.

Resource 2: Excerpt from Lakeridge Health Antimicrobial Stewardship Program Annual Report (2012-2014)



Resource 2: Excerpt from Lakeridge Health Antimicrobial Stewardship Program Annual Report (2012-2014) cont'd

Antimicrobial Stewardship Program Report

"Antimicrobial resistance costs money, livelihood, and lives, and threatens to undermine the effectiveness of heath delivery programs. It has been described as a threat to global stability and national security. Antimicrobial use is the key driver of resistance. This selective pressure comes from a combination of overuse…and also from misuse."

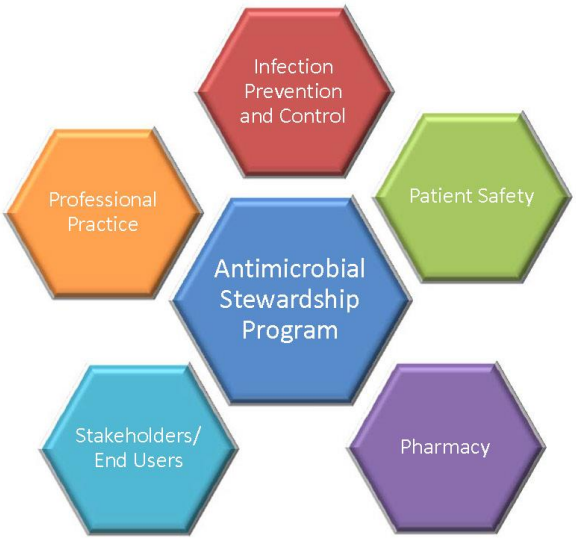
-WHO Global Strategy for Containment of Antimicrobial Resistance, 2000.

Executive Summary

The Antimicrobial Stewardship Program (ASP) at Lakeridge Health (LH) has been active since July 2011. The program aims to improve antibiotic utilization, ensuring that patients receive the best antibiotic for the right duration. The goal of the project is to optimize patient outcomes while minimizing unintended consequences of antimicrobial use. These consequences include toxicity, colonization and infection with antibiotic-resistance organisms, and costs. The program is considered a patient safety and quality improvement initiative and employs the IDEA (Investigate-Design-Experiment-Assess) framework to utilize patient and hospital-specific data to establish high-impact, evidence-based ASP interventions. The ASP aligns with the Lakeridge Health Strategic direction to "Become the Safest Hospital in Ontario". This document outlines the current progress to date and the proposed plans for the Lakeridge Health ASP.

The Lakeridge Health Antimicrobial Stewardship Team

The LH ASP is a collaborative effort and consists of a core team of two antimicrobial stewardship pharmacists and an infectious Diseases physician with strong partnerships among members of other departments.



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Resource 2: Excerpt from Lakeridge Health Antimicrobial Stewardship Program Annual Report (2012-2014) cont'd

LH ASP Team & Key Partners

LH ASP Core Team

Dan Ricciuto, MD, FRCPC Physician Lead, Antimicrobial Stewardship and Infection Prevention and Control	Tom Oommen, Pharm.D. Antimicrobial Stewardship Pharmacist Justin Chow, Pharm.D. Antimicrobial Stewardship Pharmacist

LH ASP Key Partners

Infection Prevention and Control	**Helen Gibson**, Director, Patient Care Support Services **Judy McCarten**, IPAC Resource **Elise Haley**, IPAC Administrative Assistant **All ICP's**
Information Technology	**Vince Ruttan**, Applications Developer **Kim Cooper**, Pharmacy Applications Consultant
Patient Safety	**Dr. Lisa Huzel**, Medical Director, Patient Safety & Quality Improvement
Pharmacy	**Leslie Motz**, Director, Pharmacy **Chris Ritskes**, Clinical Pharmacy Specialist **Wilson Kwong**, Drug Utilization Pharmacist **All Pharmacy Staff**
Microbiology	**Glen Johnson**, Charge Technologist, Microbiology **Grant Johnson**, Director, Lab Services

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Resource 2: Excerpt from Lakeridge Health Antimicrobial Stewardship Program Annual Report (2012-2014) cont'd

Metrics

Summary of Current ASP Activities

Location	Methods	Start Date
LHO CRITCARE	Daily prospective audit and feedback	July 2011
LHO OC7	Daily prospective audit and feedback	August 2012
LHO OG5/OG5ACU	Daily prospective audit and feedback	August 2012
LHW WW3/WW3R	Once weekly prospective audit and feedback	January 2012
LHO OG9	Daily prospective audit and feedback	September 2013
LHO OC6	Daily prospective audit and feedback	September 2013
LHO OG6	Daily prospective audit and feedback	February 2014

Definitions: Measures of Antibiotic Utilization and Cost

Days of therapy (DOT): an internationally accepted method to measure antimicrobial usage. DOT is a simply the number of days a patient is on an antibiotic. Results are standardized per 1000 patient days.

Target Antimicrobials:* These are broad spectrum antibiotics such as meropenem, piperacillin-tazobactam, ceftazidime, moxifloxacin, ciprofloxacin, ceftriaxone, clindamycin and tigecycline. These antibiotics were targeted due to the higher risk of *Clostridium difficile*, spectrum of activity, and cost.

Cost: Current antibiotic cost calculations included in this report are based on data provided by the Finance department.

Antibiotic Resistance

We hypothesize that antibiotic resistance will decrease over time due to reduced selection pressure from antibiotics on these pathogens. We have demonstrated such trends occur in both the CRITCARE area and throughout Lakeridge Health. *Pseudomonas aeruginosa* susceptibilities to meropenem have increased 7% and 16% overall at Lakeridge Health and in the LHO CRITCARE respectively. This is a direct result of utilizing less meropenem, one of the broadest spectrum antimicrobials. (See Appendix for further details)

C.difficile Infection Rates

The association between antimicrobial use and *Clostridium difficile* infection is well established. We postulated that with decreased broad spectrum antibiotic use and good infection and prevention practices, rates of *Clostridium difficile* would also decrease. We have seen an impressive decrease in hospital-acquired *C. difficile* infection rates after implementation of enhanced infection control practices and antimicrobial stewardship on the medical wards in September 2012. (See Appendix)

Resource 2: Excerpt from Lakeridge Health Antimicrobial Stewardship Program Annual Report (2012-2014) cont'd

Antimicrobial Stewardship Program

Background

Decreasing the burden of nosocomial infection has become a major priority for hospitals, exemplified by the Excellent Care for All Act, 2010. Furthermore, several hospital-acquired infections (HAIs) are publicly reported. Antimicrobial resistance results in increased morbidity, mortality and health care costs and has been associated with antimicrobial use. Epidemiologic studies have shown that 30-50% of hospitalized patients receive an antibiotic during their stay (up to 70% of ICU patients), with 30-50% of these prescriptions being unnecessary or inappropriate. Therefore, in conjunction with infection control practices, antimicrobial stewardship programs have become an integral component in the battle to thwart rising resistance rates and nosocomial infection with organisms such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococci* (VRE), *Clostridium difficile,* multidrug resistant Gram-negatives and *Candida*. Optimal antibiotic choice and dosing can also improve outcomes in patients with infection, potentially decreasing length of stay and mortality.

Development of new antibiotics is dwindling, so efforts must be made to preserve antibiotics for the future. How antibiotics are used today directly impact how effective they will be tomorrow.

Effective antimicrobial stewardship programs can improve patient care, reduce the spread of antibiotic-resistant organisms and be financially self-supporting and therefore are now a Required Organizational Practice for accreditation from Accreditation Canada.

Mission Statement and Vision

The mission of the program is to ensure that every patient at Lakeridge Health requiring antibiotics receives optimal therapy. Our goal is for the Antimicrobial Stewardship Program to improve patient outcomes during the treatment of infection and prevent the development of nosocomial infection with resistant organisms in the hospitalized population.

Expected Outcomes

- Decreased antimicrobial adverse events
- Reduced institutional antimicrobial resistance
- Reduced opportunistic infections arising from antimicrobial use (e.g., *Clostridium difficile*, invasive candidiasis, *Pseudomonas*, and other environmental Gram-negative infections)
- Decreased failure rates of antimicrobial therapy
- Improved outcomes/decreased incidence of sepsis
- Reduced costs:
    - directly, from reduced antimicrobial use
    - indirectly, from:
        - reduced nosocomial infection (*C. difficile*; MRSA; VRE)
        - reduced infection-control costs (e.g. isolation bed-days, outbreak measures
        - reduced length of stay

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Resource 2: Excerpt from Lakeridge Health Antimicrobial Stewardship Program Annual Report (2012-2014) cont'd

Current Activities

LHO Critical Care Area

Start Date: July 2011

Tom Oommen performs prospective audit and feedback on weekdays with the CRITCARE team. Data is collected and reviewed by Tom Oommen and cases are discussed with Dr. Ricciuto. The ASP team is also actively involved with education of the nursing staff, residents, and pharmacy students in this area. The ASP team continues to build on strong relationships with caregivers in the CRITCARE and use it as a model for expansion to other areas. Full results are available in the appendix, but are summarized below:

- 0.8% decline in overall antimicrobial consumption since 2012-2013 despite increased patient volumes and reduced clinical time in the CRITCARE area due to ASP expansion. Overall utilization has decreased ~30% since commencing ASP in CRITCARE.
- Per capita antimicrobial expenditures continued to decline with a cumulative decrease of 14% since fiscal year 2012-2013. Per capita antibiotic expenditures have been reduced by greater than half since the ASP started.

LHO G5, C7

Start Date: August 2012

The ASP team targeted these two medical units in response to a hospital wide *Clostridium difficile* outbreak centered on these units during the summer of 2012. Tom Oommen performs audit and feedback daily with the hospitalist, internist and cardiologist on staff (either in person if available or via telephone). See appendix for full results but a summary is below:

- 31% (OC7) and 27% (OG5/OG5ACU) decrease in overall antimicrobial use when compared to previous fiscal year
- 53% (OC7) and 28% (OG5/OG5ACU) decrease cost per patient day compared to previous fiscal year.
- 40% decline in hospital-acquired *C. difficile* infections on these wards before and after ASP.

LHO OC6/OG9

Start Date September 2013

Building on previous success and with additional staffing the ASP expanded its daily audit and feedback activities to OC6 and OG9. Justin Chow performs daily antibiotic review with the hospitalist on staff. We have seen a decrease in antimicrobial utilization when compared to pre-stewardship levels. Summary of the results:

- 33%(OC6) and 81% (OG9) decrease in cost per patient day in comparison to previous fiscal year
- 24% (OC6) and 30% (OG9) decrease in overall antimicrobial utilization in comparison to year prior

Resource 2: Excerpt from Lakeridge Health Antimicrobial Stewardship Program Annual Report (2012-2014) cont'd

Current Activities

OG6

Start Date February 2014

The ASP team has started to work with the surgical program with the hopes of optimizing antimicrobial prescribing. Justin Chow reviews antimicrobials prescribed here and provides direct feedback to the prescribing team. Although too early to make conclusions, we have seen a trend towards decreased antimicrobial utilization and cost. Full data is summarized in the appendix.

LHW (WW3/3R)

Start Date January 2012

Tom Oommen conducts informal weekly audit and feedback via telephone with the prescribers on WW3R. This was commenced in response to an outbreak of *Clostridium difficile* in 2012. Education was provided to prescribers regarding appropriate management of common infections in the elderly, with a focus on asymptomatic bacteriuria and UTIs. The ASP team was also made available via phone consultations. We continue to operate with ASP consultations on an as needed basis. Thanks to a committed team at Lakeridge Health Whitby (Dr. James Park, Michelle Acorn, Sue Whyte, Julie Earle, Elim Chien, and Janice Jones) overall antimicrobial use has been decreased significantly. This lower utilization and cost have been sustained despite decreased auditing. Full results are available in the appendix.

ASP Database (LHASR)

The ASP team has been working with Information Technology developing the Lakeridge Health Antimicrobial Stewardship Reporting Tool (LHasr). This is a web-based tool used to track and monitor outcomes for patients followed by ASP. The team has made great strides to develop a working database which allows them to track current patients on antibiotics, as well as potential patients who need ASP consultation. Unfortunately, the project has been postponed and it is not yet available for use due to the need for bug fixes and data validation. In addition, the team is working on integrating microbiology data into the database to identify bug-drug mismatches as well as high risk antibiotics that require intensive therapeutic monitoring. In the near future, we hope that completion of the database will allow for real-time antimicrobial utilization reports, as well as notifications to alert the ASP and IPAC team to patients who would benefit from further review. This database was originally showcased to Public Health Ontario in September 2012, which lead to great interest from other antimicrobial stewardship programs.

Resource 2: Excerpt from Lakeridge Health Antimicrobial Stewardship Program Annual Report (2012-2014) cont'd

Current Activities: Collaboration/Leadership

Pre-Printed Orders/Protocols

The ASP team developed and implemented an updated *Clostridium difficile* pre-printed order set. The team also collaborated on standardized orders for: Febrile Neutropenia; Post-operative Intra-abdominal Infection; Post-operative Orthopedic Admission; Dialysis Catheter Infection; and others. ASP has also worked closely with IPAC to roll out the Urinary Catheter Protocol.

The team has also changed the pharmacy practice of extending antimicrobial stop dates on patient transfers between units. This process has been in place for many years and has contributed to increased unnecessary exposure to antimicrobials.

The team has also optimized piperacillin-tazobactam dosing in the Critical Care area through automatic substitution. In January 2014 the automatic substitution was approved by the Medical Advisory Committee to maximize the use of extended infusions. The rationale for an extended infusion dosing strategy is to optimize the pharmacodynamics of this antibiotic. Recent studies have shown improvements in mortality in patients with sepsis when dosed with extended infusion as compared with traditional dosing.

Education

The ASP team plays an active role in education at Lakeridge. Dr. Ricciuto has provided education to key physician teams as well as discussing ASP at LH Hospital-wide Grand Rounds, Respiratory Therapist Education Day, Lab Education Day as well as monthly rounds on antimicrobial use to new residents on their ICU rotations. Tom Oommen has also provided education to the pharmacy team, nursing and respiratory therapy staff regarding antimicrobial stewardship, use of probiotics, duration of antibiotic therapy and aminoglycoside monitoring.

Toronto Antimicrobial Stewardship Corridor (TASC)

The Lakeridge ASP collaborates with the TASC group, which includes antimicrobial stewardship teams from 13 other hospitals including (Credit Valley Hospital, Mount Sinai Hospital, Hospital for Sick Children, North York General Hospital, University Health Network, etc.). The group shares information/resources and collaborates online. An ongoing major project includes the development of an Antimicrobial Stewardship Handbook.

Provincial Leadership

Dr. Ricciuto is a member of the Public Health Ontario Provincial Antimicrobial Stewardship Program Advisory Committee (PASPAC) and meets often to help guide the roll out of ASPs across the province. Furthermore, Lakeridge Health participated in Public Health Ontario's (PHO) ASP in Action program in the fall of 2012. The team met with leaders in Public Health to discuss how the ASP program at Lakeridge Health was formed and functions. A poster was prepared by PHO to be shared with other healthcare institutions and can be seen at the following link: Public Health Ontario: ASP

Mentoring

The ASP team met with a group from Peterborough Region Health Centre (PRHC) to aid them in developing a stewardship program. The team from PRHC consisted of a lead ASP physician and pharmacist, IT, infection control, and quality improvement. The Lakeridge Health team received great feedback from the session and hopes to work closely with the soon-to-be-ASP at PRHC. Dr. Ricciuto has also presented to members of the Central East Ontario Regional Infection Control Network (RICN) and provided support for other programs being established in the region.

Resource 2: Excerpt from Lakeridge Health Antimicrobial Stewardship Program Annual Report (2012-2014) cont'd

Future Directions

CLINICAL

Expand Audit and Feedback

With the success of stewardship on our intervention units this year we hope to expand stewardship to additional units/campuses. We plan to expand further into the surgical areas at the Oshawa campus in addition to the Emergency department. We also plan to implement a similar strategy employed at the Whitby campus at the Bowmanville campus. We intend to perform once weekly audit and feedback with the team at Bowmanville.

Standardized Infection Management

The ASP team is near completion of an antibiotic stewardship web application. This will help to standardize the management of common infections and will be available to all health care providers. This will provide prescribers with ASP approved antibiotic regimens for the most common infections. The web-app will be rolled out with the commencement of stewardship activities in the ER.

Therapeutic Drug Monitoring

The ASP team currently performs dynamic visual acuity tests (by consult) on patients who require long term aminoglycoside therapy. This is a key patient safety initiative that monitors patients for vestibular toxicity. ASP has educated team pharmacists at the Bowmanville campus to perform the test.

With additional support, the ASP team hopes to aid the pharmacy department with therapeutic drug monitoring for patients on vancomycin and aminoglycosides. This process will also ensure that only patients who require these agents with narrow therapeutic windows will receive them, thereby increasing time for clinical pharmacists to complete other duties.

Research

Antimicrobial Stewardship is a relatively new initiative and there is still a paucity of literature on optimal ways to run a program and potential outcomes, especially in community hospital settings. Lakeridge Health would is an excellent site to conduct research into antimicrobial stewardship from a community hospital perspective. The ASP is gradually compiling data to be used in research studies. Future projects include: the effects of antimicrobial stewardship and probiotics on antibiotic-associated diarrhea and isolation days; the effect of a urinary catheter protocol on antimicrobial prescriptions; and, the utilization of antimicrobials and antivirals in patients with influenza. Beginning in the summer of 2013, a student will be joining the ASP to complete a summer research studentship.

Resource 2: Excerpt from Lakeridge Health Antimicrobial Stewardship Program Annual Report (2012-2014) cont'd

Appendix

Weaknesses/Threats

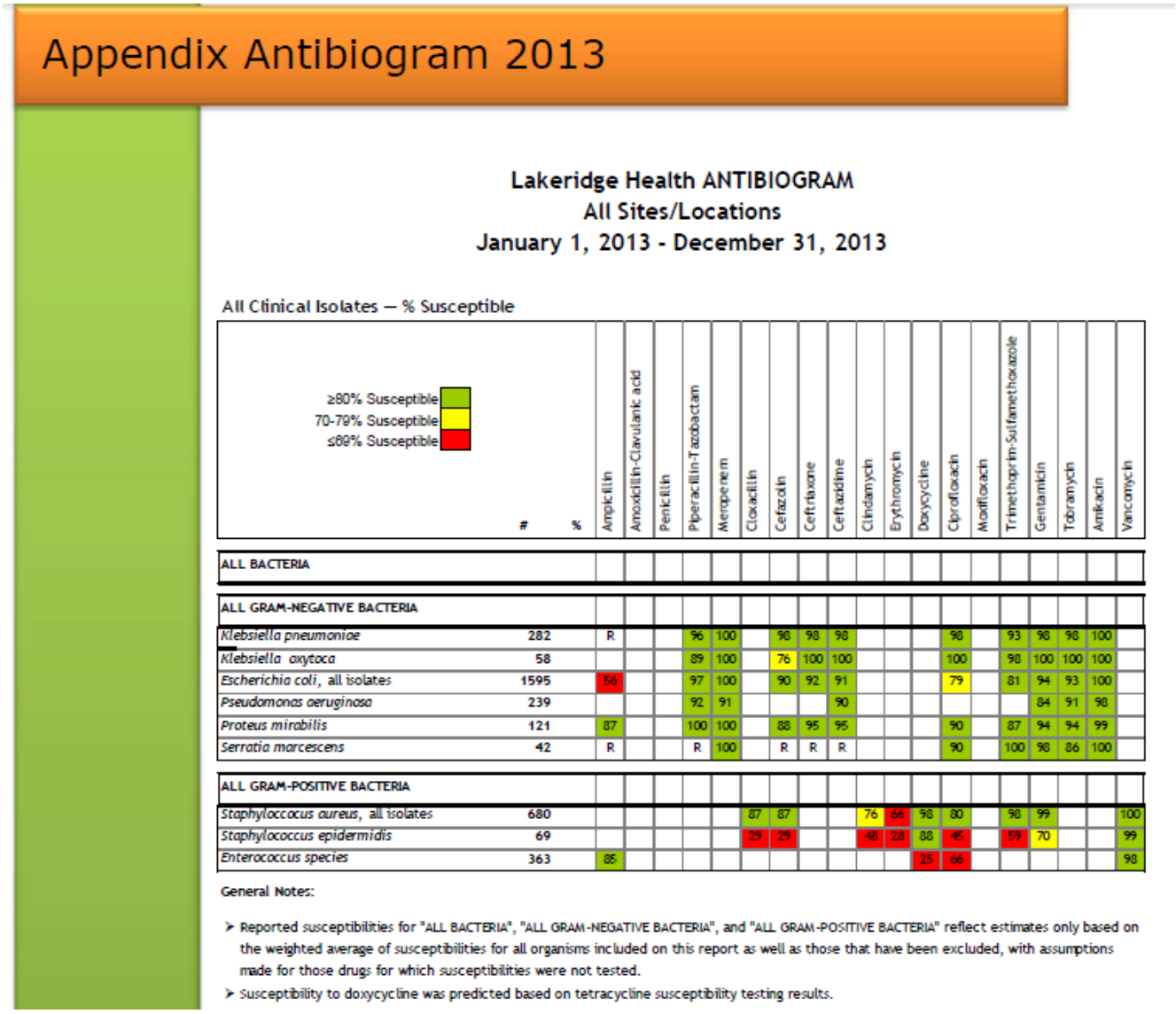
Reverting to pre-ASP Prescription Habits

During vacations and periods where daily audit and feedback were not performed on target units a trend towards increased antimicrobial utilization has been noticed. Unfortunately during these periods with no oversight, prescribing habits for some clinicians tended to return to times before the ASP existed. This tended to occur in areas where ASP has not been active for a prolonged time. Behaviour change is a slow process and with continued stewardship activities we hope to permanently change prescribing habits to ensure optimal antimicrobial therapy. Encouragingly, after decreasing presence in the CRITCARE, antimicrobial prescriptions per capita remained constant.

Time Restraints

Daily audit and feedback is the gold standard for antimicrobial stewardship. Unfortunately, this is also extremely resource intensive. We hope to increase the presence of stewardship on the wards however this limits the available resources to perform more organizational activities. One such activity that had to be abandoned was the selectivepressure.me antimicrobial stewardship blog. This blog continues to garner interest worldwide however is difficult to maintain with other competing in house activities.

Resource 3: Lakeridge Health 2013 Antibiogram



Appendix Antibiogram 2013

Lakeridge Health ANTIBIOGRAM
All Sites/Locations
January 1, 2013 - December 31, 2013

All Clinical Isolates — % Susceptible

≥80% Susceptible
70-79% Susceptible
≤69% Susceptible

	#	%	Ampicillin	Amoxicillin-Clavulanic acid	Penicillin	Piperacillin-Tazobactam	Meropenem	Cloxacillin	Cefazolin	Ceftriaxone	Ceftazidime	Clindamycin	Erythromycin	Doxycycline	Ciprofloxacin	Moxifloxacin	Trimethoprim-Sulfamethoxazole	Gentamicin	Tobramycin	Amikacin	Vancomycin
ALL BACTERIA																					
ALL GRAM-NEGATIVE BACTERIA																					
Klebsiella pneumoniae	282		R			96	100		98	98	98				98		93	98	98	100	
Klebsiella oxytoca	58					89	100		76	100	100				100		98	100	100	100	
Escherichia coli, all isolates	1595		56			97	100		90	92	91				79		81	94	93	100	
Pseudomonas aeruginosa	239					92	91				90							84	91	98	
Proteus mirabilis	121		87			100	100		88	95	95				90		87	94	94	99	
Serratia marcescens	42		R			R	100		R	R	R				90		100	98	86	100	
ALL GRAM-POSITIVE BACTERIA																					
Staphylococcus aureus, all isolates	680							87	87			76	66	98	80		98	99			100
Staphylococcus epidermidis	69							29	29			48	28	88	45		59	70			99
Enterococcus species	363		85											25	66						98

General Notes:

- Reported susceptibilities for "ALL BACTERIA", "ALL GRAM-NEGATIVE BACTERIA", and "ALL GRAM-POSITIVE BACTERIA" reflect estimates only based on the weighted average of susceptibilities for all organisms included on this report as well as those that have been excluded, with assumptions made for those drugs for which susceptibilities were not tested.
- Susceptibility to doxycycline was predicted based on tetracycline susceptibility testing results.