Antimicrobial Stewardship

Annual Report 2015-2016

Prepared by the Fraser Health Antimicrobial Stewardship Program

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Executive Summary

The Fraser Health Antimicrobial Stewardship Program (ASP) is a young but thriving program. This year, three new clinicians joined Pharmacy Coordinator Dr. Vivian Leung in support of antimicrobial stewardship clinical services. Dr. Kevin Afra signed on as the new, full-time, Medical Director in November 2015. Clinical Pharmacy Specialists Drs. Colin Lee and Ivy Chow came on board in February and March 2016, respectively. This highly skilled team works closely with other clinical staff members who are already championing antimicrobial stewardship on the front line.

Our purpose is to promote appropriate antimicrobial use within Fraser Health. To accomplish this, we have set three goals which guide all of our program activities: to optimize patient care through appropriate antimicrobial use, to slow the emergence of antimicrobial resistance, and to improve health care efficiency. These goals are consistent with the patient safety mandate to minimize preventable harm to patients.

With the expanded team of ASP clinicians, we are increasing our efforts to review patient cases involving targeted antibiotics and interacting with prescribers in a systematic fashion at multiple acute care sites. In the short time that we have been collecting data, our team has reviewed 735 patient cases and made specialized clinical interventions in 331 patient cases. Our recommendations were accepted in 85% of cases.

We have also created an FH specific ASP Handbook, which is a consolidated, evidence-based reference for treatment of common infections. This year we have released chapters to support and guide clinicians in management of community acquired pneumonia, aspiration pneumonia, and pediatric infections.

The ASP is also involved in development and revision of pre-printed order sets that include antimicrobials. Pre-printed orders help standardize care across Fraser Health in line with best practices. This year, we provided feedback on pre-printed orders for outpatient parenteral antimicrobial therapy, general surgery perioperative, and vascular surgery perioperative. The ASP also has ownership of a small number of pre-printed orders, including the Restricted Antimicrobial Order (RAD) pre-printed order form. The goal of the RAD initiative is to encourage appropriate prescribing of select antimicrobials (carbapenems, linezolid, and daptomycin) reserved due to the serious public health implications of resistance to these agents.

While our team is only just expanding, we have already begun to observe some positive impact on antimicrobial usage trends. At sites where the ASP team has had greater presence on the wards, there has been more consistent reduction in the use of broad-spectrum antibiotics. Moving forward, we endeavour to have more robust data analysis to help focus our efforts.

Improving health care efficiency is one of our three goals to ensure taxpayer money is used wisely and effectively. Fraser Health has seen a $1,026,060 reduction in antimicrobial expenditure in FY2015-16 compared to FY2014-15 – a 9.7% reduction.

This report provides further details on our program’s initiatives, as well as the various performance measures we follow. We’ve learned a great deal from our clinicians and staff, and have been tremendously fortunate to have such broad support. We look forward to any comments or questions regarding this report. As we strive to use antimicrobials wisely in today’s patients, we hope to prolong their effectiveness for tomorrow’s patients.
Background

The rise of antimicrobial resistance is a significant threat to patient care and public health. An estimated 18,000 Canadians every year develop drug-resistant infections within our hospitals.\(^1\) The emergence of antimicrobial resistance impacts patient morbidity and mortality, leading to increased healthcare costs. Major problems include the rise of methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus faecium* (VRE), and multidrug-resistant gram-negative organisms, including *Pseudomonas*, *Acinetobacter*, and carbapenem-resistant Enterobacteriaceae (CRE). Unchecked, mortality attributable to antimicrobial resistance is estimated to increase to over 300,000 annually in North America by 2050.\(^2\)

 Concurrently, the healthcare system has had to manage the rise of *Clostridium difficile* infection (CDI). Concerted efforts at reducing CDI include improving infection prevention and control practices, as well as promoting appropriate use and selection of antimicrobials through an antimicrobial stewardship program (ASP).

ASP has been shown to improve antimicrobial usage, improving the quality of patient care through more appropriate selection and dosing of antimicrobials. Patient safety is also improved through reduced toxicity and adverse events from antimicrobial misuse. Institution of an effective ASP can decrease CDI, as well as put downward pressure on the rise of antimicrobial resistance. Furthermore, all of these benefits can be realized while saving the healthcare system money.

The ASP purpose and goals are as follows:

**Purpose:**
The ASP promotes appropriate use of antimicrobials within Fraser Health (FH).

**Goals:**
The goals of the program are threefold:

- a. To optimize patient care through appropriate selection and use of antimicrobials, while minimizing adverse events
- b. To slow the emergence of antimicrobial resistance by limiting selection pressure from antimicrobial misuse
- c. To improve health care efficiency by reducing unnecessary antimicrobial use

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ASP Team Members

Clinical Team

The clinical team conducts the daily activities of the ASP. This includes performing audit and feedback of antimicrobial prescribing, providing education for clinicians, undertaking quality improvement initiatives, and liaising with stakeholders and leaders across the health authority.

Members of the clinical team include:

- Dr. Kevin Afra: ASP Medical Director & ID Consultant
- Dr. Vivian Leung: Pharmacy Coordinator, Antimicrobial Stewardship
- Dr. Colin Lee: Clinical Pharmacy Specialist, Antimicrobial Stewardship
- Dr. Ivy Chow: Clinical Pharmacy Specialist, Antimicrobial Stewardship

Administrative support for the program is provided by Julie Reynolds.

Executive Oversight

Dr. Kevin Afra, medical director of the ASP, is accountable to Linda Dempster (VP Patient Experience) and Dr. Roy Morton (VP Medicine) who provide executive-level guidance and oversight for the program. They also inform the Fraser Health Executive, the Board of Directors, and provincial stakeholders on the status of the ASP.

Dr. Vivian Leung (Pharmacy Coordinator) is accountable to Dr. Adil Virani (Manager, Pharmacy Services), who reports to Linda Morris (Director, Pharmacy Services).

Regional ASP Committee

The Regional ASP Committee is an inter-disciplinary group of clinicians and leaders within the health authority. The Committee discusses, develops, promotes, and evaluates strategies utilized by the ASP to meet its program goals.

Members of the Regional ASP Committee include:

- Dr. Kevin Afra (chair): ASP Medical Director & ID Consultant
- Dr. Yasemin Arikan: ID Consultant, RCH
- Michele Babich: Executive Director, Lower Mainland Pharmacy Services
- Wendy Bowles: Nurse Practitioner Lead
- Dr. Elizabeth Brodkin: Executive Medical Director, Infection Control & MHO
- Dr. Michael Chapman: ID Division Head & ID Consultant, SMH
- Sarah Derman: CNS, Surgical Network
- Dr. Sayeeda Hudani: Regional Department Head, Hospitalists
- Dr. Vivian Leung: ASP Pharmacy Coordinator
- Dr. Neil Mina: Medical Microbiologist
- Dr. Anurag Markanday: ID Consultant and Internal Medicine Head, ARHCC
- Dr. Laurenna Peters: ID Consultant, BH
- Julie Reynolds: Administrative Assistant
- Dr. Steven Reynolds: Program Medical Director, Critical Care
- Dr. Adil Virani: Manager, Pharmacy Services
**Acknowledgements**

The ASP would like to thank the countless individuals who have supported our program. We have been encouraged by our growing collaboration with the FH Executive Team, Site Medical Directors, and Site Executive Directors. We are fortunate to enjoy a strong partnership with Pharmacy Services. It is a privilege to support our front-line Physicians, Nurse Practitioners, and Pharmacists as we strive towards excellence in patient care.

Our special thanks also goes to:

- Regional ASP Committee members who have moved on or changed to ad hoc roles: Maneet Samra and Dr. Ben Mack
- Division of Infectious Diseases
- Medical Microbiology
- Infection Prevention and Control
- Medication Use and Evaluation Team (Anthony Tung, Dr. Angus Kinkade, and Dr. Aaron Tejani)
- Our colleagues from other antimicrobial stewardship programs, including the Antimicrobial Stewardship Programs of Providence Health Care and Vancouver Coastal Health.
- The Provincial Antimicrobial Stewardship Clinical Expert Group (PACE)
Program Activities

Audit and Feedback

Prospective audit and feedback is one of the core activities of an ASP. It involves case-by-case assessment of antimicrobial use with direct feedback to the prescribing physician. Patients receiving targeted antimicrobials are identified prospectively. One of our team members will review the patient’s medical record and investigation results to identify opportunities to optimize antimicrobial use, namely:

- Optimal drug (appropriate spectrum for identified infection and investigation results)
- Optimal dosing
- Optimal route (encouraging oral therapy when safe and appropriate)
- Optimal duration

If an opportunity for optimization is identified, a note with our suggestions is left in the medical record. We also strive to discuss the case with the prescribing physician. Our audit and feedback service does not change medication orders without the express permission of the most responsible physician.

As our program has grown, we have begun to track our audit and feedback interventions. A pilot approach to data collection was started in December 2015, with expansion to the whole team in March 2016. As such, only a small period of data collection is available for fiscal year 2015-16.

<table>
<thead>
<tr>
<th>Patient Cases Reviewed</th>
<th>Patient Cases Intervened Upon</th>
<th>Acceptance</th>
<th>Acceptance Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>735</td>
<td>331</td>
<td>280</td>
<td>Accepted 85%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>51</td>
<td>Not accepted</td>
</tr>
</tbody>
</table>

ASP Handbook

The ASP has created a Handbook to consolidate a single reference our guidance on treatment of common infectious conditions and important antimicrobial use issues. This inter-disciplinary collaboration is created by the ASP in conjunction with the Regional ASP Committee, the Division of Infectious Diseases, Medical Microbiology, and our clinicians. The Handbook integrates best available medical literature, recommendations from professional organizations, regional antimicrobial resistance (our antibiogram), and regional formulary.

This fiscal year, we developed and published our first chapters covering:

- Community acquired pneumonia
- Aspiration pneumonia
- Pediatric infections
- Vancomycin dosing and therapeutic monitoring

Multiple new chapters are planned for the coming fiscal year. Existing chapters will be reviewed annually for updates taking into account evolving practice standards, local antimicrobial resistance, and formulary.
ASP Website

The ASP created a website on the Fraser Health intranet in order to improve visibility of our program and consolidate all our communication and reports in a single location (Figure 1). Our website includes our ASP Handbook, local antibiograms, our reports, and contact information for our clinical teams across the region.

Check out our website here.

In order to improve accessibility for clinicians, we are working on mirroring our website content on an externally accessible website. We expect to complete this in the coming fiscal year.

Figure 1. Antimicrobial Stewardship intranet website

Pre-Printed Order Revisions

The ASP acts as a regional resource and reviewer for antimicrobials on pre-printed orders (PPO’s) undergoing development or revision. Some of these are initiated by the ASP, while others are at the request of other clinical departments or divisions within the Fraser Health. We collaborate with representatives from relevant specialties and stakeholder groups to review the best available medical literature, recommendations from professional organizations, regional antimicrobial resistance, and local resource availability.

This fiscal year, we have been involved in revision of the following PPO’s:

- Outpatient parenteral antimicrobial therapy (OPAT)
- General surgery peri-operative
- Vascular surgery peri-operative

We have also initiated a review of the Restricted Antimicrobial Drug (RAD) PPO, which was created and released by the ASP in 2014. The goal of this PPO is to encourage appropriate prescribing of selected restricted antimicrobials – carbapenems, linezolid, and daptomycin – due to the serious public health implications of resistance to these agents. The ASP is exploring various options for revising the RAD PPO in order to meet our goal.
Antimicrobial Usage Trends

The ASP reviews usage trends of targeted antimicrobials on an ongoing basis. Drug usage is analyzed in World Health Organization defined daily doses (DDD)\(^3\) because this unit of measure is widely adopted, dose-sensitive, and cost-relevant. Total DDD is then normalized to the common denominator of 1,000 patient-days. The resulting unit of measure, “DDD per 1,000 patient-days,” does not account for interhospital differences in case mix and patient acuity. However, it is a metric that accounts for hospital size and patient volume, and is used by many other institutions.

Usage data reflects admitted inpatients only. It does not reflect treatment of non-inpatients through emergency departments, day-medicine/infusion centres, or the home IV program.

Carbapenems are one of our most potent class of antimicrobials. Resistance to carbapenems in gram-negative infections is a serious public health threat and a strong impetus for antimicrobial stewardship. Since an inflection point in FY2014, FH has continued to see reduced usage of carbapenems (Figure 2). Furthermore, meropenem comprises a greater proportion of our carbapenem usage, which the ASP views favourably given its lower daily cost compared to imipenem and ertapenem.

Figure 2. Inpatient carbapenem usage.

During the 2015-16 fiscal year, the majority of our on-site audit and feedback interventions have occurred at SMH. While carbapenem usage at some of our other sites has remained stable or even slightly increased, usage at SMH has decreased from the prior year (Figure 3). Our experience so far is not only encouraging for the ASP, but also shows the importance of regular, on-site, audit and feedback in order to see reductions in antimicrobial usage.

\(^3\) http://www.whocc.no/atc_ddd_index/
The ASP also tracks usage of two restricted drugs aimed at gram-positive organisms: linezolid and daptomycin. Linezolid usage has remained stable the past year (Figure 4). Conversely, daptomycin usage has continued to increase.

Please refer to the statistical appendix for hospital-specific usage of carbapenems, linezolid, and daptomycin.
Financials

Antimicrobial expenditures are presented for combined inpatient and outpatient antimicrobial usage based on pharmacy data. The expenditures exclude some patients on our home IV program as they are supplied by the vendor Calea.

Daptomycin continues to be our agent with the highest expenditure (Table 1). However, contract pricing and lower usage of carbapenems has contributed to a net reduction in the combined cost of five restricted antimicrobials drugs.

Combined antimicrobial expenditure across 15 acute care cost centres has continued a strong downward trend over the past two fiscal years (Figure 5). Antimicrobial expenditures in Fraser Health have been reduced by $1,026,060 from FY2014-15, a 9.7% reduction.

Table 1. Combined cost of five restricted antimicrobial drugs.

<table>
<thead>
<tr>
<th>Restricted Antimicrobials</th>
<th>Total Inpatient &amp; Outpatient Expenditure (excluding Home IV supplied by Calea)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FY2014</td>
<td>FY2016</td>
</tr>
<tr>
<td>Daptomycin</td>
<td>$1,547,352</td>
<td>$1,827,867</td>
</tr>
<tr>
<td>Ertapenem*</td>
<td>$1,425,784</td>
<td>$1,073,966</td>
</tr>
<tr>
<td>Meropenem*</td>
<td>$1,053,891</td>
<td>$531,317</td>
</tr>
<tr>
<td>Linezolid</td>
<td>$717,889</td>
<td>$148,025</td>
</tr>
<tr>
<td>Imipenem*</td>
<td>$395,985</td>
<td>$69,278</td>
</tr>
<tr>
<td>Total</td>
<td><strong>$5,140,901</strong></td>
<td><strong>$3,650,453</strong></td>
</tr>
</tbody>
</table>

*Carbapenems $2,875,660 $1,674,561 $1,201,099

Figure 5. Combined antimicrobial expenditure of 15 acute care cost centres.

Combined Antimicrobial Expenditure of 15 Acute Care Cost Centres (ARH, BH, CGH, DH, ERH, FCH, JP, CSH, LMH, MMH, MSA, PAH, QPCC, RCH, RMH, SMH)

- FY2010, $10,097,928
- FY2011, $10,792,278
- FY2012, $11,023,424
- FY2013, $11,269,705
- FY2014, $11,607,905
- FY2015, $10,546,330
- FY2016, $9,520,270

Full-Time ASP Pharmacist

ASP Expansion

FH ASP Started

- Actual expenditure
- Linear (extrapolation)
Statistical Appendix

Notes to Interpretation
Antimicrobial usage data is expressed in World Health Organization standardized Defined Daily Doses (DDD) per 1,000 acute care patient-days. Usage data reflects admitted inpatients only. It does not reflect treatment of non-inpatients through emergency departments, day-medicine/infusion centres, or the home IV program.

The vertical axis for all graphs has been set to the same scale to provide consistency between sites.

Restricted Antimicrobial Usage by Site

ARH

BH