

Antimicrobial Stewardship

Annual Report 2016 - 2017



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Executive Summary

Best Practices

There is ongoing work to develop and revise clinical tools, protocols and order sets. Items completed and actively being developed/revise include:

- Antimicrobial Dosing Guidelines for Adults clinical tool 2016/17 update (completed April 2017)
- Empiric Treatment of Common Infections in Adults clinical tool 2016/17 update (completed April 2017)
- Revision/regionalization of Sexual Assault Order set (Antimicrobial section completed March 2017)
- Creation/Regionalization of Chronic Obstructive Pulmonary Disorder (COPD) order sets (projected completion Sept 2017)
- Pharmacist Managed Pharmacokinetic Monitoring and Dosing of Vancomycin and Aminoglycosides clinical practice standard (projected completion Sept 2017)
- Intravenous to oral antimicrobial conversion order set (pilot project Dawson Creek – implemented March 2017)
- Revision of Outpatient IV Antimicrobial Therapy options; re-instatement of ceFAZolin + Probenecid (Probenecid available for use May 1st; order set completion projected August 2017)
- Regional Sepsis protocol revisions/updates (projected completion August 2017)
- Pharmacy Resident Research project – Gap analysis of outpatient IV antimicrobial therapy (OPAT) across NH (completed May 2017)
- Decompensated Cirrhosis Order set (completed)
- Oseltamivir for Influenza Outbreak order set (completed)
- Automatic Stop Order policy revision (completed)
- Regional Febrile Neutropenia protocol (completed)

Future projects in active initial or planning stages include:

- Education module and treatment algorithm development for Urinary Tract Infections (including catheter associated and asymptomatic bacteriuria)
- Education Module development for Community Acquired Pneumonia and Aspiration Pneumonia in Adults

Antimicrobial Usage Metrics

Antibiotic utilization, measured in defined daily dose (DDD) per 100 patient-days, is calculated to track the utilization trend over time. The DDD is the assumed average adult maintenance dose per day for a drug used for its main indication. The conversion of drug utilization amount to DDD units is performed to standardize utilization of different classes of antibiotics, allowing comparisons to be made across different facilities or patient groups (excluding pediatric populations).

For the 2016/17 FY, overall usage of the targeted antimicrobials (carbapenems, 3rd generation cephalosporins cefotaxime and ceftRIAXone, DAPTOmycin, aminoglycosides, micafungin, piperacillin-tazobactam and vancomycin) has increased more than 10% with the highest increases being in the North East and at UHNBC. The Northern Interior (excluding UHNBC) showed a smaller increase and the North West showed a decrease compared to previous FY.

Clinical Service/Audit & Feedback

Over the course of the fiscal year, variations of Prospective Audit and Feedback (A&F) of targeted antimicrobials have been occurring (with mentorship from the AMS program coordinator at UHNBC) at GR Baker, Mills Memorial Hospital, Prince Rupert Regional Hospital, Bulkley Valley & District Hospital and Wrinch Memorial Hospital. During the fourth quarter, A&F reviews commenced at Fort St. John Hospital and the Omineca Lakes district facilities. GR Baker Hospital graduated to a more independent model for identifying and resolving drug therapy problems related to antimicrobials. Over the 2016/17 fiscal year approx. 4356 patient cases were reviewed during AMS reviews and 1662 drug therapy problems were identified with a 60% resolution rate. The top 3 drug therapy problems were consistent from quarter to quarter and include: A. Unnecessary Antimicrobial Discontinued, B. Suboptimal or ineffective therapy and C. Converting IV antimicrobial to an oral agent.

Patient case reviews at Kitimat General Hospital are planned to commence September 5th 2017.

Introduction

Northern Health's Antimicrobial Stewardship (AMS) Program development began in November 2014. Research was done to find out what was happening within our Province as well as across the country with regards to the development and operations of an AMS program within the acute care setting. A case was built based on the standards set by Accreditation Canada and the structure of Northern Health. Resource allocation was granted in October 2015 for a full time pharmacist lead (the AMS program Coordinator), data analyst support and a 0.4 FTE equivalent Medical Co-lead position with shared interest between the AMS program and the Infection Prevention and Control (IPC) program.

In the beginning an AMS working group was established with interdisciplinary and regional representation to help guide and support the lead pharmacist in establishment of the framework for the AMS program. Now the AMS working group has become a permanent committee under the NH Medication Safety and Quality Committee and as the AMS Subcommittee. The position of Medical co-Lead for the AMS program and IPC was filled by our infectious disease expert Dr. Abu Hamour in March 2017. Plans for collaborative work with the co-leads will be commencing in quarter 1 of the 2017/18 FY.

The goal of the NH AMS program is to improve patient care related to antimicrobial use in all NH facilities through collaboration with healthcare providers in order to: successfully treat infections, reduce inappropriate antimicrobial use, minimize toxicities and adverse events and limit selection of antimicrobial resistant strains.

Antimicrobial Stewardship Program Team Members

AMS Program Coordinator (Pharmacist Lead)
<ul style="list-style-type: none"> Alicia Ridgewell
AMS Program/ Infection Prevention and Control Medical Lead
<ul style="list-style-type: none"> Dr. Abu Hamour
AMS Sub-committee Members
<ul style="list-style-type: none"> Amy Nunley (Clinical Pharmacy Specialist - NI) Andrew Lowe (Clinical pharmacist - NE) Dr. Barb Falkner (Profession Practice lead pharmacist) Carey-Anne Lawson (IT-CIS pharmacist) Carly Rosger (Clinical pharmacist - NW) Carol Pruner (Clinical pharmacist - NI) Deanna Danskin (Quality Resource Technologist Microbiology) Dr. Fareen Din (Intensivist, Nephrologist/Internist - NI) Dr. Inban Reddy (Family Practice MD - NI) Judy Klein (IPC practitioner - NE) Kelsey Breault (IPC practitioner - NE) Dr. Kyla Bertschi (Clinical pharmacy Specialist - NI) Kyla Redlon (Clinical Nurse Educator - NI) Nancy Dyck (Medication Use Management pharmacist) Sharri Leslie (Microbiology Technologist - NI)
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<ul style="list-style-type: none"> Rebecca Arsenault – MMH Manuela Krisinger – MMH Aron Nenninger - MMH Samantha Holland – Omineca Lakes District Tracy Moraes – PRRH Michael Gentleman - PRRH Riley Whyte – GR Baker

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Best Practices

Clinical Tools, Standards and Policies

1. Antimicrobial Dosing Guidelines for Adults clinical tool 2016/17 update

A tri-fold pocket card was first adapted by the AMS program in November 2015. It contains renal dosing adjustments for adults for various antibiotics, antifungals and antiviral medications. It also contains guidance and suggestions for oral antimicrobial conversion options. The annual revision/update to this clinical tool has been completed and published. Distribution of this pocket-card to clinicians in each HSDA commenced in May 2017 and has been coordinated through document source.

2. Empiric Treatment of Common Infections in Adults clinical tool 2016/17 update

A tri-fold pocket card was first created in October 2015. It is structured as a quick reference guide and contains empiric treatment options for various infections in adults, including the suspected pathogens and suggested durations of treatment. This clinical tool was updated this past FY and has also been distributed to clinicians in each HSDA starting in May 2017 via document source.

3. Pharmacist Managed Pharmacokinetic Monitoring and Dosing of Vancomycin and Aminoglycosides Clinical Practice Standard (projected completion June 2017)

Creation of a new regional clinical practice standard is underway. This CPS will authorize pharmacists to provide monitoring and dosing of vancomycin and aminoglycosides (gentamicin, tobramycin and amikacin). In addition to this policy, there will be updates to pharmacists training of new staff as well as opportunity for current staff to be oriented to the standardized procedure for managing these medications. The draft policy has been reviewed by the pharmacy group and is now awaiting circulation for stakeholder feedback from nursing and physician leadership.

4. Pharmacy Resident Research project – Gap analysis of outpatient IV antimicrobial therapy (OPAT) across NH

A research project was led by the NH pharmacy resident for 2016/17. He completed his data analysis phase in April 2017 which involved compiling responses from site interviews to identify successes and areas for improvement. The goals of this work were to provide a gap analysis of current practices for outpatient IV antimicrobial therapy in NH compared to standardized criteria found in the literature and to provide possible solutions to the more common barriers identified.

The pharmacy resident will be developing in collaboration with the AMS subcommittee, a regional order set and clinical practice standard for OPAT in NH. A manuscript of the findings for this project is underway with plans for submission to a peer reviewed journal.

5. Retrospective Evaluation of *Clostridium Difficile* Infection Risk Factors and Management at a University Teaching Hospital in Northern BC.

The primary objective of this research project is to assess if management of *Clostridium difficile* infection (CDI) at UHNBC complies with provincial and national standards in the absence of Health Authority CDI management support tools. The secondary objectives of this research project are a) to identify the proportion of CDI patients who had modifiable risk factors, such as presence of antibiotics, whether antibiotics were broad spectrum or of prolonged duration, presence of proton-pump inhibitors (PPIs) or histamine-2 antagonists (H2RAs) and b) patient outcomes such as length of hospital stay, mortality rate and recurrence rate.

The retrospective chart reviews are being carried out by the AMS program coordinator in collaboration with 2 other clinical pharmacists from the Intensive Care Unit and the Clinical Teaching Unit. The data collection phase should be complete by September 2017.

Education Initiatives

The AMS program coordinator hopes to once again have increased resources via pharmacy student summer employment to aid with development of learning modules for pharmacists and other health care providers. Priority topics include:

- Urinary Tract Infections (including catheter associated and asymptomatic bacteriuria)
- Community Acquired Pneumonia and Aspiration Pneumonia in Adults
- Hospital Acquired Pneumonia

Order Set Development

1. Decompensated Cirrhosis Order set

In collaboration with one of our gastroenterologists, the AMS Subcommittee provided feedback and guidance on the antimicrobial orders found within this comprehensive order set. It was approved by NHMAC for regional use and is now available on document source, through the OurNH order set page.

2. Oseltamivir for Influenza Outbreak order set

The AMS Subcommittee has revised the order set previously titled: Influenza and Pneumococcal Vaccines and the Use of Oseltamivir Orders that is typically used at all Long term care facilities in Northern Health. It is now titled: Oseltamivir for influenza outbreak declared by medical health officer.

This order set has been reviewed by an extensive group of stakeholders. New information you will find in this order set includes:

- Treatment dosing for oseltamivir based on renal function
- Prophylaxis dosing for oseltamivir based on renal function

This order set was approved for regional use and is found on document source via the OurNH order set page.

3. Revision/Regionalization of Sexual Assault Order set

Revision to UHNBC's currently existing order set is underway. The AMS subcommittee was asked for feedback on updated antimicrobial options. This has been provided and presented at the March 2017 NHMAC meeting. The order set lead RN was given feedback requesting a protocol be developed and added to the current order set. This work is currently awaiting stakeholder feedback.

4. Creation/Regionalization of Chronic Obstructive Pulmonary Disorder Acute Exacerbation (COPDAE) order sets

Creation of a new order set for COPDAE is being led by the Respiratory Therapy group. This order set contains admission orders, orders for 48 hours after admission as well as discharge orders which can be sent to a patient's community pharmacy. A draft was distributed to stakeholder groups, feedback received has been incorporated and submitted for reformatting to document source. The working group has set a goal for completion and implementation in September 2017.

5. Revision of Outpatient IV Antimicrobial Therapy order set: re-instatement of Cefazolin + Probenacid

Currently there is no regional order set for outpatient IV therapy. In conjunction with the research project discussed above (gap analysis for OPAT across NH), there is work being done to create a regional order set (using UHNBC's site specific order set) which will include a re-instatement of a previously used management strategy of ceFAZolin plus probenecid, for outpatient IV management of uncomplicated skin and soft tissue infections. In 2011, probenecid was removed from the Canadian Market. At that time, cefTRIAxone replaced ceFAZolin plus probenecid in the outpatient setting for skin and soft tissue infections. This is not ideal because cefTRIAxone has suboptimal activity against *S. aureus*, has a higher risk for developing *C. difficile* infection and provides unnecessary Gram negative coverage promoting antimicrobial resistance. Gentes and Bolduc (division of Galenova) are now compounding probenecid capsules. Several other Health Authorities (HA) in Canada (including BC) are currently ordering from this manufacturer. The AMS subcommittee has conducted a review and cost analysis to support bringing this product back to NH. Probenecid was made available for prescribing May 1st/17 and this treatment option will be added to the regional order set being developed.

6. Regional Sepsis protocol revisions/updates

The AMS program coordinator is representing the AMS Subcommittee on a regional working group led by the Critical Care Program. Extensive revisions are underway for this regional document with hopes of shortening the form and updating the content to align with the 2016 Surviving Sepsis guidelines. The working group has monthly meetings and the order set is currently still in the revision stage of development.

Clinical Service (Prospective Audit & Feedback)

Audit and Feedback (A&F) is an evidence-based practice of reviewing a patient's medical chart and diagnostic test results and engaging with prescribers to collaboratively optimize antimicrobial therapies. This practice involves the selection of the most appropriate, narrowest spectrum agent based on clinical status, indication, allergies, culture results, potential drug interactions and adverse effects, taking into account current clinical practice guidelines.

The A&F clinical service and evaluation efforts are focused on:

- optimizing empiric therapies
- targeting therapy based on additional diagnostic information
- optimizing antimicrobial dosing and treatment durations
- converting intravenous (IV) antimicrobials to oral formulations when appropriate to prevent the complications associated with IV agents
- providing education to prescribers on the clinical practice guidelines for the treatment of infections
- promoting consultation of infectious disease specialist when necessary

Over the course of the fiscal year, variations of Prospective Audit and Feedback (A&F) of targeted antimicrobials have been occurring (with mentorship from the AMS program coordinator at UHNBC) at GR Baker, Mills Memorial Hospital, Prince Rupert Regional Hospital, Bulkley Valley & District Hospital and Wrinch Memorial Hospital. During the fourth quarter, A&F reviews commenced at Fort St. John Hospital and the Omineca Lakes district facilities. GR Baker Hospital graduated to a more independent model for identifying and resolving drug therapy problems related to antimicrobials. Patient case reviews at Fort St. John Hospital are on hold pending clinical pharmacist training; case reviews at Kitimat General Hospital are planned to commence September 5th 2017.

An intravenous to oral antimicrobial conversion order set has been developed and approved for use in the Dawson Creek District Hospital. Due to pharmacist work load constraints the AMS focus at this site will be using this order set and encouraging IV to PO step down. A pilot project was started in March 2017 and results of this (number of interventions carried out or prompted by the pharmacist using this order set) will be reviewed in September with plans for extending this order set regionally.

Outcome and Process Measures

Antibiotic Utilization across NH

Antibiotic utilization, measured in defined daily dose (DDD) per 100 patient-days, is calculated to track the utilization trend over time. The DDD is the assumed average adult maintenance dose per day for a drug used for its main indication. The conversion of drug utilization amount to DDD units is performed to standardize utilization of different classes of antibiotics, allowing comparisons to be made across different facilities or patient groups (excluding pediatric populations). Table 1 below is a summary of the change in usage of certain targeted antimicrobials (carbapenems, 3rd generation cephalosporins: cefotaxime and cefTRIAXone, DAPTOmycin, aminoglycosides, micafungin, piperacillin-tazobactam and vancomycin) compared to last fiscal year. It shows that overall usage has increase more than 10% with the highest increases being in the North East and at UHNBC. The Northern Interior (excluding UHNBC) showed a smaller increase and the North West showed a decrease compared to previous FY. This is a broad indication that the AMS program initiatives have not yet reached their full potential, which is not surprising considering the clinical service and audit/feedback has not been fully functional at any one (1) site for more than one (1) year yet. The North West currently has the most clinical pharmacist involvement and there are plans for duplicating this involvement in the North East as well however there is issues with workload and lack of pharmacist clinical training. Due to the size and acuity of patients at UHNBC it is not surprising that their usage has increased. There is the inability to have clinical pharmacist support on a regular basis for all areas of the hospital. The AMS program coordinator will review patients on these targeted antimicrobials when able, however currently the mentorship of other sites and the administrative responsibilities make this task very irregular. Should an increase in clinical pharmacist positions be made available, this is an area that would benefit greatly.

Table 1

Targeted Antimicrobial Utilization Trends (DDD/100 patient-days) (Comparison of FY 2015/16 to FY 2016/17) (Carbapenem (Ertapenem, Imipenem-Cilastatin, Meropenem), Cefotaxime, Ceftriaxone, Daptomycin, Gentamicin, Miconazole, Piperacillin-Tazobactam, Tobramycin, Vancomycin)	
HSDA	Antimicrobial Usage
North East	↑
Northern Interior (excludes UHNBC)	↑
University Hospital of Northern BC	↑
North West	↓
Northern Health (includes UHNBC)	↑

Data source: Discern Analytics/AMS Supply Chain (GL) Ward Issues and Credits; AMS Product Disperses & Selectable Facilities DDD/ run March 14&20, April 6, 2017

Table prepared by: Planning and Performance Improvement

Legend

Increase of more than 10 % compared to previous YTD	↑
Increase of less than or equal to 10 % compared to previous YTD	↑
No Change	→
Decrease compared to previous YTD	↓

In order to keep track of where the increases and decreases are happening across the health authority we have divided the information from Table 1 further to show individual drug usage in each HSDA, see Figures 1 – 4.

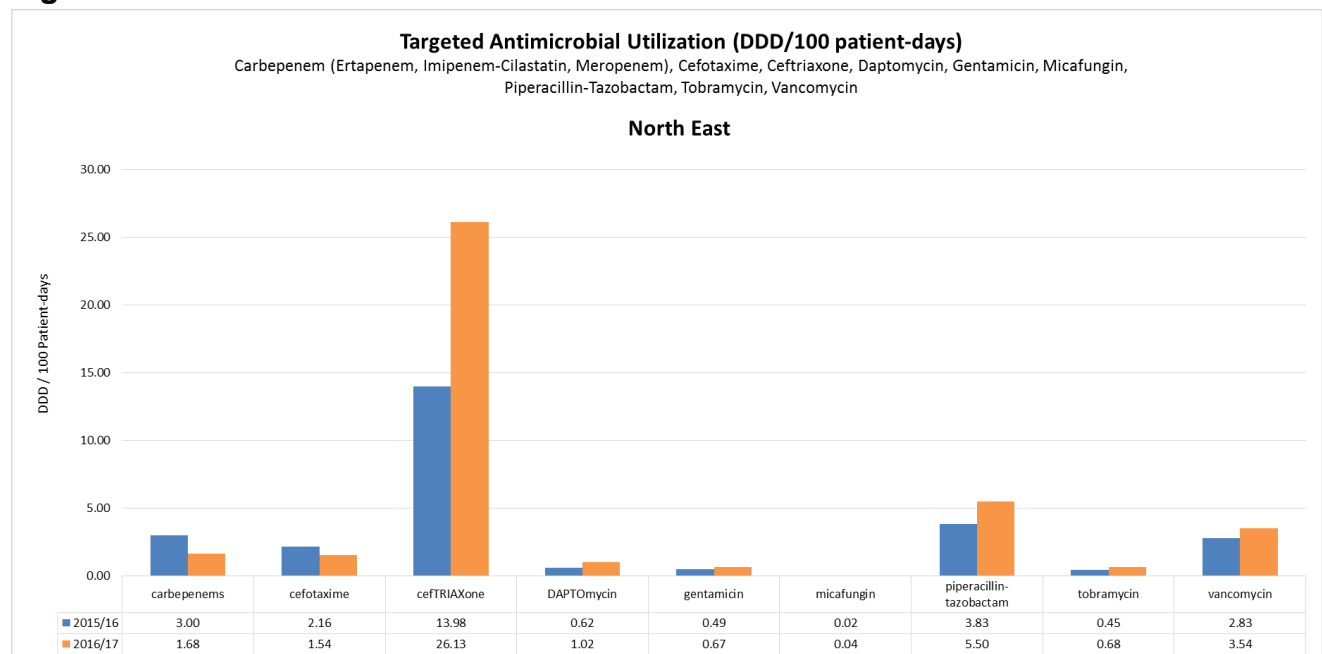
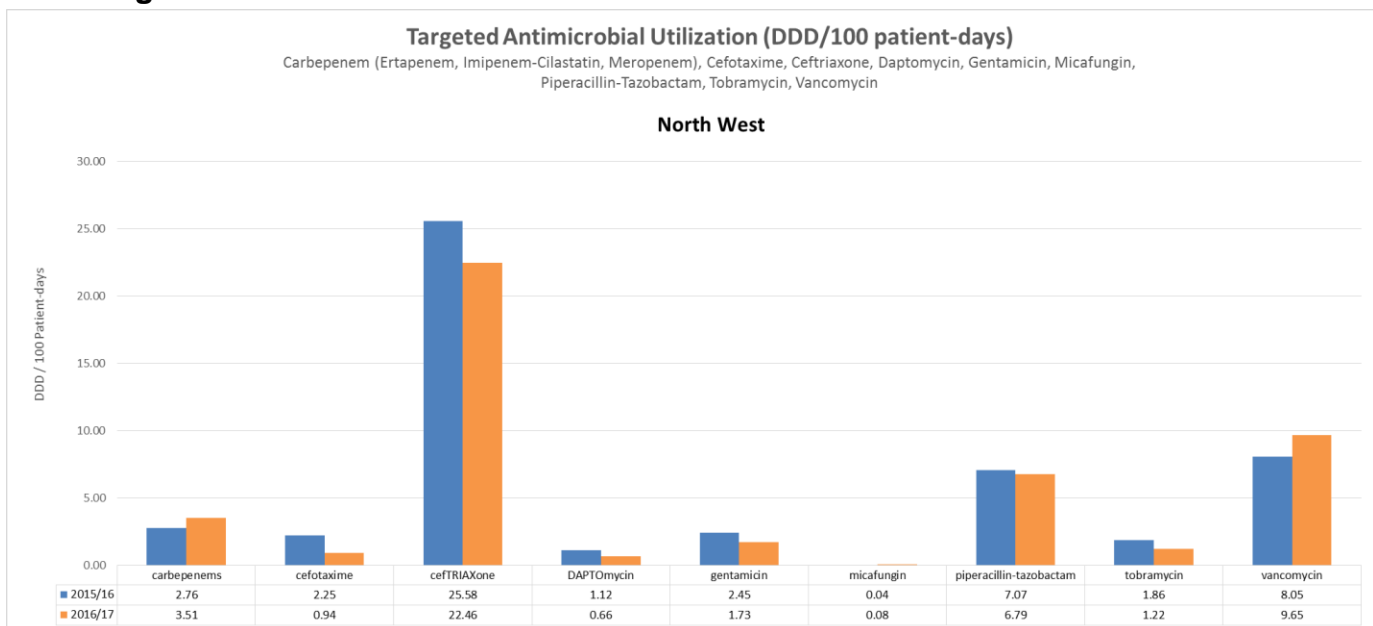
Figure 1

Figure 1 Data source: Discern Analytics/AMS Supply Chain (GL) Ward Issues and Credits; AMS Product Disperses & Selectable Facilities DDD/ run March 14&20, April 6, 2017

Graph prepared by: Planning and Performance Improvement

It is clear to see in the North East the increase in usage is primarily due to cefTRIAXone, however there were noticeable increases in piperacillin-tazobactam as well as vancomycin. On the positive side, the use of carbapenems has decreased and this could be due to the preferential use of cefTRIAXone empirically for a variety of infections allowing for the broad spectrum carbapenem class to be spared. CefTRIAXone is commonly used for treatment of community acquired pneumonia (possibly when a narrower spectrum agent such as ampicillin or amoxicillin would have sufficed) or for skin and soft tissue infections, especially in the outpatient setting. With the recent re-introduction of ceFAZolin plus probenecid for outpatient treatment we may see either a stabilization or a decrease in cefTRIAXone usage over the next fiscal year. As of right now we do not have the ability for pharmacist focused reviews of patients prescribed antimicrobials at our North East facilities but hope to rectify that in the 2017/18 FY.

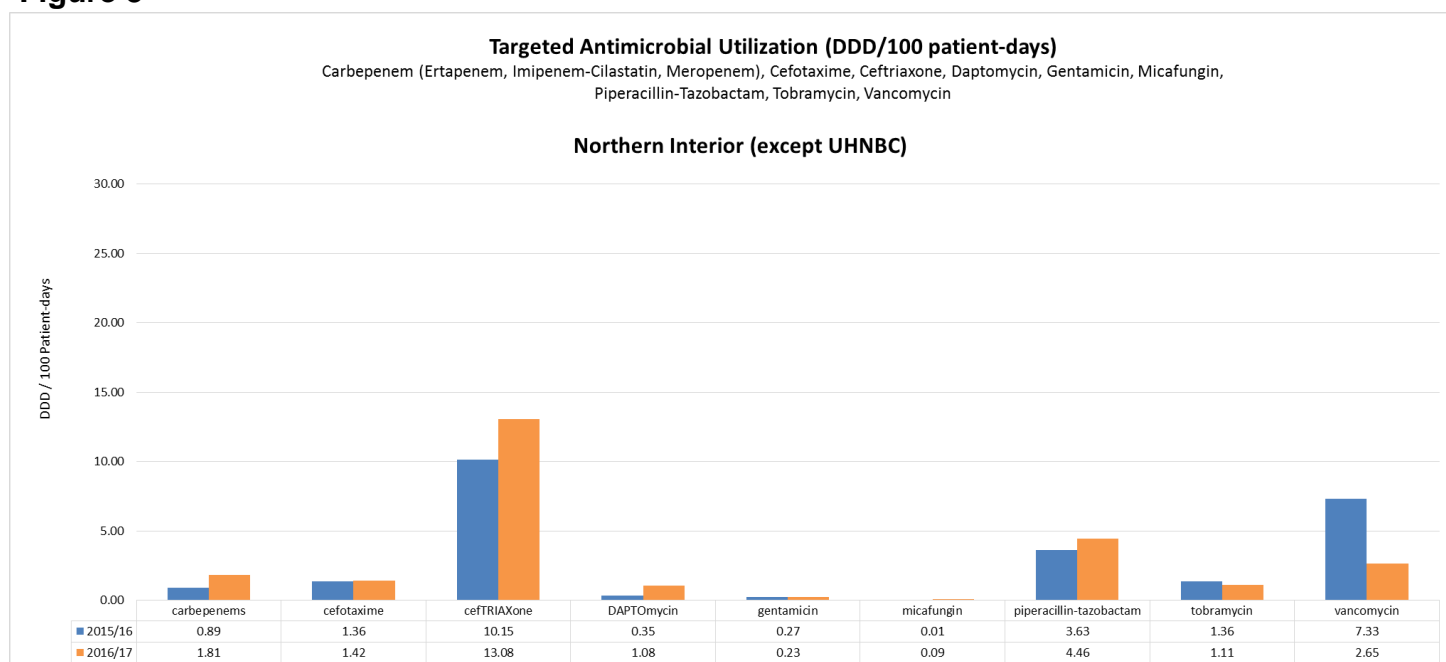
Figure 2



Data source: Discern Analytics/AMS Supply Chain (GL) Ward Issues and Credits; AMS Product Dispenses & Selectable Facilities DDD/ run March 14&20, April 6, 2017
Graph prepared by: Planning and Performance Improvement

The data for the North West shows a decrease in majority of the targeted antimicrobials with the exception of vancomycin and the carbapenems. The increase in carbapenem use is concerning and will need to be monitored over the next FY to ensure it is due to increased incidence of multi-drug resistant bugs and not just due to inappropriate broad spectrum agent used empirically. Pharmacists at four (4) of the major sites in the North West have been making efforts to target antimicrobial prescribing to ensure more appropriate use either empirically or targeted based on culture results.

Figure 3

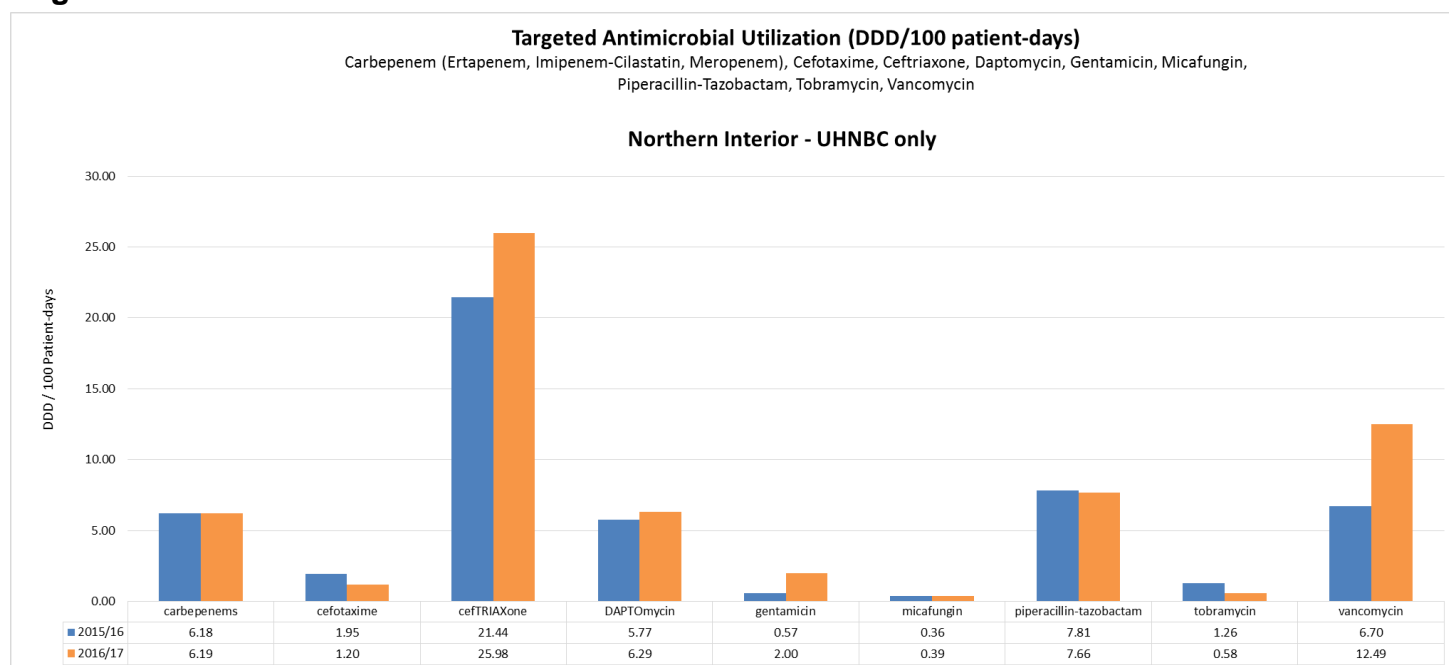


Data source: Discern Analytics/AMS Supply Chain (GL) Ward Issues and Credits; AMS Product Dispenses & Selectable Facilities DDD/ run March 14&20, April 6, 2017

Graph prepared by: Planning and Performance Improvement

The Northern Interior data shows a mixture of increased and decreased usage compared to last fiscal. Similar to the North East there is an increase in cefTRIAxone usage, it is hard to say what this is due to, could be due to increase usage for community acquired pneumonia or for skin and soft tissue infections and more specifically for outpatient management. We have pharmacists at 2 sites in the NI (excluding UHNBC) that try to review antimicrobials at least once per week. With the recent re-introduction of ceFAZolin plus probenecid treatment we may see either a stabilization or a decrease in cefTRIAxone usage over the next fiscal year.

Figure 4



Data source: Discern Analytics/AMS Supply Chain (GL) Ward Issues and Credits; AMS Product Dispenses & Selectable Facilities DDD/ run March 14&20, April 6, 2017

Graph prepared by: Planning and Performance Improvement

The differences in aminoglycoside usage at UHNBC are likely due to the previous gentamicin shortage that required a temporary interchange to tobramycin. Gentamicin did return in this fiscal year and therefore usage would be higher compared to 2015/16 and would explain the decrease in tobramycin usage this FY. It is interesting to note the increase in cefTRIAxone, vancomycin and DAPTOmycin. Is this due to skin and soft tissue infections specifically in the outpatient setting? Are we seeing high incidence of MDR gram positive organisms such as MRSA and *Staph epī*? At this time we are unable to define any correlation but hope to collaborate with microbiology surveillance in the future. It is interesting that the carbapenem usage is unchanged from last year, could indicate that the clinical situations they are being used for are consistent whether or not these are appropriate situations remains to be seen.

High Bioequivalent Antimicrobials

Timely conversion from intravenous (IV) to oral (PO) antimicrobial therapy is effective for a variety of infections, especially for agents with high bioavailability (the fraction of unchanged drug that is absorbed and reaches the systemic circulation). Conversion from IV to PO antimicrobials in select patients results in cost savings for the facility as well as positive clinical outcomes such as shortened hospital stay, reduced risk of line-related infections and adverse events and no IV related mobility restrictions for patients. There is a group of antimicrobials where the oral formulation is equally

potent compared to the IV formulation; this group is referred to as high bioequivalent antimicrobials.

A selection of these high bioequivalent targeted antimicrobials are compared per HSDA using the DDD per 100 patient-days, see Tables 2-5 below.

Table 2
High Bioequivalence Drugs (IV versus Oral) (DDD / 100 patient-days)

HSDA

North East

Medication	% 2015/16		% 2016/17	
	IV	PO	IV	PO
ciprofloxacin	26%	74%	21%	79%
clindamycin	72%	28%	75%	25%
fluconazole	17%	83%	64%	36%
linezolid	0%	100%	99%	1%
metroNIDAZOLE	67%	33%	64%	36%
moxifloxacin	38%	62%	40%	60%

Data source: Discern Analytics/AMS Supply Chain (GL) Ward Issues and Credits; AMS Product Disposes & Selectable Facilities DDD/ run March 14&20, April 6, 2017

Table prepared by: Planning and Performance Improvement

Looking at the proportional breakdown of IV versus PO one can see that the medications with higher use orally consistent between fiscal years include ciprofloxacin and moxifloxacin. Conversely clindamycin and metroNIDAZOLE have consistent higher use of IV. Fluconazole IV usage was much lower in the 2015/16 FY as was linezolid. Both of these medications show a transition to greater use of IV in the 2016/17 FY. There was the beginning of a pilot project in Dawson Creek using an order set which helps prompt and guide prescribers to convert patients on IV treatment to oral, especially with these targeted high bioequivalent agents, however their pharmacist workload has not been conducive to utilizing this form to its fullest potential. We hope to see more of an impact from this order set in the upcoming fiscal quarters. The variability in IV versus PO lends one to think that there is room for education on which agents can reasonably be given orally when the patient meets appropriate criteria (i.e. GI tract functioning).

Table 3**High Bioequivalence Drugs (IV versus Oral) (DDD / 100 patient-days)**

HSDA

North West

Medication	% 2015/16		% 2016/17	
	IV	PO	IV	PO
ciprofloxacin	26%	74%	38%	62%
clindamycin	77%	23%	68%	32%
fluconazole	32%	68%	39%	61%
linezolid	7%	93%	22%	78%
metroNIDAZOLE	63%	37%	51%	49%
moxifloxacin	36%	64%	87%	13%

Data source: Discern Analytics/AMS Supply Chain (GL) Ward Issues and Credits; AMS Product Dispenses & Selectable Facilities DDD/ run March 14&20, April 6, 2017

Table prepared by: Planning and Performance Improvement

The North West shares a similar pattern with the higher IV usage of clindamycin and metroNIDAZOLE. The high use of IV clindamycin may be due to its known tolerability issues when used orally. There is a large increase in IV moxifloxacin use this fiscal compared to last. It is unclear what this is due to; pharmacist assessment of antimicrobials is a more regular occurrence at the NW sites, and therefore may be a good next step for the IV to PO conversion order set next fiscal.

Table 4**High Bioequivalence Drugs (IV versus Oral) (DDD / 100 patient-days)**

HSDA

Northern Interior (excludes UHNBC)

Medication	% 2015/16		% 2016/17	
	IV	PO	IV	PO
ciprofloxacin	30%	70%	28%	72%
clindamycin	73%	27%	64%	36%
fluconazole	25%	75%	13%	87%
linezolid	9%	91%	0%	100%
metroNIDAZOLE	67%	33%	58%	42%
moxifloxacin	48%	52%	42%	58%

Data source: Discern Analytics/AMS Supply Chain (GL) Ward Issues and Credits; AMS Product Dispenses & Selectable Facilities DDD/ run March 14&20, April 6, 2017

Table prepared by: Planning and Performance Improvement

In the Northern Interior (excluding UHNBC) we see similar trends of higher PO usage in ciprofloxacin, fluconazole and linezolid. Moxifloxacin has fairly equal usage between

the 2 forms and metroNIDAZOLE shows higher use of IV in both fiscal years. Again, the high use of IV clindamycin may be due to its known tolerability issues when used orally.

Table 5
High Bioequivalence Drugs (IV versus Oral) (DDD / 100 patient-days)

HSDA University Hospital of Northern BC

Medication	% 2015/16		% 2016/17	
	IV	PO	IV	PO
ciprofloxacin	21%	79%	21%	79%
clindamycin	76%	24%	75%	25%
fluconazole	17%	83%	27%	73%
linezolid	19%	81%	50%	50%
metroNIDAZOLE	57%	43%	59%	41%
moxifloxacin	34%	66%	33%	67%

Data source: Discern Analytics/AMS Supply Chain (GL) Ward Issues and Credits; AMS Product Dispenses & Selectable Facilities DDD/ run March 14&20, April 6, 2017

Table prepared by: Planning and Performance Improvement

UHNBC follows a similar pattern of usage to the rest of the Northern Interior, however with higher oral usage of moxifloxacin indicating that the higher use of IV in the rest of the NI may simply be due to a lack of education around the high bioequivalent nature of this medication.

Audit and Feedback Recommendations and Acceptance rates

Over the 2016/17 fiscal year approx. 4356 patient cases were reviewed during AMS case reviews and 1662 drug therapy problems were identified and resolved with a 60% resolution rate. The term antimicrobial therapy problems resolved, refers to medication issues which a pharmacist has resolved on their own (e.g. dose optimization based on condition being treated or patient's renal function) or recommendations made to and accepted by the appropriate physician (e.g. discontinuing an unnecessary antimicrobial or changing agents based on culture results). The resolution rate (60%) has continued to increase from previous quarters; our goal is to maintain this level above 50% moving forward with a target of 80%. In the fourth (4th) quarter, issues which were unresolved because the pharmacist is unable to follow through due to workload constraints represented 56% of the unresolved drug therapy problems and

22% of all identified drug therapy problems. Unresolved issues due to patient's discharge occurring before interventions could be made equated to 25% of the unresolved drug therapy problems and only 9.5% of all identified drug therapy problems in quarter four (4). We will continue to monitor the percentage of identified issues unresolved due to pharmacist workload constraints (stable at 22%) to ensure it doesn't increase as this identifies an issue with our current system and will warrant further review of resources.

There are a variety of types of antimicrobial therapy problems; Figure 5 displays various types of drug therapy problems **identified**. The top 3 drug therapy problems were consistent from quarter to quarter and include: A. Unnecessary Antimicrobial Discontinued, B. Suboptimal or ineffective therapy and C. Converting IV antimicrobial to an oral agent.

Analysis of the cases reviewed, drug therapy problems identified and resolved was done collectively for all sites active at any point during the fiscal year (see Table 6).

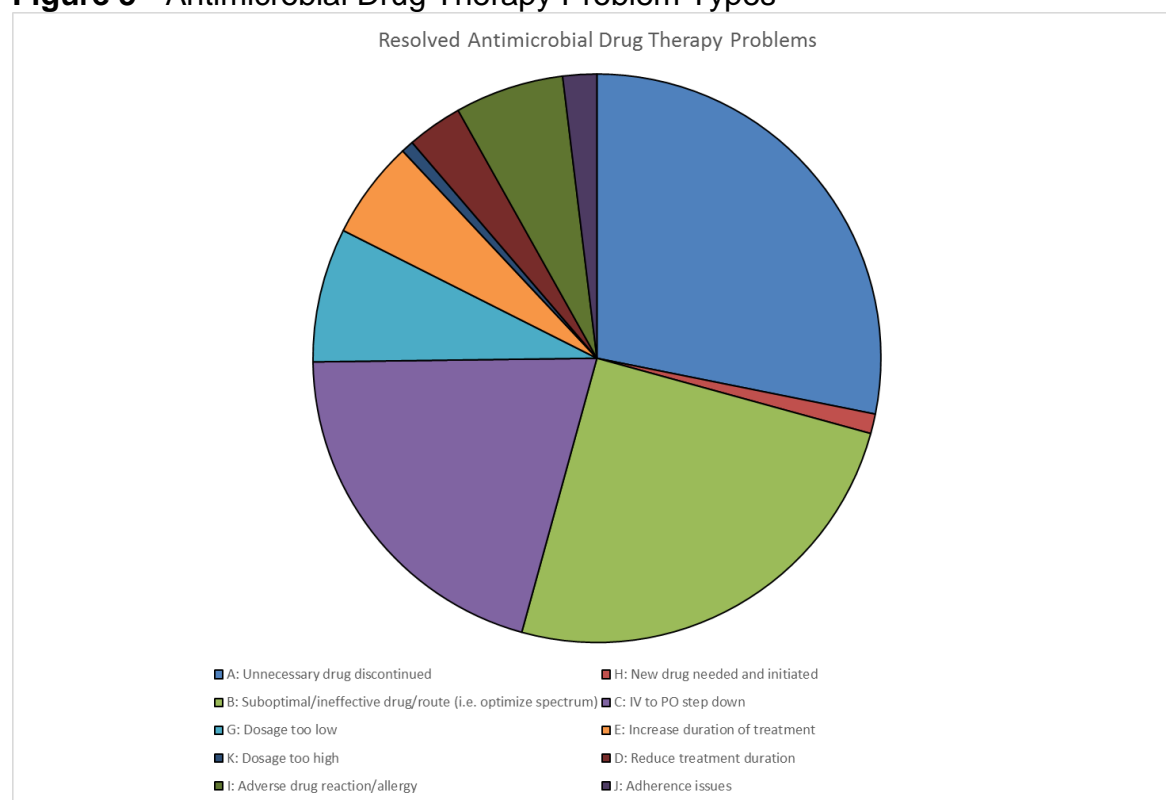
Table 6 - Audit and Feedback antimicrobial drug therapy problem resolutions

Measure	Number of Patients
Patient Chart Reviewed	4356
Antimicrobial therapy problems identified	1662
Antimicrobial therapy recommendations resolved	990 (60%)
Quarter 4 break down:	
Unresolved drug therapy problems due to pharmacist workload demands	56%
Unresolved drug therapy problems due to patient discharge	25%

Data source: manual tracking spreadsheet maintained by AMS program coordinator with input from clinical pharmacists

Table prepared by: AMS program Coordinator

Figure 5 - Antimicrobial Drug Therapy Problem Types



Data source: manual tracking spreadsheet maintained by AMS program coordinator with input from clinical pharmacists

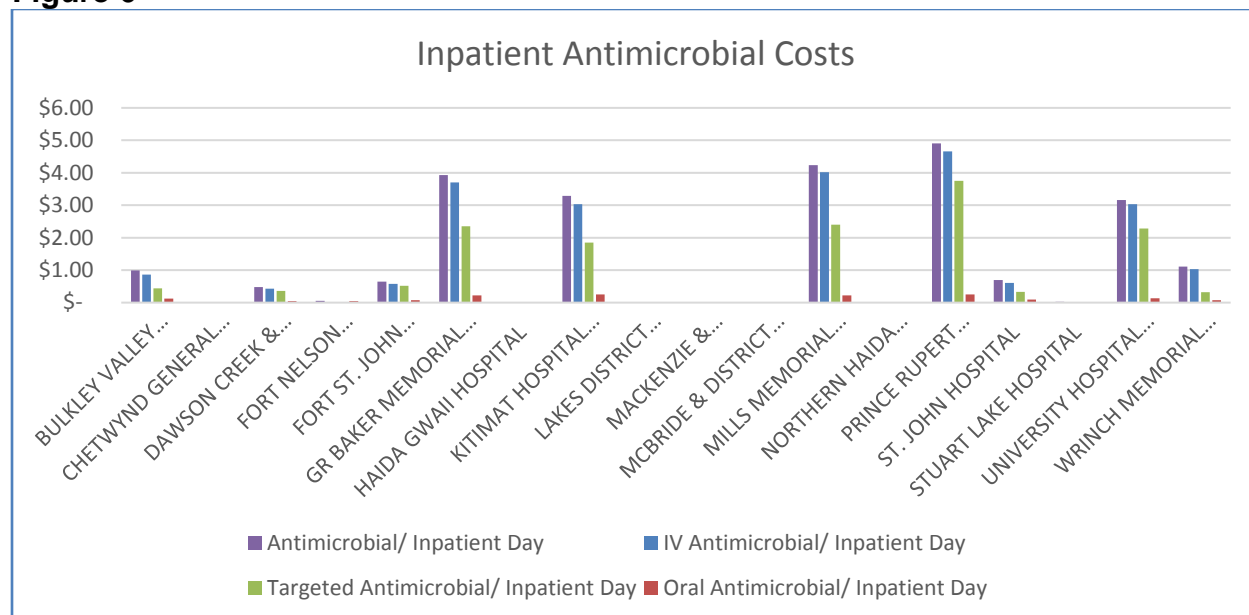
Graph prepared by: AMS program Coordinator

Antimicrobial Costs

In the 2016-17 fiscal year, Northern Health spent just under half a million dollars on antimicrobial therapies for patients admitted to NH facilities; the majority of that cost (~\$450,000) on intravenous therapies alone. These costs equate to an average of \$2 per inpatient day. If we include costs for outpatient visits including emergency visits the total amount spent on antimicrobials in the last fiscal year increases our total by \$30,000. The amount spent on antimicrobials represents approx. 6% of the total drug expenditures for the 2016/17 fiscal year. Figure 6 shows the break down per facility for money spent on all antimicrobials per inpatient day (purple bar) as well as the proportion of which is due to IV (blue bar) versus oral (red bar) formulations. This graph also shows the cost contributed to the targeted antimicrobials alone (green bar - these being the antimicrobials reported on in previous figures) and you can see by the size of the graphs that the targeted antimicrobials (mainly IV formulations) make up the

majority of the daily antimicrobial cost. This reinforces our aim to focus efforts for prospective audit & feedback and therefore optimization of prescribing of these targeted antimicrobials including IV to PO conversion.

Figure 6



Data source: Cerner database/Accessed July 17 2017

Graph prepared by: Business Analyst for Pharmacy group

Accreditation

In 2013, Accreditation Canada developed a new Required Organizational Practice (ROP) stating that organizations which provide acute care services are required to have a program for antimicrobial stewardship. Northern Health did not meet the tests of compliance during the 2014 survey and in response, a 9 month term for a pharmacist was created (but not funded) (AMS Program Coordinator) with the purpose of developing a comprehensive plan around antimicrobial stewardship in NH. The requirements from Accreditation Canada in order to be found compliant for this ROP include:

Major 2.3.1	The organization implements an antimicrobial stewardship program.
Major 2.3.2	The program includes lines of accountability for implementation.
Major 2.3.3	The program is inter-disciplinary involving pharmacists, infectious disease physicians, infection control specialists, physicians, microbiology staff, nursing staff, hospital administrators and information system specialists as available and appropriate.
Major 2.3.4	The program includes interventions to optimize antimicrobial use (listed below).
Minor 2.3.5	The organization establishes mechanisms to evaluate the program on an ongoing basis and shares the results with stakeholders in the organization.

The term AMS program coordinator presented to Executive Oct 6, 2015 in order to provide an overview of the progress to date and request funding resources to sustain an AMS program in NH. As a result of this presentation, Executive agreed to fund a permanent pharmacist position to continue the work. There was also a commitment to find the physician-resources that would be needed. A 0.4 FTE position was created for a joint Medical Lead for the AMS and Infection Prevention and Control Programs.

The AMS program coordinator put together evidence for submission in November 2015. The results were that additional information was required on the outstanding item below on May 6/16.

Minor	2.3.5	The organization establishes mechanisms to evaluate the program on an ongoing basis, and shares results with stakeholders in the organization.	Antimicrobial Stewardship
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Another evidence submission was created and reviewed by the Accreditation Decision Committee. The result was that the follow-up requirements have been met and therefore as of November 2016, NH was found in compliance of the Antimicrobial Stewardship ROP. The next Accreditation survey will be occurring in June 2018.