fraserhealth
Better health.
Best in health care.

Antimicrobial Stewardship

Annual Report 2021-2022

Prepared by the Fraser Health Antimicrobial Stewardship Program

June 2022

fraserhealth Better health. Best in health care.

Contents

Executive Summary

The Fraser Health Antimicrobial Stewardship Program (ASP) is a small but highly skilled team. We work closely with other clinical staff members who are already championing antimicrobial stewardship on the front line. Our team is currently comprised of four specialized pharmacists and one Infectious Diseases consultant.

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.

Prospective audit and feedback, where our team of ASP clinicians routinely review patient cases in real time, remains the core of our ASP. During the past year, our team intervened in over 2,700 patient cases amounting to nearly 4,300 individual interventions. Discontinuing antibiotics remains our most common intervention. Our recommendations were accepted in 93% of cases.

We have continued to expand our 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 sepsis in obstetrical patients; we have also completed major revisions of our Community Acquired Pneumonia and Intra-abdominal/Biliary Tract Infections chapters.

We continue to collaborate on quality improvement projects including a successful collaborative project on the RCH Vascular unit. We have resumed our involvement in the international point prevalence survey, Global-PPS, which allows us to longitudinally track antimicrobial use in our facilities. Guideline compliant antimicrobial prescribing is 84% overall; compliance with duration of therapy recommendations is 86% overall.

The ASP is involved in development and revision of pre-printed order sets that include antimicrobials. Pre-printed orders (PPO) help standardize care across Fraser Health in line with best practices. Our team continues to synthesize best-available clinical practice for COVID-19 inpatient and outpatient therapies in PPOs and related treatment guidelines in our Firstline smartphone application. These were revised regularly throughout the pandemic.

Broad-spectrum antibiotic usage continued to increase this past year as a result of the COVID-19 pandemic. Use of carbapenems, a last-line antibiotic, has increased but remains far below pre-ASP levels. Usage of agents targeting resistant gram-positive infections remains stable. *C. difficile* infection rates continue to remain low.

In an effort to improve health care efficiency, the ASP seeks to promote wise and effective use of taxpayer money. Antimicrobial expenditures have remained below projected increases for several years. Fraser Health has seen a $714,052 increase in antimicrobial expenditure in FY2021-22 compared to FY2020-21. This was expected as the FY2020-21 year was an outlier in antimicrobial expenditures due to marked shifts from the COVID-19 pandemic. Antimicrobial expenditures remain approximately $1.5 million per year below the inflation adjusted trend from FY2017.

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 *Clostridioides difficile* infection (CDI). Concerted efforts to reduce CDI include improving infection prevention and control practices, as well as promoting appropriate use and selection of antimicrobials through an antimicrobial stewardship program (ASP).

ASPs have 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.

Our ASP's 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:

1. To optimize patient care through appropriate selection and use of antimicrobials, while minimizing adverse events
2. To slow the emergence of antimicrobial resistance by limiting selection pressure from antimicrobial misuse
3. To improve healthcare efficiency by reducing unnecessary antimicrobial use

[1] Public Health Agency of Canada. Antimicrobial resistance and use in Canada: A federal framework for action. Can Commun Dis Rep. 2014;40 Suppl 2:2-5.
[2] Review on Antimicrobial Resistance. Antimicrobial resistance: tackling a crisis for the health and wealth of nations. 2014. Available from http://amr-review.org/Publications.

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. Maggie Wong	*Pharmacy Coordinator, Antimicrobial Stewardship*
Ms. Julia Cahill	*Clinical Pharmacy Specialist, Antimicrobial Stewardship*
Dr. Ivy Chow	*Clinical Pharmacy Specialist, Antimicrobial Stewardship*
Dr. Anish Krishnan	*Clinical Pharmacy Specialist, Antimicrobial Stewardship*
Dr. Tim Leung	*Clinical Pharmacy Specialist, Antimicrobial Stewardship*

We'd like to thank Ms. Julia Cahill who has moved on to another position during the fiscal year.

Administrative support for the program was provided by Anita Michela.

Data Team

Our data team is a collaboration with Infection Prevention and Control. The data team conducts the regular extraction, analysis, and synthesis of data for the ASP. They also provide expert guidance in study design and interpretation.

Members of the data team include:

Katy Short	*Senior Epidemiologist, IPC*
Katherine Wang	*Epidemiologist, IPC*
Eunsun (Sunny) Lee	*Data Analyst, IPC*
Joyce Ng	*Consultant, IPC*

Executive Oversight

Dr. Kevin Afra, medical director of the ASP, is accountable to Linda Dempster (VP Patient Experience and Pandemic Response) and Dr. Ralph Belle (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. Maggie Wong is accountable to Dr. Adil Virani (Manager, Pharmacy Services), who reports to Mr. Spencer Tuttle (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. An associated Advisory Group is drawn upon as needed.

Members of the Regional ASP Committee include:

Dr. Kevin Afra (chair)	*ASP Medical Director & ID Consultant*
Ms. Wendy Bowles	*NP & Regional Department Head, Nurse Practitioners*
Dr. Michael Chapman	*ID Division Head & ID Consultant, SMH*

Dr. Greg Deans	*ID Consultant, SMH*
Dr. Yiannis Himaras	*ID Consultant, ARH*
Dr. Sangita Malhotra	*ID Consultant, RCH*
Dr. Shazia Masud	*Medical Microbiologist*
Dr. Neil Mina	*Medical Microbiologist*
Dr. Susan Roman	*Medical Director, IPC & Medical Microbiologist*
Dr. Gabi Vasile	*Hospitalist, ERH*
Dr. Adil Virani	*Manager, Pharmacy Services*
Dr. Davie Wong	*ID Consultant, RCH*
Dr. Maggie Wong	*ASP Pharmacy Coordinator*
Ms. Anita Michela	*Administrative Assistant*

Members of the Regional ASP Committee Advisory Group include:

Dr. Mark Ballard	*Regional Department Head, Medicine*
Dr. Dave Konkin	*Regional Department Head, Surgery*
Dr. Laurenna Peters	*ID Consultant, BH*
Dr. Steven Reynolds	*Critical Care Physician & Site Medical Director, RCH*
Dr. Michael Paletta	*Regional Department Head, Hospitalists*

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 medical and clinical staff as we strive towards excellence in patient care.

Our special thanks also goes to:

- Division of Infectious Diseases
- Medical Microbiology
- Infection Prevention and Control (IPC)
- Clinical Policy Office
- 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

Prospective Audit and Feedback

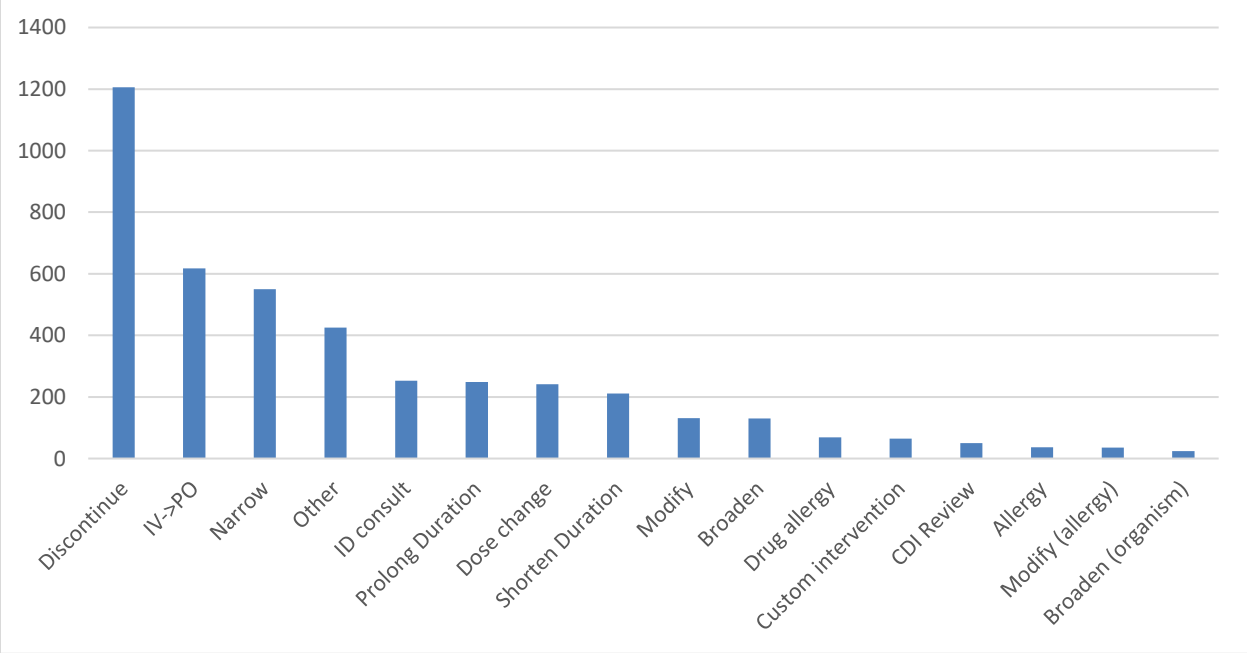
Prospective audit and feedback is one of the core activities of an ASP. It involves real time case-by-case assessment of patients with direct feedback to the patient's care team – most often Medical Staff and Pharmacists. We prospectively identify patients receiving targeted antimicrobials or with certain infectious conditions. One of our team members assesses the patient and identifies whether there is an opportunity to optimize infection management. If so, recommendations are communicated to the care team. Our audit and feedback service does not change medication orders without permission of the most responsible provider.

Our team's intervention statistics are as follows:

Fiscal Year	# Patient Cases Intervened	# Total Interventions	Acceptance Rate
FY2018	3,191	N/A	90 %
FY2019	3,928	N/A	87 %
FY2020	4,927	N/A	87 %
FY2021	3,558	6,359	94 %
FY2022	2,731	4,295	93 %

The ASP transitioned to using LUMED as a dedicated ASP software system starting April 2020. LUMED allows ASP to track all interventions at a patient-level, something we were not previously able to do. A breakdown of ASP audit and feedback interventions by type is shown in **Figure 1**.[3]

Figure 1. ASP prospective audit and feedback interventions by type[4]



[3] A patient case may be associated with more than one concurrent intervention, e.g., narrowing therapy plus IV to PO step-down

[4] Interventions dated Apr 1, 2021 to Mar 31, 2022 were extracted from LUMED.

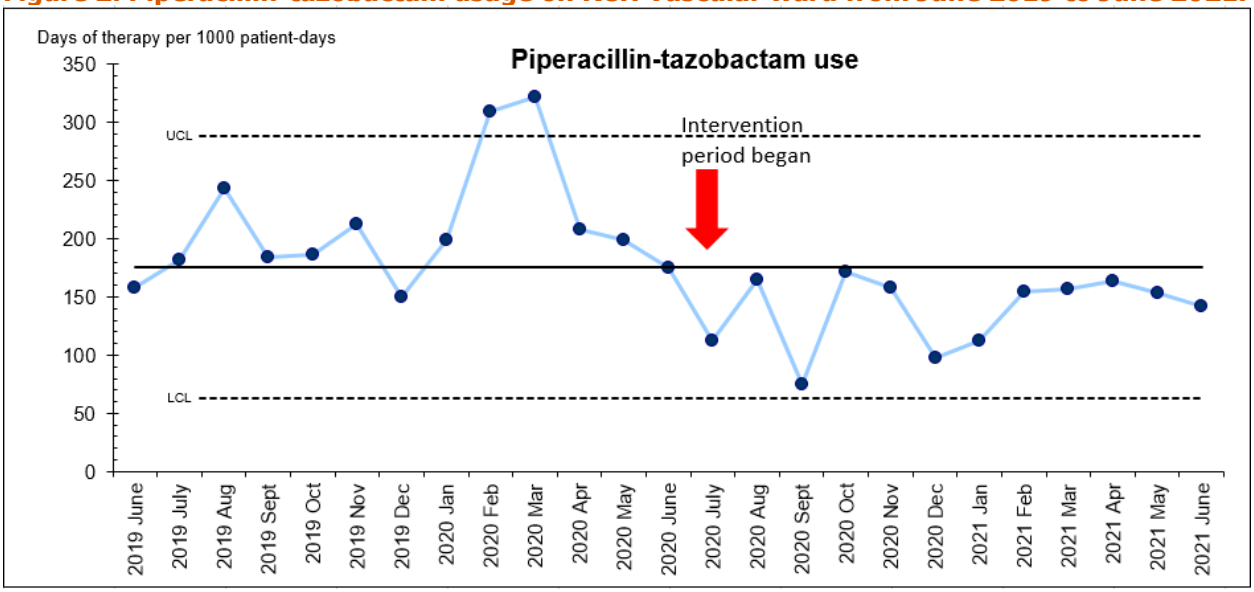
Quality Improvement

RCH Vascular Ward

Since July 2020, we have been undertaking a joint quality improvement project on the vascular surgery ward at RCH. All patients admitted to the vascular surgery ward for any vascular related issues, and received piperacillin-tazobactam or carbapenem were included. The primary outcome is appropriateness of carbapenem and piperacillin-tazobactam use in concordance with local policies. Secondary outcome is consumption of these agents. The interventions consist of education, with an emphasis on audit and feedback via rounding with nurse practitioners who work closely with the vascular surgeons. Mandatory ID consultation for carbapenems is the last resort if AMS recommendations are not accepted.

During a pre-intervention audit, 76% of carbapenem or piperacillin-tazobactam prescribing had appropriate indications. During the intervention period, appropriateness increased to 87%. The mean days of therapy (DOT) per 1000 patient-days for carbapenem decreased from 94.6 to 56.6 for pre- and intervention periods, respectively. For piperacillin-tazobactam, the mean DOT per 1000 patient-days decreased from 209.9 to 138.5 for pre- and intervention periods. The reduced usage of piperacillin-tazobactam remained sustainable post-intervention (**Figure 2**). Only a small number of mandatory ID consultations were necessary.

Figure 2. Piperacillin-tazobactam usage on RCH Vascular ward from June 2019 to June 2021.



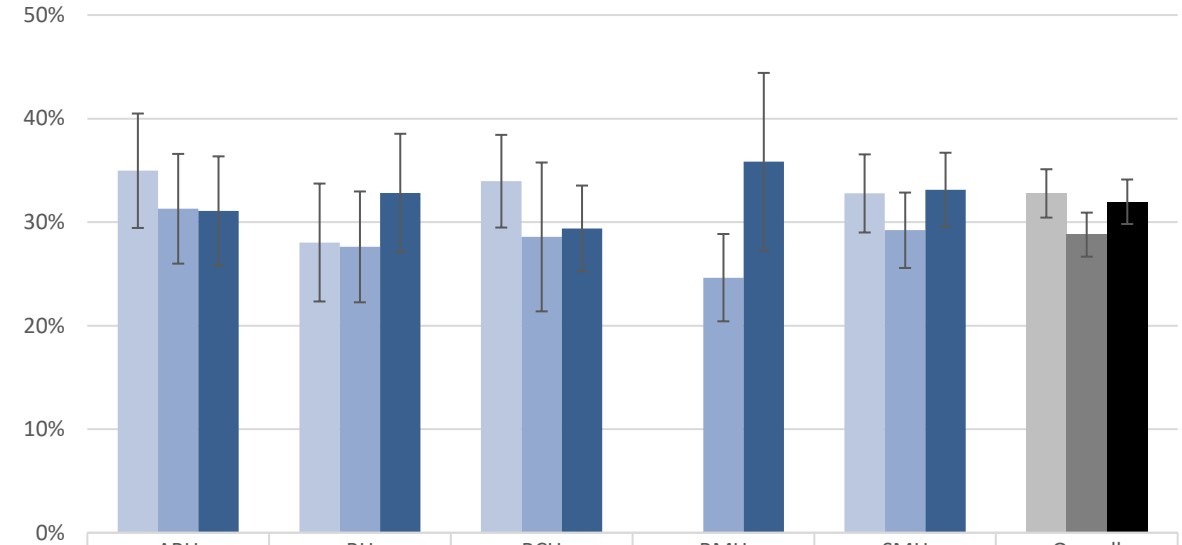
Our multi-pronged approach, consisting of education, prospective audit feedback with the surgical team, and mandatory ID consult in selected cases, was effective in decreasing inappropriate broad-spectrum antibiotic use on the vascular ward at RCH.

Point Prevalence Survey

During the fall of 2021, the ASP resumed its involvement in an international point prevalence survey called Global-PPS. This was after deferring audits in 2020 because of the COVID-19 pandemic. Five hospitals were audited (ARH, BH, RCH, RMH, SMH), each in the span of a single day, for every patient receiving an antimicrobial. Antimicrobial use prevalence was 32% overall (**Figure 3**). In other words, one in three hospitalized patients on any given day was receiving an antimicrobial. This finding is consistent

with antimicrobial use reported in the literature. Antimicrobial use prevalence was higher in 2021 compared to 2019, but this was not statistically significant.

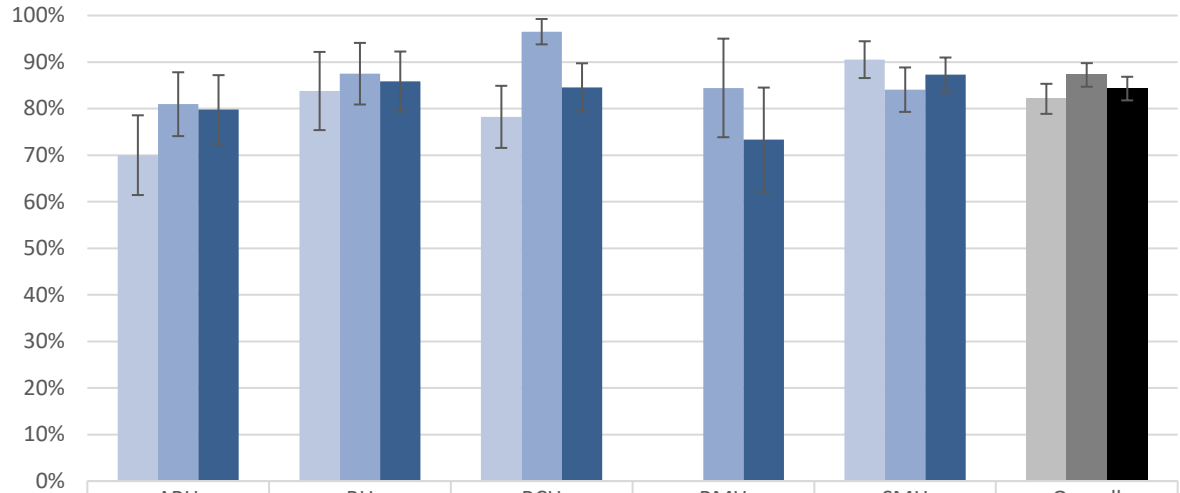
Figure 3. Prevalence of antimicrobial use by hospital, Global-PPS audit.



	ARH	BH	RCH	RMH	SMH	Overall
2018	35%	28%	34%		33%	33%
2019	31%	28%	29%	25%	29%	29%
2021	31%	33%	29%	36%	33%	32%

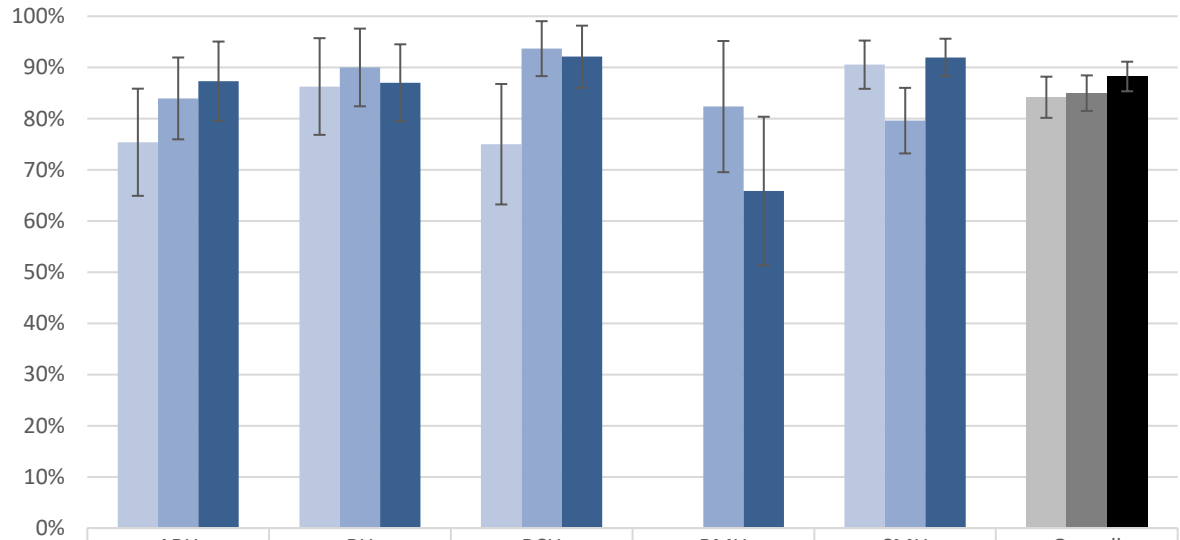
Overall, 84% of antimicrobial therapy was concordant with clinical guidelines. Guideline concordance by hospital and unit type is shown below, with year-over-year trends (**Figures 4 to 7**). Medical units tend to have strong performance. There is room for improvement in surgical units. This was a challenging year for critical care units due to the COVID-19 pandemic; guideline concordance slipped from previous high levels. Note that in the Global-PPS methodology, route of administration or duration of therapy is not considered when assessing guideline concordance.

Figure 4. Guideline concordant antimicrobial use on all units, Global-PPS audit.



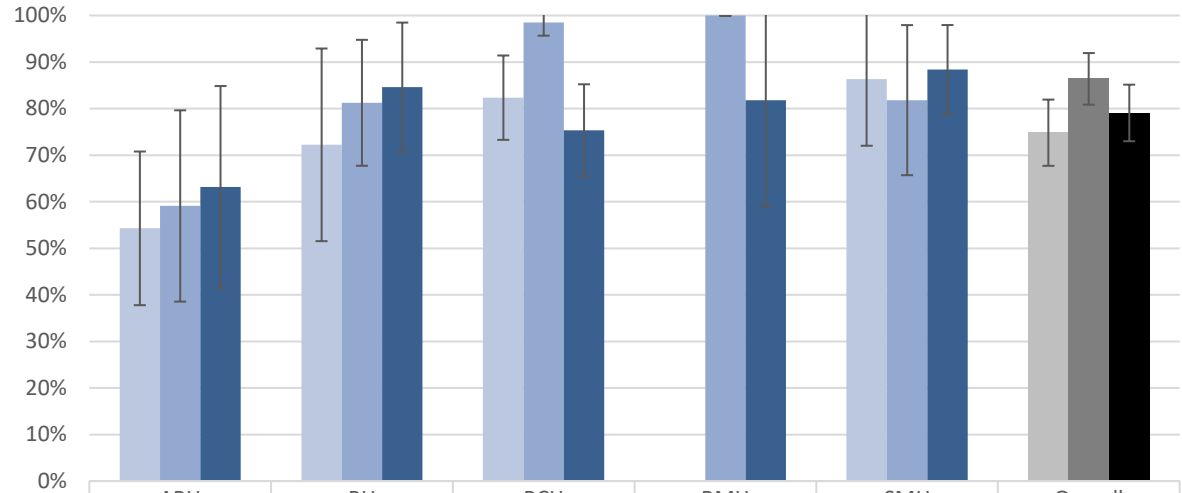
	ARH	BH	RCH	RMH	SMH	Overall
2018	70%	84%	78%		91%	82%
2019	81%	88%	97%	84%	84%	87%
2021	80%	86%	85%	73%	87%	84%

Figure 5. Guideline concordant antimicrobial use on Medical units, Global-PPS audit.



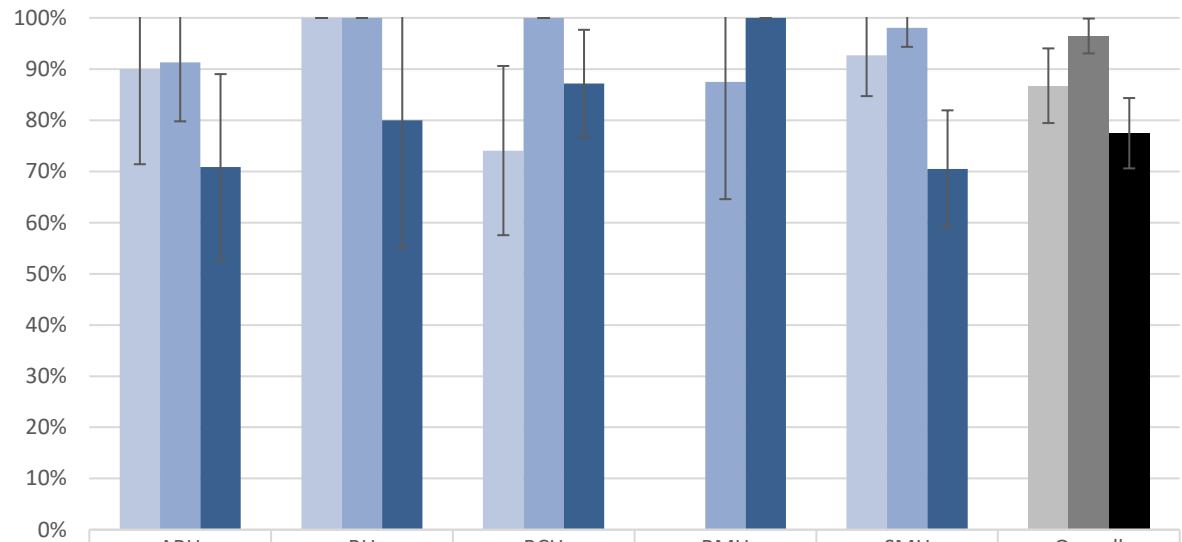
	ARH	BH	RCH	RMH	SMH	Overall
2018	75%	86%	75%		91%	84%
2019	84%	90%	94%	82%	80%	85%
2021	87%	87%	92%	66%	92%	88%

Figure 6. Guideline concordant antimicrobial use on Surgical units, Global-PPS audit.



	ARH	BH	RCH	RMH	SMH	Overall
2018	54%	72%	82%		86%	75%
2019	59%	81%	99%	100%	82%	86%
2021	63%	85%	75%	82%	88%	79%

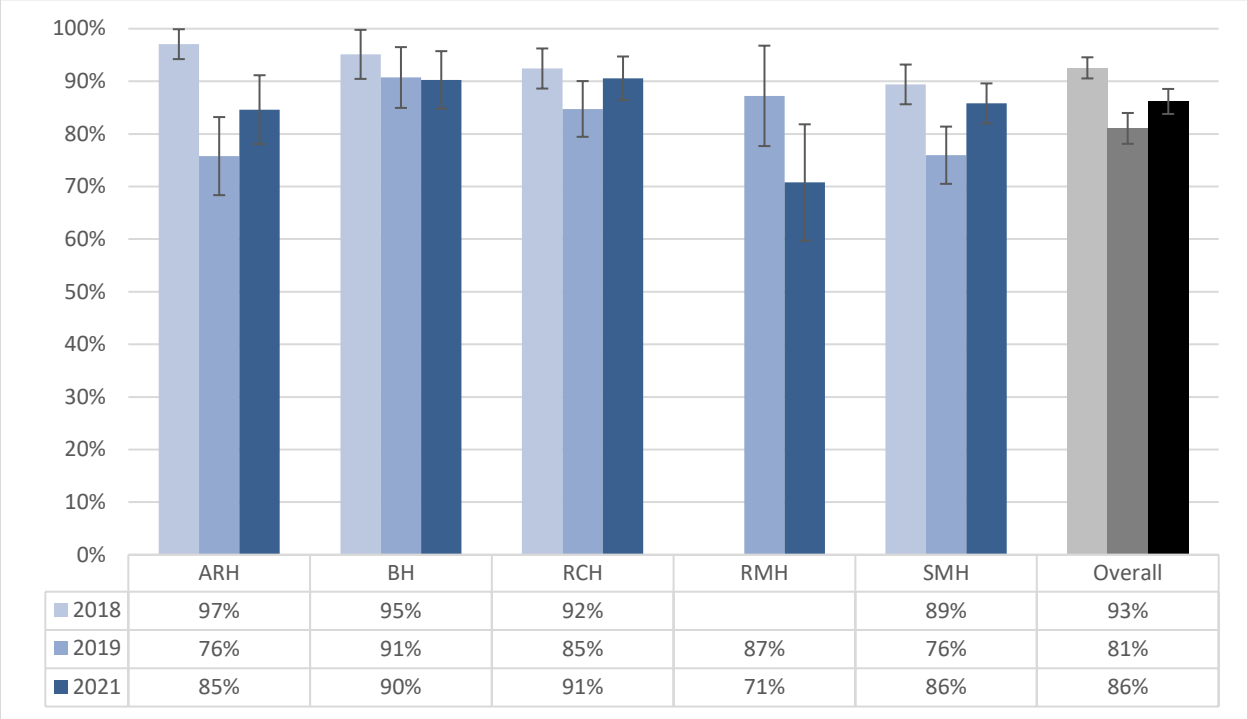
Figure 7. Guideline concordant antimicrobial use on Critical Care units, Global-PPS audit.



	ARH	BH	RCH	RMH	SMH	Overall
2018	90%	100%	74%		93%	87%
2019	91%	100%	100%	88%	98%	96%
2021	71%	80%	87%	100%	70%	77%

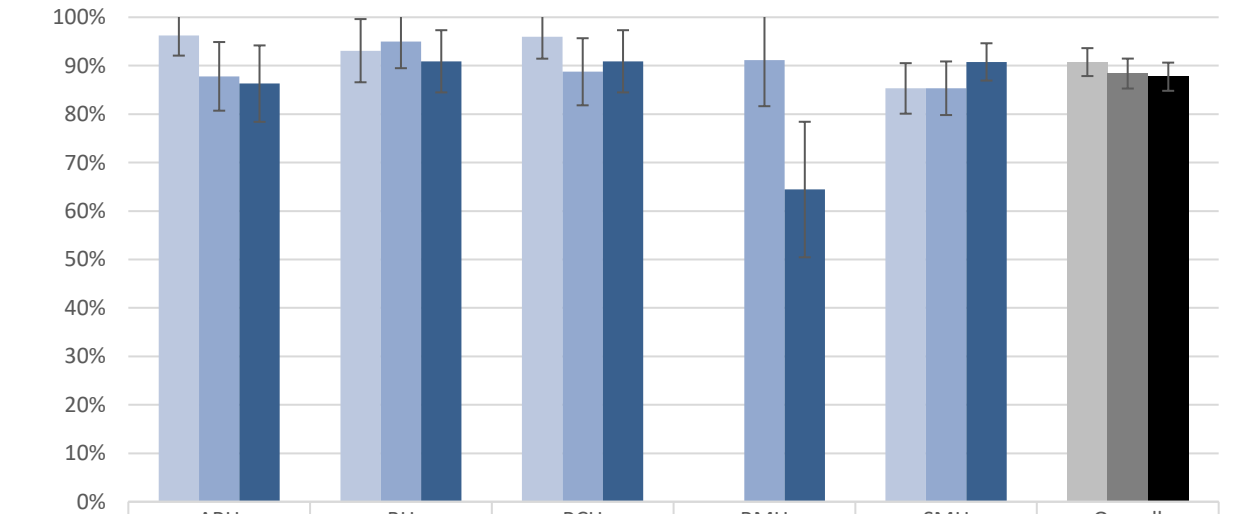
Overall, 86% of antimicrobial therapy duration was compliant with clinical guidelines (**Figures 8 to 11**). Similar patterns are seen here as well. Medical units tend to perform highly on this metric. Surgical units tend to do better with duration of therapy than guideline concordant therapy. Some critical care units have room for improvement with treatment duration.

Figure 8. Guideline compliant duration of therapy on all units, Global-PPS audit.



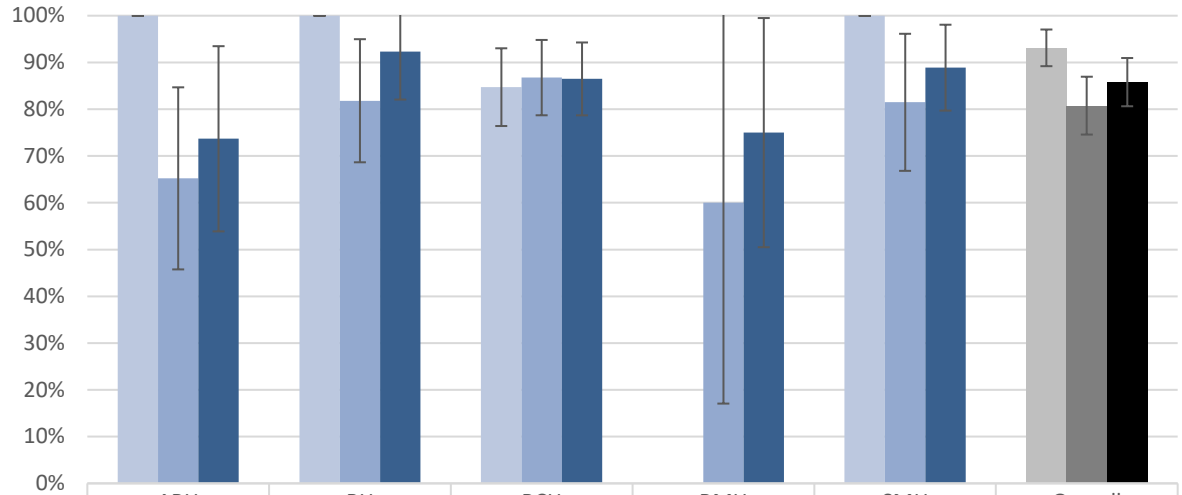
	ARH	BH	RCH	RMH	SMH	Overall
2018	97%	95%	92%		89%	93%
2019	76%	91%	85%	87%	76%	81%
2021	85%	90%	91%	71%	86%	86%

Figure 9. Guideline compliant duration of therapy on Medical units, Global-PPS audit.



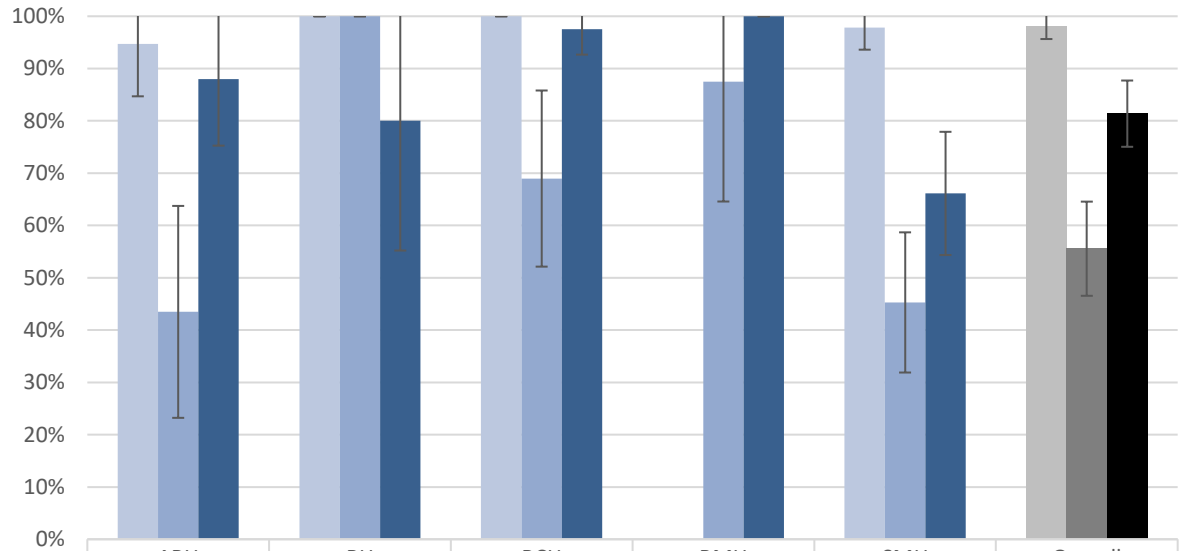
	ARH	BH	RCH	RMH	SMH	Overall
2018	96%	93%	96%		85%	91%
2019	88%	95%	89%	91%	85%	88%
2021	86%	91%	91%	64%	91%	88%

Figure 10. Guideline compliant duration of therapy on Surgical units, Global-PPS audit.



	ARH	BH	RCH	RMH	SMH	Overall
2018	100%	100%	85%		100%	93%
2019	65%	82%	87%	60%	81%	81%
2021	74%	92%	86%	75%	89%	86%

Figure 11. Guideline compliant duration of therapy on Critical Care units, Global-PPS audit.



	ARH	BH	RCH	RMH	SMH	Overall
2018	95%	100%	100%		98%	98%
2019	43%	100%	69%	88%	45%	56%
2021	88%	80%	98%	100%	66%	81%

We plan to continue performing point prevalence surveys on an annual basis. This will allow ongoing longitudinal monitoring and comparison.

ASP Handbook

The ASP has created a Handbook to consolidate in 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 have continued to develop and publish content:

- COVID-19 Guidelines (Firstline only)
- New Sepsis – Obstetrics (Firstline only)
- Major revision of intra-abdominal and biliary tract infections content
- Revision of community-acquired pneumonia content

This adds to our previously released content on:

- Community-acquired pneumonia
- Aspiration pneumonia
- Hospital acquired pneumonia
- Ventilator-associated pneumonia
- Pathogen directed therapy for pneumonia
- Pleural infections
- COPD Exacerbation
- Pneumonia in Long Term Care
- Bacteremia – Enterococcus
- Bacteremia – S. aureus
- Skin and soft tissue infections
- Diabetic foot infections
- C. difficile infection
- Urinary tract infections
- Central Nervous System infections
- Inpatient sepsis
- Sepsis in CPO Colonized Patients
- Penicillin allergies
- Pediatric infections
- Vancomycin dosing and therapeutic monitoring
- Aminoglycoside dosing and therapeutic monitoring
- Colistin dosing

New chapters are planned for the coming fiscal year. Existing chapters are reviewed regularly for updates taking into account evolving practice standards, local antimicrobial resistance, and formulary.

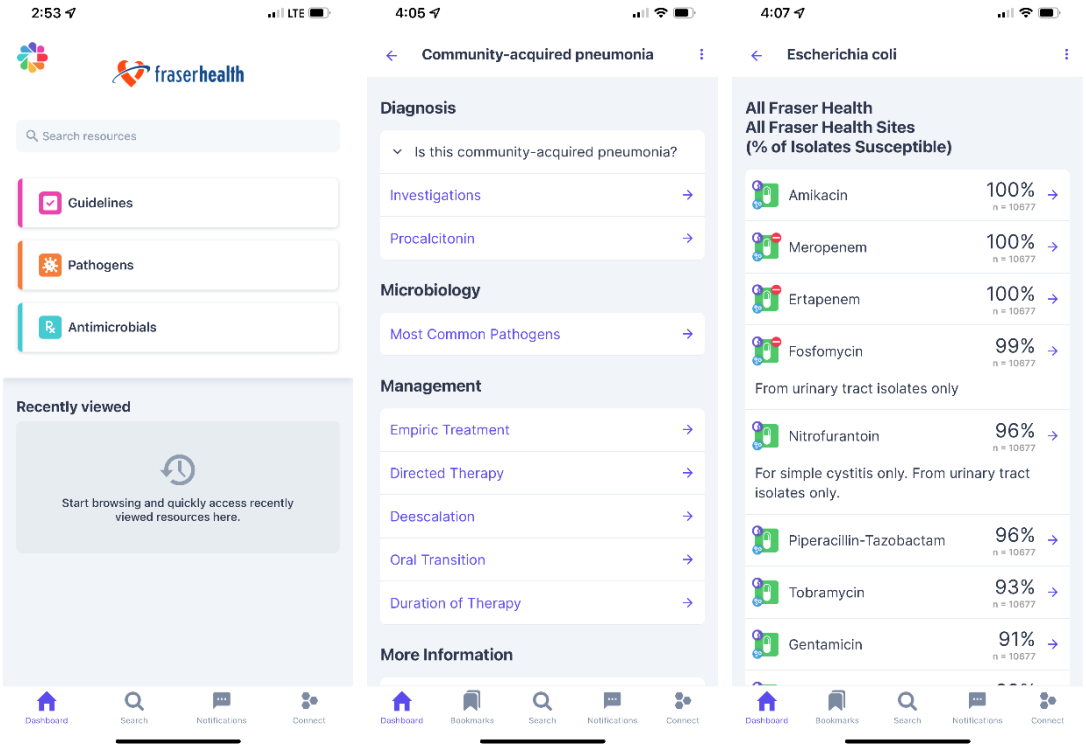
ASP Website

The ASP has 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. Our website includes our ASP Handbook, local antibiograms, our reports, and contact information for our clinical teams across the region. In order to improve accessibility for clinicians, we have mirrored our content on the externally accessible Fraser Health Medical Staff website. Click here to take a look.

ASP Smartphone App (Firstline)

The ASP has clinical guidance content integrated into a customized antimicrobial stewardship smartphone app called Firstline (**Figure 12**). This app is available for free on iOS and Android based devices. We currently have over 1200 active monthly users.

Figure 12. Firstline antimicrobial stewardship smartphone app



Pre-Printed Orders

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 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/development of the following PPO's:

- Suspected/Confirmed COVID-19 Treatment
- COVID-19 Confirmed or Presumed in Long Term Care
- COVID-19 Monoclonal Therapy
- Paxlovid Treatment for Residents with COVID-19 in Long-Term Care and Assisted Living
- Emergency Sepsis
- PD Peritonitis
- Antibiotic Lock Solutions for Catheter Related Bloodstream Infections in Hemodialysis
- Transcatheter Mitral Valve Repair
- TAVI Pre- and Post-operative
- Cardiac Surgery: Rapid surgical recovery transfer

- ARH/SMH Forensic Nursing Services

COVID-19 Response

The ASP took a leadership role in supporting Fraser Health's COVID-19 response. We synthesized best available clinical evidence to create a COVID-19 PPO used for adult inpatients with suspected or confirmed COVID-19. We worked with a wide range of clinical experts including Hospitalists, Critical Care, Internal Medicine, Emergency, Obstetrics, Infectious Diseases, Medical Microbiology, Lab Medicine, and Pharmacy. Our team continues to update this PPO as our understanding of best-practices in the care of COVID-19 patients evolves. The ASP summarizes COVID-19 management guidelines in its Firstline smartphone app. Furthermore, as the pandemic and therapeutic arsenal shifted in FY2021-22, the ASP also supported outpatient COVID-19 therapeutics.

Our team continued to provide daily prospective audit and feedback clinical support despite the COVID-19 pandemic, including for patients with suspected and confirmed COVID-19. Our mandate to promote appropriate antimicrobial use did not change with the pandemic.

Antimicrobial Usage Trends

The ASP reviews usage trends of targeted antimicrobials on an ongoing basis. Our primary reporting metric is days of therapy (DOT). DOT is the number of days that a patient receives an antimicrobial agent regardless of dose. This is the most accurate and preferred measure of antimicrobial use, endorsed by the Centers for Disease Control and the US National Healthcare Safety Network.[5] Total DOT is then normalized to the common denominator of 1,000 patient-days. The resulting unit of measure, "DOT per 1,000 patient-days", does not account for interhospital differences in case mix and patient acuity. It is also sensitive to changes in both the numerator and denominator that may be independent of one other. However, it is a metric that accounts for hospital size and patient volume, and is used by many other institutions.

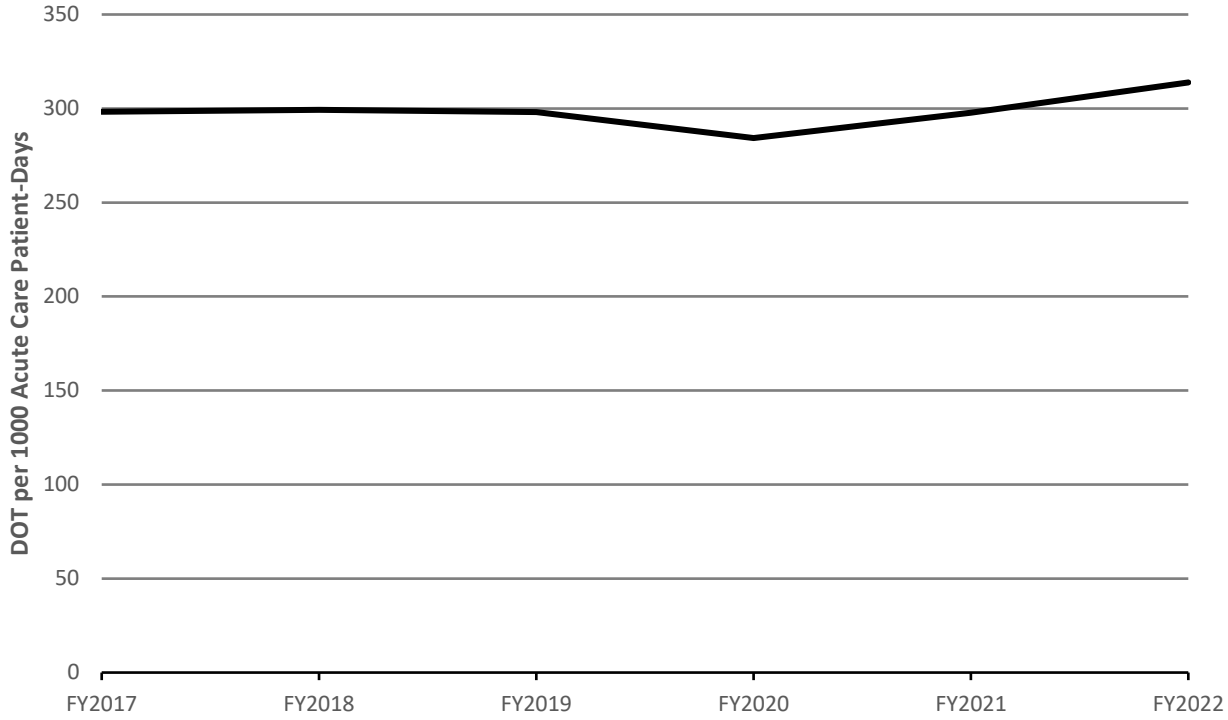
The inpatient DOT at the facility level were extracted from LUMED for FY2017-2022, and from Meditech for FY2013-2016 for selected antimicrobials. The patient days for units reportable by ASP were extracted from Meditech for FY2018-2022, from the Infection Prevention and Control CDI tool for FY2017, and from MicroStrategy for FY2013-2016.

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

After several years of decline, overall inpatient broad-spectrum antibiotic usage continued an upwards trend in FY2021-22 (**Figure 13**). A rate of inpatient antibiotic use is likely due to ongoing shifts in hospital case-mix as a result of the COVID-19 pandemic. The ASP will continue to monitor these trends closely.

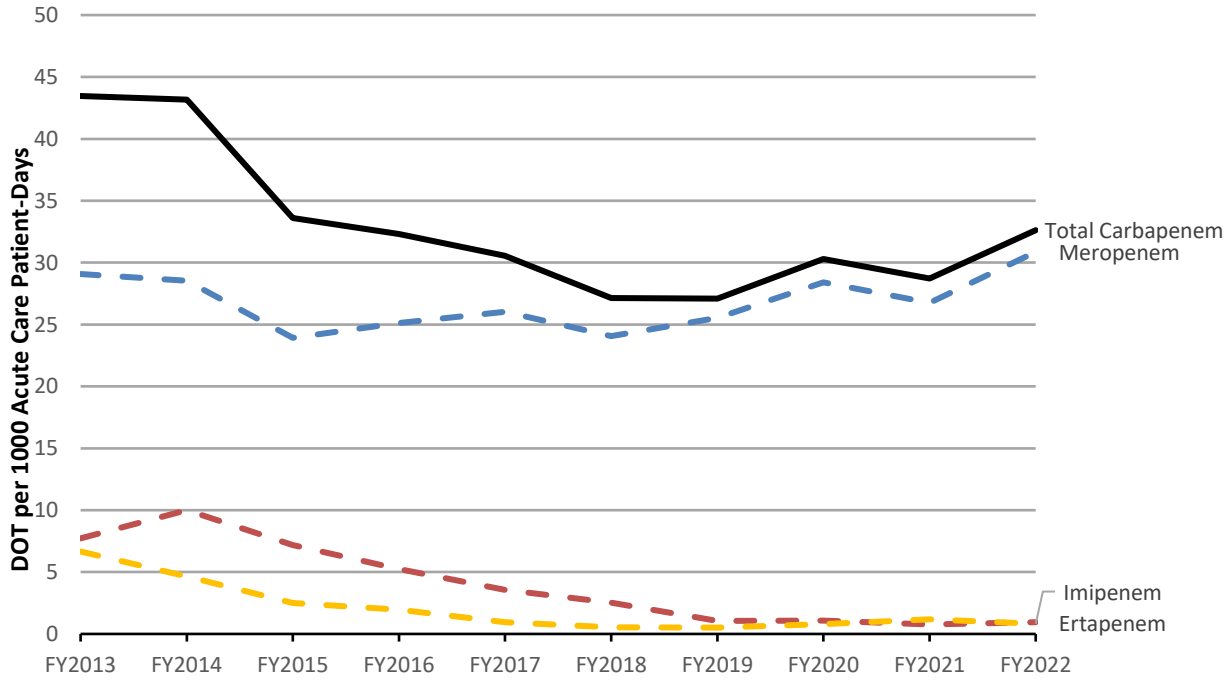
[5] https://www.publichealthontario.ca/en/eRepository/Antimicrobial_Stewardship_Metrics_Evaluation_2014.pdf

Figure 13. Inpatient broad-spectrum usage.



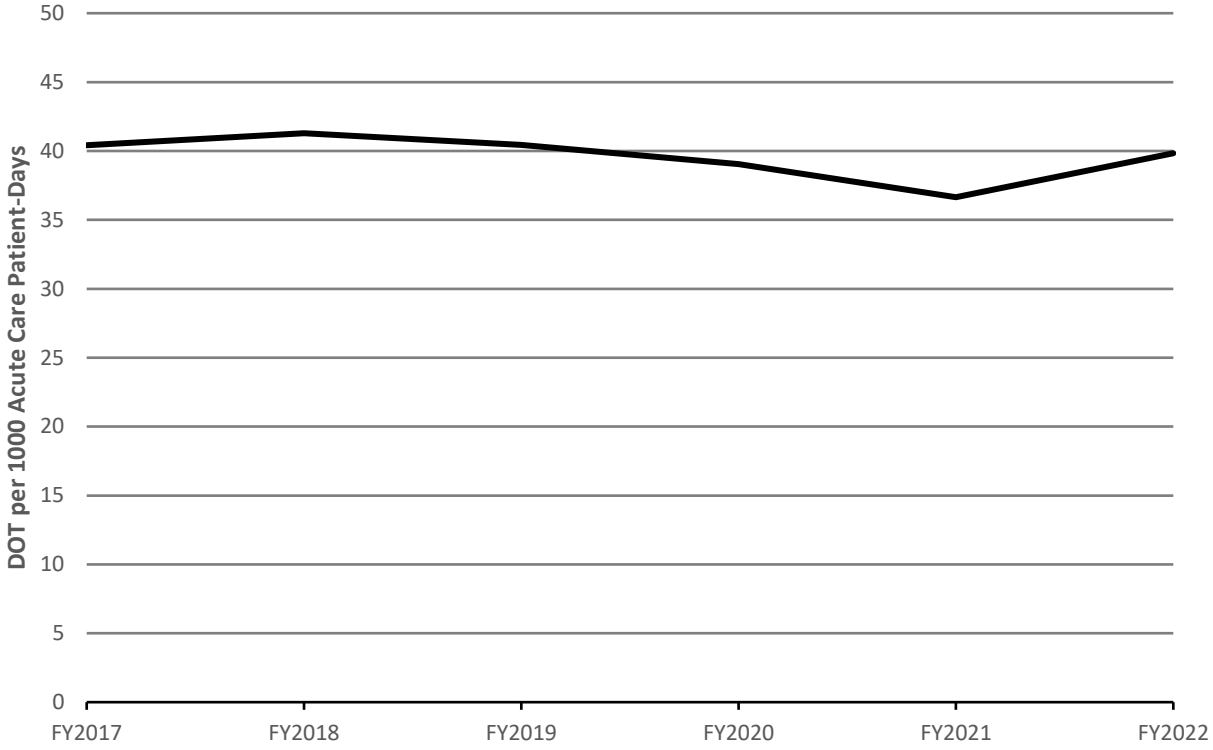
Carbapenems are one of our most potent class of antimicrobials. Resistance to carbapenems in gram-negative infections is a serious public health threat and a strong impetus for antimicrobial stewardship. Carbapenem usage increased over the previous year (**Figure 14**) but remains significantly below pre-ASP trends.

Figure 14. Inpatient carbapenem usage.



The ASP also tracks agents used for treatment of resistant gram-positive infections (e.g., MRSA and VRE). Usage of these agents remains stable (**Figure 15**).

Figure 15. Inpatient gram-positive agents usage.



Please refer to the statistical appendix for hospital-specific antimicrobial usage.

Financials

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

Daptomycin continues to be our antimicrobial agent with the highest expenditure (**Table 1**). Daptomycin is mostly used in the outpatient setting for treatment of resistant infections, or where alternative agents requiring multiple daily doses are logistically unfeasible. Ertapenem is also nearly exclusively used in the outpatient setting, as a therapeutic interchange to meropenem governs inpatient use. Decreased expenditure on daptomycin has been the most prominent change from FY2021.

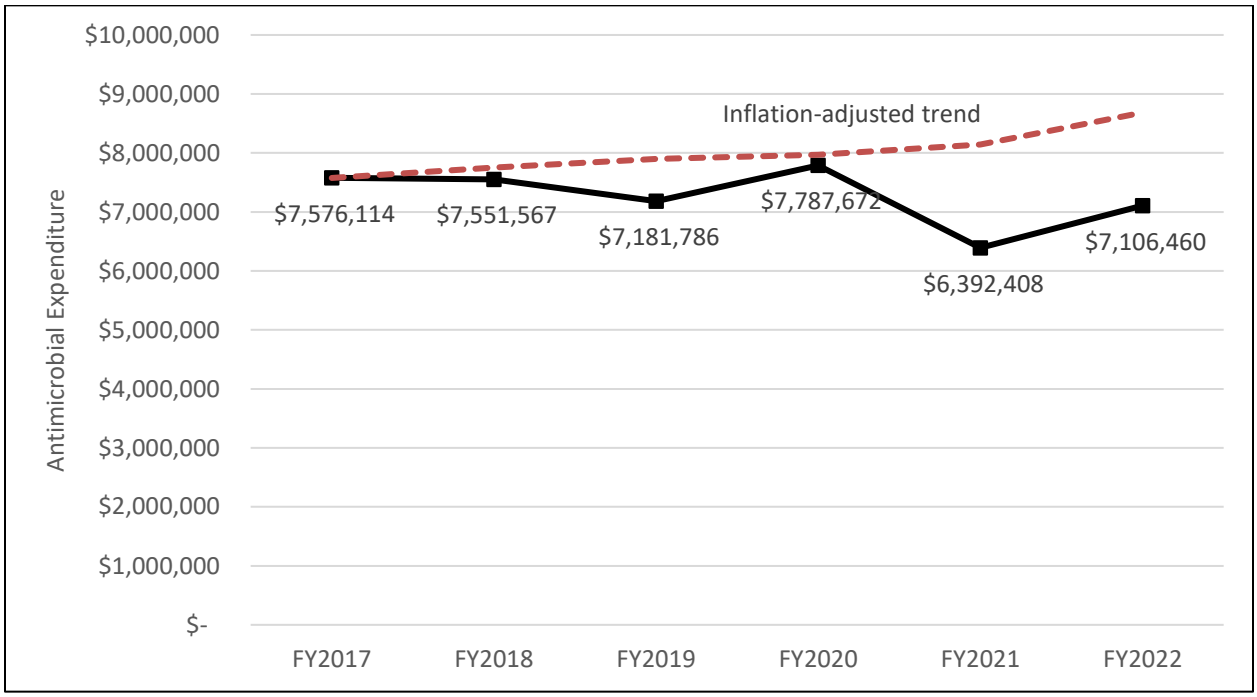
Overall antimicrobial expenditure in Fraser Health has remained below inflation-adjusted trends for the past several fiscal years **(Figure 16)**. Over the past year, antimicrobial expenditures have increased by $714,052 (an 11.2% increase). This was expected as the FY2020-21 year was an outlier in antimicrobial expenditures due to marked shifts from the COVID-19 pandemic. Antimicrobial expenditures remain approximately $1.5 million per year below the inflation adjusted trend from FY2017.

Table 1. Combined cost of five restricted antimicrobial drugs.

Restricted Antimicrobials	**Total Inpatient & Outpatient Expenditure** (excluding Home IV supplied by Calea)		**Difference** (FY2022 vs. FY2021)
	FY2021	**FY2022**	
Daptomycin	$1,341,855	$792,644 ↓	- $549,211
Ertapenem*	$552,648	$529,743 ↓	- $22,905
Meropenem*	$304,785	$375,002 ↑	$70,217
Linezolid	$77,018	$112,061 ↑	$35,043
Imipenem*	$37,380	$29,803 ↓	- $7,577
Total	**$2,313,686**	**$1,839,253** ↓	**- $474,433**
*Carbapenems	$894,813	$934,548 ↑	$39,735

Source: LMPS Datamart

Figure 16. Fraser Health antimicrobial expenditures.



Source
Actual expenditures: LMPS Datamart. All Anti-Infective Agents by AHFS Classification.
Inflation-adjusted trend: Statistics Canada Table 18-10-0004-01 using All Items for Canada in March of every fiscal year. Baseline year FY2017.

Statistical Appendix

Antimicrobial Aggregations

Throughout this report, the following antimicrobial aggregations are used to show overarching trends in antimicrobial usage.[6]

Broad-spectrum antimicrobials include all the following sub-groups:
1. Antibiotics used primarily to treat hospital-acquired infections: amikacin, aztreonam, cefepime, ceftazidime, gentamicin, imipenem-cilastatin, meropenem, piperacillin-tazobactam, tobramycin.
2. Antibiotics used primarily to treat community-acquired infections: cefixime, cefotaxime, cefprozil, ceftriaxone, cefuroxime, ciprofloxacin, ertapenem, levofloxacin, moxifloxacin.
3. Antibiotics used primarily to treat MDR infections: ceftazidime-avibactam, ceftolozane-tazobactam, colistin (colistimethate), tigecycline.
4. Agents used primarily to treat resistant gram-positive infections: ceftaroline, ceftobiprole, daptomycin, linezolid, vancomycin

Gram-positive agents include only the sub-group of antibiotics used primarily to treat resistant gram-positive infections (detailed above)

Notes to Interpretation

Antimicrobial usage data is expressed in days of therapy (DOT) 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 facilitate interhospital comparison.

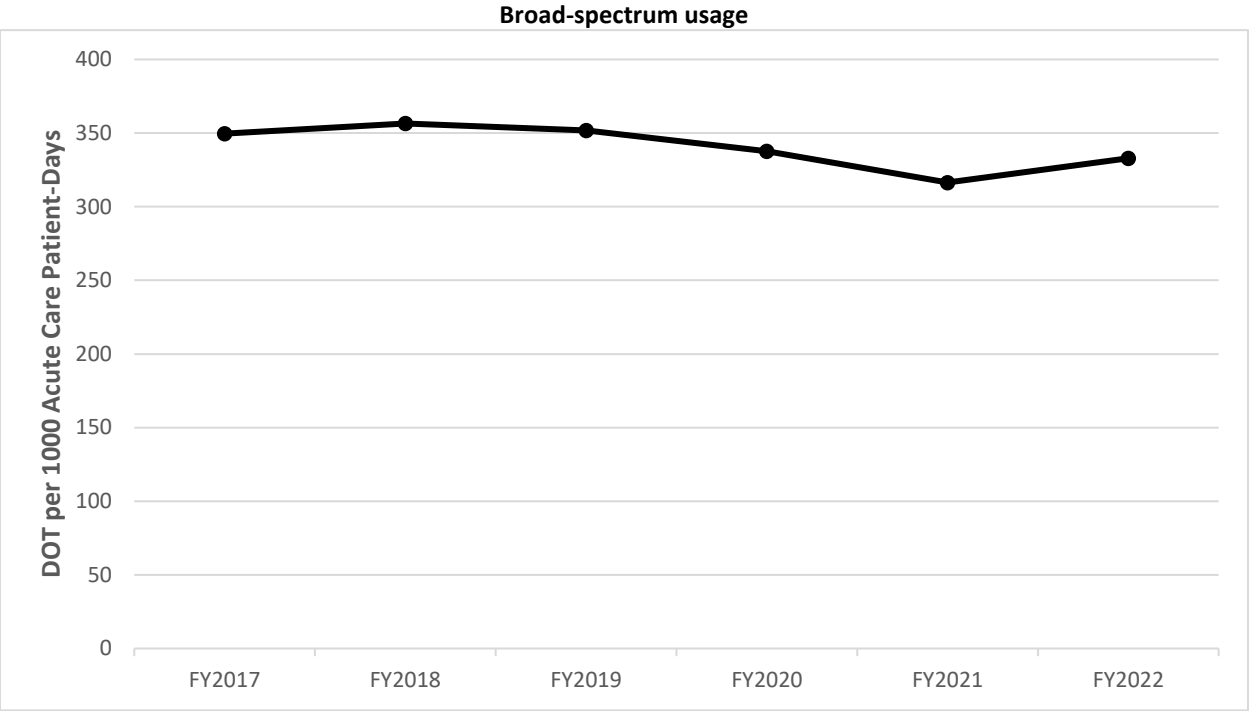
Data Sources

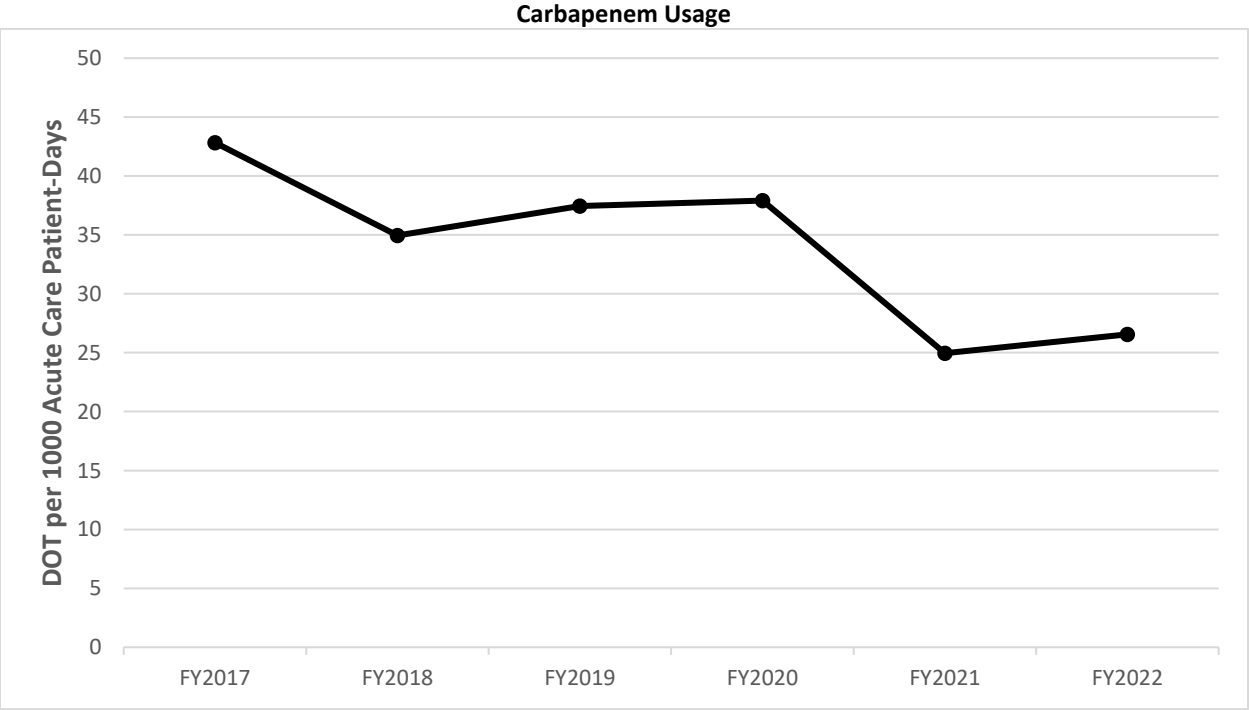
The inpatient DOT at the facility level for FY2017-2022 were extracted from LUMED. The patient days for units reportable by ASP were extracted from Meditech for FY2018-2022 and from the Infection Prevention and Control CDI tool for FY2017.

[6] Antimicrobial groupings are derived from those used by the U.S. Centers for Disease Control and Prevention in their NHSN AUR Module. See https://www.cdc.gov/nhsn/pdfs/pscmanual/11pscaurcurrent.pdf.

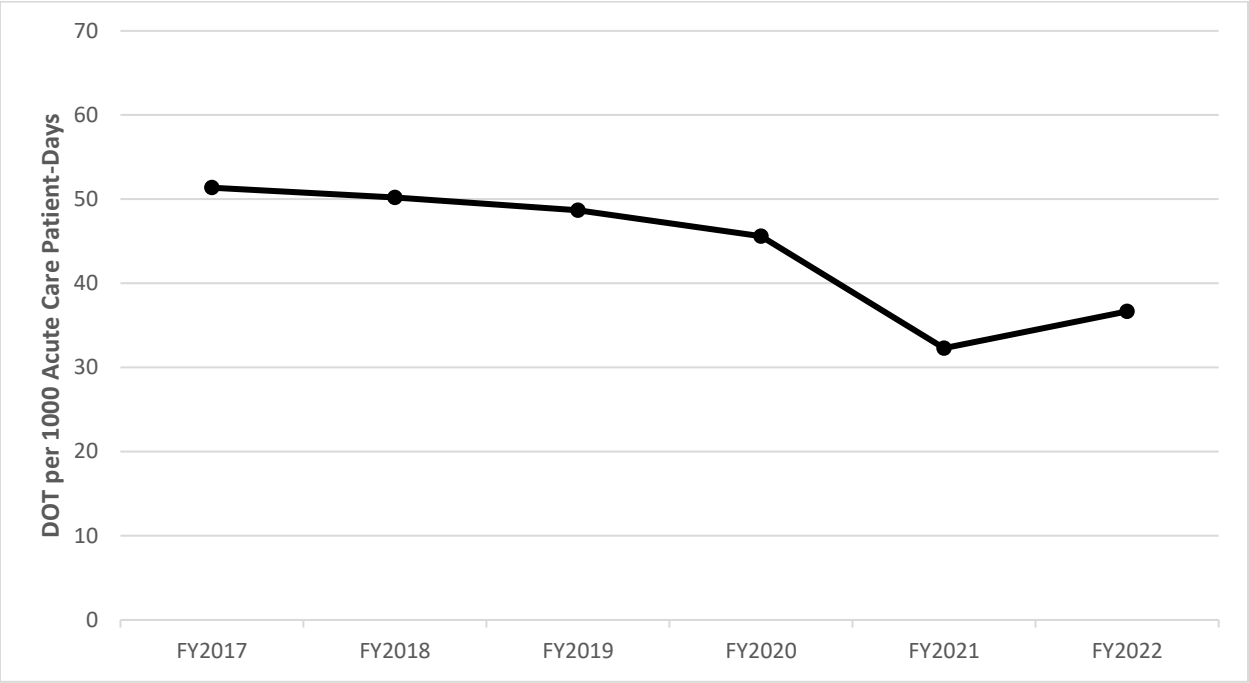
Targeted Antimicrobial Usage by Site

ARH

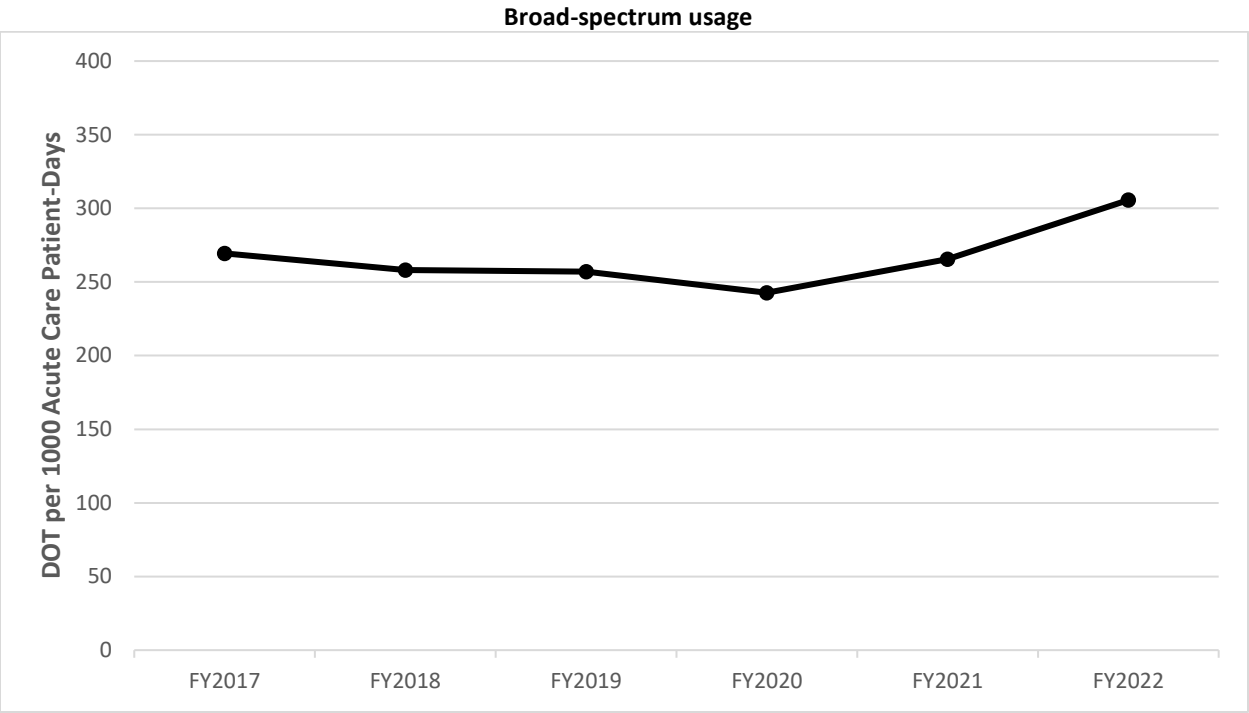


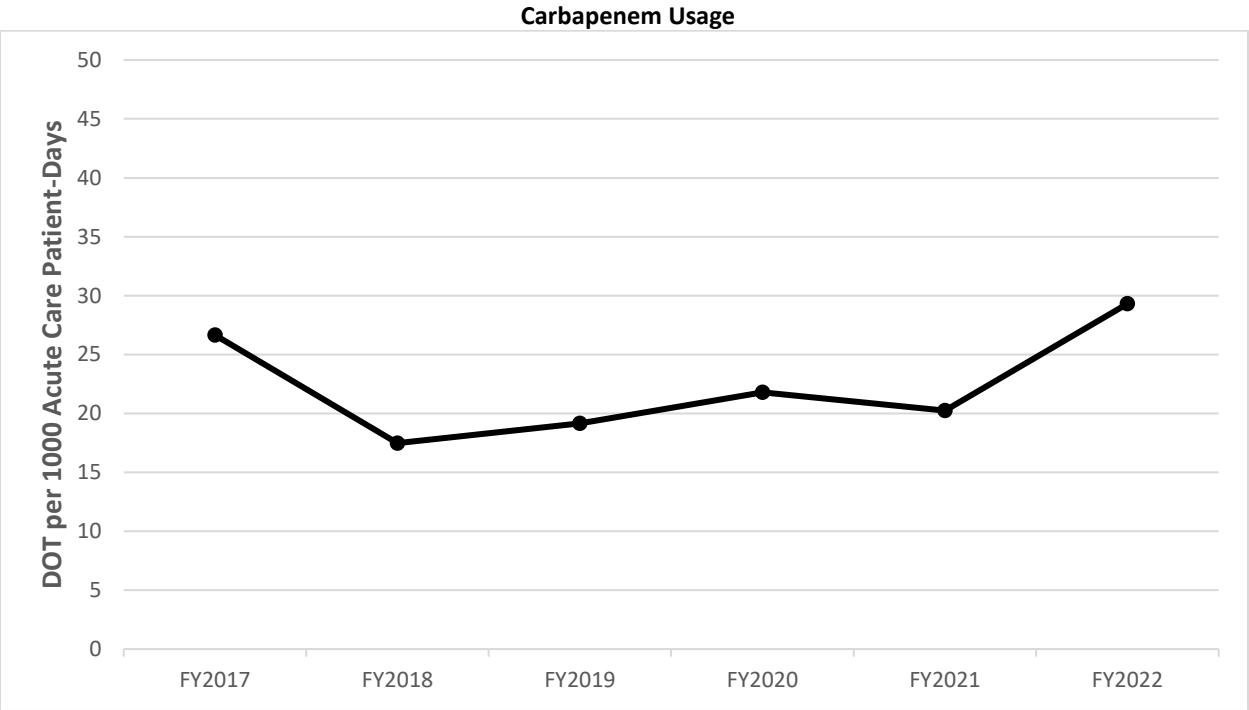


Gram-positive Agents Usage

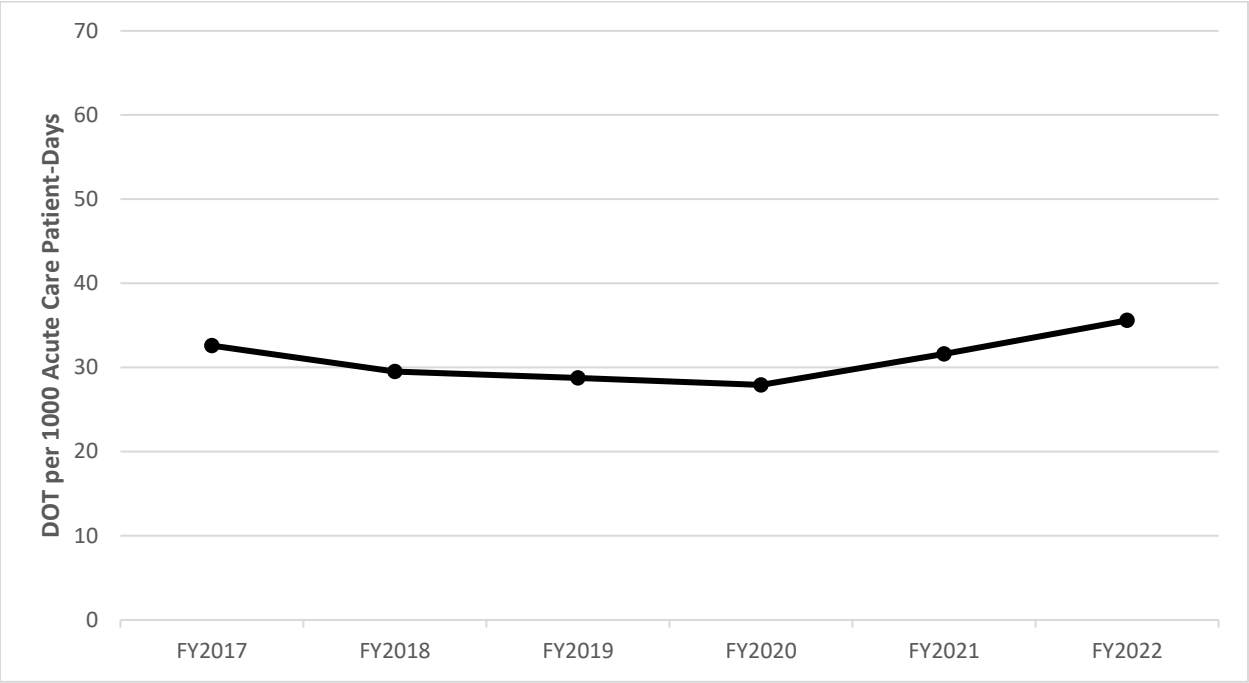


BH

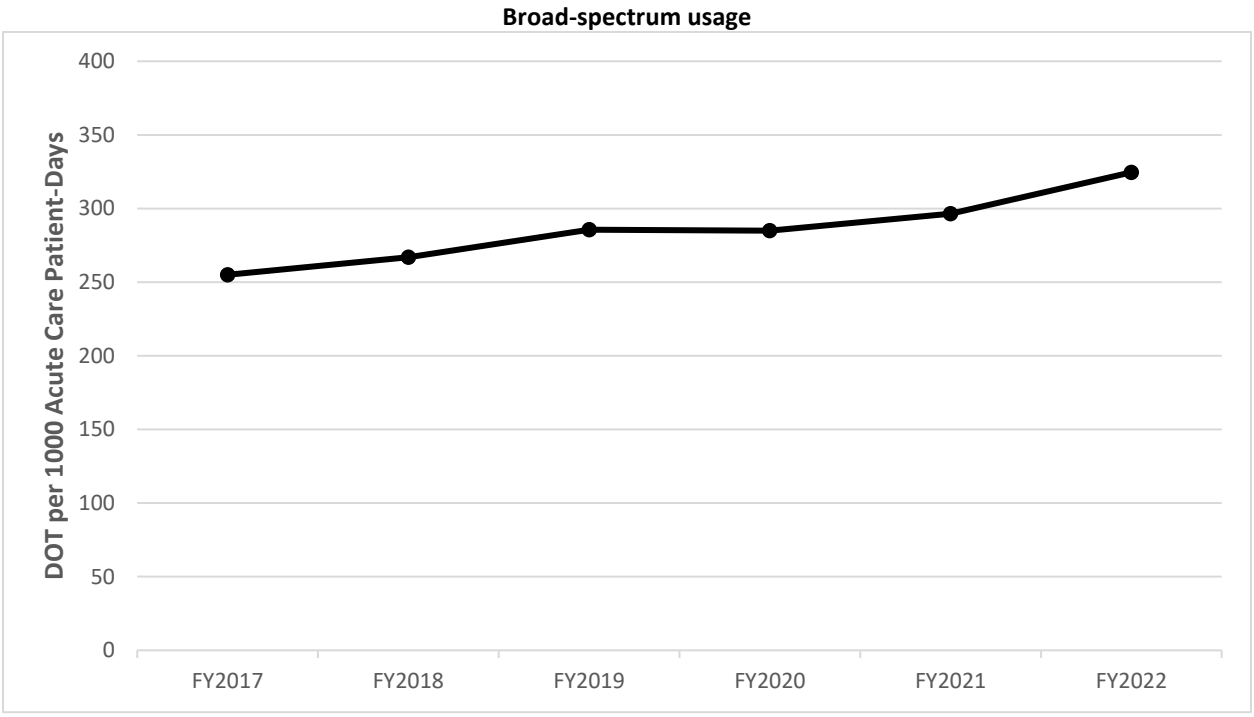

Broad-spectrum usage
DOT per 1000 Acute Care Patient-Days
400
350
300
250
200
150
100
50
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

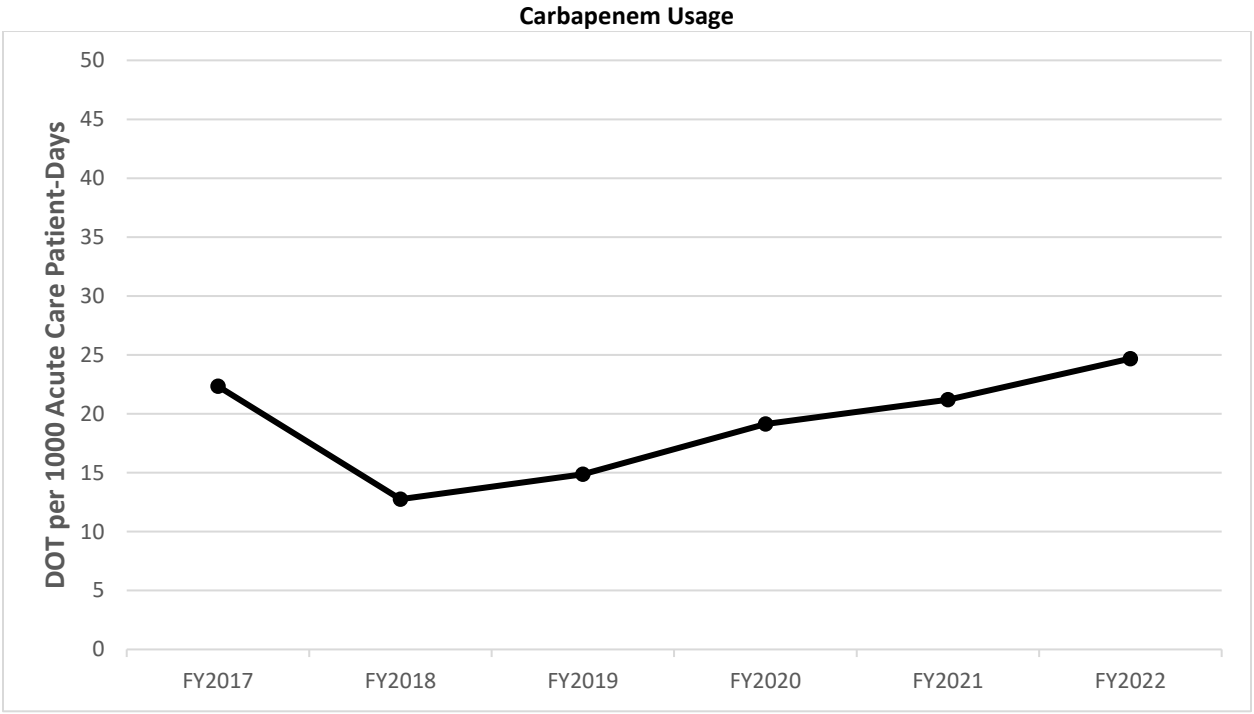

Carbapenem Usage
DOT per 1000 Acute Care Patient-Days
50
45
40
35
30
25
20
15
10
5
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

Gram-positive Agents Usage

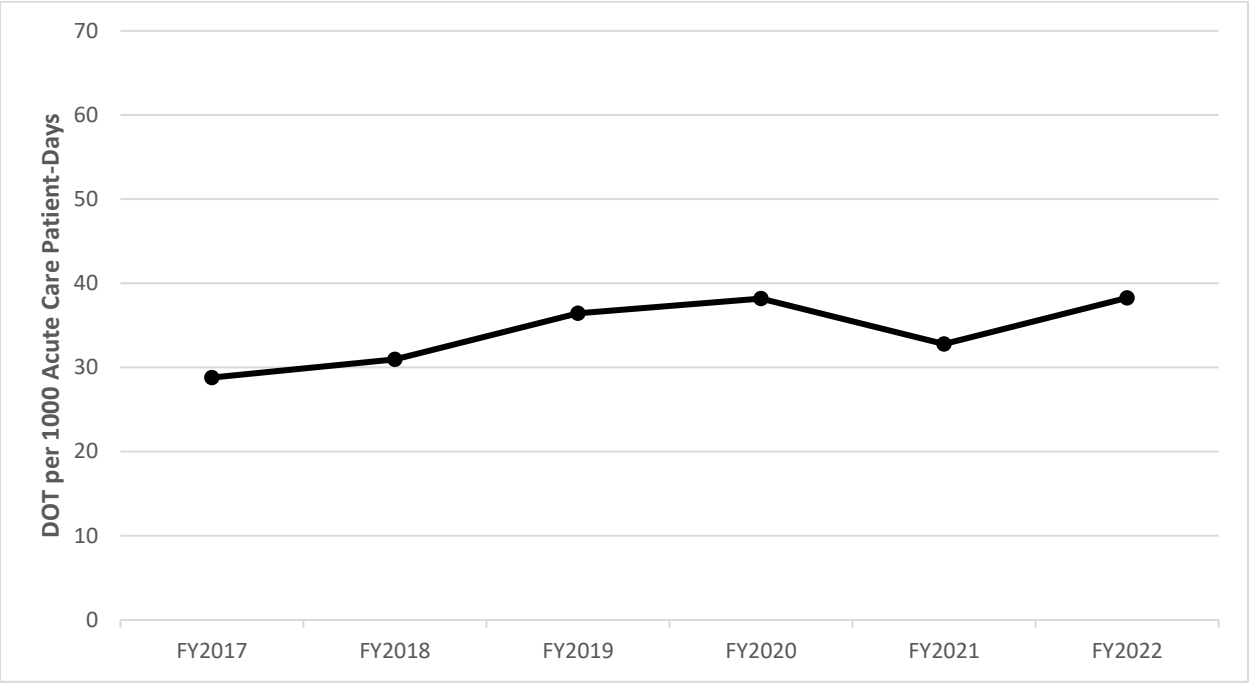


CGH

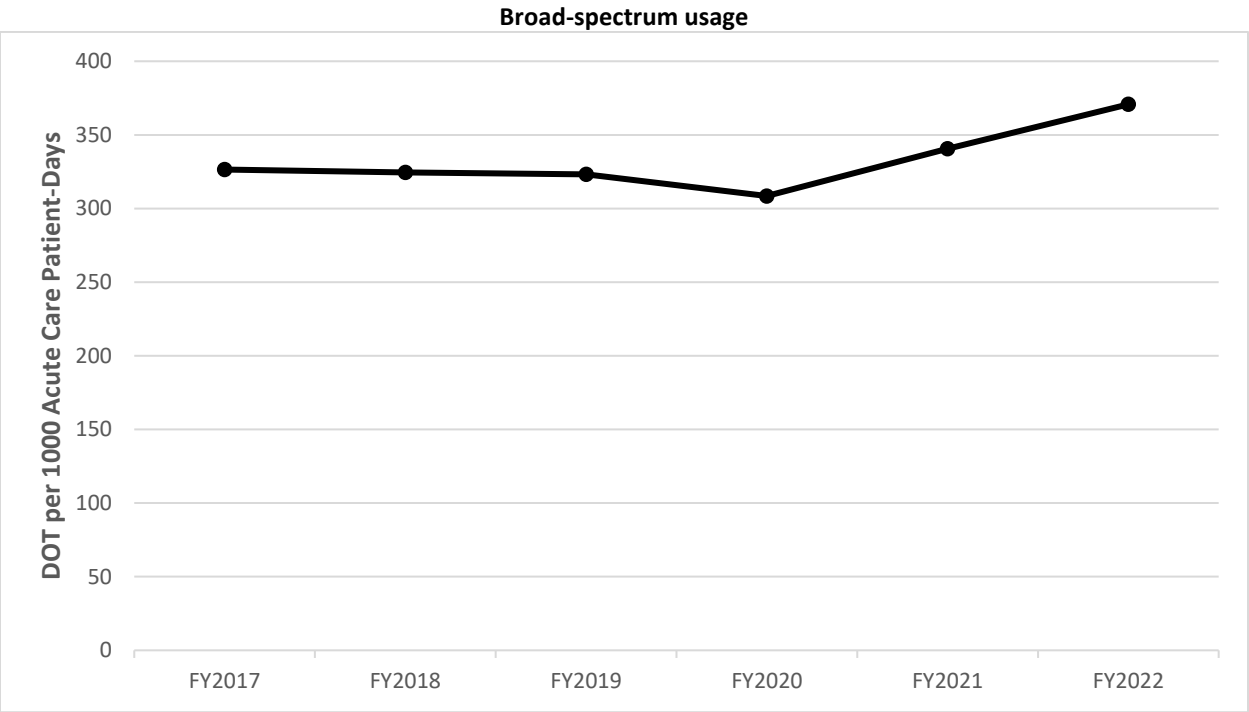

Broad-spectrum usage
DOT per 1000 Acute Care Patient-Days
400
350
300
250
200
150
100
50
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

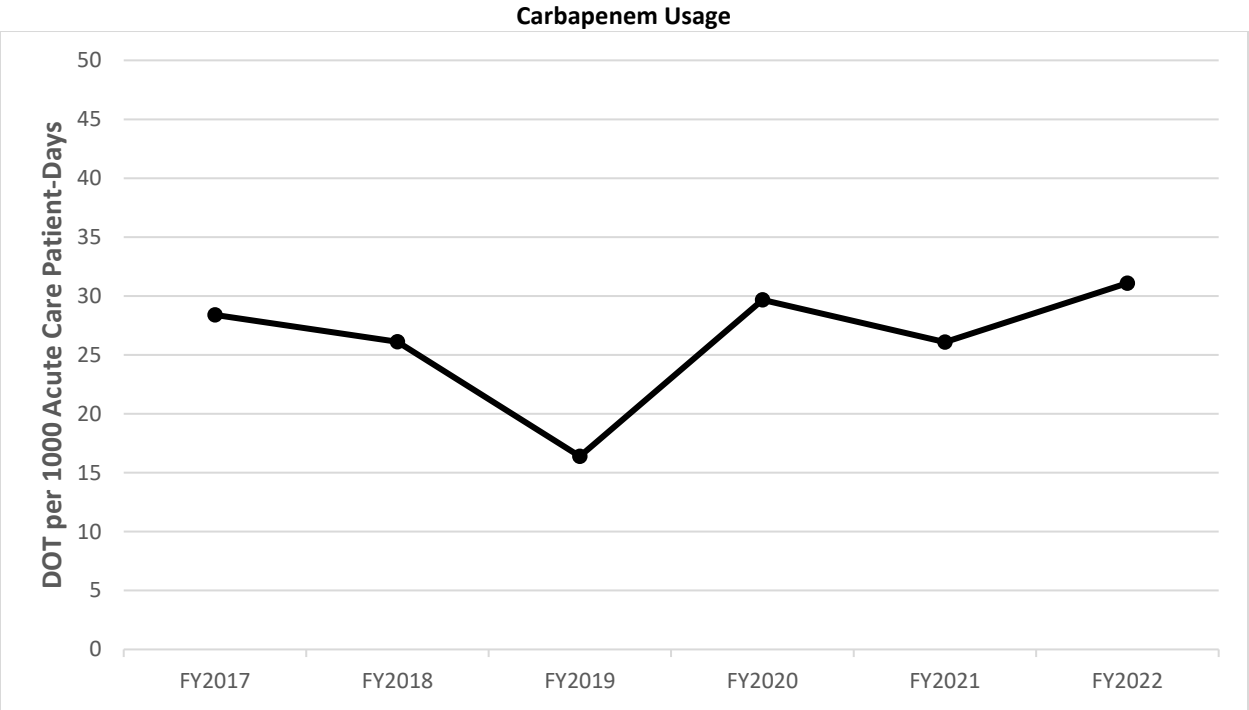

Carbapenem Usage
DOT per 1000 Acute Care Patient-Days
50
45
40
35
30
25
20
15
10
5
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

Gram-positive Agents Usage

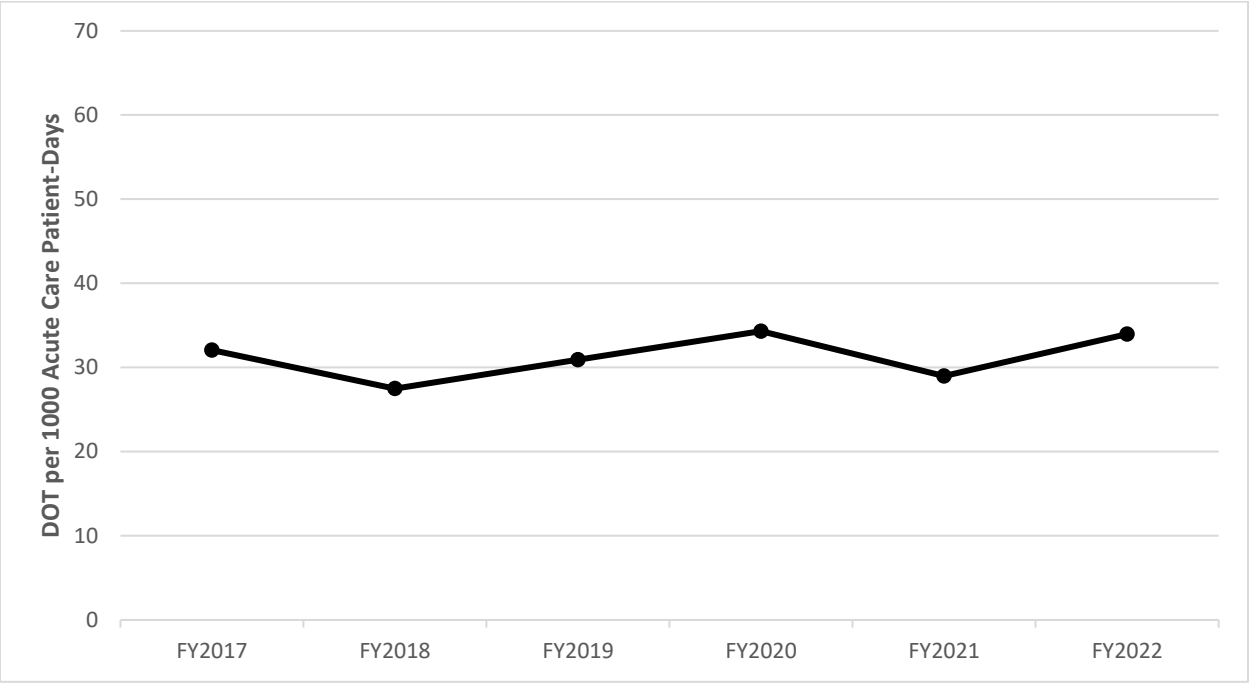


DH

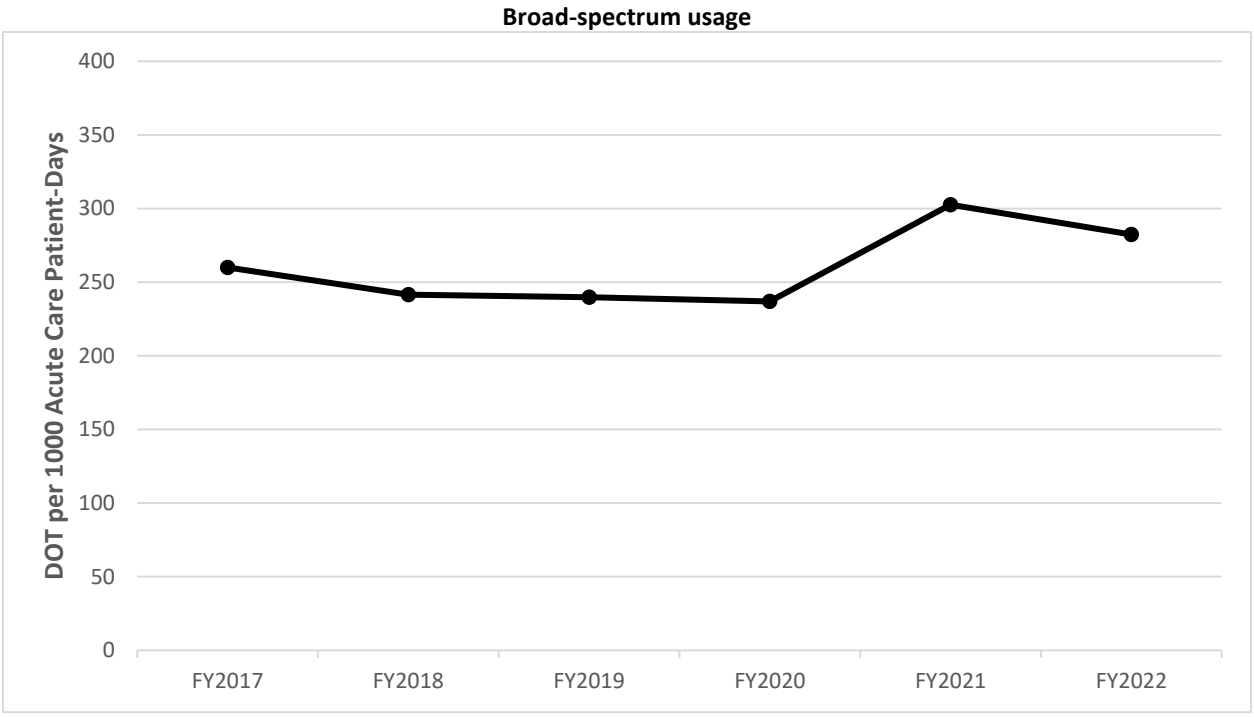

Broad-spectrum usage
DOT per 1000 Acute Care Patient-Days
400
350
300
250
200
150
100
50
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

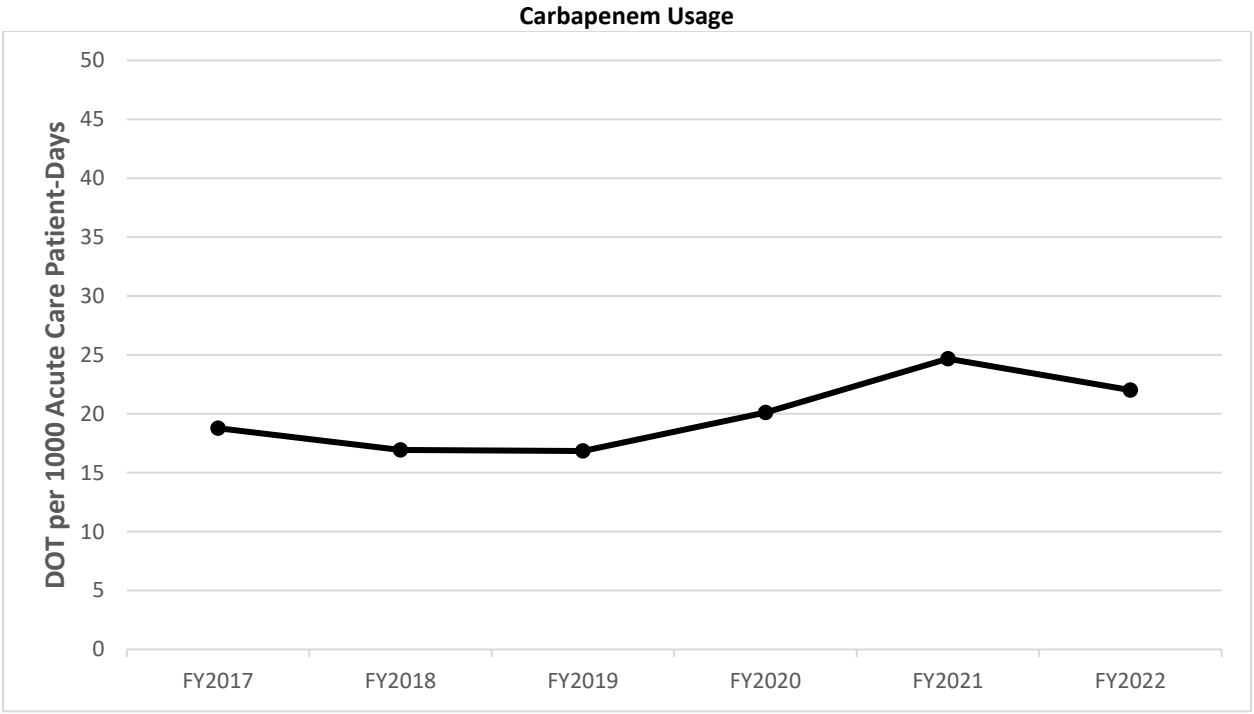

Carbapenem Usage
DOT per 1000 Acute Care Patient-Days
50
45
40
35
30
25
20
15
10
5
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

Gram-positive Agents Usage

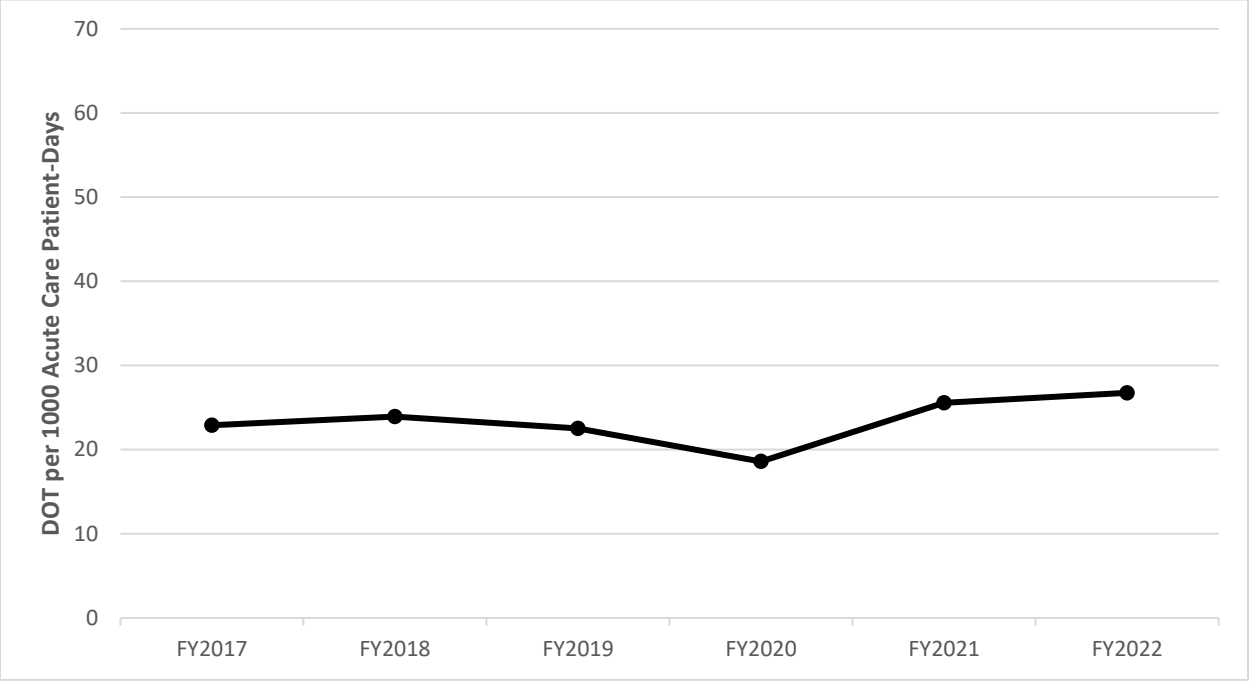


ERH

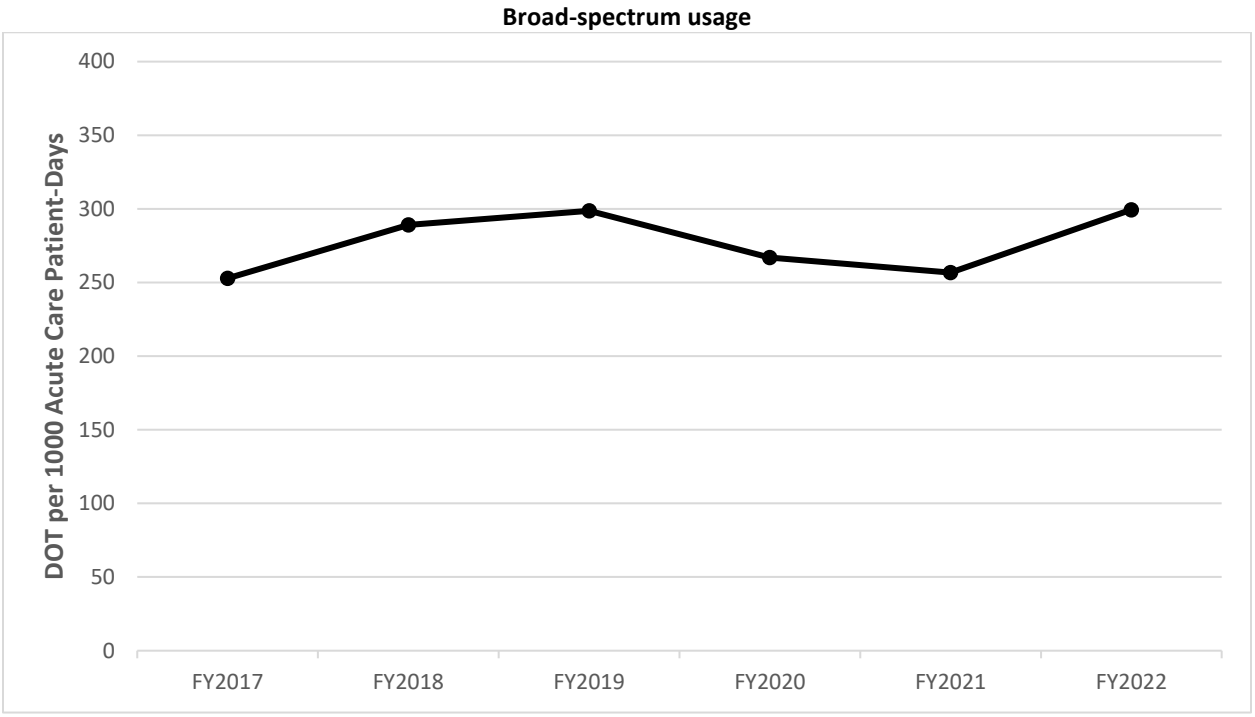

Broad-spectrum usage
DOT per 1000 Acute Care Patient-Days
400
350
300
250
200
150
100
50
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

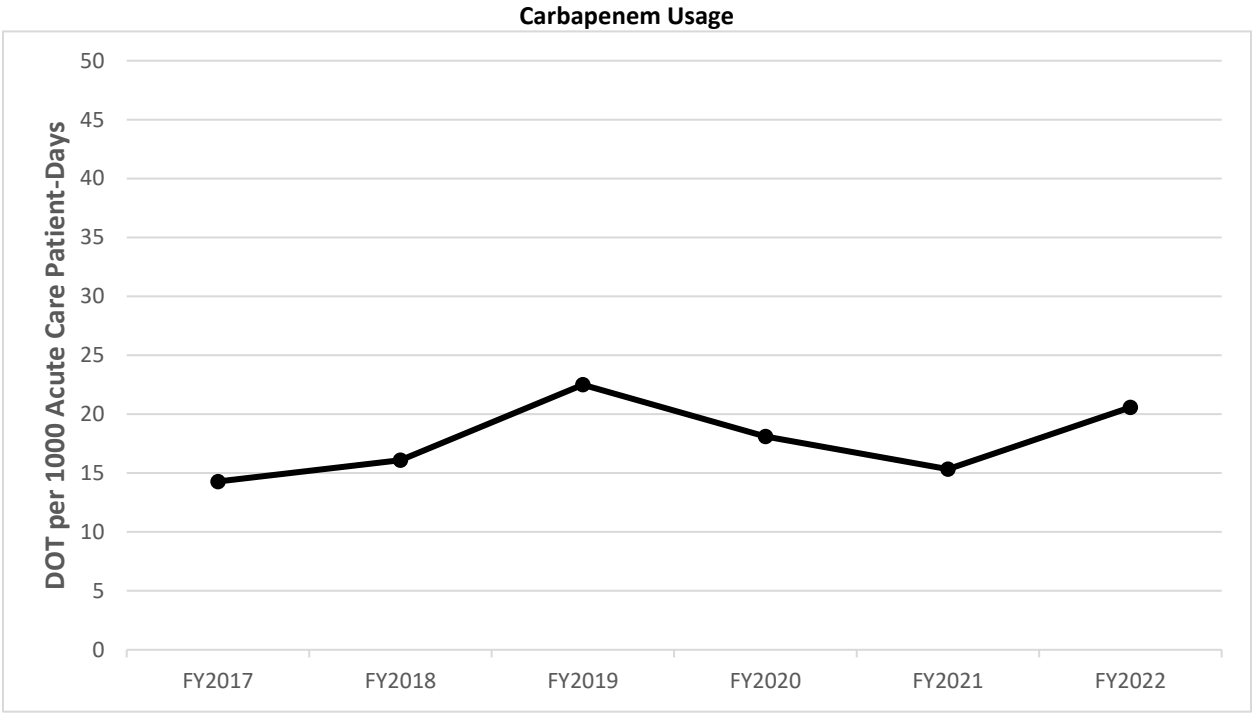

Carbapenem Usage
DOT per 1000 Acute Care Patient-Days
50
45
40
35
30
25
20
15
10
5
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

Gram-positive Agents Usage

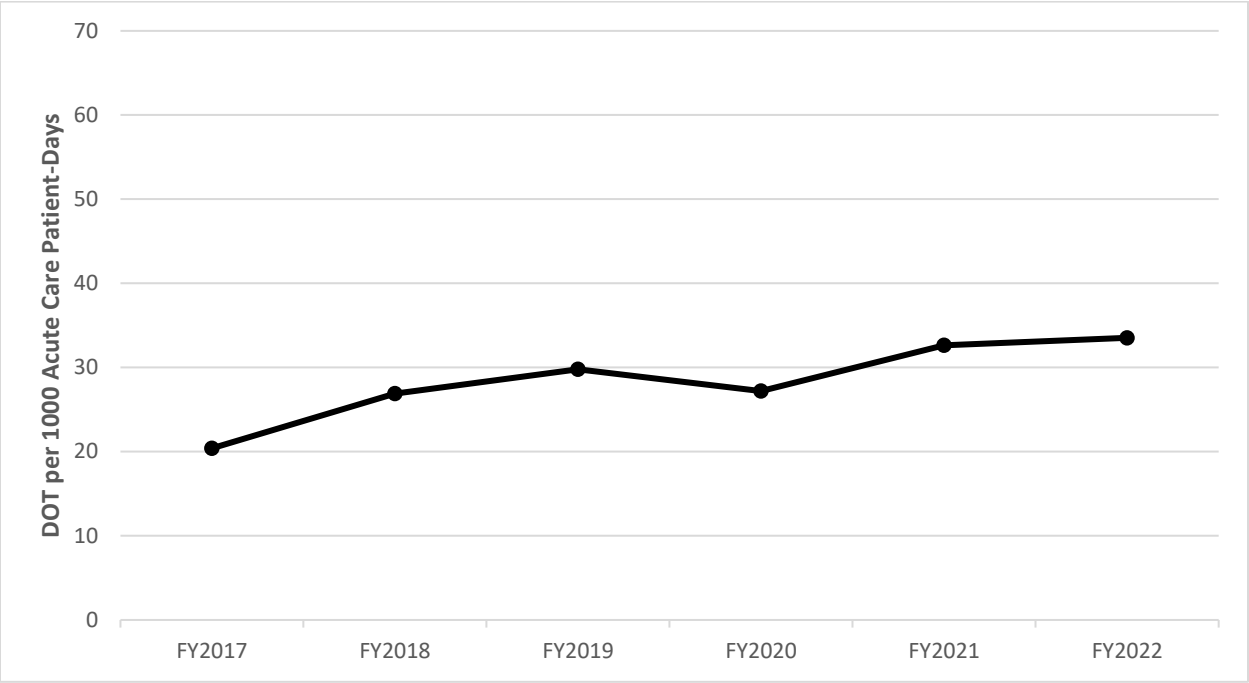


LMH

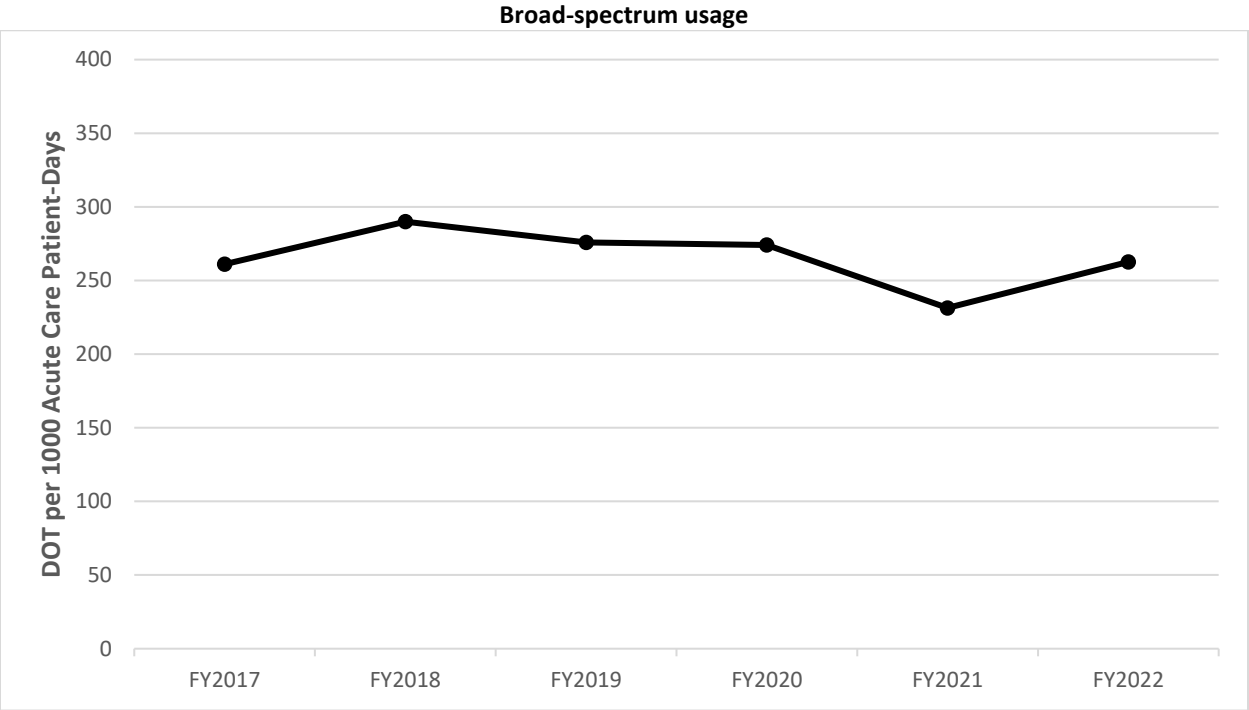

Broad-spectrum usage
DOT per 1000 Acute Care Patient-Days
400
350
300
250
200
150
100
50
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

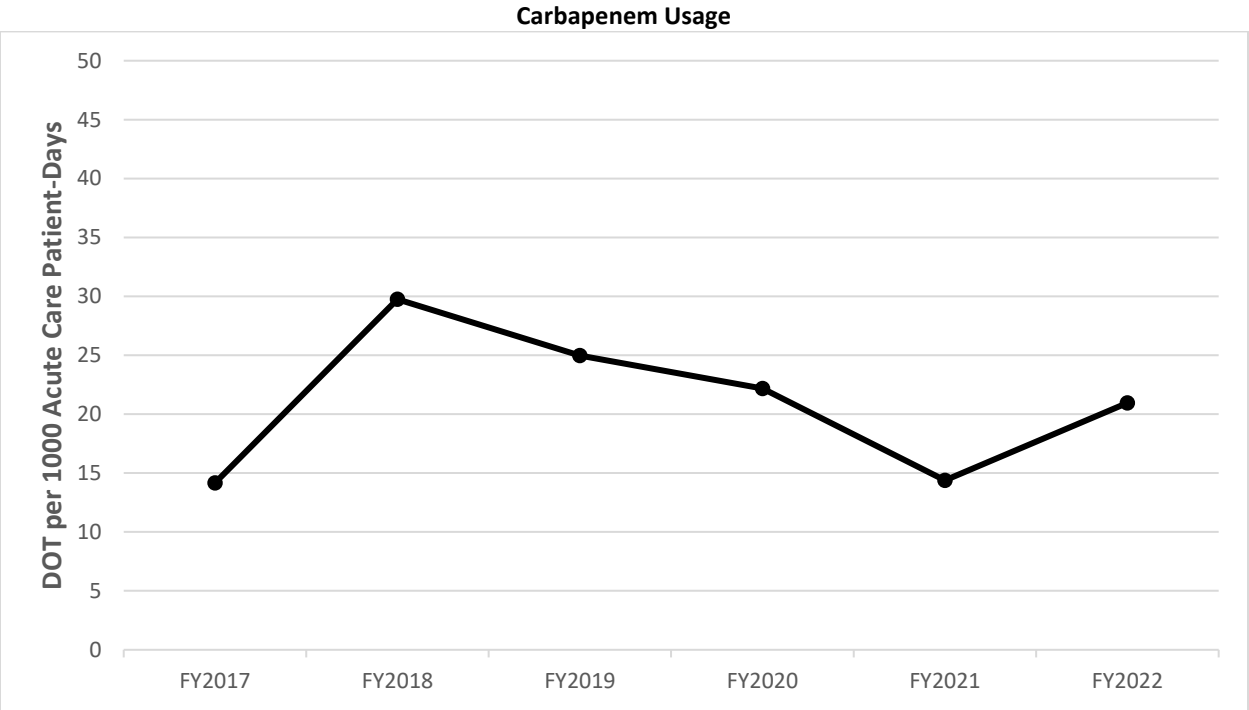

Carbapenem Usage
DOT per 1000 Acute Care Patient-Days
50
45
40
35
30
25
20
15
10
5
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

Gram-positive Agents Usage

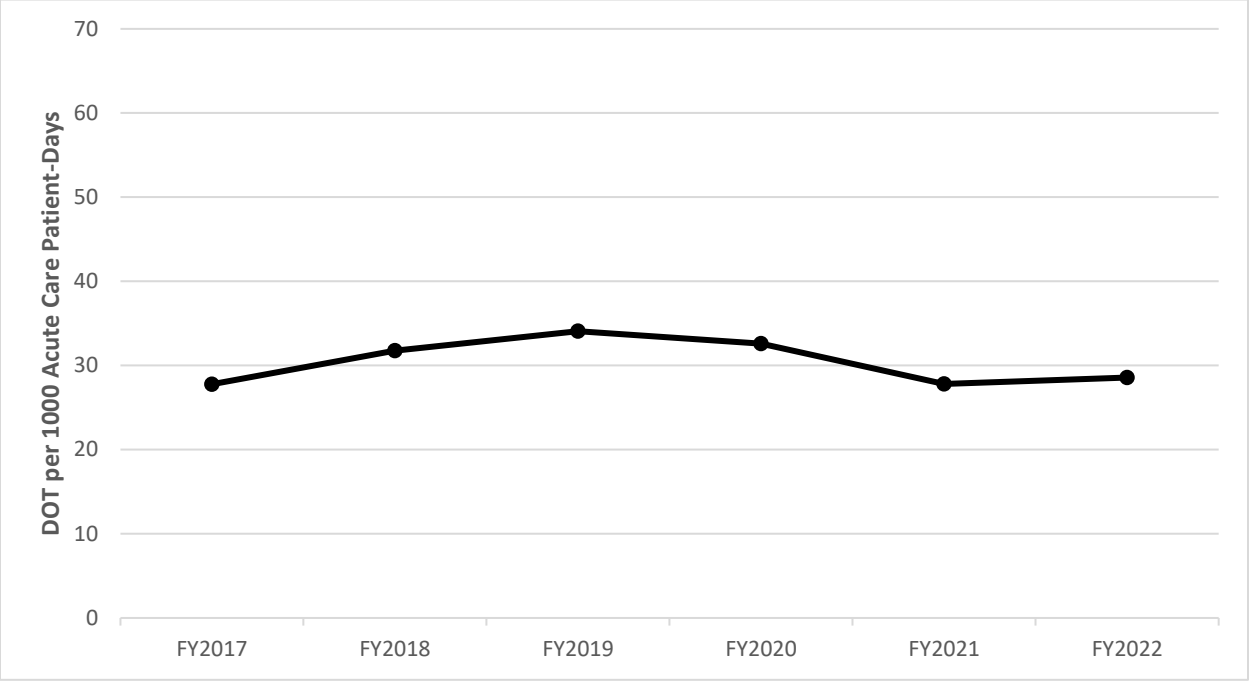


MMH

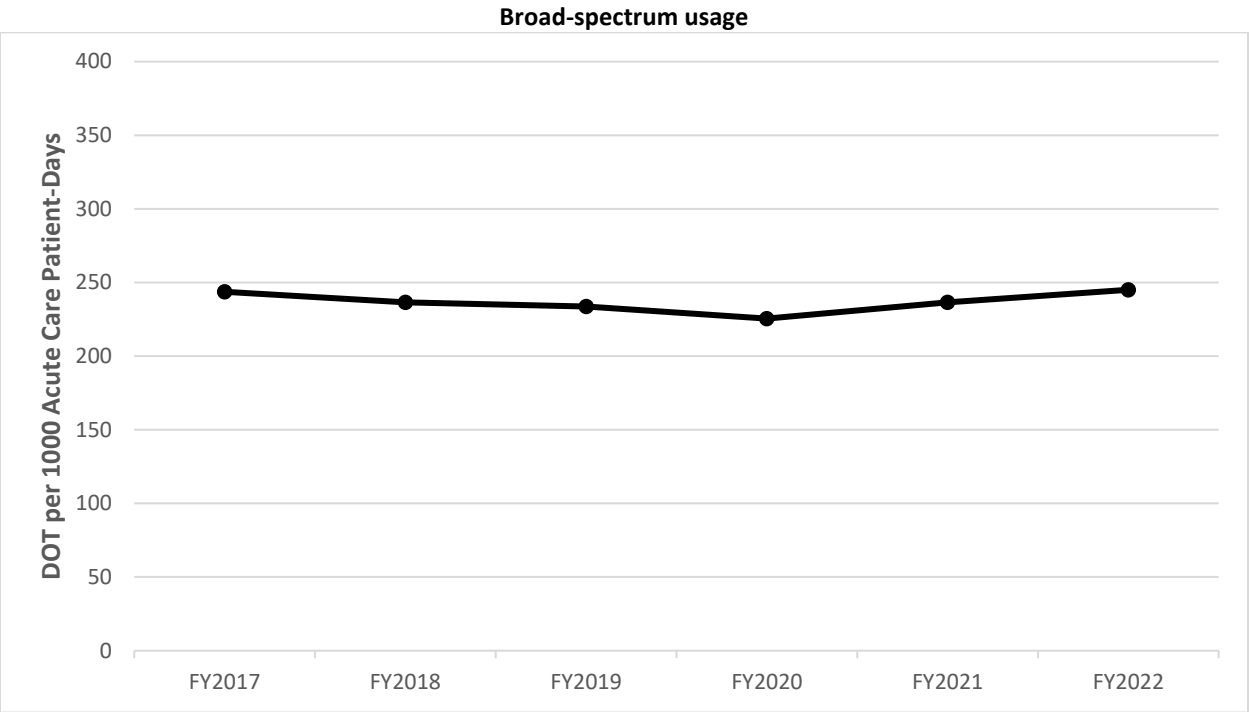

Broad-spectrum usage
DOT per 1000 Acute Care Patient-Days
400
350
300
250
200
150
100
50
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

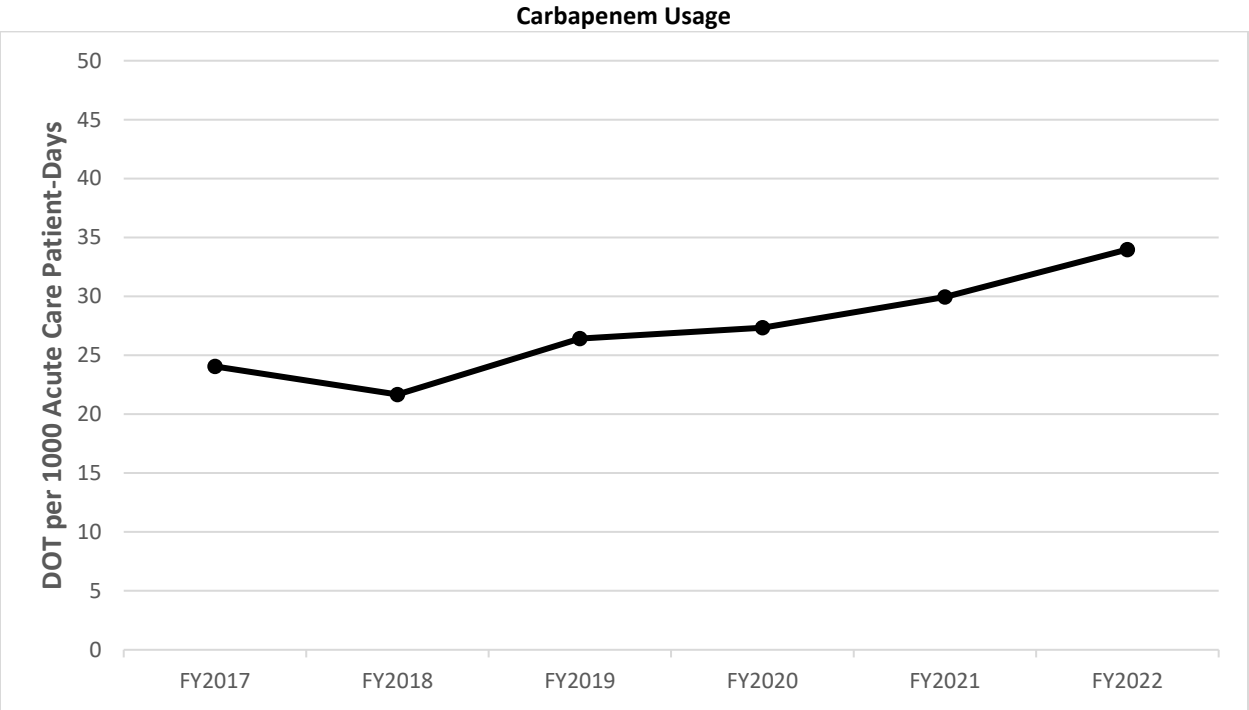

Carbapenem Usage
DOT per 1000 Acute Care Patient-Days
50
45
40
35
30
25
20
15
10
5
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

Gram-positive Agents Usage

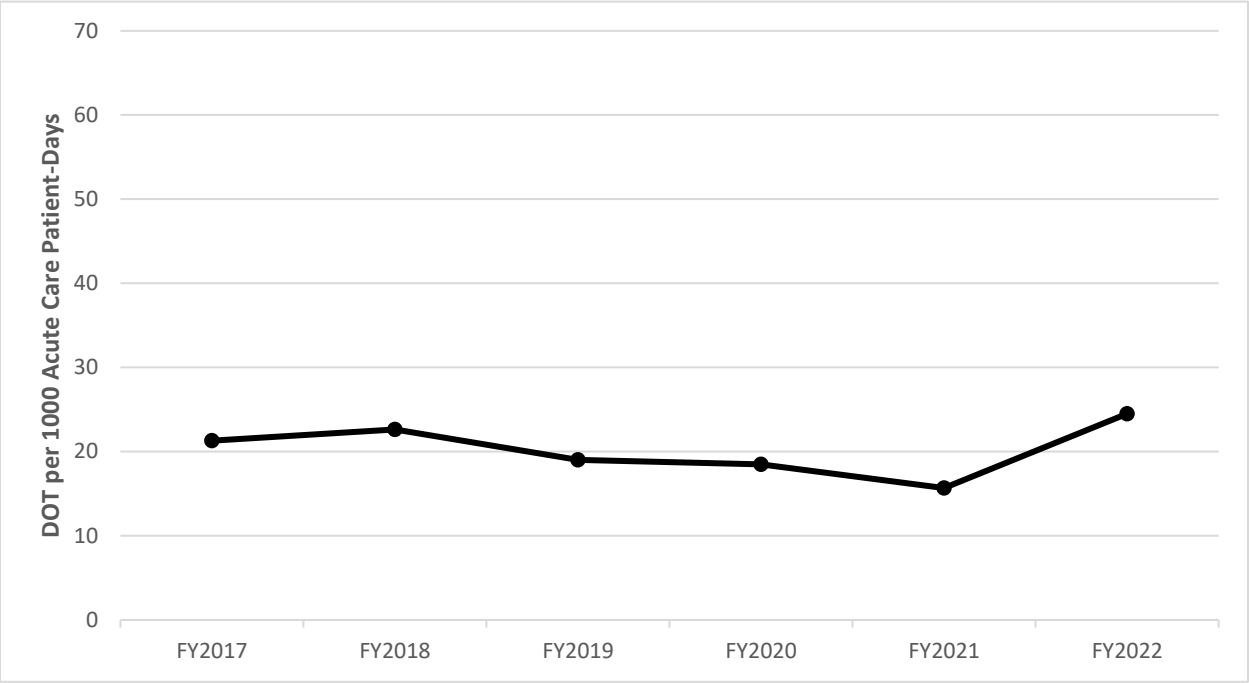


PAH

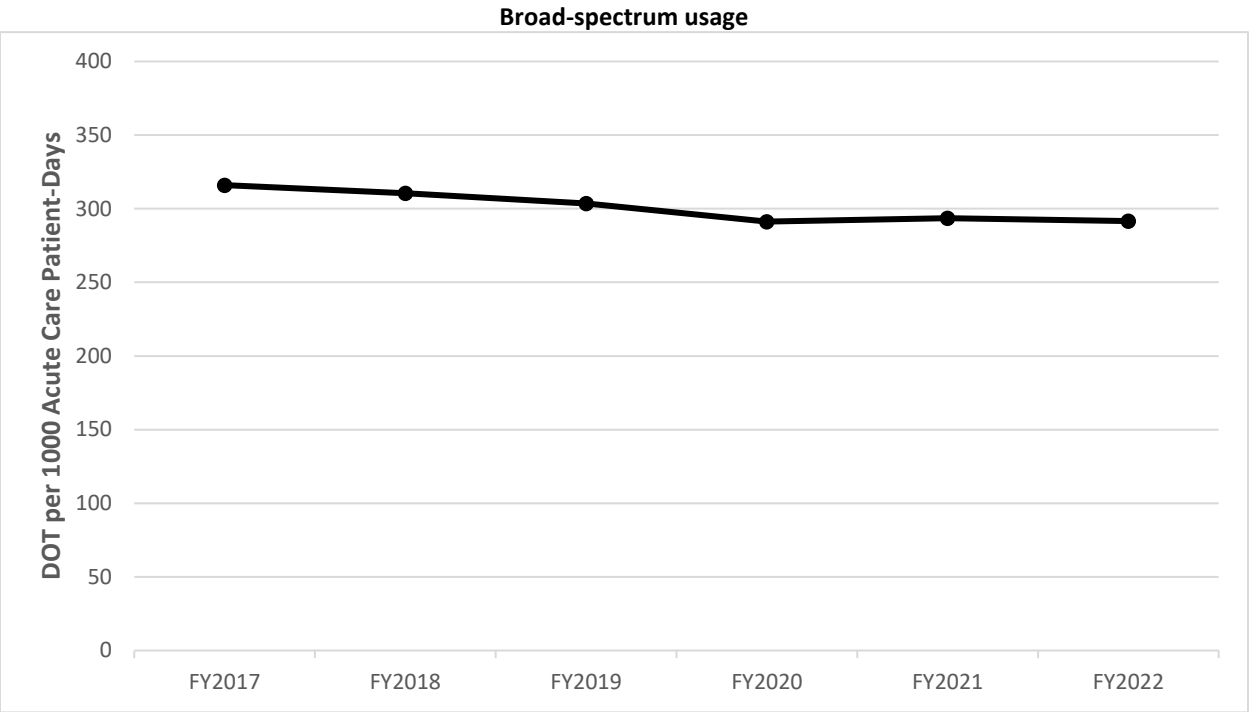

Broad-spectrum usage
DOT per 1000 Acute Care Patient-Days
400
350
300
250
200
150
100
50
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

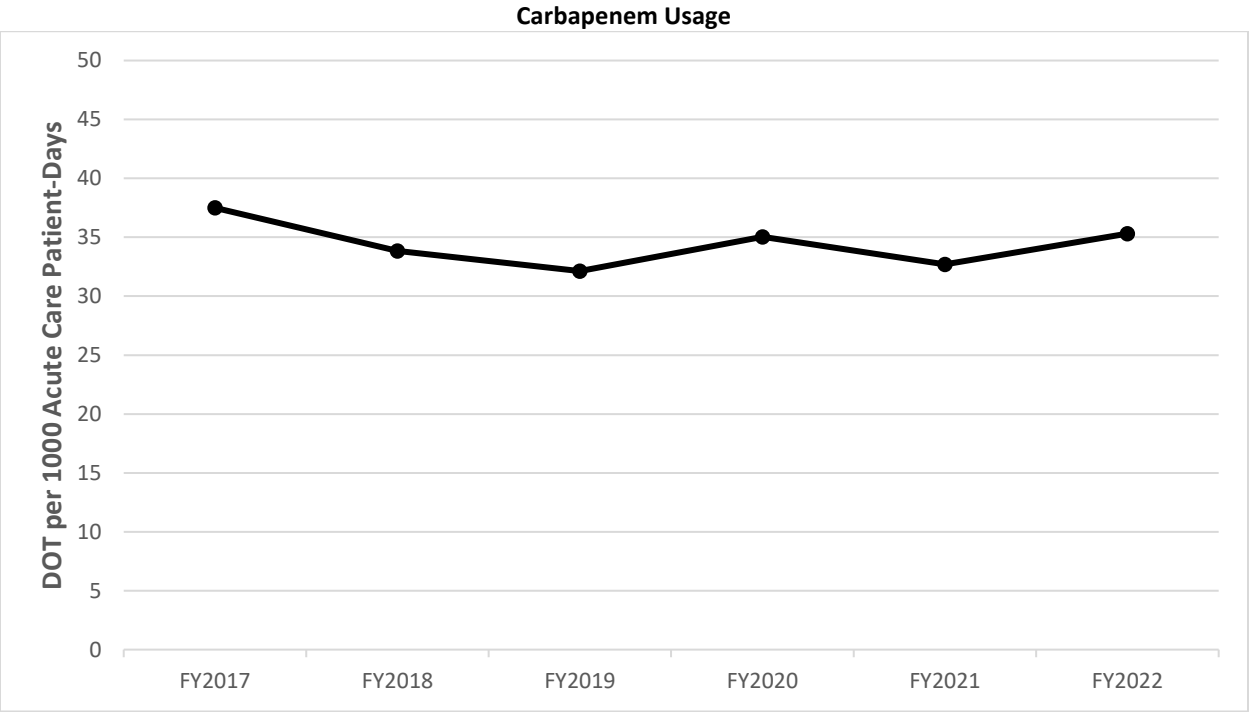

Carbapenem Usage
DOT per 1000 Acute Care Patient-Days
50
45
40
35
30
25
20
15
10
5
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

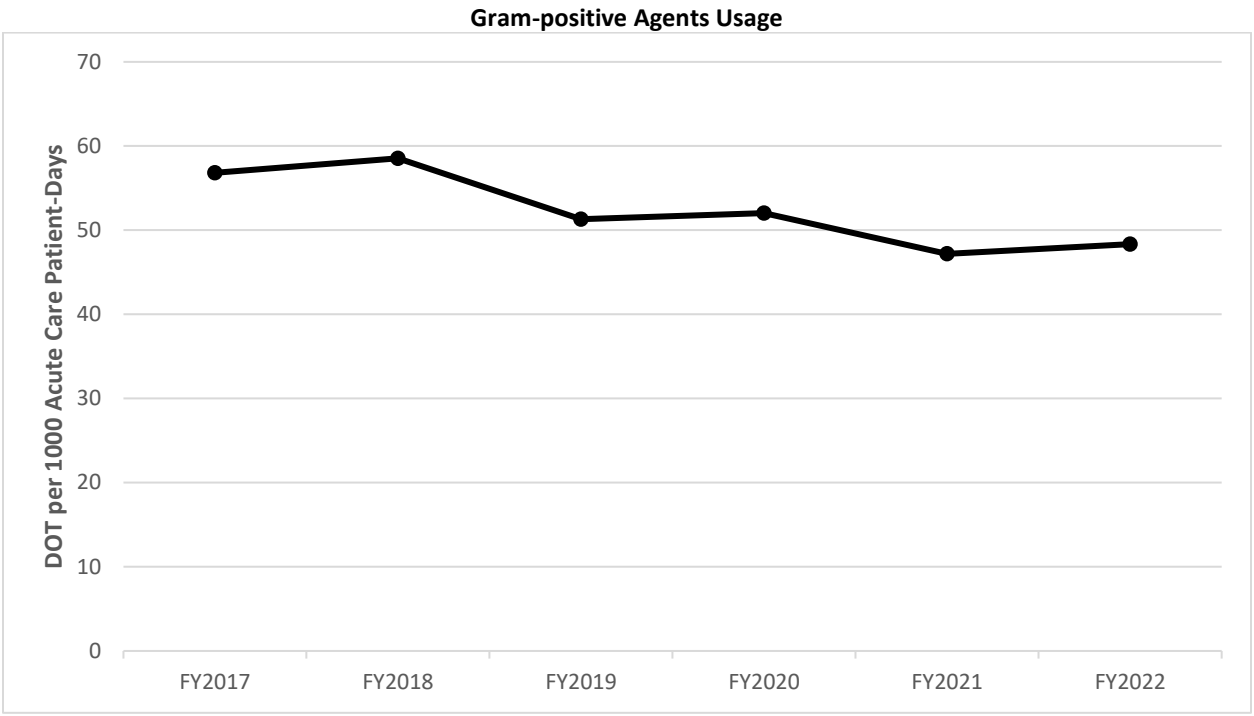
Gram-positive Agents Usage



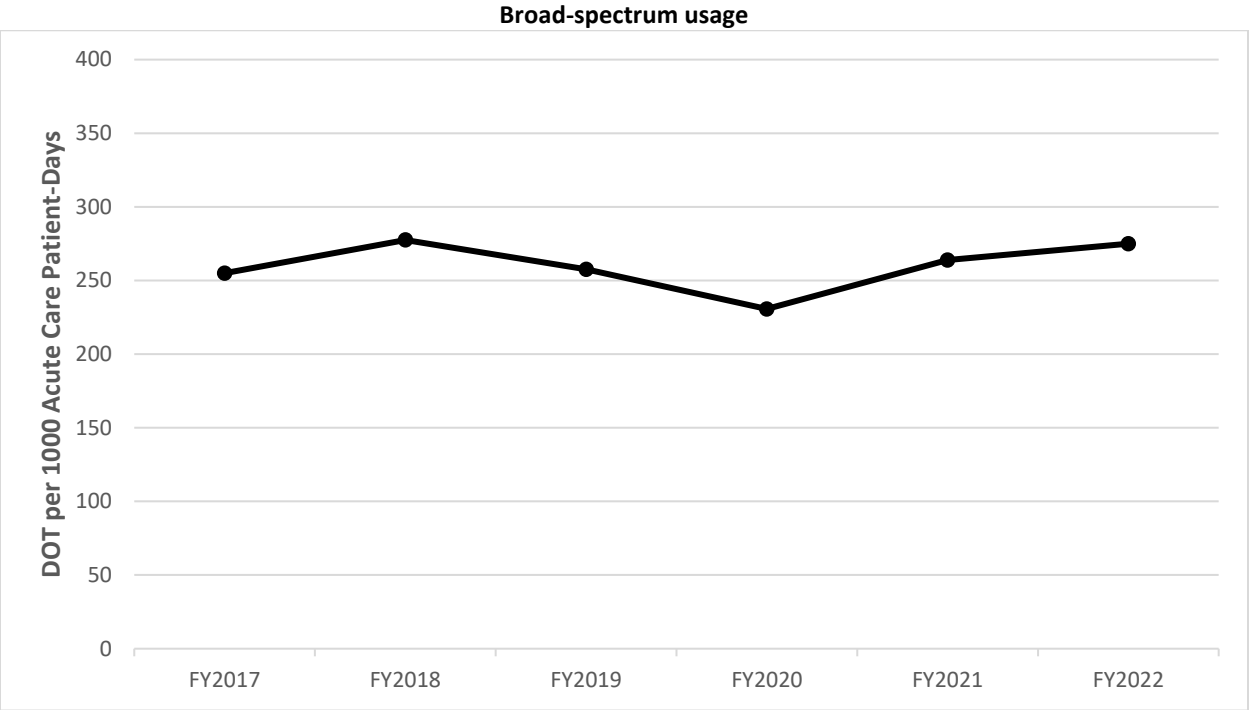
RCH

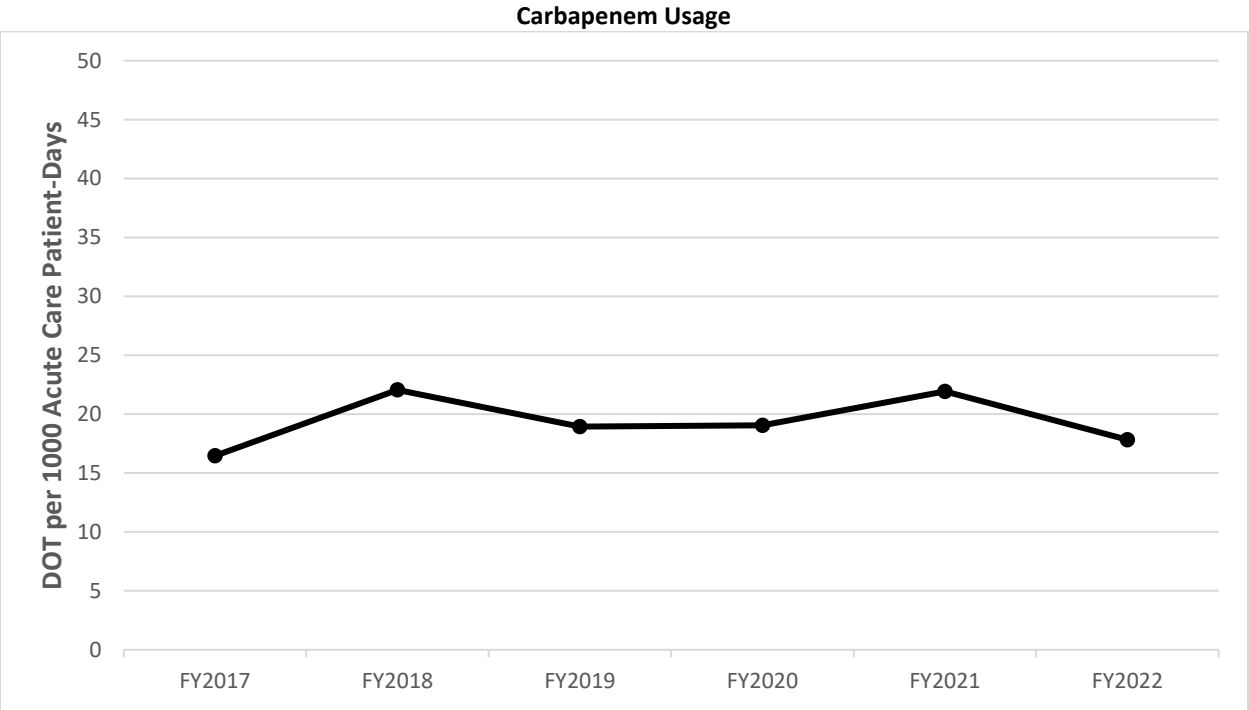

Broad-spectrum usage
DOT per 1000 Acute Care Patient-Days
400
350
300
250
200
150
100
50
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022


Carbapenem Usage
DOT per 1000 Acute Care Patient-Days
50
45
40
35
30
25
20
15
10
5
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

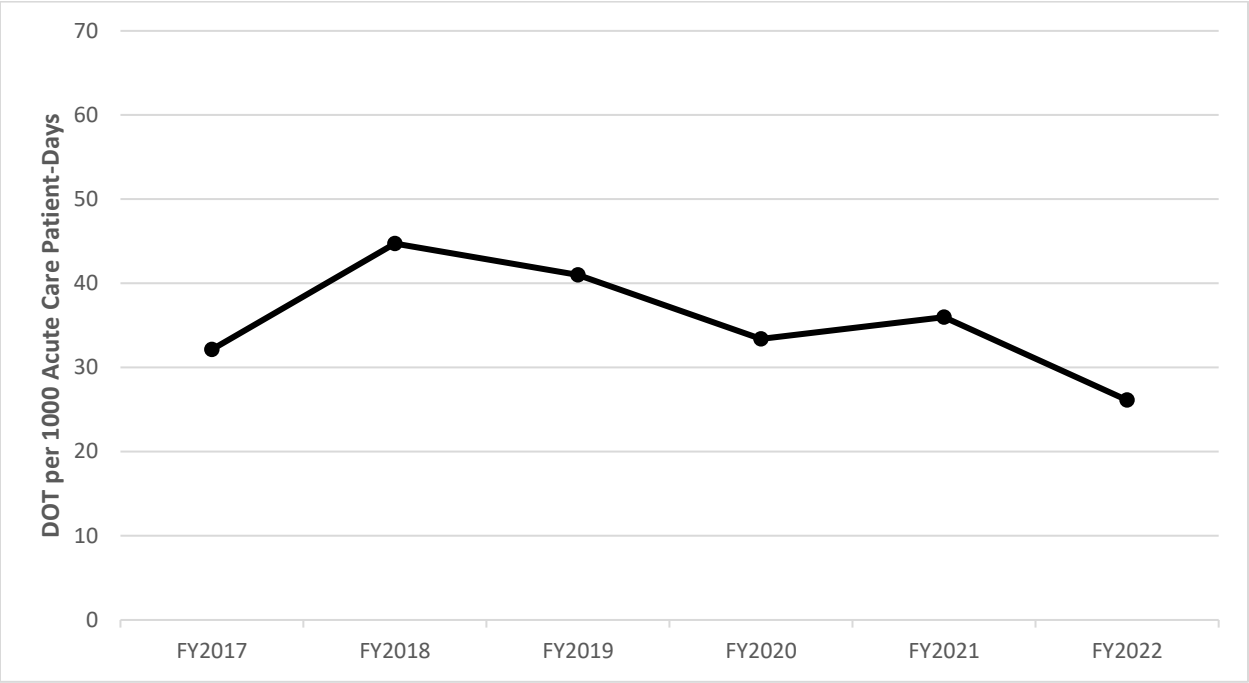

Gram-positive Agents Usage
DOT per 1000 Acute Care Patient-Days
70
60
50
40
30
20
10
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

RMH

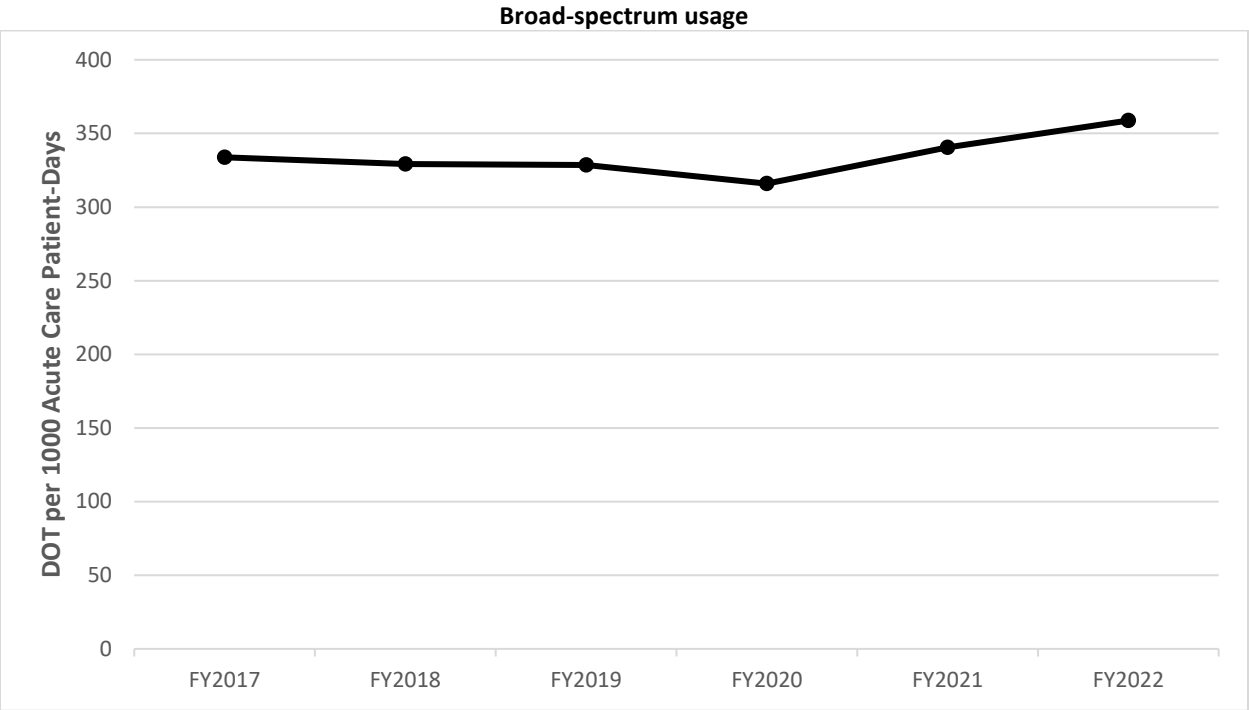

Broad-spectrum usage
DOT per 1000 Acute Care Patient-Days
400
350
300
250
200
150
100
50
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

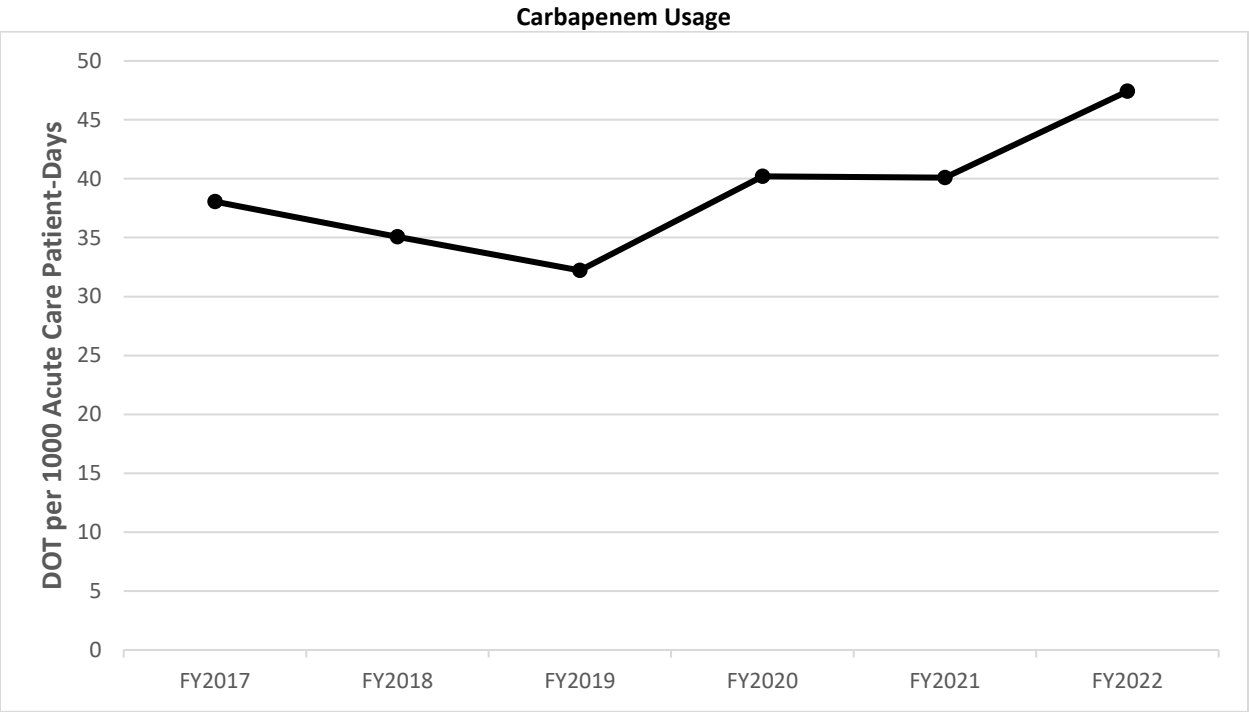

Carbapenem Usage
DOT per 1000 Acute Care Patient-Days
50
45
40
35
30
25
20
15
10
5
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

Gram-positive Agents Usage



SMH


Broad-spectrum usage
DOT per 1000 Acute Care Patient-Days
400
350
300
250
200
150
100
50
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022


Carbapenem Usage
DOT per 1000 Acute Care Patient-Days
50
45
40
35
30
25
20
15
10
5
0
FY2017
FY2018
FY2019
FY2020
FY2021
FY2022

Gram-positive Agents Usage