

OUTCOMES OF AN ANTIBIOTIC STEWARDSHIP TEAM AT AN ACADEMIC MEDICAL CENTER: 11 YEARS OF EXPERIENCE

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ABSTRACT

Background:

The University of Minnesota Medical Center (UMMC) is a tertiary care facility, which has had a comprehensive antimicrobial stewardship program (ASP) for 11 years.

Methods:

The antimicrobial stewardship team is comprised of a full-time PharmD and ID staff physicians who rotate on the service. Recommendations are placed in the electronic medical record as a progress note. Verbal recommendations may also be made.

Results:

There was a downward trend in Hospital Acquired (HA) C. difficile diarrhea from 2007 to 2014 from 1.2 to 0.5/1000 patient days (pt day). C. difficile infection (CDI) rates appear stable from 2014-2018 with adjustment for change to NHSN lab based CDI surveillance. (Fig.1) From 2009-2018 a decrease was seen in VRE hospital acquired infections (HAI) from 0.53 to 0.25/1000 pt days and in MRSA HAIs from 0.2 to 0.04/1000 pt days. Newly acquired ESBL HAIs have increased from 2009-2017 at 0.09 to 0.15/1000 pt days. CRE HAIs are an emerging problem with a low stable rate 2015-2018, but increased rates compared to 2009, when CRE was rare at UMMC.

Cost savings continued from year to year. The greatest cost savings was observed after initial implementation (2006-08) in which antimicrobial doses/pt day declined by 7%, antibiotics costs declined by \$7.40/pt day. In 2012, we observed our lowest antibiotic cost/pt day at \$37.51. From 2013-2016, we observed a sustained average antibiotic cost per patient day of \$42.23. After adjusting for inflation annually, our expected costs (\$84.08) compared to actual costs (\$38.44 ytd 2018), demonstrates effective cost management of antimicrobial agents.

Conclusion:

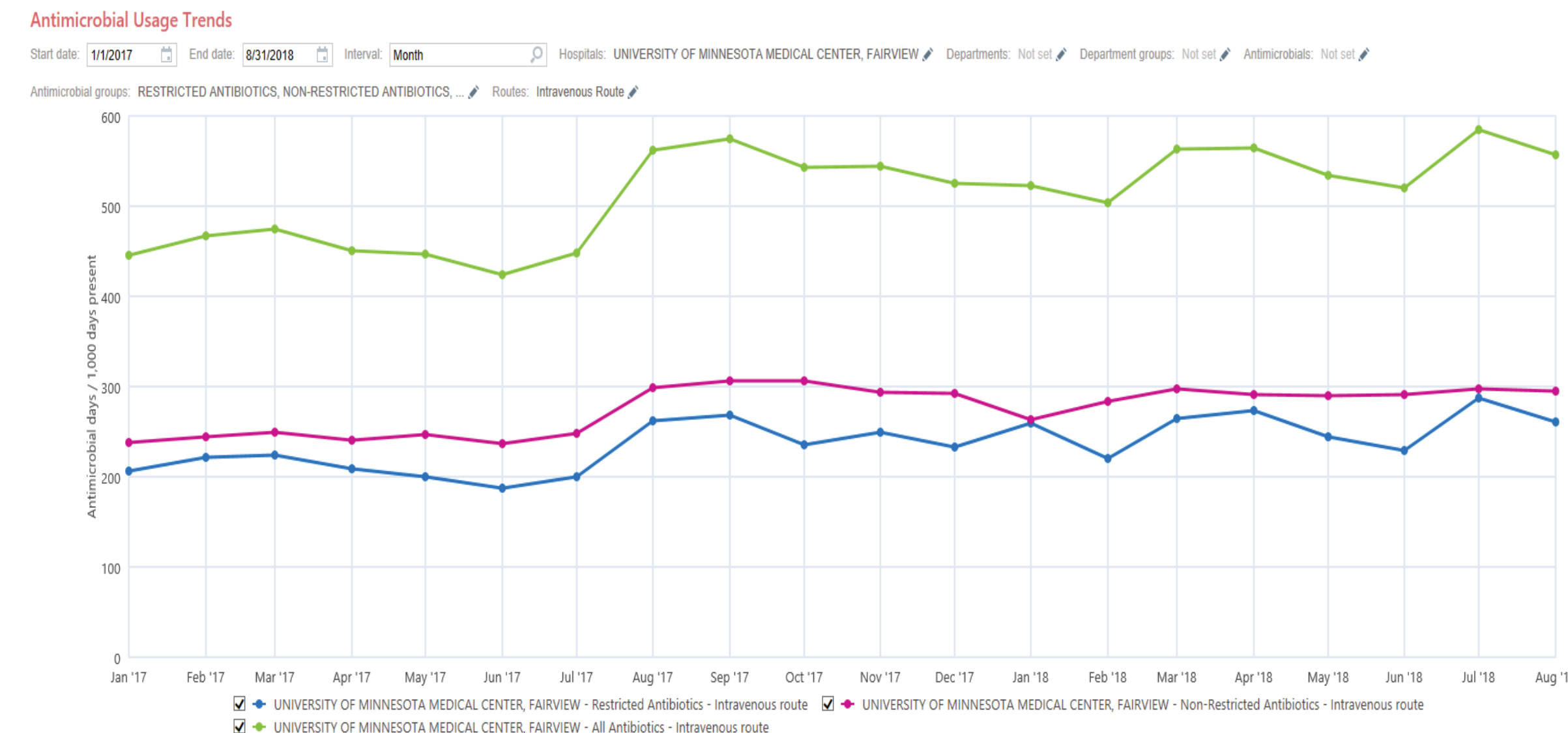
We observed a decrease in HAIs VRE and C. difficile infections after 3 years of operation, and MRSA after 5 years. MDRO gram negative rod infections, ESBL and CRE have increased over the intervention period. Therefore we are now focusing efforts of limiting unneeded carbapenem use. Our antibiotic costs/pt day have leveled off in the last 3 years and remained low despite rising antibiotic costs due to market inflation and drug shortages. The ASP outcomes have continued to cost justify ongoing efforts. The effects of the program and the Infection Prevention Department appear to be synergistic.

Future areas for focus include preventing rising GNR MDRO HAIs, and focusing on limiting use of PPIs and non-restricted antibiotics (e.g. fluoroquinolones) that contribute to C. difficile diarrhea. Also we will start reporting antibiotic DOT into NHSN to generate a Standardized Antimicrobial Administration Ratio (SAAR) which will allow us to compare our antibiotic use to other institutions.

INTRODUCTION

Objective: To track and measure the impact of the antimicrobial stewardship program (ASP) on key outcome measures over time since implementation in 2007, compared to pre-intervention period of 2006.

- Interventions made by the ASP team (~1,900-2,400/year)
- Acceptance Rate (~ 80%/year)
- Morbidity, mortality, length of stay (LOS) (stable)
- Antibiotic costs- (decreasing)
- Antimicrobial resistance trends- (GPs down but GNs up) (CDI down)
- Antibiotic usage (since institution of EPIC in 2011 downward trend, but upward trend 2018 compared to 2017)



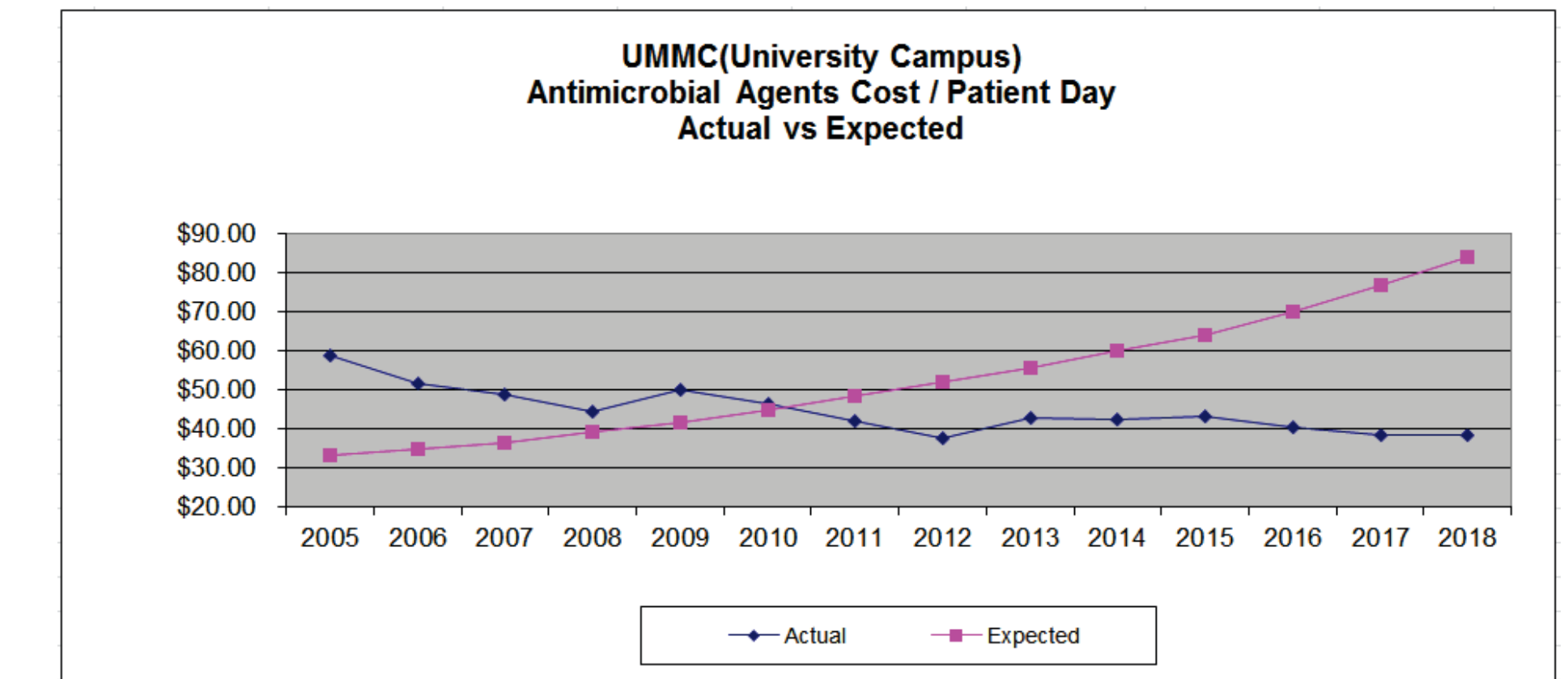
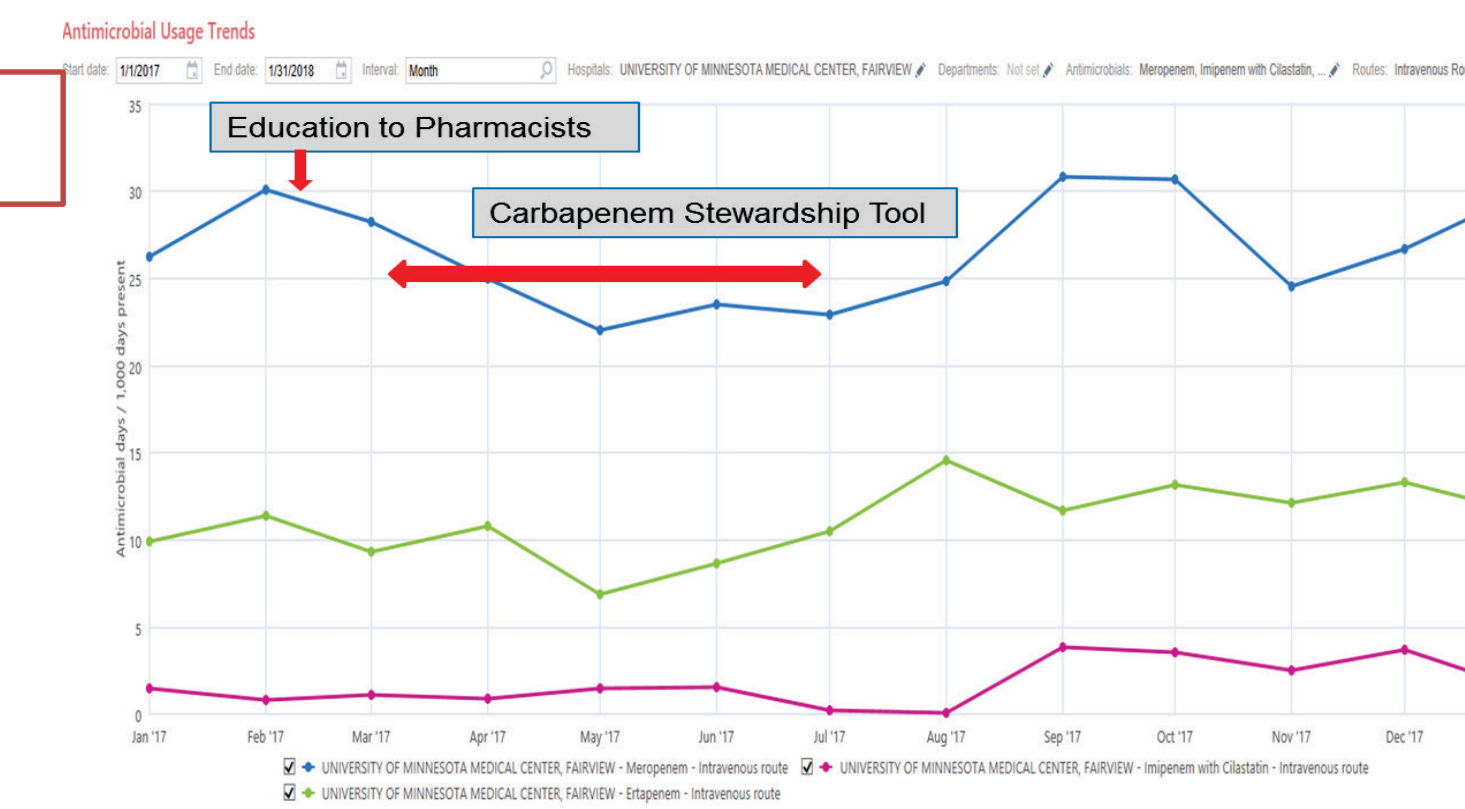
Clinical Outcomes: University Health Consortium/ Vizient Data								
Discharge Year	Cases	Mean LOS Observed	Mean LOS Expected	LOS Index	% Deaths Observed	% Deaths Expected	Mortality Index	UHC/Vizient Risk Model
2006	28,071	5.21	5.33	0.98	1.66	1.98	0.84	Pre-2012 model
2012	28,216	5.71	5.99	0.95	1.76	2.05	0.86	2012 model
2013	28,302	5.98	5.80	1.03	1.97	1.85	0.81	2012 model 2015 model
2014	27,738	6.02	5.93	1.02	2.06	2.01	1.03	2015 model
2015	26,701	6.10	6.34	0.96	2.22	2.32	0.96	2015 model 2016 model
2016	27,801	6.31	6.59	0.96	2.06	2.32	0.89	2016 model 20017 model
2017	27,325	6.31	6.40	0.99	2.24	2.33	0.96	2017 model
2018_Q1&Q2	13,790	6.30	6.35	0.99	2.34	2.44	0.96	2017 model

ANTIMICROBIAL COSTS TABLE

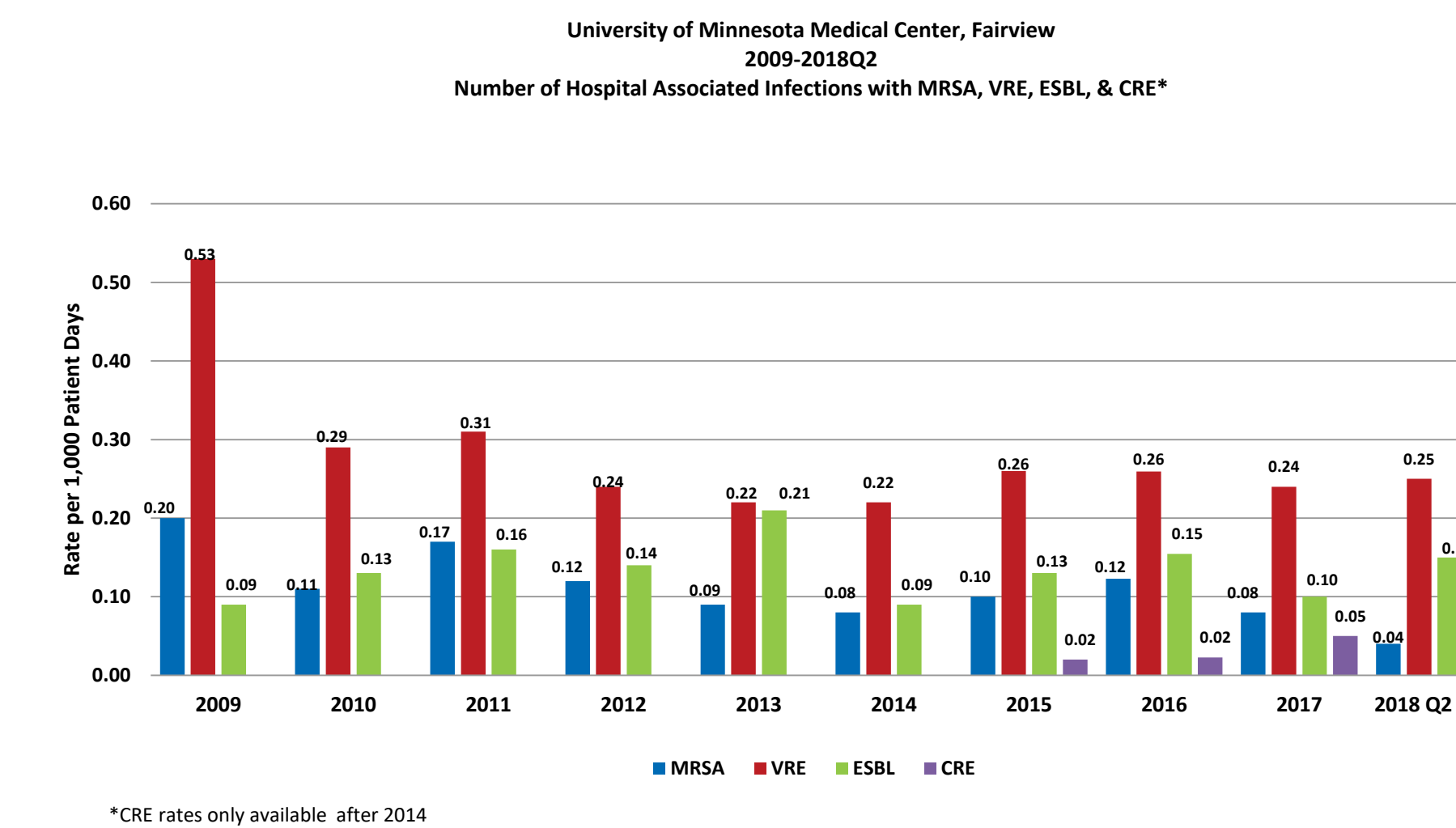
Antimicrobial Agents Activity	University Campus													
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	YTD AUG 2018
Total Expenditures	\$5,712,589	\$4,954,776	\$4,841,578	\$4,396,983	\$5,081,645	\$4,533,310	\$3,766,276	\$3,180,736	\$3,936,274	\$ 4,059,295	\$ 4,280,557	\$ 4,222,841	\$ 4,019,082	\$2,691,704
Total Patient Days	96,791	95,709	98,910	99,090	101,949	97,692	89,311	87,479	93,343	95,404	98,672	104,545	104,561	70,022
Cost per Patient Day	\$59.02	\$51.77	\$48.95	\$44.37	\$49.84	\$50.33	\$42.17	\$36.36	\$42.17	\$42.55	\$43.38	\$40.39	\$39.45	\$38.44

From 2008 to 2009 there was a \$5.47 increase in antimicrobial cost/patient day: primary expenditure increase was due to antifungal utilization and vancomycin resistant Enterococcus (VRE) treatment. Antibiotic cost was adjusted for percent inflation for the market. Inflation increased steadily from 2005-2015 (4.9%, 5.2%, 5.1%, 7.5%, 6.4%, 7.5%, 7.5%, 6.4%) with the highest inflation observed in 2016 at 10%. The University ABX \$/patient day have continued to decrease. By 2011, the ABX \$/patient day was below the expected market cost. In 2012, we observed our lowest antibiotic cost/patient day, this was a difference of \$19.03 before implementation of the stewardship program.

Carbapenem DOT



MULTIDRUG RESISTANT HAI RATES



*CRE rates only available after 2014

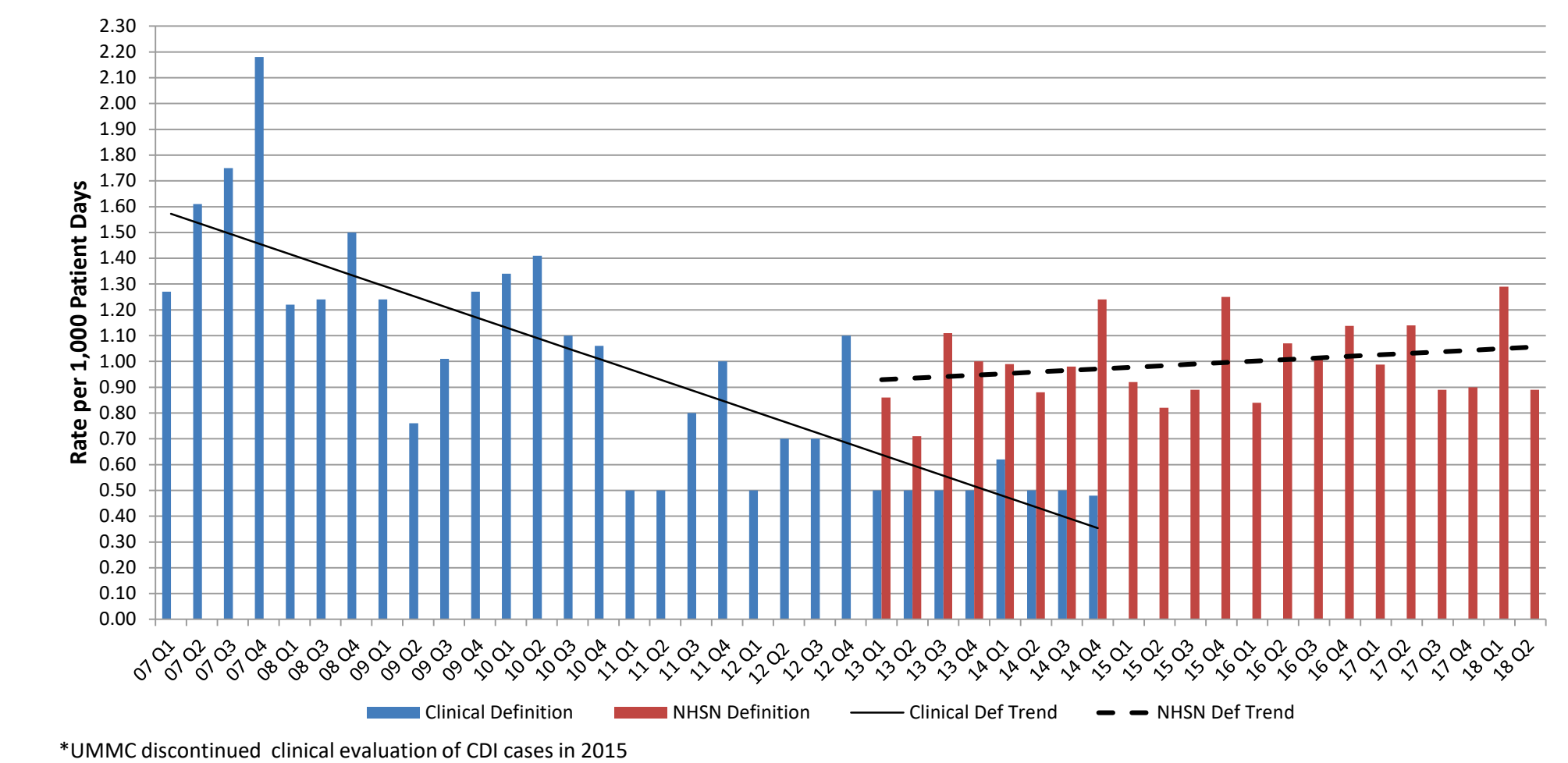
HAI Definitions: Beginning in 2009 all positive VRE, MRSA and ESBL cultures, which are identified on a patient for the first time, from all hospital units are evaluated to determine if the culture represents a hospital acquired infection (HAI) as defined by NSHN diagnostic criteria. HAI includes: BSI, UTI, SSTI, SSIs, pneumonias, bone and joint infections, cardiovascular, CNS, GI, EENT, LRIs, reproductive and systemic infections.

- Active surveillance cultures for VRE stool carriage are done in BMT patients
- and active surveillance for MRSA nasal carriage is done in ICUs.
- C. difficile HAI cases are also identified using NHSN criteria

Additional infection control interventions were taken for C. difficile with enhanced environmental cleaning in those rooms with patients with CDI

CDI RATE TREND 2007-2018Q2

Differences in Clinical and NHSN Surveillance Definitions of Hospital Acquired CDI, University of Minnesota Medical Center, Fairview, 2007-2018Q2*



*UMMC discontinued clinical evaluation of CDI cases in 2015

SUMMARY

1. HAI trends, MRSA and VRE rates have decreased during the intervention period but ESBL and CRE rates have increased.
2. C. difficile diarrhea rate has decreased during the intervention period. CDI rates increased with shift to lab based surveillance.
3. Morbidity, mortality and LOS have remained stable since implementation of ASP.
4. Antibiotic costs declined over time of ASP. Cost of ASP is justified.
5. Effects of ASP and infection prevention appear to be synergistic.