

# DOES SIZE MATTER? SYSTEMWIDE VARIATION OF ANTIMICROBIAL UTILIZATION: OPPORTUNITIES FOR COST SAVINGS AND ANTIMICROBIAL STEWARDSHIP AT ASCENSION HEALTH

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## ABSTRACT

**Background:** Inappropriate antimicrobial use is associated with increased cost, significant patient harm, and infection control challenges with multidrug resistance, and Clostridium difficile infection. With the growing nationwide epidemic of antimicrobial resistance concern, we assessed antimicrobial utilization across 69 Ascension Health hospitals.

**Methods:** We evaluated systemic antimicrobial acquisition cost of 69 hospitals from 2010 to 2012. In addition to antimicrobial cost per patient day, daily defined dose (DDD) of systemic broad spectrum antibiotic classes including quinolone, carbapenem, piperacillin/tazobactam, streptogramin, tetracycline, macrolide, lipopeptide, oxazolidinone, third and fourth generation cephalosporin, and antifungal agents, including azole, polyene, echinocandin were calculated. We also compared hospital volume using annual patient days, case mix index (CMI) and cost categories, evaluating changes over the 3-year periods.

**Results:** The 3 years included 9,456,762 patient-days, with 4,962,072 DDDs, with a cost of \$124,222,245. There were no significant changes for individual hospitals in the mean antimicrobial use of targeted broad-spectrum agents (DDD 0.77, 0.74, 0.8) or cost (\$14.8, \$14.2, \$13.8) per patient-days for paired comparisons for 2010, 2011, and 2012 respectively. In 2012, hospitals with ≤50,000 patient-days were more likely to use antimicrobials (DDD>1: 14/41, 34.1%; DDD≤1: 27/41, 65.9%) than hospitals with >50,000 patient-days (DDD>1: 2/28, 7.1%; DDD≤1: 26/28, 92.9%; p=0.009). Lower antimicrobial cost hospitals tended to have continued cost reduction during the 3 years, in contrast to those with baseline of high cost. In addition, hospitals with CMI ≤1 had higher cost (\$17.7±11.3) compared to hospitals with CMI >1 (12.7±5.4; p=0.024).

**Conclusion:** Our findings suggest that smaller size hospitals had more antimicrobial use than large hospitals and similar results were found in facilities with lower CMI. The analysis provides us a great tool for further evaluation and process standardization to achieve antimicrobial stewardship across the hospitals in our system. There are significant opportunities for practice improvements in smaller hospitals, which may not have a structure for antimicrobial stewardship program.

## INTRODUCTION

Medical costs attributable to multidrug resistant organism (MDRO) infections are estimated between \$20,000-30,000 per case, and length of stay increased from 6-12 days. Inappropriate antimicrobial use plays a role in developing antimicrobial resistance. Evaluating antimicrobial use is a first step to identifying opportunities to improve use, in addition to reducing the risk of patients to being exposed unnecessarily to antibiotics, leading to harm. The recent CDC vital signs from March 2013 identifies a very concerning rise in carbapenem resistant enterobacteriaceae (CRE) isolates from hospitals, particularly long-term care hospitals.

## METHODS

We evaluated systemic antimicrobial acquisition cost of 69 hospitals from 2010 to 2012.

### Measures collected:

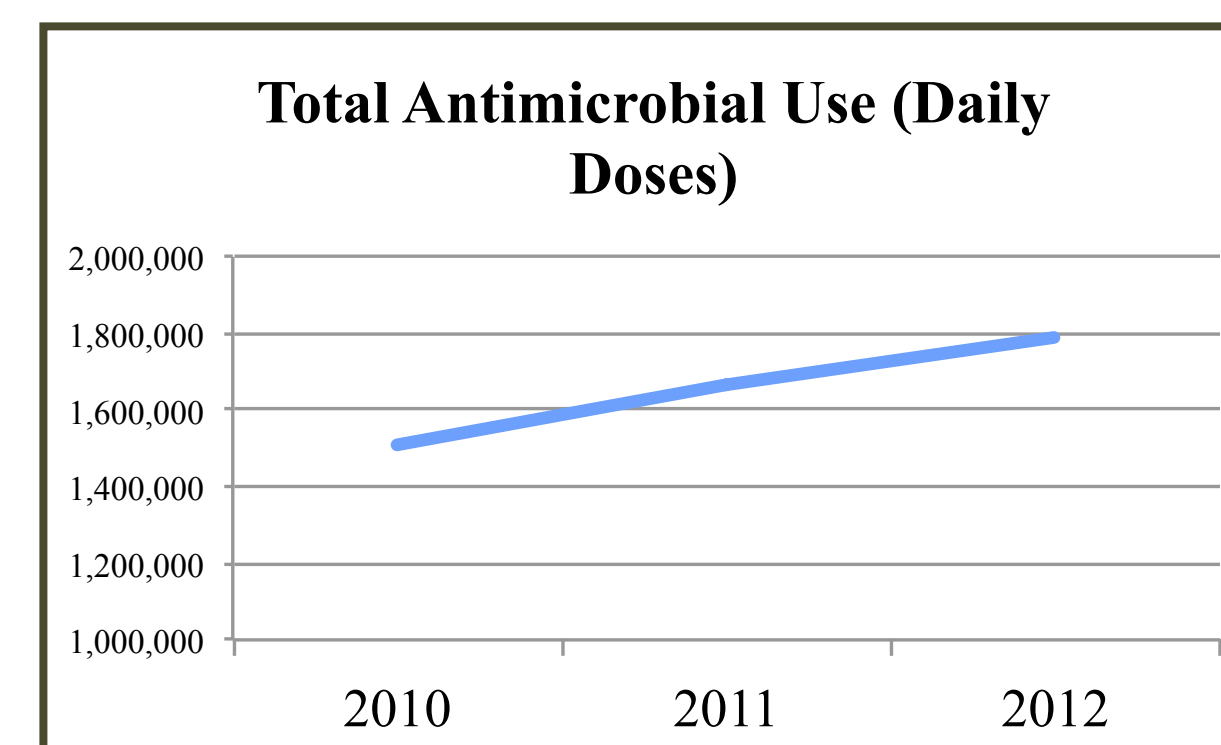
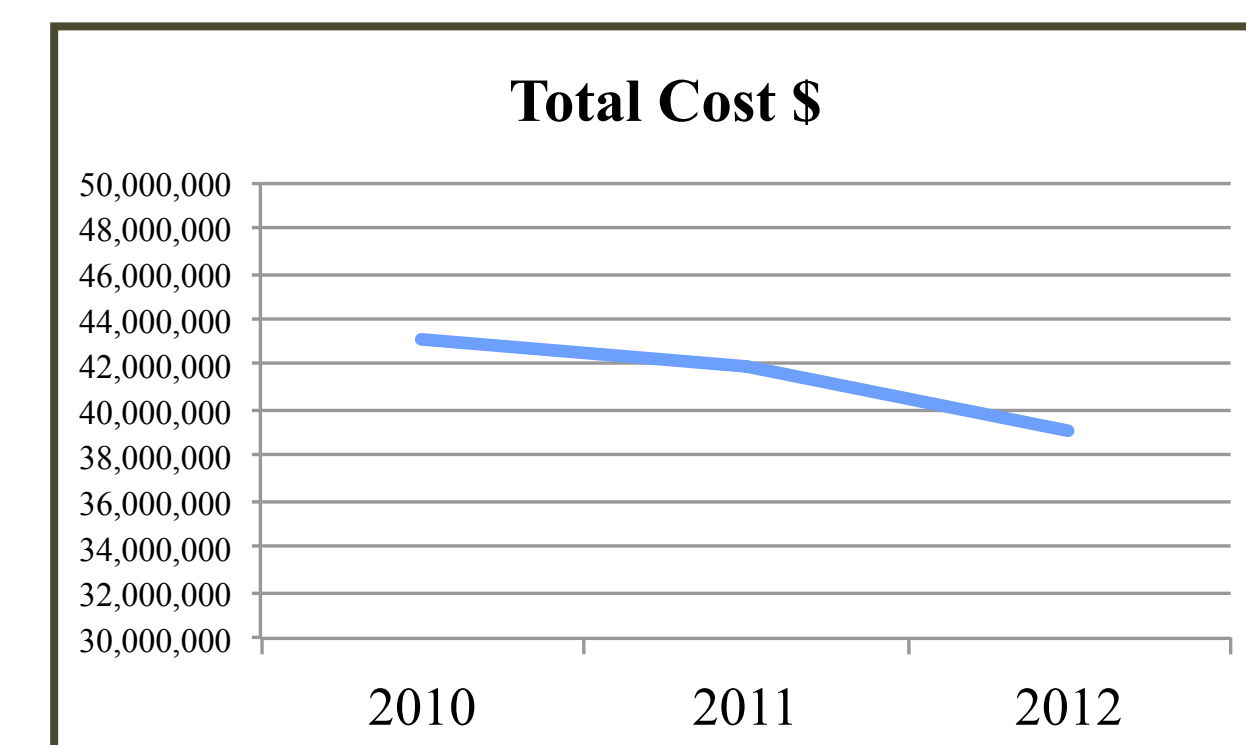
- Antimicrobial cost per patient day
- Daily defined dose (DDD) per day of systemic broad spectrum antibiotic classes including quinolone, carbapenem, piperacillin/tazobactam, streptogramin, tetracycline, macrolide, lipopeptide, oxazolidinone, third and fourth generation cephalosporin, and antifungal agents, including azole, polyene, echinocandin

### Evaluation of different groups:

- Hospitals with annual patient days: ≤50,000, > 50,000
- Case mix index (CMI): ≤1 vs >1
- Cost categories per day: <\$10, \$10-20, >\$20
- DDD per day: ≤1, >1.

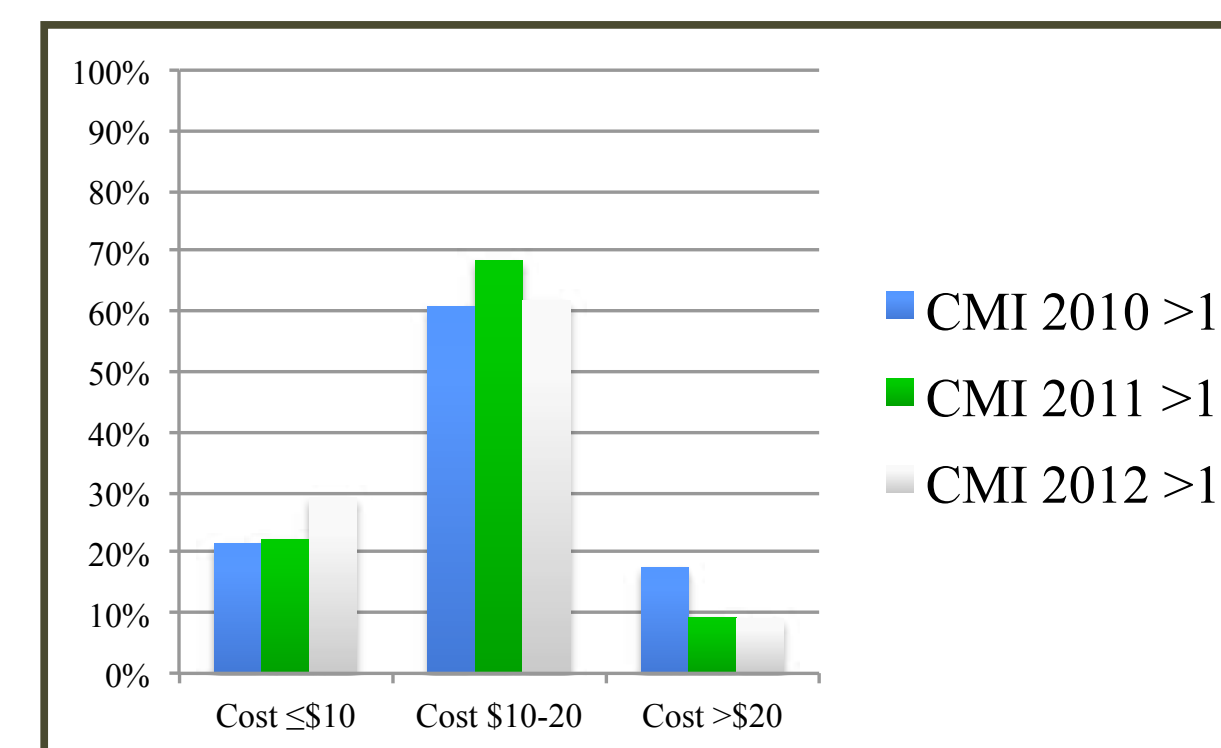
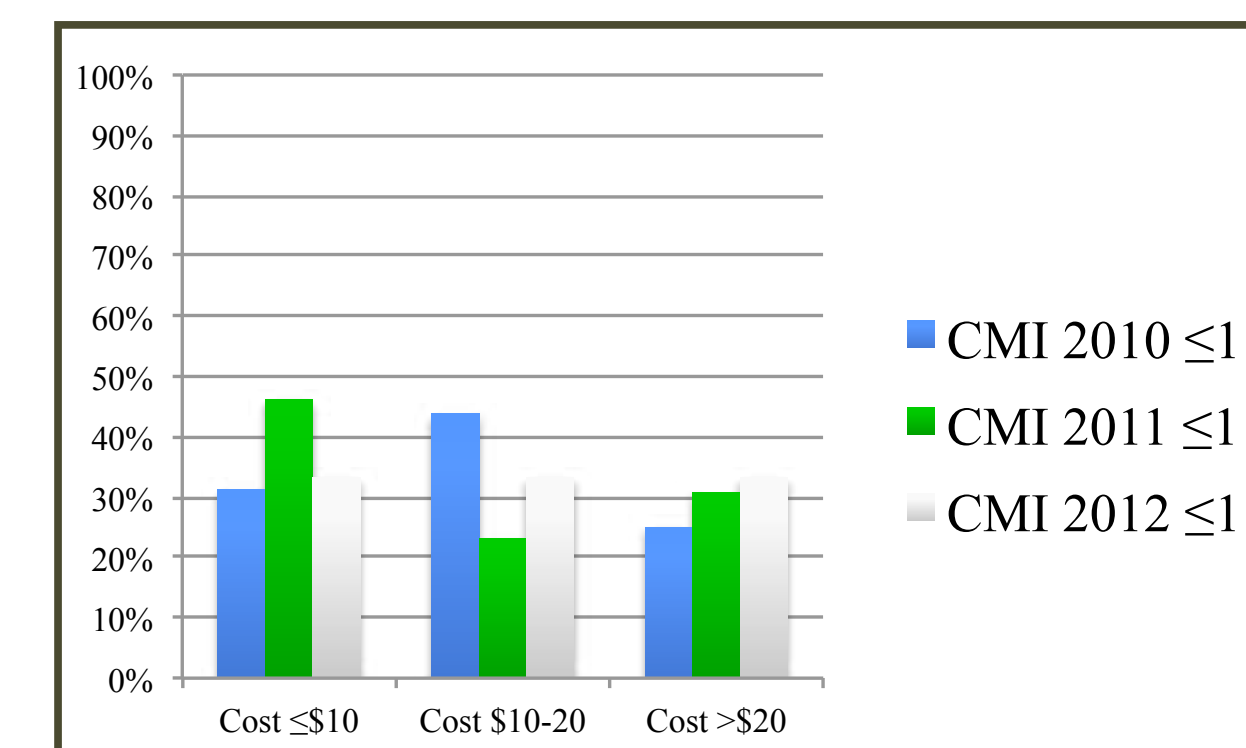
## RESULTS

### COST AND USE OF THE ANTIMICROBIAL GROUPS EVALUATED (69 HOSPITALS):



- Cost somewhat decreased, but use increased
- Risk with increased use: more resistance, worse patient outcomes, more C diff- publicly reported and tied to Inpatient Quality report

### CASE MIX INDEX AND COST PER DAY TREND 2010-2012



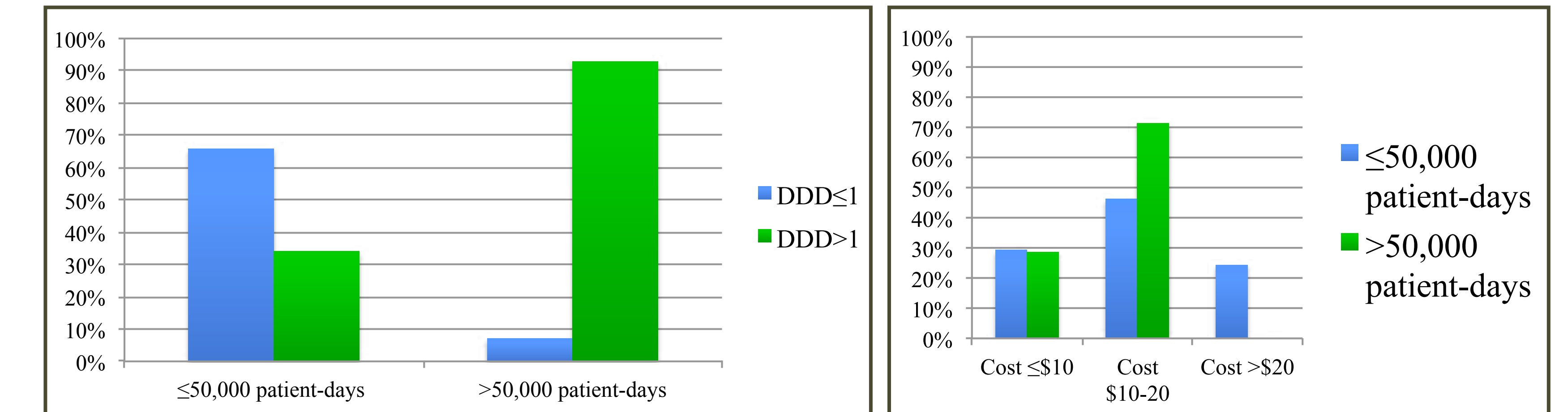
- Low Case Mix use more costly antimicrobials than Higher Case Mix
- Significant opportunities to move cost close to the \$10/day range

### ONE SYSTEM (SJPHS): PRACTICE VARIANCE AMONG HOSPITALS (2012)

	CMI2012	Average antimicrobial use per patient day	Cost of antimicrobial per patient day
A (365 beds)	1.60	0.80	\$11.37
B (200 beds)	1.34	1.03	\$11.11
C (68 beds)	1.14	1.07	\$20.90
D (804 beds)	1.52	0.34	\$7.11
E (376 beds)	1.41	1.27	\$12.68

- Smallest hospital: highest cost
- Largest hospital: lowest use and cost
- Largest hospital: very strict control on antibiotics with very active pharmacy and Infectious Diseases physicians involvement

## HOSPITAL SIZE, USE AND COST



Smaller hospitals use and cost more antimicrobials per patient-day.

## MAIN FINDINGS:

- Significant variation Systemwide related to cost and use
- Increased use and cost was associated with lower CMI and hospital size (likely smaller hospitals do not have as robust of an antimicrobial stewardship program as larger hospitals)
- Mean cost per patient-day over 3 years is \$13.10; the potential cost reduction for antimicrobials alone per year is \$10,000,000-19,000,000 (if mean cost changes to \$10-\$7). This does not include reducing resistant organisms and Clostridium difficile infection.
- Significant cost savings at two surrogate case hospitals

### LIMITATIONS:

- Review based on purchase data
- Comparison against resistance pending

## RECOMMENDATIONS:

- Identify antimicrobial stewardship best practices and implement at other hospitals
- Develop run charts to monitor antimicrobial usage and resistance at individual hospitals
- Identify facilities that may need assistance to implement an antimicrobial stewardship program
- Engage Infectious Diseases, Pharmacy and Infection Prevention
- Encourage developing antimicrobial stewardship programs at the Health Ministry level
- Learn from high-performers (low use, low cost, low resistance)
- Develop plans for real-time data to monitor use and resistance

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