1023

ECONOMIC IMPACT OF AN ANTIMICROBIAL STEWARDSHIP PROGRAM IMPLEMENTATION IN THREE HIGH-COMPLEXITY HOSPITALS IN COLOMBIA

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ABSTRACT

Background. Antimicrobial stewardship (AMS) programs in hospitals seek to optimize antimicrobial prescribing in order to improve individual patient care as well as reduce hospital costs and slow the spread of antimicrobial resistance. In Colombia, few healthcare institutions have implemented well-designed AMS programs. The purpose of this study was to assess the economic impact of the implementation of an AMS program in high-complexity hospitals in Colombia.

Methods. We conducted a quasi-experimental study between January 2007 and December 2014 in three high-complexity hospitals in two Colombian cities (Cali and Barranquilla). The study variables were evaluated in two periods: two years before and two years after the implementation of the AMS program. The structure and development of the AMS program was determined for each one. A modified index of AMS (ICATB1), which has a maximum score of 20, was used. Micro-costing techniques were used to determine the consumption of hospital resources. Cost assignment was performed based on the reference costs 2014. Antibiotic use was estimated based on the defined daily doses (DDD). Data was analyzed using descriptive and inferential statistics.

Results. The study was implemented in medical-surgical intensive care units (ICUs) and general wards. All three hospitals had empirical antibiotic guidelines according to the local epidemiology, and staff prospectively monitored the AMS program. The global ICATB1 score ranged from 17.75 to 19.75 during the implementation. Antibiotic consumption in the ICUs decreased post-implementation with meropenem decreasing 20% (p = 0.005), piperacillin/tazobactam 21% (p = 0.003), and cefepime 6% (p = 0.4). The cost of antibiotic consumption had a 52.3% reduction per month, on average $33,540 USD pre-implementation vs $15,989 USD post-implementation (p < 0.001). The cost of the AMS program implementation on average was $4,305 USD per month.

Conclusions. Our study outcomes confirm the economic impact and importance of implementing an AMS program in healthcare institutions. When instituting an AMS program, a hospital should tailor its choice of strategies to its needs and available resources. Similar programs in several other institutions in the country are on their way.

BACKGROUND

- Healthcare-associated infections (HAIs) are common in hospitals and health systems, affecting roughly one of every 20 inpatients, becoming one of the leading causes of death (1). Many HAIs are the result of excessive or inappropriate antibiotic use and the emergence and transmission of multidrug-resistant organisms.
- Up to 50% of antimicrobial use in hospitals is unnecessary or inappropriate (2). Systemic anti-infective agents are the third most costly items in the pharmacy budgets of U.S. nonfederal hospitals, with expenditures exceeding $1.9 billion in 2012 (3).
- Antimicrobial stewardship (AMS) —a coordinated effort to promote the judicious and effective use of antimicrobial agents that includes but is not limited to the appropriate selection, dosing, route of administration, and duration of antimicrobial therapy— is an important strategy for achieving this goal (2).
- The primary goal of AMS is to optimize clinical outcomes while minimizing unintended consequences of antimicrobial use (e.g., toxicity, selection of pathogenic organisms and emergence of resistance) (2). Reducing healthcare costs without adversely affecting the quality of care is a secondary goal of AMS (4).

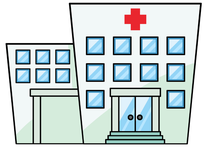
METHODS

- We conducted a retrospective, multicentric, quasi-experimental study. The variables were evaluated in two periods: two years before and two years after the implementation of the AMS programs in the participating institutions:

✓ **Institution A**: Private hospital, 400 beds, Barranquilla-Colombia: Pre-implementation period (2010-2011), implementation –6 months to 1 year– (2012) and post-implementation period (2013-2014).
✓ **Institution B**: Private teaching hospital, 400 beds, Cali-Colombia: Pre-implementation period (2010-2011), implementation –6 months to 1 year– (2012) and post-implementation period (2013-2014).
✓ **Institution C**: Public teaching hospital, 900 beds, Cali-Colombia: Pre-implementation period (2007-2008), implementation –6 months to 1 year– (2009) and post-implementation period (2010-2011).

- To describe the structure, resources and costs of implementing an AMS program in the three high-complexity healthcare institutions, the modified AMS index (ICATB1) was applied at the beginning of the AMS program implementation, and then every six months for two years. Monthly used resources and costs during the implementation of the AMS program was evaluated using micro-costing techniques and Colombian reference costs of every resource (number of hours worked by the infectious diseases specialist, epidemiologist, general physician, nurse, microbiologist, pharmacist or administrative assistant dedicated to the AMS program implementation).

- To compare antibiotic utilization trends during the pre- and post-AMS program implementation, the defined daily dose (DDD) was applied in intensive care units (ICUs) and general wards of each hospital. The antibiotics evaluated were cefepime (FEP), ertapenem (ETP), piperacillin/tazobactam (TZP), meropenem (MEM), vancomycin (VAN), and ceftriaxone (CRO). The DDD index was constructed per 1000 bed-days for each antibiotic.



AMS program implementation

Resources and costs evaluated

DDD trend evaluations

Two years before

Two years after

RESULTS

Modified Antimicrobial Stewardship Index (ICATB1)

Criteria	Institution A	Institution B	Institution C
Dedication level of the AMS team	3	2	4
Existence of an antimicrobial prescribing referent	2.5	4	4
Digital clinical records	1	1	1
Computerized antimicrobial prescription	2	2	2
Training for those who prescribe antibiotics	1	1	1
Antimicrobial Use Guidelines	2	2	2
List of available antibiotics for prescription	0.25	0.25	0.25
List of controlled dispensation antibiotics	1	0.25	0.25
Control of antibiotic time during therapy administration	0.25	0.25	0.25
Surveillance of antibiotic consumption	2.5	2.5	2.5
Evaluation of antibiotic prescription	2.5	2.5	2.5
Global average score (biannual measurement during two years)	**18**	**17.75**	**19.75**

AMS program implementation costs

Average monthly costs associated with the implementation of the AMS program	USD 2,469	USD 5,907	USD 5,488

Antimicrobials consumption (DDD x 1000 bed-days)

Average monthly DDD decrease post AMS program implementation (2 years)	7%	10%	49%

Antimicrobial costs consumption

Average monthly costs decrease post AMS program implementation (2 years)	29%	45%	20%

- All the hospitals had an ICATB1 score above the percentile 70, four of them above the percentile 90 (the higher score was for the institution C with 19.75 points).
- The three institutions with higher ICATB1 score (A, B and C) had one general practitioner or nurse with almost 118 hours/month dedicated exclusively to the AMS program implementation (focused on training, education, feedback and surveillance).
- All the hospitals achieved reduction of extended-spectrum antimicrobials (FEP, TZP, MEM, ETP, VAN and CRO) consumption in DDD per 1000 bed-days in the ICUs and general wards (24% average/month for two years after implementation, p < 0.001).
- The three institutions achieved reduction of costs associated with extended-spectrum antimicrobial consumption (FEP, TZP, MEM, ETP, VAN and CRO) in the ICUs and general wards (30.5% average/month for two years after implementation).

CONCLUSIONS

- AMS programs reduce in a cost-effective way the consumption of high-spectrum antimicrobials, as well as their consumption-associated costs, health resources costs and time required to antimicrobial administration by the hospital staff in high complexity healthcare institutions.

REFERENCES

1. U.S. Department of Health and Human Services. National action plan to prevent healthcare-associated infections: roadmap to elimination. http://1.usa.gov/17FlqsO (accessed Oct 31 2014).
2. Dellit TH , Owens RC , McGowan JE Jr et al. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Clin Infect Dis*. 2007; 44:159-77.
3. Hoffman JM, Li E, Doloresco F, et al. Projecting future drug expenditures in U.S. nonfederal hospitals and clinics—2013. *Am J Health Syst Pharm*. 2013; 70:525-39.
4. Rosenberg DJ. Infections, bacterial resistance, and antimicrobial stewardship: the emerging role of hospitalists. *J Hosp Med*. 2012; 7(S1):S34-S43.

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