The Double-Edged Sword of Cost Effectiveness in Evaluating Antimicrobial Stewardship Interventions

Omar Zmerli, M.D., Amanda Chamieh, M.D., PhD (c), Sanaa Saliba, M.D. , Claude Afif, M.D., Eid Azar, M.D.

Division of Infectious Diseases, Saint George Hospital University Medical Center, Beirut, Lebanon

Introduction

The multiple classical benefits of reducing antimicrobial consumption extend beyond the impact on rates of antimicrobial resistance and infections to include a cost-saving effect of 100,000$-300,000$ per intervention as estimated by the CDC. However, the recent introduction of novel antimicrobial molecules with a high price tag and the fall in the prices of older agents presents a substantial challenge in maintaining cost-effectiveness.

Objectives

- Analyze the cost of antibiotics over a 10-year period at a tertiary care center in Beirut, Lebanon.
- Determine the cost-saving effect of Antimicrobial Stewardship practices.
- Demonstrate the effect of high-cost novel molecules on cost-effectiveness savings achieved through Antimicrobial Stewardship practices.

Materials & Methods

We retrieved from the antimicrobial stewardship program(ASP) database the consumption of the Gram-negative broad-spectrum antibacterial agents (GNBS): imipenem, meropenem, ertapenem, piperacillin-tazobactam, amikacin, colistin, ceftazidime, ceftolozane-tazobactam and cefepime from January 2015-August 2019 at Saint George Hospital(SGH), a 333-bed tertiary care center in Lebanon. The yearly cost of all antibacterials consumed during this period were obtained from SGH billing records.

Materials & Methods

GNBS consumption was calculated as Daily Defined Doses (DDD)/1000 Patient Days(PD) per WHO guidelines.

Results

The carbapenem consumption significantly dropped from a peak of 205 DDD/1000PD in 2015 to 33 DDD/1000PD in 2019. This drop was not accompanied by an increase in the consumption of other GNBS. The total use of GNBS dropped by 54% from 288 DDD/1000PD in 2015 to 132 DDD/1000PD by August 2019. Currently, SGH serves a yearly average of 82,000 patient-days. Hence, this reduction in total GNBS consumption corresponds to 12,792 fewer daily defined doses of antimicrobial therapy per year.

The average annual cost of all antibacterials at SGH is 1,100,000 $ (U.S. Dollars), ranging from 955679 $ to 1340109 $ for the period 2015-2019. (Table 1)

Conclusion

- The striking decrease in GNBS consumption, namely carbapenems, was not mirrored with a reduction of total antibacterial cost.
- Although novel antimicrobials carry great potential, they come at a significant increase in overall cost.
- Modeling ASP interventions solely around cost-effectiveness will limit the better placement of these new agents in institutional therapeutic guidelines.
- Strict continuous analysis of consumption, antimicrobial resistance, and cost within an ASP provides a proactive and vigilant approach to navigate through the complexity of difficult to treat bacterial infections.

Table 1: Consumption of Gram-negative Broad-Spectrum Antimicrobial Agents and Cost of Antibiotics at Saint George Hospital, Lebanon

	2015	2016	2017	2018	August 2019
Imipenem - Meropenem - Ertapenem	205	164	80	56	33
Piperacillin Tazobactam – Cepefime - Ceftazidime – Tigecycline	69	80	48	92	78
Amikacin - Colistin	14	15	9	6	11
Ceftolozane/Tazobactam	0	0	5	13	10
Total (DDD/1000 PD)	288	259	142	167	132
Carbapenems proportion out of GNBS Antibiotics (in percent)	71	63	56	34	25
Yearly Cost of All Antibiotics (in U.S. Dollars)	1,237,216	1,127,513	955,679	1,340,109	766,670

References

Centers for Disease Control and Prevention (CDC). (2015). Impact of Antibiotic Stewardship Program Interventions on Costs | Antibiotic Use | CDC. https://www.cdc.gov/antibiotic-use/healthcare/evidence/asp-int-costs.htm

Contact Information

Eid Azar, M.D.
eeazar@stgeorgehospital.org

Omar Zmerli, M.D.
obzmerli@stgeorgehospital.org

Submission ID: 906499