Presentation Type:
Oral Presentation
Subject Category: MDR GNR

How Does Antimicrobial Resistance Increase Medical Costs in Community-Acquired Acute Pyelonephritis?

Bongyoung Kim; Taul Cheong and Jungmo Ahn

Background: The proportion of antimicrobial-resistant Enterobacterales that are causative pathogens for community-acquired acute pyelonephritis (CA-APN) has been increasing. We examined the effect of antimicrobial resistance on medical costs in CA-APN. **Methods:** A single-center retrospective cohort study was conducted at a tertiary-care hospital in Korea between January 2018 to December 2019. All hospitalized patients aged ≥19 years who were diagnosed with CA-APN were recruited, and those with Enterobacterales as a causative pathogen were included. Comparisons between CA-APN caused by extended-spectrum β-lactamase (ESBL)–producing pathogens (ESBL+ group) and those by non–ESBL-producing organisms (ESBL– group) as well as CA-APN caused by ciprofloxacin-resistant pathogens (CIP-R group) and those by ciprofloxacin-sensitive pathogens (CIP-S group) were performed. Log-linear regression was performed to determine the risk factors for medical costs. **Results**: In total, 241 patients were included in this study. Of these, 75 (31.1%) had an ESBL-producing pathogen and 87 (36.1%) had a ciprofloxacin-resistant pathogen. The overall medical costs were significantly higher in the ESBL+ group compared with the ESBL− group (US$3,730.18 vs US $3,119.32) P <0.001) as well as in CIP-R group compared with CIP-S group (3,730.18 USD vs. 3,119.32 USD, P =0.005). In addition, length of stay was longer in ESBL+ group compared with ESBL-group (11 vs. 8 days, P <0.001) as well as in CIP-R group compared with CIP-S group (11 vs. 8 days, P <0.001). There were no significant difference in the proportion of clinical failure between ESBL+ and ESBL- groups; CIP-R and CIP-S groups. Based on the log-linear regression model, the costs associated with ESBL-producing Enterobacterales as the causative pathogen would be, on average, 27% higher or US$1,211 higher than its counterpart (P = .026). By the same token, a patient who is a year older would incur US$23 higher cost ($P$ = .040). Having any structural problem in urinary tract would incur US$1,231 higher cost ($P$ = .015). A unit increase in Pitt score would incur US$767 USD higher cost (P < 0.001) higher cost, all other things constant. **Conclusions**: Medical costs for hospitalized patients with CA-APN are increased by the existence of ESBL-producing Enterobacterales but not by the existence of ciprofloxacin-resistant Enterobacterales.

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Table. Comparison of outcomes of community-acquired acute pyelonephritis (unit: USD)

	Total	Extended-spectrum beta-lactamase			Ciprofloxacin		
		Positive	Negative	*P*	Resistant	Sensitive	*P*
Medical costs, median (IQR)	3,350.27	3,730.18	3,119.32	0.001	3,730.18	3,119.32	0.005
Consultation fee	126.93	139.94	122.56	0.212	141.65	112.98	0.005
Hospitalization expenditures	1194.31	1331.24	1098.96	0.018	1360.73	1067.5	0.002
Meal	117.41	137.27	107.24	0.008	145.89	103.18	0.005
Prescription drugs	52.61	60.15	46.66	0.071	59.84	47.49	0.141
Parenteral medication	329.38	421.95	284.77	0.001	421.03	292.98	0.005
Cost of treatment	36.48	55.43	24.13	0.018	63.48	21.74	<0.001
Laboratory examination	777.9	827.79	765.23	0.489	802.73	763.61	0.350
Radiologic examination	22.58	28.21	19.65	0.489	28.87	20.84	0.350
Therapeutic materials	255.12	314.63	234.82	0.127	274.12	243	0.229
Computed tomography	195.94	195.94	195.94	0.781	200.3	183.88	0.421
Magnetic resonance imaging	0	0	0	0.399	0	0	0.839
Ultrasound	0	0	0	0.328	0	0	0.787
Rehabilitation	0	0	0	0.139	0	0	0.268
Others	18.18	18.18	18.18	0.248	18.18	18.18	0.126
Length of hospital stay, median (IQR)	9	11	8	<0.001	11	8	<0.001
Clinical failure (%)	14 (5.8)	6 (8.0)	8 (4.8)	0.374	7 (8.1)	7 (4.6)	0.302
Change in Braden scale, mean ± SD	-1.01 ± 2.56	-1.23 ± 2.84	-0.91 ± 2.42	0.410	-1.38 ± 3.10	-0.81 ± 2.18	0.138

Abbreviations: IQR, interquartile range; SD, standard deviation

Table. Risk factors for higher medical costs using a log-linear regression model

Parameter	Coefficient Estimate	Standard Error	*P*	Average Marginal Effect
ESBL-producing Enterobacteriales as a causative pathogen	0.273	0.122	0.026	1,210.52
Ciprofloxacin-resistance Enterobacteriales as a causative pathogen	-0.024	0.082	0.771	-106.51
Age	0.005	0.003	0.040	23.18
Female sex	0.086	0.123	0.486	381.29
Charlson's comorbidity index	-0.011	0.018	0.517	-50.62
Bedridden status	-0.284	0.130	0.030	-1,262.58
Any structural problem in urinary tract	0.277	0.113	0.015	1,230.72
History of admission during 1 year prior to inclusion	-0.014	0.115	0.903	-62.83
History of antibiotic usage during 1 year prior to inclusion	-0.222	0.092	0.017	-987.19
History of urinary tract infection during 1 year prior to inclusion	0.004	0.096	0.965	18.71
Use of chemotherapeutic agents	0.185	0.148	0.213	819.60
Use of immunosuppressants	0.015	0.101	0.885	64.46
History of urinary catheterization during 1 month prior to inclusion	0.366	0.244	0.134	1,625.40
History of urinary tract operation during 3 months prior to inclusion	-0.384	0.190	0.044	-1,705.39
Pitt score	0.173	0.037	<0.001	766.71
Discordance between antibiotic susceptibility of the causative pathogen and initial antibiotic regimen	-0.044	0.123	0.721	-194.40
Initial Braden scale	-0.054	0.013	<0.001	-240.16
Stayed in a premium room at least for a day during hospitalization	0.040	0.104	0.703	176.44
Constant	15.678	0.371	<0.001	–

Abbreviations: ESBL, extended-spectrum-beta-lactamase

"Coefficient estimate" column displays the estimate from log-linear regression (semi-elasticity) and "average marginal effect" column reports the average marginal effect of a unit increase in the control variable on medical costs. The coefficient of the constant term in linear regression is estimated to capture the intercept; thus, its average marginal effect is omitted.

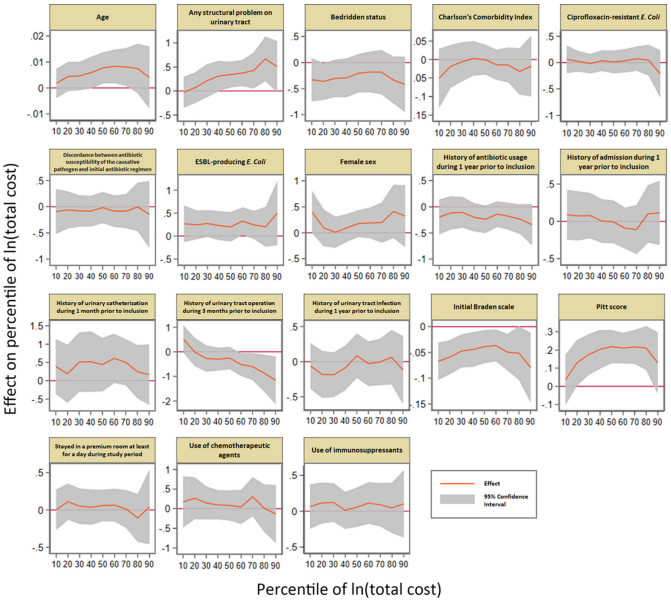

Figure 1.

Presentation Type:
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Automated Nationwide Benchmarking Dashboard for Antimicrobial Stewardship Programs within the Veterans' Health Administration

Michihiko Goto; Eli Perencevich; Alexandre Marra; Bruce Alexander; Brice Beck; Daniel Livorsi; Julia Friberg; Christopher Richards; DeShauna Jones and Michael Sauder

Group Name: VHA Center for Antimicrobial Stewardship and Prevention of Antimicrobial Resistance (CASPAR) **Background:** Antimicrobial stewardship programs (ASPs) are advised to measure antimicrobial consumption as a metric for audit and feedback. However, most ASPs lack the tools necessary for appropriate risk adjustment and standardized data collection, which are critical for peer-program benchmarking. We created a system that automatically extracts antimicrobial use data and patient-level factors for risk-adjustment and a dashboard to present risk-adjusted benchmarking metrics for ASP within the Veterans' Health Administration (VHA). **Methods:** We built a system to extract patient-level data for antimicrobial use, procedures, demographics, and comorbidities for acute inpatient and long-term care units at all VHA hospitals utilizing the VHA's Corporate Data Warehouse (CDW). We built baseline negative binomial regression models to perform risk-adjustments based on patient- and unit-level factors using records dated between October 2016 and September 2018. These models were then leveraged both retrospectively and prospectively to calculate observed-to-expected ratios of antimicrobial use for each hospital and for specific units within each hospital. Data transformation and applications of risk-adjustment models were automatically performed within the CDW database server, followed by monthly scheduled data transfer from the CDW to the Microsoft Power BI server for interactive data visualization. Frontline antimicrobial stewards at 10 VHA hospitals participated in the project as pilot users. **Results:** Separate baseline risk-adjustment models to predict days of therapy (DOT) for all antibacterial agents were created for acute-care and long-term care units based on 15,941,972 patient days and 3,011,788 DOT between October 2016 and September 2018 at 134 VHA hospitals. Risk adjustment models include month, unit types (eg, intensive care unit [ICU] vs non-ICU for acute care), specialty, age, gender, comorbidities (50 and 30 factors for acute care and long-term care, respectively), and preceding procedures (45 and 24 procedures for acute care and long-term care, respectively). We created additional models for each antimicrobial category based on National Healthcare Safety Network definitions. For each hospital, risk-adjusted benchmarking metrics and a monthly ranking within the VHA system were visualized and presented to end users