Outpatient Antibiotic Use in Orthopaedic Surgery Practice is Increasing: A Review of Medicare Part D Claims from 2013 to 2021

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INTRODUCTION:

The rise of multi-drug resistant organisms secondary to widespread antibiotic use has led to guidelines restricting their use in surgical practice. The purpose of this study is to characterize national-level outpatient antibiotic prescribing trends of practicing adult orthopaedic surgery providers in the United States. We hypothesized that the use of antibiotics would decrease over the study period.

METHODS:

A retrospective cross-sectional analysis of the Medicare Part D Prescriber Public Use File produced by the Centers for Medicare and Medicaid Services was conducted for the years 2013 to 2021. This publicly available database provides information on prescription drugs claims generated by individual physicians and healthcare professionals and paid for under the Medicare Part D Prescription Drug program. The primary outcomes included total claims and total claims per 1000 prescribers for each antibiotic. Secondarily, combined annual growth rate (CAGR) and percent growth was calculated for all medications using linear regression. Linear regression was performed for all trends using R software (Version 4.0.3, R Foundation for Statistical Computing, Vienna, Austria). A p-value less than 0.05 was considered statistically significant. Biases were not addressed a priori. A power analysis was not performed.

RESULTS:

Antibiotic claims increased during the study period from a low of 304,817 (5.1%) claims in 2013 to a high of 580,736 (10.1%) claims in 2021 (Table 1). The five most prescribed antibiotics included amoxicillin, cephalexin, mupirocin, clindamycin, and sulfamethoxazole / trimethoprim (Table 1 / Figure 1). The use of amoxicillin, amoxicillin/clavulanic acid, penicillin V, cephalexin, cefadroxil, mupirocin, clindamycin, sulfamethoxazole / trimethoprim, and doxycycline significantly increased with time while the use of ciprofloxacin, levofloxacin, azithromycin, and vancomycin significantly decreased (Table 2).

DISCUSSION AND CONCLUSION:

Outpatient antibiotic prescriptions by orthopaedic surgery providers increased between 2013 and 2021 with greatest increases in the use of cefadroxil, doxycycline, amoxicillin, and clindamycin. Considering national-level guidelines advocating for increased antibiotic stewardship and growing antibiotic resistance, this is of notable concern. Further study is needed to identify if these practice patterns represent rising use of prophylactic versus therapeutic antibiotics in orthopaedic surgery practice.

Figure 1 – Outpatient antibiotic claims by orthopaedic surgery providers from 2013 - 2021

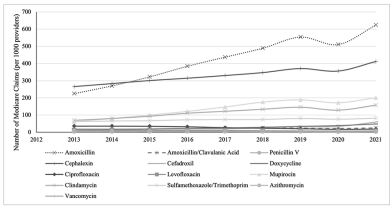

Table 1 – Antibiotic claims by orthopaedic surgery providers from 2013 - 2021

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Antibiotics	304,817	342,164	377,675	419,947	454,078	490,599	533,343	484,472	580,736
% of Claims	(5.1%)	(5.7%)	(6.5%)	(7.2%)	(7.9%)	(8.9%)	(9.5%)	(9.0%)	(10.1%)
Amoxicillin	85,955 (28.2%)	103,313 (30.2%)	121,684 (32.2%)	143,563 (34.2%)	161,683 (35.6%)	178,170 (36.3%)	200,751 (37.6%)	180,021 (37.2%)	219,798 (37.8%)
Amox / Clav	5,615 (1.8%)	6,199 (1.8%)	6,860 (1.8%)	7,499 (1.8%)	8,009 (1.8%)	9,027 (1.8%)	8,663 (1.6%)	7,725 (1.6%)	8,952 (1.5%)
Penicillin V	1,246 (0.4%)	1,394 (0.4%)	1,431 (0.4%)	1,431 (0.3%)	1,600 (0.4%)	1,682 (0.3%)	1,687 (0.3%)	1,592 (0.3%)	1,774 (0.3%)
Cephalexin	101,420 (33.3%)	108,384 (31.7%)	113,465 (30.0%)	117,442 (28.0%)	122,013 (26.9%)	126,381 (25.8%)	134,248 (25.2%)	125,498 (25.9%)	145,052 (25.0%)
Cefadroxil	7,418 (2.4%)	7,341 (2.1%)	7,157 (1.9%)	7,380 (1.8%)	7,321 (1.6%)	9,673 (2.0%)	11,691 (2.2%)	12,047 (2.5%)	20,971 (3.6%)
Doxycycline	6,168 (2.0%)	6,477 (1.9%)	7,337 (1.9%)	8,608 (2.0%)	9,026 (2.0%)	10,568 (2.2%)	12,444 (2.3%)	13,646 (2.8%)	16,806 (2.9%)
Ciprofloxacin	13,717 (4.5%)	13,794 (4.0%)	13,214 (3.5%)	12,064 (2.9%)	9,907 (2.2%)	8,735 (1.8%)	7,573 (1.4%)	6,115 (1.3%)	6,653 (1.1%)
Levofloxacin	4,855 (1.6%)	4,647 (1.4%)	4,585 (1.2%)	4,438 (1.1%)	4,021 (0.9%)	3,469 (0.7%)	2,993 (0.6%)	2,677 (0.6%)	2,766 (0.5%)
Mupirocin	23,708 (7.8%)	30,717 (9.0%)	37,679 (10.0%)	45,351 (10.8%)	54,421 (12.0%)	63,892 (13.0%)	68,311 (12.8%)	60,542 (12.5%)	70,884 (12.2%)
Clindamycin	26,710 (8.8%)	30,697 (9.0%)	35,216 (9.3%)	41,384 (9.9%)	45,113 (9.9%)	48,671 (9.9%)	52,752 (9.9%)	45,256 (9.3%)	55,464 (9.6%)
TMP / SMX	23,671 (7.8%)	25,033 (7.3%)	25,346 (6.7%)	27,162 (6.5%)	27,371 (6.0%)	27,214 (5.5%)	29,166 (5.5%)	26,801 (5.5%)	28,921 (5.0%)
Azithromycin	2,104 (0.7%)	1,790 (0.5%)	1,617 (0.4%)	1,576 (0.4%)	1,517 (0.3%)	1,202 (0.2%)	1,225 (0.2%)	908 (0.2%)	1,275 (0.2%)
Vancomycin	2,230 (0.7%)	2,378 (0.7%)	2,084 (0.6%)	2,049 (0.5%)	2,076 (0.5%)	1,915 (0.4%)	1,839 (0.3%)	1,644 (0.3%)	1,420 (0.2%)

* Amoxicillin (Amox), Clavulanic Acid (Clav), Trimethoprim (TMP), Sulfamethoxazole (SMX)

Table 2 – Antibiotic claim growth from 2013 - 2021

	Drug Name	CAGR (2013-2021)	% Growth	p
Claims	Amoxicillin	11.0%	155%	< 0.001
	Amoxicillin/Clavulanic Acid	5.32%	59.4%	0.002
	Penicillin V	4.00%	42.4%	< 0.001
	Cephalexin	4.06%	43.0%	< 0.001
	Cefadroxil	12.4%	183%	< 0.001
	Ciprofloxacin	-7.72%	-51.5%	< 0.001
	Levofloxacin	-6.06%	-43.0%	< 0.001
	Mupirocin	12.9%	199%	< 0.001
	Clindamycin	8.46%	108%	< 0.001
	Sulfamethoxazole/Trimethoprim	2.25%	22.2%	0.003
	Doxycycline	11.8%	173%	< 0.001
	Azithromycin	-5.41%	-39.4%	< 0.001
	Vancomycin	-4.89%	-36.3%	< 0.001
Per 1000 Prescribers	Amoxicillin	11.5%	166%	< 0.001
	Amoxicillin/Clavulanic Acid	5.79%	66.0%	< 0.001
	Penicillin V	4.47%	48.2%	< 0.001
	Cephalexin	4.52%	48.9%	< 0.001
	Cefadroxil	12.9%	194%	0.008
	Ciprofloxacin	-7.31%	-49.5%	< 0.001
	Levofloxacin	-5.64%	-40.7%	< 0.001
	Mupirocin	13.5%	211%	< 0.001
	Clindamycin	8.94%	116%	< 0.001
	Sulfamethoxazole/Trimethoprim	2.71%	27.2%	< 0.001
	Doxycycline	12.3%	184%	< 0.001
	Azithromycin	-4.99%	-36.9%	< 0.001
	Vancomycin	-4.47%	-33.7%	< 0.001