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Decomposition Analysis of Spending and Price Trends for Biologic Anti-Rheumatic Drugs in Medicare and Medicaid

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Abstract

Objective: Billions of public dollars are spent each year on biologic disease-modifying anti-rheumatic drugs (bDMARDs), but the drivers of recent increases in bDMARD spending are unclear. We characterized changes in total spending and unit-prices for bDMARDs in Medicare and Medicaid and quantified the major sources of these spending increases.

Methods: We accessed drug spending data for years 2012–2016, covering all Medicare Part B (fee-for-service), Part D, and Medicaid enrollees. After calculating five-year changes in total spending and unit-prices for each bDMARD and in-aggregate, we performed standard decomposition analyses to isolate four sources of spending growth: drug prices, uptake [# recipients], treatment intensity [mean # doses/claim], and treatment duration [annual # claims/recipient]), both excluding and including time-varying rebates.

Results: From 2012–2016, annual spending on public-payer claims for the 10 included bDMARDs more than doubled (\$3.8 to \$8.6 billion), with median drug price increases of 51% in Part D (mean 54%) and 8% within Part B (mean 21%). Adjusting for general inflation, unit-price increases alone accounted for 57% of the five-year, \$3.0 billion spending increase within Part D; 37% was from increased uptake. Accounting for time-varying rebates, prices were still responsible for 54% of increased spending. Unit-prices and spending were lower under Medicaid than Part D, but temporal trends and contributors were similar.

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Conclusion: Post-market drug-price changes alone account for the majority of recent spending growth for bDMARDs. Policy interventions targeting price increases, particularly under Part D plans, may help mitigate drug financial burdens for public payers and bDMARD recipients.

INTRODUCTION

Over the past two decades since biologic disease-modifying anti-rheumatic drugs (bDMARDs) were first approved by the Federal Drug Administration (FDA), they have improved the health(1–4) and productivity(5–7) of many patients with moderate-to-severe rheumatoid arthritis (RA), psoriasis/psoriatic arthritis, ankylosing spondylitis, lupus, systemic vasculitis, and other rheumatic and autoimmune diseases, which together affect more than one million Medicare beneficiaries.(8–10) However, due to their high prices (\$22,000 to \$44,000 per-patient annually(11)) and placement in specialty tiers with high levels of cost-sharing, they pose substantial financial burdens for patients and taxpayers. For example, a recent analysis of acquisition costs(12) found that three biologics (adalimumab, etanercept, and infliximab) ranked among the top-five prescription medications in the US for the greatest total spending.

With annual prescription drug spending exceeding \$333 billion dollars,(13) the US is in the midst of active public debate about approaches for mitigating the high cost of prescription drugs for patients and payers. These include moving some drugs from Medicare Part B to Part D(14) and passing manufacturers' rebates through to beneficiaries at the point-of-sale. (15) bDMARDs, which are covered by Medicare as a medical and pharmacy benefit (Parts B and D, respectively), are a prime target for such measures due to the high levels of spending. Recent reports documented increases in total spending(12) and per-person treatment costs(16) for bDMARDs, but could not differentiate between various sources of growth. Specifically, detailed decompositions that separate spending growth into changes in price, recipient numbers, and treatment intensity are important to understand the spending changes and their implications.(17) Therefore, we used national-level Medicare and Medicaid data to decompose growth in spending between 2012 and 2016 for the bDMARDs used in the treatment of rheumatic diseases.

PATIENTS AND METHODS

Data Source

We used the Medicare and Medicaid Drug Spending Dashboards for 2012 through 2016 published by Centers for Medicare and Medicaid Services (CMS).(18) These datasets contain aggregated, non-identifiable, national-level data for outpatient prescription medications. Part D files(19) were derived from Prescription Drug Event claims for Medicare beneficiaries enrolled in Part D, including stand-alone prescription drug plans and Medicare Advantage plans. Approximately 70% of all Medicare beneficiaries are enrolled in a Part D plan; this included 31.9 million individuals in 2012 and 41.2 million in 2016(20) (five-year increase of 29%). Part B files(21) include administrative claims data for non-self-administered drugs prescribed to Medicare beneficiaries with fee-for-service plans (32.9 million individuals in 2012 and 33.7 million in 2016(20)). Medicaid files(22) contain data for outpatient drugs paid by state Medicaid agencies. As this analysis was based on

aggregated data and involved no patient health records, it was exempt from institutional review board approval.

Study Data

We included all bDMARDs approved by the FDA for the treatment of one or more rheumatic diseases through December 2014 (Table S1). We required this inclusion criterion in order to have at least two full years of follow up data; for example, we excluded secukinumab (approval in 2015). Similarly, for drugs (or formulations) newly approved during the period, we only assessed trends in individual drugs for years where it was approved for the whole 12 months. For example, for intravenous golimumab (approved in July 2013), we assessed the trend over 2014–2016. Since the datasets did not contain information on disease indication, we excluded rituximab from our primary analysis as it is commonly used for the treatment of lymphoma and spending for this indication may differ from the treatment for rheumatic diseases.

Variable and Data Extraction

For each drug and calendar year, we extracted total spending, recipients, doses, claims, and average number of doses per-claim and per-recipient over the year. From these variables we calculated the drug unit-price (average cost per dose) for each bDMARD. Total spending included amounts paid by Medicare, federal and state Medicaid programs, beneficiaries (as deductible, coinsurance, or copayment), and third-parties (e.g., supplemental Part B insurance plans). For Part D and Medicaid, total spending included the ingredient cost, dispensing fees, and sales tax.

CMS defined total recipients as the total number of Part D or Part B fee-for-service beneficiaries receiving the drug each year; this information was not reported for Medicaid. Total doses reported by CMS were the total number of doses dispensed, weighted to account for variation in strength and dosage form. For self-administered drugs, a single dose was the amount in a pre-filled syringe or injector pen. Dosage quantities and frequencies for each drug are listed in Table S1. While the datasets did not contain information on disease indication or prescriber specialty, claims data stratified by prescriber specialty were available for a subset of the Medicare files,(23,24) approximately 40% of Part B spending data for 2016 and 80% of Part D spending. We used these data to assess the proportion of costs from claims submitted by rheumatologists, dermatologists, and gastroenterologists.

Statistical Analysis

After adjusting all spending amounts to 2016 dollars using general inflation rates obtained from the US Bureau of Labor Statistics Consumer Price Index,(25) we calculated five-year changes in total spending and drug price (our primary endpoint) for each bDMARD and in aggregate. We then analyzed changes in the average number of doses and cost per-claim, number of recipients dispensed each drug, and claims per-recipient, in each calendar year.

As increases in spending (C) can result from increases in prices (P), volume (V , e.g. number of recipients, treatment intensity), or both ($C = P * V$), we employed standard decomposition methods to determine the major drivers of the expected five-year spending

increases. These methods, used previously to assess changes in outpatient(26,27) and drug(27–30) expenditures, isolate the impact of each driver (or effect) by estimating the change in spending from the change in one effect, holding the others constant. For each bDMARD, we considered a single price effect (specifically, change in price per-dose) and three volume effects: number of recipients (V_a); number of claims per-recipient (V_b), reflecting the duration of treatment; and number of doses per-claim (V_c), reflecting the intensity of treatment. The product of the three volume effects ($V_a * V_b * V_c$) equaled the change in total number of doses dispensed. Though price effects are usually the product of changes in individual drug prices and use of lower-cost generic medications,(31) the latter was not applicable to this analysis of biologics, given the absence of generic drugs in this class. We determined the absolute and percentage-contribution of these effects towards the increase in spending for each bDMARD, as well as in aggregate, employing formulas adapted from those used by the US Congressional Budget Office (CBO).(26) Since Medicaid datafiles do not contain information on the number of recipients,(22) we defined volume effects for bDMARDs covered under Medicaid simply as the total number of doses dispensed.

Rebate Adjustment

The spending amounts represent actual program spending and directly impact beneficiary out-of-pocket spending, which were our main outcomes of interest. These amounts do not include Medicare Part D rebates from manufacturers to either Pharmacy Benefit Managers (PBMs) or Part D plans (there are no such point-of-sale rebates in Part B). For Medicaid, the drug rebate amounts are based on statutory formulas; the minimum basic rebate for bDMARDs, which Medicaid classifies as single-source innovator drugs, is 23.1%.(32) Manufacturers pay the Medicaid drug rebates on a quarterly basis, with the rebate split between the states and federal government.(32) Therefore, we conducted our analyses including the Medicaid rebates (as these decrease public spending), but both excluding and including consideration of the Medicare Part D rebates. As CMS is prohibited from publicly disclosing the rebates paid for specific drugs, rebate amounts for each year of study were extrapolated from the average rebates for brand-name specialty drugs reported by the CBO for years 2010 (Part D=2.6%; Medicaid=42.1%) and 2015 (Part D=10.5%; Medicaid=50.0%).(33) The extrapolated Part D rebate-percentages were 5.8% (year 2012), 7.3% (year 2013), 8.9% (year 2014), and 12.1% (year 2016), and the corresponding statutory Medicaid rebates (basic and inflation rebates combined) were 45.2% (year 2012), 46.7% (year 2013), 48.3% (year 2014), and 51.6% (year 2016). The CBO was granted access to confidential data from the years 2010–2015 on the rebates paid to Part D plans and statutory Medicaid rebates for individual drugs, which they used to determine the average rebates for brand-name drugs in each program. Thus, we applied the same rebate amount to each bDMARD.

Sensitivity Analysis

Evidence suggests that higher-than-average rebates may be negotiated for brand-name specialty drugs available from multiple manufacturers, possibly including bDMARDs. Thus, to account for this uncertainty and lack of transparency surrounding rebates, we repeated our Medicare Part D analysis using larger time-varying rebate amounts, as employed in previous

analyses of Medicare drug spending,(34,35) though not specific to specialty brand-name drugs. These ranged from 20% (in 2012) to 30% (in 2016). We also reassessed spending trends and contributors with rituximab included. Furthermore, we separately assessed spending trends and contributors for tofacitinib, an oral medication that was the only targeted synthetic DMARD approved by the FDA during the study period (approved for RA in November 2012).

RESULTS

Ten bDMARDs met inclusion criteria and were included in the main study cohort: abatacept, anakinra, adalimumab, belimumab, certolizumab, etanercept, golimumab, infliximab, tocilizumab, and ustekinumab (Table S1). From 2012–2016, annual spending on Medicare and Medicaid claims for these 10 bDMARDs increased by \$4.8 billion (from \$3.8 billion in 2012 to \$8.6 billion in 2016; 128% increase). bDMARD drug price increases alone were responsible for \$2.5 billion of this \$4.8 billion rise in spending. By program, total annual spending increased by 177% within Part D, 80% within Part B, and 204% within Medicaid. Majority of 2016 Medicare claims were from rheumatologists, except for ustekinumab (71% from dermatologists) and rituximab (Table S2).

Medicare Part D Spending on Biologic DMARDs

Reported Part D spending increased by \$3.0 billion over the five years; bDMARDs with the biggest increases included adalimumab (\$1.5 billion increase), etanercept (\$813 million), ustekinumab (\$211 million), and abatacept (\$197 million). When applying time-varying manufacturers' rebates, the five-year increase in Part D spending still exceeded \$2.5 billion. Drug prices for most bDMARDs increased substantially over the period, with a median list price increase of 51% (mean 54%) and rebate-adjusted median price increase of 41% (mean 45%) (Table 1). Controlling for increases in dosage volume, drug price increases accounted for 57% of the five-year increase in aggregate, inflation-adjusted spending within Part D. Growth in the number of recipients accounted for 37% while annual number of claims per-recipient accounted for 6%. After applying CBO-reported time-varying rebates, prices were still responsible for 54% of the aggregate Part D spending increase (Figure); when applying larger time-varying rebate amounts (20–30% of the list price), unit-price hikes still accounted for half of the five-year, 142% spending increase (Figure S1).

For most Part D drugs individually, drug prices accounted for approximately 50% or more of the increase in spending (Figure). Adalimumab and etanercept, two of the oldest bDMARDs, were prescribed to the largest numbers of Part D beneficiaries (> 47,000 in 2016) and had the biggest five-year price increases: 84% and 88%, respectively (72% and 75% respectively, accounting for rebates). Total annual spending on the oral targeted synthetic DMARD tofacitinib increased by \$175 million (over 2013–2016). Forty-eight percent of this increase was from increased number of recipients, with increases in drug price and number of claims per-recipient each responsible for 25%.

Medicare Part B Spending on Biologic DMARDs

In Part B, total annual spending increased by \$1.2 billion over 2012–2016, with abatacept (\$300 million increase) and infliximab (\$284 million) as the biggest contributors to this increase. In comparison to Part D, drug price increases for bDMARDs covered under Part B were far-lower (median change of 8%, mean 21%) (Table 2). Yet, drug price increases accounted for 50% of the increase in aggregate Part B spending, while growth in recipient numbers contributed 33%, number of claims per-person 10%, and changes in treatment intensity (number of doses per-claim) 8%. Majority of spending growth for the two oldest Part B drugs in our primary analysis (abatacept and infliximab) was from price increases (81% and 72% of spending growth, respectively), whereas for the five newer drugs (golimumab, ustekinumab, tocilizumab, certolizumab, and belimumab), number of recipients was the main driver (63–81% of spending growth) (Figure). When rituximab was included, the five-year increase in Part B spending exceeded \$1.3 billion, with 64% from unit-price increases; 30% from numbers of recipients; and 6% from numbers of doses per-claim. Unlike abatacept, whose total spending increase was predominantly driven by the 79% increase in its unit price, infliximab and rituximab exhibited a different pattern, with modest increases in unit-price (20% and 18% respectively) but even smaller changes in dosage volume (6% increase for infliximab; 6% decrease for rituximab).

Medicaid Spending

As shown in Table S3, prices and total spending amounts were numerically lower under Medicaid than Medicare Part D, but temporal trends were similar. Controlling for changes in dosage volume, drug price increases were responsible for 36% of total spending growth (Figure).

DISCUSSION

This study of Medicare and Medicaid data indicates that spending on bDMARDs more than doubled between 2012 and 2016, reaching \$8.6 billion in 2016. Post-market drug-price increases alone (e.g., increases in the prices of drugs already being marketed) accounted for the majority of the increase in total annual spending (i.e., \$2.5 billion of the \$4.8 billion increase), after adjusting for changes in numbers of recipients and treatment intensity. Moreover, the drug price increases were more prominent in Medicare Part D than Part B. These detailed decomposition data suggest policy interventions targeting price increases, particularly under Part D plans, may help mitigate drug financial burdens for patients and taxpayers.

Drug spending growth could be attributable to a range of factors, each with different potential implications for the value of the spending and for the viability of policy interventions to mitigate the financial concerns. For example, bDMARD spending growth attributable to increases in recipient numbers could be desirable to the extent that it reflects better adherence to effective treatments or reductions in underuse. For drugs that gained new indications during the study period (e.g., ustekinumab for psoriatic arthritis), the increased number of recipients in part reflects patients switching from a therapy that may have been less effective or poorly tolerated to one from which they may have greater benefit. In other

scenarios (e.g., belimumab for systemic lupus), it reflects patients gaining access to biologic treatment for the first time. Alternatively, some growth in drug recipients could reflect overtreatment, e.g., early use of biologics when older, non-biologic DMARDs might offer greater value,(36) or even extension of treatment to those with more questionable indications

The prominent bDMARD drug cost increases observed in this study, which were substantially greater under Part D than Part B, even when accounting for rebates, represent a growing burden to taxpayers and beneficiaries. The magnitude of these increases is independent from any assessment of value. Our findings are consistent with recent reports on US wholesale drug expenditures where spending on adalimumab and etanercept increased by 180% and 61%, respectively, over 2012(37) to 2016.(12) Similarly, total spending and out-of-pocket costs for biologics increased among approximately 14,000 privately-insured rheumatoid arthritis (RA) patients in the US.(38) One might expect the price increases would be lower in Part D than Part B, given the ability to negotiate prices in Part D. However, these negotiations may not necessarily result in lower price increases since pharmacy benefit managers, who negotiate on behalf of Part D plans, retain a percentage of the negotiated rebates as compensation,(39) and higher list prices can achieve higher rebates. While these rebates accrue to insurance plans and pharmacy benefit managers,(40) they do not directly impact Part D beneficiaries' out-of-pocket costs, which are driven by pre-rebate (list) prices. Thus, many patients end up paying higher out-of-pocket costs when the list price increases, creating financial barriers to use and adherence.(41–43) Furthermore, this greater accumulation of out-of-pocket costs can also increase government spending(44) by pushing more beneficiaries into the catastrophic coverage phase, where Medicare itself pays 80% of prescription costs. As the patient cost-sharing burden for biologics tends to be greater under Part D,(45,46) ongoing shifts from Medicare Parts B to D could further exacerbate these concerns.

The recent introduction of biosimilars could foster more competition and lower prices in theory, but as of August 2019, only two of nine FDA-approved DMARD biosimilars (infliximab-dyyb and infliximab-abda) were marketed in the US. The DMARD markets also are potentially more complicated than basic theory might suggest. For example, adalimumab and etanercept, two of the earliest approved drugs to market, also experienced some of the largest relative price increases, even as the number of other approved bDMARDs increased.

A limitation of this analysis was our reliance on aggregated data, which were more current and standardized than raw data but prevented us from assessing trends in treatment indications as might be possible with individual-level data. The aggregated dataset, however, did include all bDMARD claims processed for the entire Medicare Part D and Part B fee-for-service populations (as opposed to the portions of data examined previously(41)) and allowed us to examine the spending trends overall and by component. While we could not incorporate proprietary data on individual drug-specific manufacturers' rebates, applying time-varying manufacturers' rebates of up to 30% did not meaningfully impact our findings. Furthermore, our rebate-adjusted findings expand on a recent analysis(47) showing little impact of incorporating manufacturers' rebates and other discounts for adalimumab and etanercept when assessing their price hikes over 2009–2015.

Fundamentally, there is a lack of transparency surrounding the rebates paid for specific drugs and even classes of drugs. While rebates for brand-name specialty drugs tend to be smaller than non-specialty drugs' on-the-whole (e.g., 10.5% vs. 28.4% of the list price in 2015),(33) this varies by class. Reports suggest rebates are higher for specialty drugs that are available from multiple manufacturers (e.g., insulin,(40,47) hepatitis C therapies(40)), where insurance plans have more negotiating power, than for specialty drugs with limited competition or those in protected classes like anti-neoplastics.(40,47,48) It is difficult to speculate about the rebates for bDMARDs, though a third-party analysis of selected bDMARDs(47) suggests they may be relatively low, with total price discounts for etanercept, abatacept, and adalimumab (inclusive of rebates, concessions given to wholesalers and distributors, and other discounts) averaging around 20%. As such, while rebate pass-through at the point of sale (or similar proposals wherein rebates are converted to discounts off the list price) may help lower out-of-pocket costs for patients prescribed highly-rebated medications,(40) those taking bDMARDs may reap fewer benefits. We echo notions that a multifaceted approach(40,49) is needed to control prescription drug spending and out-of-pocket costs, potentially one that eliminates specialty tiers,(50) changes how pharmacy benefit managers are compensated,(40) and increases pricing transparency.(49,50)

In conclusion, post-market drug-price changes alone accounted for the majority of recent multi-billion-dollar increases in bDMARD spending. Policy interventions that target price increases, particularly under Part D plans, may help mitigate drug financial burdens for taxpayers and elderly and disabled bDMARD recipients alike.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Component proportion of Biologic DMARD spending increases from 2012 to 2016, by public program

Figure:
Component proportion of Biologic DMARD spending increases from 2012 to 2016 (drugs ranked by 2016 spending), by public program

Table 1:
Annual Spending and Utilization for Biologic DMARDs Covered under Medicare Part D (drugs ranked by 2016 spending)

Biologic DMARD	Total Spending in 2016	Number of Recipients in 2016	Total Spending	Change from 2012			Drug Prices, Rebate-Adjusted ^d
				Total Spending, Rebate-Adjusted ^d	Number of Recipients	Number of Doses per Claim	
Adalimumab SC (injector pen)	\$1,638,715,583	48,164	261%	237%	80%	0%	84%
Etanercept SC	\$1,572,038,339	47,795	107%	93%	11%	-1%	88%
Adalimumab SC (pre-filled syringe)	\$490,135,622	15,477	107%	93%	11%	1%	84%
Ustekinumab SC	\$264,877,321	6,616	401%	367%	249%	4%	37%
Abatacept SC ^b	\$185,560,929	6,916	72%	66%	19%	-3%	31%
Certolizumab SC	\$160,787,675	5,903	172%	154%	61%	6%	51%
Golimumab SC	\$111,914,458	3,549	124%	109%	11%	18%	49%
Infliximab IV	\$68,074,955	2,407	110%	96%	37%	19%	20%
Tocilizumab (IV or SC) ^c	\$61,489,157	3,499	142%	134%	60%	-34%	100%
Abatacept IV	\$22,475,179	1,162	99%	85%	24%	-8%	54%
Anakinra SC	\$10,858,651	388	142%	126%	11%	11%	87%
Belimumab IV	\$8,612,441	388	385%	352%	304%	-10%	3%
Golimumab IV ^d	\$5,836,741	292	149%	141%	70%	-1%	17%
ALL	\$4,670,514,740	-	177%	159%	-	-	51%^e

DMARD=Disease-Modifying Anti-Rheumatic Drug; IV=intravenous/infusion formulation; SC=subcutaneous formulation

Percent-changes are five-year changes from year 2012, unless otherwise indicated.

^a Average annual rebate percentages were extrapolated from those reported by the Congressional Budget Office for brand-name specialty drugs for the years 2010 (2.6%) and 2015 (10.5%). Extrapolated annual percentages were 5.8% (2012), 7.3% (2013), 8.9% (2014), and 12.1% (2016).

^b Three-year changes in spending and dosage volume since no data were available for 2012 and limited data were available for 2013.

^c We report three-year changes in spending and dosage volume since the subcutaneous formulation of tocilizumab was not approved until October 2013.

^d We report three-year changes in spending and dosage volume since no data were available for the year 2012, and limited data were available for 2013 (year of FDA approval).

^e Median change across all bDMARDs covered under Part D.

Table 2:

Annual Spending and Utilization for Biologic DMARDs Covered under Medicare Part B Fee-for-Service (drugs ranked by 2016 spending)

Biologic DMARD	Total Spending in 2016	Number of Recipients in 2016	Total Spending	Change from 2012		Drug Prices
				Number of Recipients	Number of Doses per Claim	
Infliximab IV	\$1,338,726,191	58,397	27%	-2%	6%	20%
Abatacept (IV or SC)	\$586,532,893	22,879	104%	11%	0%	79%
Certolizumab SC^a	\$235,364,173	11,953	93%	60%	1%	8%
Golimumab IV^a	\$186,707,915	10,521	195%	144%	1%	0%
Tocilizumab IV	\$184,202,071	11,167	102%	56%	4%	8%
Belimumab IV	\$76,797,133	2,922	124%	84%	-6%	8%
Ustekinumab SC	\$46,408,889	1,752	379%	235%	10%	21%
ALL	\$2,654,874,949	-	80%	-	-	8% ^b

DMARD=Disease-Modifying Anti-Rheumatic Drug; IV=intravenous/infusion formulation; SC=subcutaneous formulation

Percent-changes are five-year changes from year 2012, unless otherwise indicated.

^aWe report three-year changes in spending and dosage volume since no data were available for the years 2012 and 2013.^bMedian change across all bDMARDs covered under Part B.