By Joshua D. Gottlieb, Adam Hale Shapiro, and Abe Dunn

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THE PRACTICE OF MEDICINE

The Complexity Of Billing And Paying For Physician Care

ABSTRACT The administrative costs of providing health insurance in the US are very high, but their determinants are poorly understood. We advance the nascent literature in this field by developing new measures of billing complexity for physician care across insurers and over time, and by estimating them using a large sample of detailed insurance "remittance data" for the period 2013–15. We found dramatic variation across different types of insurance. Fee-for-service Medicaid is the most challenging type of insurer to bill, with a claim denial rate that is 17.8 percentage points higher than that for fee-for-service Medicare. The denial rate for Medicaid managed care was 6 percentage points higher than that for fee-for-service Medicare, while the rate for private insurance appeared similar to that of Medicare Advantage. Based on conservative assumptions, we estimated that the health care sector deals with $11 billion in challenged revenue annually, but this number could be as high as $54 billion. These costs have significant implications for analyses of health insurance reforms.

Joshua D. Gottlieb (Joshua.Gottlieb@ubc.ca) is an associate professor in the Vancouver School of Economics, University of British Columbia, and a faculty research fellow at the National Bureau of Economic Research, in Cambridge, Massachusetts.

Adam Hale Shapiro is a research advisor at the Federal Reserve Bank of San Francisco, in California.

Abe Dunn is an assistant chief economist in the Office of the Chief Economist, Bureau of Economic Analysis, Department of Commerce, in Washington, D.C.

The United States spends a large share of its health care resources on administrative costs, with some authors estimating the share at 30 percent.[1] Another study estimated that administrative costs make up one-seventh of total health care spending in the US.[2] This far exceeds the share of administrative costs in other countries and drives widespread concern about the efficiency of US medical spending.[3] Administrative expenses take many forms, but one of the most prominent is the process of billing and paying for medical care. For example, hospitals generally have more billing specialists than beds.[4] Physician offices' spending on billing costs totals $30 billion per year.[5]

Relative to the size of these administrative costs, very little existing research has attempted to shed light on where they arise or how they vary across the US health care system, although the system's complexity has been shown to influence reimbursement structures.[6] In comparisons of overall health care spending between the United States and Canada, the largest source of the difference is administrative costs.[7] But the details of these costs remain opaque.[8]

A primary reason for this dearth of evidence is the limitations inherent in existing data sources. Although administrative claims data are excellent sources for measuring care provision, spending, and prices, they do not capture the full set of interactions between doctors and insurers. To measure billing complexity, a richer set of detail on billing interactions is needed. To examine the origins of administrative costs in the context of billing for physician visits, we used a novel data set with information on all interactions between a group of physician practices and insurers. This approach provided a level of detail not previously available in the literature.

The new data set allowed us to control for numerous detailed characteristics of a visit and

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the physician involved. Previous analyses, which generally relied on survey data,[9–11] could not attain this level of detail. The controls ensured that the differences we observed in billing complexity were not driven by variation in which practices tend to treat which types of patients. In contrast to payer-specific databases, our data contained billing information for multiple payers within the same physician practice. This allowed us to compare billing complexity across different payers interacting with the same physicians.

Study Data And Methods

OVERVIEW OF THE STUDY DESIGN Our study focused on outpatient visits to physicians. Our goals were to measure the complexity of billing for each patient encounter and to analyze the determinants of that complexity. It is well known that Medicare and Medicaid have substantially lower reimbursement rates for physicians than private payers do.[12–15] However, it is not known whether the public insurers compensate for those lower rates with simplified billing practices.

We used a new data set to construct novel measures of billing complexity. The data came from the IQVIA Real-World Data Adjudicated Claims (from IQVIA) and include information on physician visits in the period 2013–15. IQVIA collects all of the claims submitted and data on subsequent interactions between a sample of physicians and the insurers whom they billed. In contrast with standard claims sources, these data allowed us to observe physicians' requests for payment, insurers' responses to those requests, any resubmissions needed, and the ultimate settlement of the claim. Although extremely detailed, the data do not offer any way to determine whether the ultimate resolution of the claim was appropriate or inappropriate. Our analysis documents the complexity involved in resolving claims and the extent of the financial disputes, but it cannot determine whether physicians or insurers were correct in their requests and decisions.

The analysis sample consists of claims in five broad specialty categories: cardiology, internal and family medicine, obstetrics and gynecology, orthopedics, and pediatrics. To determine the representativeness of this sample, we built a comprehensive physician reference data set by combining data from private and public sources to capture information on all physicians practicing nationally in our five specialty categories. Details about this combined data set are presented in online appendix exhibit A1.[16] We then compared the characteristics of physicians in the IQVIA data with those of the physicians in the comprehensive physician reference data set. Specifically, we compared the numbers and ages of physicians in the relevant specialties, the specialty composition among the physicians, physicians' distribution across census regions, and the demographic characteristics of physicians' locations.

DATA DETAILS The IQVIA data sample is quite large. It contains information about nearly 90,000 physicians, representing about 27 percent of the physicians in the comprehensive national physician reference data set. Our main analysis sample included claims from the 68,000 physicians we observed in the 2015 IQVIA data. We found broad similarities across sources, including a similar mix of specialties, ZIP code median income, and share of the ZIP code population that was elderly. The only notable differences were that physicians in the IQVIA data were, on average, about three years older than those in the more comprehensive physician reference data set, and that the IQVIA data had a larger share of physicians in the South and a smaller share of them in the West. The differences were modest, so the IQVIA physician sample appeared to be quite representative of the broader physician population.

The IQVIA data specified the insurer to which each bill was submitted. We aggregated the detailed insurer codes into five categories: fee-for-service Medicare, Medicare Advantage (managed care), fee-for-service Medicaid, Medicaid managed care, and private. In appendix exhibit A2,[16] we separately consider claims processed by secondary insurers such as Medigap and Medicaid (for dual-eligible beneficiaries).

To use the most current data available, we relied exclusively on data for 2015 for most of our analyses. When we examined changes over time, we included the complete sample of data for 2013–15.

STUDY OVERSIGHT This study was approved by the Clinical Research Ethics Board at the University of British Columbia, with a waiver of informed consent requirements.

DEFINITION OF COMPLEXITY For each patient encounter (visit), we began by computing how much of the physician's fee was never paid during the billing process. We computed this in two ways—the amount challenged and the share challenged. These served as our primary measures for this study.

The amount challenged is the difference between the amount actually spent on a visit and the amount that would have been spent had the insurer paid the full negotiated amount for the service provided. To compute this amount, we first determined how much would have been paid for each visit if there had been no denials

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Despite the declines we found over time, the still-elevated level of billing complexity in Medicaid raises concern.

and every service had been paid for at the full negotiated amount. The full negotiated amount was reduced from the billed amount to reflect contractual adjustments (for example, those due to negotiated discounts), as these discounts are standard in all insurance contracts and do not represent billing difficulty. The amount challenged equals the total authorized revenue minus the amount ultimately paid.

The share challenged is the share of authorized revenue for a visit that was never paid. This is defined as the amount challenged divided by the full negotiated amount.

To understand where exactly the bill was challenged and where other difficulties arose in the billing process, we defined four measures of billing complexity; these served as our secondary measures.

The first measure is time to payment, or the number of days that elapsed from the date the first bill was submitted for a given underlying visit to the date the final bill for that visit was paid or denied.

The second measure is the number of interactions, or the number of additional times a bill was transmitted between the insurer and the physician for a given underlying visit, beyond the minimum of one transmission in each direction. This is measured using the number of unique claim keys per underlying visit. For example, consider a bill that is submitted and then rejected. Later a new claim is submitted, which the insurer accepts. This visit would have two additional interactions.

The third measure is claim denial, which is a dummy variable indicating that the insurer denied payment for that claim.

The fourth measure is nonpayment, which is a dummy variable for services (line items) when the doctor was not paid by either the patient or the insurer.

We analyzed some billing complexity measures (amount challenged per visit, share challenged, time to payment, and number of interactions) using means, and we analyzed claim denials and nonpayment using proportions.

STATISTICAL ANALYSIS Different physicians may treat different types of patients, who could have bills of different complexity. To account for these differences, we ran a multiple linear regression model. This model accounted simultaneously for insurance type, complexity of the bill submitted, and fixed effects for each physician. Our controls for complexity included the following variables that could complicate the billing process: the logarithm of the allowed charge (that is, the total amount expected by the provider for the services performed during a visit after negotiated discounts are accounted for), the number of claims, and the patient's Charlson Comorbidity Index score (a well-validated statistical predictor of mortality in various settings) and age. The last two variables captured differences in the complexity of the billing process that might arise from the patient's health. When analyzing differences within private insurance, we analyzed the five largest insurers separately and grouped all of the others together. (We considered the five largest insurers whether measured by market capitalization or total premiums.) All regressions were weighted by the allowed charge.

These multivariate regressions eliminated two types of potential confounders. First, if different physicians treated different types of patients, using physician-specific fixed effects to control for each physician would prevent these differences from influencing our estimates across insurers. Second, if different insurers served different types of patients, the insurers covering more complex patients might have more challenges in processing their patients' bills. For example, if Medicare patients were sicker than private patients, the same billing code could require more physician time or be more challenging. By controlling for the complexity of the visit, we eliminated that concern.

To analyze changes in complexity over time, we used the expanded sample of data for 2013–15. We separately modeled time trends for the five payer types to estimate changes over time for each type while controlling for physician identity and bill complexity.

ESTIMATING TOTAL CHALLENGED AMOUNTS To estimate the total amount challenged in billing processes nationwide, we extrapolated our estimates of amounts challenged to the entire US physician sector. We used data from the National Health Expenditure Accounts from the Centers for Medicare and Medicaid Services to determine the spending on physician and clinical services from each type of insurer.

We assumed that this spending reflected the

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original negotiated amount reduced by the share challenged that we estimated for that insurance type. That is, the total challenged amount is equal to the original amount minus the final spending observed in the National Health Expenditure Accounts.

Since we observed the National Health Expenditure Accounts spending, and our results provided an estimate of the share challenged, this relationship allowed us to back out the original spending amount and the aggregate dollars challenged. The specific calculation is described in detail on page 6 of the appendix.[16]

LIMITATIONS Our study had several limitations. First, our data included only claims from the physicians who participated in the data provider's collection process. In addition, only physicians in the five large specialties selected by the Bureau of Economic Analysis for the study were included. For these reasons, the data are potentially not representative nationally, but our controls helped address this concern. We have no reason to suspect that the differences across insurers outside of our sample would be different from the patterns we saw within our sample, once we controlled for the physician who submitted the bill.

Second, at a broader level, the data we studied were limited to one segment of administrative costs and applied exclusively to office visits. We did not observe other costs such as those of preauthorization requirements, which can require significant time and effort from physicians and insurers. Insurance also entails general administrative services, actuarial services, customer service, and marketing.[17] Our methods did not capture these costs.

Study Results

ESTIMATION SAMPLE We observed 37.2 million visits in 2015, for which 44.5 million claims were submitted. Collectively, these claims contained 99.4 million line items. Fee-for-service Medicare and private insurance each accounted for around 40 percent of the claims in our sample, with Medicare Advantage accounting for approximately another 15 percent. Our samples for both fee-for-service Medicaid and Medicaid managed care were much smaller, but we still observed over two million claims and over four million service lines in each of these insurer categories.

The summary statistics show stark differences across the five insurer categories in the measures of billing complexity (exhibit 1). Medicaid (both fee-for-service and managed care) had the highest billing complexity by far across the measures. The average share challenged was much higher

EXHIBIT 1

Billing complexity measures and control variables summary in IQVIA Real-World Data Adjudicated Claims, by insurer category

	Medicaid				Medicare					
	Fee-for-service		Managed care		Fee-for-service		Medicare Advantage		Private	
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SUMMARY STATISTICS BY VISIT										
Number of visits (thousands)	1,628		1,821		12,397		5,742		15,603	
Number of interactions	0.77	1.84	0.32	1.03	0.56	1.34	0.33	1.04	0.34	1.19
Share challenged	0.21	0.40	0.13	0.32	0.07	0.23	0.08	0.26	0.06	0.23
Amount challenged per visit	$18	$160	$22	$401	$21	$555	$19	$315	$21	$420
Time to payment (days)	39.2	56.8	26.5	43.8	18.9	29.7	14.3	30.6	13.7	26.7
Patient age (years)	29.0	24.3	26.1	22.9	72.2	10.9	73.4	9.3	35.6	20.5
Charlson Comorbidity Index score[a]	0.45	1.01	0.32	0.83	0.93	1.32	0.89	1.33	0.21	0.66
SUMMARY STATISTICS BY CLAIM										
Number of claims (thousands)	2,239		2,088		15,358		6,647		18,146	
Number of service lines per claim	1.67	2.94	1.73	3.74	1.63	3.66	1.68	3.11	1.70	2.58
Allowed amount	$98	$326	$132	$534	$189	$1,408	$172	$766	$216	$836
Claims denial (proportion)	0.22	0.41	0.10	0.30	0.03	0.18	0.04	0.18	0.04	0.20
SUMMARY STATISTICS BY LINE ITEM										
Number of line items (thousands)	5,014		4,795		34,441		14,799		40,326	
Nonpayment (proportion)	0.29	0.46	0.22	0.41	0.10	0.30	0.14	0.34	0.07	0.25
SUMMARY STATISTICS BY PHYSICIAN										
Number of physicians	14,186		19,162		33,029		44,889		42,327	
Number of claims per physician	158	423	109	316	465	936	148	376	429	866

SOURCE Authors' analysis of data for 2015 from the IQVIA Real-World Data Adjudicated Claims. **NOTES** Line items are services. FFS is fee for service. SD is standard deviation. [a]Higher numbers indicate greater risk of mortality.

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for Medicaid claims than for claims from any other category of insurer, although because of Medicaid's lower baseline reimbursement rates, the dollar value of the amount challenged per visit was similar to Medicare and private insurers. It took almost twice as long for a fee-for-service Medicaid claim to be processed and paid than it did for a fee-for-service Medicare claim. Medicaid claims had over three times the denial rate of Medicare claims.

We also observed notable differences in the characteristics of claims across insurer types. Medicare and private insurer claims included more service lines than Medicaid claims did, which indicated more complex visits among the former. Medicare patients were the oldest and had the most comorbidities. These differences emphasize the importance of including controls for patient characteristics and visit complexity in the following statistical analyses.

BILLING COMPLEXITY ACROSS INSURERS In exhibit 2, we compare measures of billing complexity across each insurance category in 2015, after adjusting the measures via the multivariate regressions described above. The full results of these estimates, including all of the control variables, are available in appendix exhibit A4.[16] We generally found that more complex bills, as measured by the number of service lines per claim, billed amounts, and patients' Charlson Comorbidity Index scores, tended to lead to higher administrative costs.

After controlling for these factors in the regression, we found that the share challenged across any insurance type was substantial, ranging from 6 percent for private insurers to 18 percent for fee-for-service Medicaid (exhibit 2). While some of these payment disputes are likely due to legitimate factors, such as fraudulent claims or insurers' utilization controls, the magnitude of the amount challenged clearly indicates that billing practices are important for physicians across all insurer types. Claims for fee-for-service Medicaid exhibited significantly more billing complexity than those for fee-for-service Medicare or private insurers. The share challenged in claims for fee-for-service Medicaid was 10.7 percentage points higher (95% confidence interval: 7.8, 13.6) compared with fee-for-service Medicare. However, since the overall potential payments were lower for Medicaid, the overall dollar amount challenged (shown in appendix exhibit A3)[16] is comparable, and statistically indistinguishable, across the different payers.

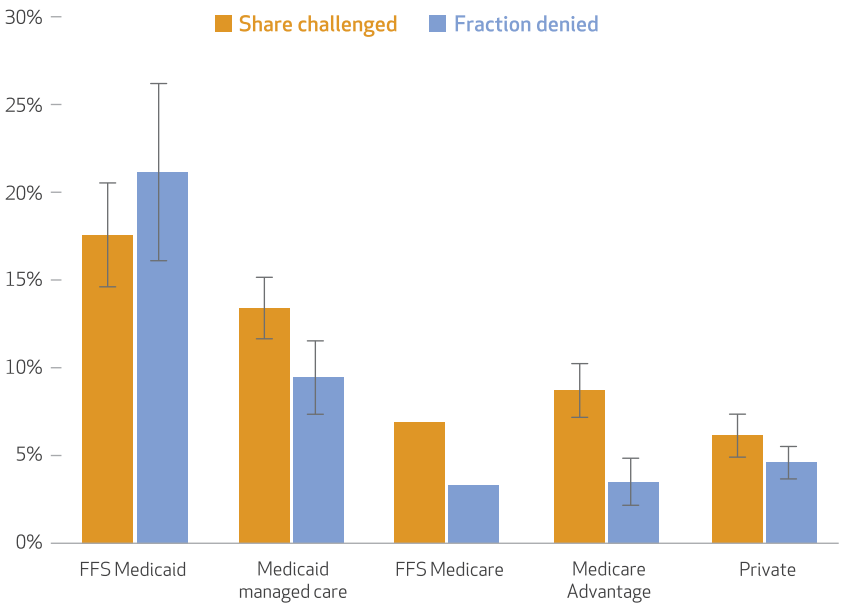
When we compared private insurers to fee-for-service Medicare, we found small or insignificant differences in billing complexity. For example, private insurance plans were 1.3 percentage points more likely to deny a claim (95% CI: 0.3, 2.3). Private insurers also paid 4.1 days faster (95% CI: 2.2, 5.9) (appendix exhibit A3).[16]

To understand why the share challenged in Medicaid claims was so high, we delved further into the different types of billing complexity. Exhibit 2 shows that fee-for-service Medicaid's denial rate was 17.8 percentage points above that of fee-for-service Medicare's (95% CI: 12.7, 22.8) and Medicaid managed care's denial rate was 6.1 percentage points above that of fee-for-service Medicare's (95% CI: 3.9, 8.3) Additional complexity measures are shown in appendix exhibit A3.[16] It took fee-for-service Medicaid 19.0 days longer to adjudicate claims than fee-for-service Medicare (95% CI: 12.9, 25.1) but required no additional interactions.

BILLING COMPLEXITY OVER TIME Our next analysis considered how billing complexity changed over time for each of the five insurance types, with physician and patient characteristics adjusted for. The time to payment for Medicaid managed care claims declined significantly from 2013 to 2015, from 72.7 to 36.6 days (exhibit 3). The time to payment for fee-for-service Medicaid claims also declined significantly, from 101.2 to 53.6 days.

EXHIBIT 2

Measures of billing complexity, by insurance type, with patient characteristics and physician identity controlled for



SOURCE Authors' analysis of data for 2015 from the IQVIA Real-World Data Adjudicated Claims. **NOTES** The exhibit shows two billing complexity measures for each category of insurance in 2015, adjusted for differences across physicians and differences in patient complexity. Details on these adjustments are discussed on pages 2 and 3 of the appendix (see note 16 in text). The error bars denote 95% confidence intervals, which tested for differences relative to fee-for-service (FFS) Medicare.

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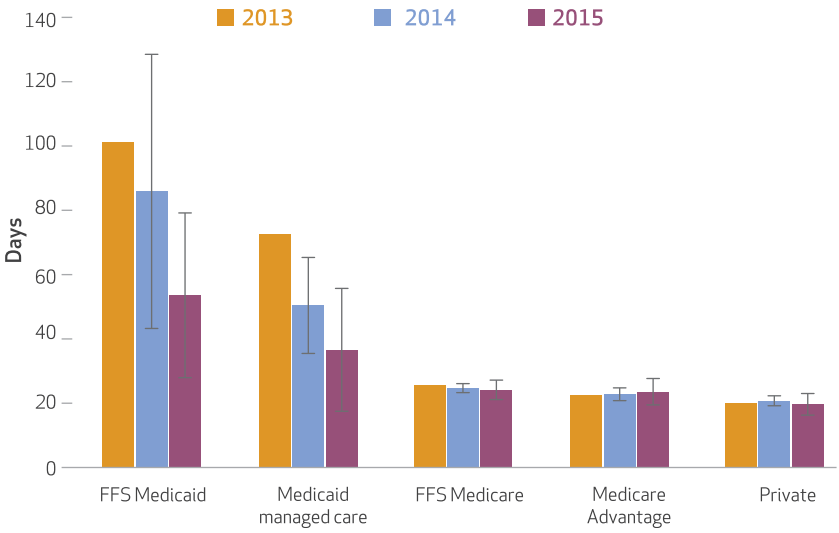
EXHIBIT 3

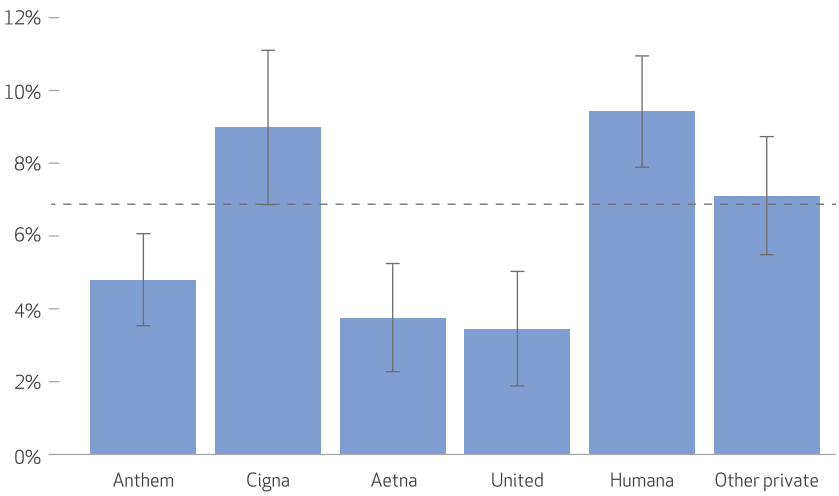
Changes in time to payment over time, by insurance type, with patient characteristics and physician identity controlled for



SOURCE Authors' analysis of data for 2015 from the IQVIA Real-World Data Adjudicated Claims. **NOTES** This exhibit shows the time to payment (in days) for each category of insurance from 2013 to 2015, adjusted for differences across physicians and differences in patient complexity. Details on these adjustments are discussed on page 4 of the appendix (see note 16 in text). The error bars denote 95% confidence intervals, which are shown for changes in 2014 and 2015 relative to the level in 2013.

EXHIBIT 4

Share challenged by private insurers, with patient characteristics and physician identity controlled for



SOURCE Authors' analysis of data for 2015 from the IQVIA Real-World Data Adjudicated Claims. **NOTES** This exhibit shows the share challenged by private insurers in 2015, adjusted for differences across physicians and differences in patient complexity. Details on these adjustments are discussed on page 4 of the appendix (see note 16 in text). As explained in the text, the five insurers shown are the five largest in the country; all other private insurers have been combined. The error bars denote 95% confidence intervals. The dashed horizontal line indicates the share challenged by fee-for-service Medicare, for comparison.

Graphs for our other measures appear in appendix exhibit A5.[16] Most notably, Medicaid managed care's share challenged declined from 26.2 percent in 2013 to 20.0 percent in 2015, and its denial rate fell from 17.1 percent to 8.9 percent. Private insurance had a modest decline in denial rates, from 5.6 percent to 3.9 percent. Denial rates in Medicare Advantage fell by a similar amount, from 4.2 percent to 3.0 percent, while the rates for fee-for-service Medicare stayed essentially flat over the study period.

BILLING COMPLEXITY ACROSS SPECIFIC INSURERS Next, we looked at the share challenged for individual insurers compared to fee-for-service Medicare (exhibit 4). As noted above, we show the results for the five largest insurers and group all of the remaining insurers together into the "other private" category. Of the five largest insurers, only Cigna and Humana had higher shares challenged than fee-for-service Medicare did. Cigna's share was 2.1 percentage points above that for fee-for-service Medicare (95% CI: −0.1, 4.3), while Humana's was 2.5 percentage points above (95% CI: 0.9, 4.1). Aetna, UnitedHealthcare, and Anthem had lower values than fee-for-service Medicare, with Anthem 2.1 percentage points lower (95% CI: 0.9, 3.3), Aetna 3.1 percentage points lower (95% CI: 1.5, 4.7) and UnitedHealthcare 3.4 percentage points lower (95% CI: 1.8, 5.0).

ESTIMATED NATIONAL AMOUNT CHALLENGED As explained above and described in greater detail on page 6 of the appendix,[16] we used the estimates of share challenged to determine that the contested amount nationally was $54 billion. If the share challenged were reduced to the minimum share that we observed in the data, the total challenged amount would be $11 billion lower. Although the challenged amount and administrative costs are different concepts, our estimates are similar in order of magnitude to previous estimates of administrative costs.[4,18,19] Our overall estimate of $54 billion is near the high end of those previous estimates.

To interpret this number, note that physicians might be able to recover some of these challenged payments by hiring additional personnel or upgrading billing technology. Presumably they would attempt to do this if it were worthwhile. Therefore, the administrative costs are likely to exceed the potential revenue, and our estimated amount challenged provides a strong indication that the administrative costs are very large.

Discussion

High administrative costs are often identified as a pronounced inefficiency of the complicated US

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Administrative costs have implications for health care beyond measurement.

health care system. This analysis focused on a central part of administrative costs that is common across providers and insurance types—claims processing and billing. Using a unique data source, we presented some of the first data to directly compare proxies for the complexity of billing for physician services across insurance providers and over time, while controlling for physician and patient characteristics. We found substantial variation across public and private payers.

Although administrative costs are an essential input in overall health care production, the significantly lower complexity we observed for fee-for-service Medicare billing relative to fee-for-service Medicaid billing indicates that there may be ways for Medicaid to reduce its billing complexity and associated costs. In turn, such reforms might increase physicians' propensity to accept public insurance[20] and use public health care resources more efficiently.[1–3]

Despite the declines we found over time, the still-elevated level of billing complexity in Medicaid raises concern. Medicaid pays physicians lower reimbursements than other insurers do.[13,14] In combination with these lower reimbursements, a higher billing complexity—whether arising from stricter documentation requirements or another cause—could make it especially costly for physicians to treat Medicaid patients. If Medicaid billing complexity remained relatively high, it could reduce Medicaid patients' access to physicians.[20] Improvements in this area could ultimately be beneficial for physicians, insurers, and patients.

This work has significant implications for a range of other national policy discussions. First, improved measurement of administrative costs could affect antitrust policy. Because of the associated administrative costs, physicians care about billing complexity when contracting with insurers.[20] Insurers in turn may set nonprice elements of their physician interactions—such as billing complexity—based on market conditions, just as they do with reimbursement rates.[12] With the data and methods we have introduced, analysts and policy makers can begin to evaluate this possibility and incorporate nonprice aspects of insurer-physician contracts into merger analyses.

Second, administrative costs may have a substantial impact on researchers' understanding of productivity in the health care sector. Some amount of administrative cost is undoubtedly warranted: Billing processes are intended to detect fraud and inappropriate utilization. But our time-series evidence indicated that insurers can and do reduce billing complexity. The improvement in billing speed over time suggests that the US health care system may yet be able to improve its administrative efficiency. These types of improvements might not be captured by traditional measures of productivity. Additional research is needed to determine how changes in billing complexity affect measured productivity in the health care sector.

Administrative costs have implications for health care beyond measurement. When billing complexity declines, both physicians and patients stand to benefit. Time that physicians don't spend on administration could instead be used to treat more patients or extend the length of visits, ultimately increasing the productivity of physician care. Easier billing processes reduce staffing needs and billing expenses, which could raise physicians' incomes or free up resources for patient care. Savings that accrued to insurers could be used to reduce premiums. Using the methods and data we introduced, future analyses will be able to determine whether the benefits that the current billing system provides justify the resources it requires.

Elements such as sales and marketing are a more fundamental requirement of private insurance, compared to public insurance—a difference that has led previous analysts to conclude that public plans have an advantage in reducing administrative costs.[21] Our results indicate that this is not the complete picture, and that public insurance can involve significant administrative costs as well. Acknowledgment of these costs, and ongoing efforts to quantify them, will be essential to future health care reforms, especially those that envision a growing role for the public sector. ■

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