Outsourcing the Revenue Cycle: Effects on Hospital Coding, Reimbursement, and Finances

Joseph Dov Bruch[1], Cal Chengqi Fang[2], Ashvin D. Gandhi[3]

[1]Division of Health Policy and Economics, Weill Cornell Medicine
[2]Department of Public Health Sciences, University of Chicago
[3]University of California, Los Angeles, Anderson School of Management

Extended abstract prepared for
the NBER Conference on Assessing the US Medical Innovation System (February 5, 2027).

Abstract Revenue cycle management (RCM) firms increasingly handle billing, coding, prior authorization, and collections for U.S. nonprofit hospitals. We examine whether outsourcing these functions improves hospital financial performance and whether it translates into higher Medicare reimbursement through more intensive diagnosis coding. We link IRS Form 990 contractor disclosures to Medicare Cost Reports and 100% Medicare fee-for-service claims from 2009 to 2023, identifying 515 RCM adopters and 1,411 hospitals that never contracted with RCM. RCM contracting expanded substantially, reaching 36.6% of nonprofit hospitals by 2023, up from 6.6% in 2009. Using a staggered difference-in-differences design, we find that, following adoption, hospitals experienced a significant decline in accounts receivable, but we found no statistically significant changes in net patient revenue or operating margins. Among Medicare admissions, RCM adoption was associated with an increased probability of assignment to the highest-severity diagnosis-related group tier for pneumonia and stroke, as well as higher covered charges for acute myocardial infarction and pneumonia. However, Medicare payments did not significantly increase for any of the three conditions. These findings suggest that RCM outsourcing may improve receivables management and increase diagnosis-coding intensity without generating measurable gains in hospital financial performance or realized Medicare reimbursement. As RCM vendors expand their use of AI-based coding tools, whether these patterns persist remains an important question for hospitals and policymakers.

Keywords Hospital outsourcing; coding; reimbursement.

JEL Codes I11, I13, L24, L31

Introduction

Alongside clinical advances, U.S. health care has seen substantial administrative innovation: technologies and business models that change how care is documented, coded, and billed. Revenue cycle management (RCM) is a leading example. As insurance claims processing has grown more complex, many hospitals have outsourced some or all of their billing, coding, prior authorization, and collections to specialized RCM firms, which combine coding software, analytics, and dedicated staff. RCM firms are also beginning to incorporate AI into these functions, marketing automated coding and claims tools as a way to increase revenue and reduce administrative costs.

Whether such administrative innovation creates value or mainly shifts payments is an open question. The upcoding literature shows that hospitals respond to payment incentives through diagnosis coding (Dafny 2005; Silverman and Skinner 2004; Crespin et al. 2024), and that revenue-generating documentation practices spread unevenly across hospitals (Sacarny 2018). Adler-Milstein and Jha (2014) found no evidence that EHR adoption raised Medicare reimbursement. However, none of this work isolates the role of external vendors that increasingly perform these coding and billing functions on hospitals' behalf.

We provide, to our knowledge, the first large-scale empirical analysis of RCM outsourcing's effects on hospital finances and coding behavior. We ask whether RCM adoption improves hospital financial performance and whether changes in coding intensity translate into higher Medicare reimbursement. Our study examines RCM outsourcing before the broader deployment of AI-based coding tools, providing a benchmark for assessing whether the next generation of these technologies changes the relationship between coding intensity and the reimbursement hospitals actually receive.

Methods

We combine three data sources spanning 2009–2023: **IRS Form 990 filings.** All nonprofit entities disclose their five highest-compensated external contractors paid more than $100,000 annually, including a description of services rendered. We match these disclosures to S&P Capital IQ firm records via a supervised record-linkage model to identify RCM contractors. **Medicare Cost Reports.** Hospital-level financial and operational measures, including bad debt expense, accounts receivable, net patient revenue, operating margin, Medicare case mix index, and the Medicare inpatient cost-to-charge ratio. **Medicare Claims (MedPAR/MBSF).** 100% Medicare fee-for-service hospitalization records, used to construct claim-level measures of Major Complication and Comorbidity (MCC) DRG coding, covered charges, and Medicare payment for **pneumonia, AMI, stroke** admissions, with patient-level risk adjustment via age, sex, race/ethnicity, dual-eligibility status, and Charlson-Elixhauser comorbidity score.

The sample constitutes 2,257 nonprofit hospital systems identified from Form 990; 1,926 hospitals in the analytic sample (1:1 EIN–CCN match); 515 RCM adopters vs. 1,411 never-adopters.

We define treatment timing as the first calendar year in which a hospital reports an RCM firm among its five highest-compensated independent contractors, each paid more than $100,000, in its Form 990 filing. This measure captures the first observed RCM engagement that meets these reporting criteria, rather than the first RCM engagement of any size. It also does not distinguish between full and partial outsourcing of revenue cycle functions. We estimate group-time average treatment effects using the Callaway and Sant'Anna (2021) estimator, with never-adopting hospitals as the comparison group, avoiding the contamination concerns regarding TWFE estimation (Goodman-Bacon 2021). Identification relies on the parallel-trends assumption: that adopting and never-adopting hospitals would have followed similar outcome trends absent RCM adoption. We assess this directly with pre-treatment event-study estimates and report dynamic treatment effects over an event window of -4 to +4 years relative to adoption, with a universal base period at the year before adoption.

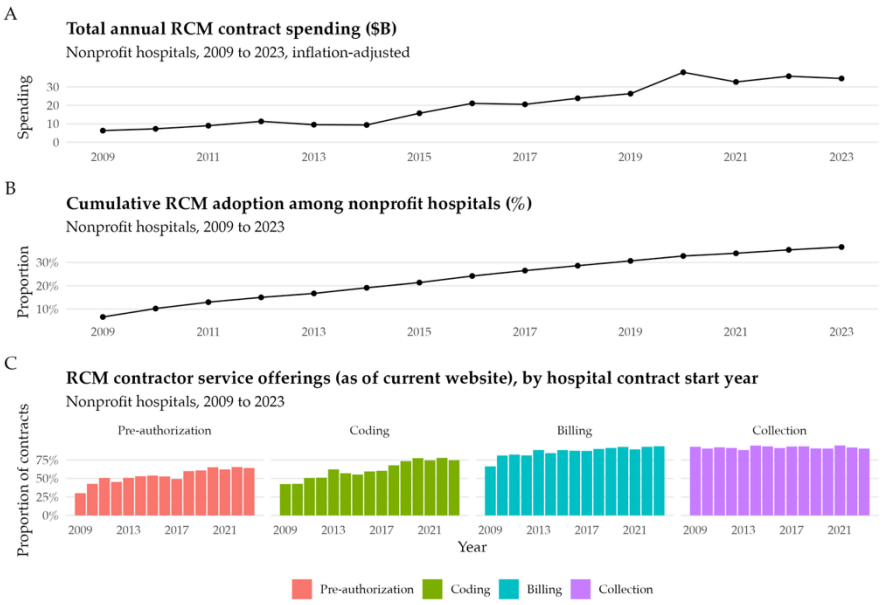
For hospital-level outcomes, we estimate models without covariates. All monetary outcomes are normalized by each hospital's licensed bed count as reported in 2019. For admission-level outcomes, we adjust for patient age, sex, race/ethnicity, dual-eligibility status, and Charlson-Elixhauser comorbidity score from pre-admission diagnoses. MCC-tier DRG assignment is modeled with a linear probability model; covered charges and Medicare payment are estimated on the log scale. Standard errors are clustered at the hospital level.

In robustness checks, we include hospitals that share a Form 990 filing with other hospitals (all EINs), estimate a matched stacked difference-in-differences design, and use the Sun and Abraham (2021) estimator. For admission-level outcomes, we also estimate a differential distance IV design.

Findings

Total annual RCM contract spending among nonprofit hospitals rose from approximately $6.3 billion in 2009 to $34.6 billion in 2023, constituting an over fivefold increase after inflation adjustment (Figure 1). Growth was relatively gradual through 2014, accelerated sharply after 2015, peaked in 2020, and remained near that level through 2023. By 2023, around 36.6% of nonprofit hospitals had contracted with at least one RCM firm, up from 6.6% in 2009. Billing and collections were offered by the contractors in nearly all contracts throughout the period. The mix of vendors hospitals hired, however, shifted toward firms offering a broader range of revenue cycle services: the share of contracts with a contractor that currently offers coding rose from 42.5% in 2009 to 74.5% in 2023, and the share with one that currently offers pre-authorization rose from 30.1% to 64.2%.

Figure 1. Growth and composition of RCM contracting among nonprofit hospitals, 2009–2023.



Notes: Service offerings are based on each contractor's current website and may not reflect the services provided under a given contract or in that year.

Hospitals contracting with RCM firms were more likely to be larger hospitals but less likely to be chain-affiliated (Table 1). These hospitals also carried significantly higher bad debt expense (median: $4.0 million vs $2.1 million, P<0.001) and had lower operating margin (median: 2.7% vs 3.9%, P<0.001).

After RCM adoption, patient-attributable bad debt declined slightly (−3.73 thousand dollars per bed; P=0.11) though such decline is not statistically significant (Figure 2). Accounts receivable declined significantly (−11.52 thousand dollars per bed; P=0.04) after outsourcing. However, net patient revenue (−35.62 thousand dollars per bed; P=0.20), gross patient revenue (−100.00 thousand dollars per bed; P=0.25), and operating margin (0.01; P=0.21) did not significantly improve.

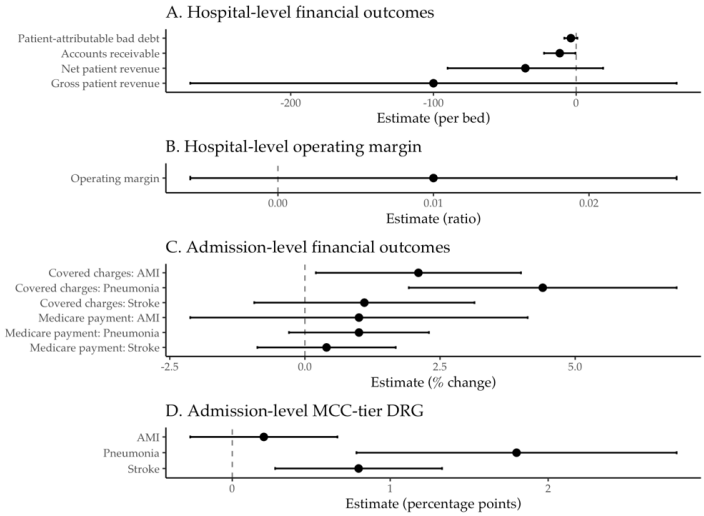
Table 1. Baseline characteristics of nonprofit hospitals by Revenue Cycle Management adoption status.

Characteristic	Level	RCM-adopting hospitals (N = 505)	Never-adopting hospitals (N = 1192)	P-value
Bed size (%)	>350	50 (10.0)	103 (8.7)	<0.001
	151–350	150 (29.9)	244 (20.6)	
	0–150	302 (60.2)	835 (70.6)	
Teaching status (%)	Major	61 (12.2)	105 (8.9)	0.063
	Minor	81 (16.1)	173 (14.6)	
	Non-teaching	360 (71.7)	907 (76.5)	
Chain-affiliated (%)		144 (28.5)	485 (40.7)	<0.001
Urban (%)		301 (59.6)	659 (55.3)	0.112
Bad debt expense ($M, median [IQR])		3.96 [1.62, 8.82]	2.14 [0.76, 5.59]	<0.001
Operating margin (%, median [IQR])		2.73 [-1.56, 6.77]	3.88 [-0.13, 8.73]	<0.001

Notes: RCM, revenue cycle management. Estimates are numbers of hospitals that fall into the category and the corresponding proportion, except for bad debt expense and operating margin, which are reported as median and interquartile range. P-values for continuous variables use the Wilcoxon rank-sum test; p-values for categorical variables use the chi-squared test. Some hospitals are missing the data at event time -1, so the sum of sample sizes does not match the total sample size.

Among Medicare fee-for-service beneficiaries admitted for AMI, pneumonia, or stroke at hospitals that adopted RCM outsourcing, the probability of receiving an MCC-tier DRG increased significantly for pneumonia (1.8 pp; P<0.001) and stroke (0.8 pp; P=0.003), but not for AMI (0.2 pp; P=0.40). Covered charge amounts increased significantly for AMI (2.1%; P=0.03) and pneumonia (4.4%; P<0.001), but not for stroke (1.1%; P=0.29). However, Medicare payment amount showed no change for any condition (AMI: 1.0%, P=0.53; pneumonia: 1.0%, P=0.13; stroke: 0.4%, P=0.54).

Figure 2. Estimated effects of revenue cycle management outsourcing on hospital-level and admission-level outcomes



Notes: MCC, major complication or comorbidity; DRG, diagnosis-related group. Point estimates are average treatment effects on the treated from the Callaway and Sant'Anna (2021) staggered difference-in-differences estimator, using never-adopting hospitals as the comparison group and the year before adoption as the base period. Horizontal bars show 95% confidence intervals based on standard errors clustered at the hospital level. Panels A–B report hospital-level outcomes from Form 990 and Medicare Cost Reports, 2009–2023, without covariates. Monetary outcomes are in thousands of 2023 dollars per licensed bed (2019 bed count). Operating margin is a ratio; 0.01 is 1 percentage point. Panels C–D report admission-level outcomes for Medicare fee-for-service admissions for acute myocardial infarction (AMI), pneumonia, and stroke, 2009–2023. Models adjust for patient age, sex, race/ethnicity, dual-eligibility status, and Charlson–Elixhauser comorbidity score constructed from pre-admission diagnoses. Covered charges and Medicare payment are estimated in logs and reported as percent changes 100 × β. MCC-tier DRG assignment is estimated with a linear probability model and reported in percentage points.

Conclusions

Following RCM adoption, hospitals experienced a decline in accounts receivable, but we found no statistically significant changes in net patient revenue or operating margin. RCM adoption also raised diagnosis-coding intensity for pneumonia and stroke without a corresponding increase in realized Medicare payment. It is possible that claims review and DRG validation may be limiting the financial return to coding-intensity changes, though our analysis cannot confirm this hypothesis. This pattern is relevant given RCM vendors' pivot to AI-based coding tools (all of the largest vendors in our sample had launched such products by October 2026): our estimates describe the return to a software-assisted predecessor technology, and whether the same effect holds as AI changes the scale of coding effort remains an open question.

Our study has several limitations. First, because Form 990 reports only the five highest-compensated contractors, some hospitals classified as never-adopters may have held smaller RCM contracts, while some adopters may have engaged an RCM firm before the contract became reportable. These forms of misclassification may attenuate estimated effects. Second, our estimates average across contracts covering a range of services, from collections to end-to-end revenue cycle outsourcing. The null financial effects may mask heterogeneity by contract scope.

Taken together, our findings suggest that RCM outsourcing is associated with improvements in receivables management and greater diagnosis-coding intensity, but we find little evidence that these changes translate into higher hospital revenues, operating margins, or Medicare payments. These estimates should be interpreted with caution, as our data may miss smaller RCM engagements. Moreover, average effects may mask differences across contracts depending on which revenue cycle functions hospitals outsource. As RCM vendors expand their use of AI-based coding tools, future research should examine whether these technologies change the relationship between coding intensity and realized reimbursement. This distinction matters for hospitals evaluating the returns to RCM contracts and for policymakers assessing the implications of increasingly automated coding for billing integrity.

References

Adler-Milstein, Julia, and Ashish K. Jha. 2014. "No Evidence Found That Hospitals Are Using New Electronic Health Records to Increase Medicare Reimbursements." *Health Affairs* (Project Hope) 33 (7): 1271–77. https://doi.org/10.1377/hlthaff.2014.0023.

Callaway, Brantly, and Pedro H. C. Sant'Anna. 2021. "Difference-in-Differences with Multiple Time Periods." *Journal of Econometrics*, Themed Issue: Treatment Effect 1, vol. 225 (2): 200–230. https://doi.org/10.1016/j.jeconom.2020.12.001.

Crespin, Daniel, Michael Dworsky, Jonathan Levin, Teague Ruder, and Christopher M. Whaley. 2024. "Upcoding Linked To Up To Two-Thirds Of Growth In Highest-Intensity Hospital Discharges In 5 States, 2011–19." *Health Affairs* 43 (12): 1619–27. https://doi.org/10.1377/hlthaff.2024.00596.

Dafny, Leemore S. 2005. "How Do Hospitals Respond to Price Changes?" *American Economic Review* 95 (5): 1525–47. https://doi.org/10.1257/000282805775014236.

Goodman-Bacon, Andrew. 2021. "Difference-in-Differences with Variation in Treatment Timing." *Journal of Econometrics*, Themed Issue: Treatment Effect 1, vol. 225 (2): 254–77. https://doi.org/10.1016/j.jeconom.2021.03.014.

Sacarny, Adam. 2018. “Adoption and Learning Across Hospitals: The Case of a Revenue-Generating Practice.” *Journal of Health Economics* 60 (July): 142–64. https://doi.org/10.1016/j.jhealeco.2018.06.005.

Silverman, Elaine, and Jonathan Skinner. 2004. “Medicare Upcoding and Hospital Ownership.” *Journal of Health Economics* 23 (2): 369–89. https://doi.org/10.1016/j.jhealeco.2003.09.007.

Sun, Liyang, and Sarah Abraham. 2021. “Estimating Dynamic Treatment Effects in Event Studies with Heterogeneous Treatment Effects.” *Journal of Econometrics*, Themed Issue: Treatment Effect 1, vol. 225 (2): 175–99. https://doi.org/10.1016/j.jeconom.2020.09.006.