

DANIEL J. CRESPIN, VIRGINIA ZHANG

Inpatient Hospital Upcoding in California Among Fully Insured Commercial and Medicare Advantage Stays Between 2018 and 2023

This research was sponsored by the California Health Care Foundation.

Research Report

This publication has completed RAND's research quality-assurance process but was not professionally copyedited.

For more information on this publication, visit **www.rand.org/t/RRA5012-1**.

About RAND

RAND is a research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier and more prosperous. RAND is nonprofit, nonpartisan, and committed to the public interest. To learn more about RAND, visit www.rand.org.

Research Integrity

Our research integrity is grounded in RAND's core values of quality and objectivity. Rigorous quality assurance procedures, conflict of interest screening, and transparency in funding ensure that every study is objective and nonpartisan. Learn more at www.rand.org/integrity.

RAND's publications do not necessarily reflect the opinions of its research clients and sponsors.

Published by the RAND Corporation, Santa Monica, Calif.
© 2026 RAND Corporation
RAND® is a registered trademark.

Limited Print and Electronic Distribution Rights

This publication and trademark(s) contained herein are protected by law. This representation of RAND intellectual property is provided for noncommercial use only. Unauthorized posting of this publication online is prohibited; linking directly to its webpage on rand.org is encouraged. Permission is required from RAND to reproduce, or reuse in another form, any of its research products for commercial purposes. For information on reprint and reuse permissions, visit www.rand.org/about/publishing/permissions.

RR-A5012-1

About This Report

This report examines recent trends in hospital billing practices in California, focusing on the use of Medicare Severity Diagnosis Related Groups (MS-DRGs) to classify inpatient stays for enrollees of Medicare Advantage (MA) and fully insured commercial health plans. Using data from the California Health Care Payments Database (HPD) covering fiscal years 2018 to 2023, the study analyzes the growth of upcoding—assigning patients to higher-severity MS-DRGs—and its impact on hospital payments and patient out-of-pocket spending. The findings indicate that a portion of the increase in high-severity coding among commercial stays is not explained by changes in patient demographics or pre-existing health conditions, which suggests that there was an increase in upcoding that contributed to higher hospital payments. These findings underscore the need for policy action and enhanced oversight. However, the findings suggest that it is unlikely that upcoding led to an increase in high-severity coding among MA stays.

RAND Health

This work was conducted within the Financing and Organization Program in RAND Health, a division of RAND, which promotes healthier societies by improving health care systems in the United States and other countries. We do this by providing health care decisionmakers, practitioners, and consumers with actionable, rigorous, objective evidence to support their most complex decisions. For more information, visit www.rand.org/health or contact Health@rand.org.

Funding

This research was funded by the California Health Care Foundation.

Acknowledgments

We gratefully acknowledge the support and assistance of Michael Dworsky, Melony Sorbero, Christine Eibner, and Peter Hussey for their thoughtful reviews of this work.

Summary

Background

Hospital inpatient stays are typically reimbursed using Medicare Severity Diagnosis Related Groups (MS-DRGs), which tie payments to the clinical complexity of each stay. This system can create incentives for hospitals to systematically assign patients to higher-severity MS-DRGs—a practice known as *upcoding*—to increase reimbursement, for example by adding fraudulent secondary diagnoses or by increasing coding intensity of clinically supported diagnoses that have historically gone undocumented.[1] While the latter results in more accurate coding, it also leads to higher payments to hospitals and potential payment inefficiencies, especially if higher-severity MS-DRGs are assigned to healthier patients than when payment rates were established.

One study implies that MS-DRG upcoding accounted for a 2 percent increase in nationwide hospital payments in 2019 relative to 2011, although we are unaware of studies specific to California (Crespin et al., 2024). Upcoding may be a driver of recent growth in hospital care spending in California, where hospital expenditures rose nearly 30 percent from 2018 to 2023 (Wilson, 2023). Upcoding may financially impact patients through higher cost-sharing because MS-DRGs with higher severity levels have higher prices (i.e., allowed amounts). This can result in higher out-of-pocket (OOP) spending if the patient has not yet reached their deductible or has coinsurance for hospital services. Understanding the extent and impacts of upcoding can support policymakers seeking to control costs and protect patients from financial burdens.

Study Approach

This study analyzed trends in upcoding among fully insured commercial and Medicare Advantage (MA) hospital inpatient stays in California from federal fiscal year (FY) 2018 to FY2023 using data from the California Health Care Payments Database (HPD). The analysis focused on assignment to the highest-severity MS-DRGs. It examined whether increases in the highest-severity MS-DRGs can be explained by changes in patient demographics and health at admission, or whether they likely reflect upcoding because their use diverges from historical associations between severity levels and patient characteristics. Following previous academic studies, we defined upcoding as a combination of fraudulent and non-fraudulent coding intensity, without distinguishing between them (Crespin et al., 2024; Cook and Averett, 2020; Dafny, 2005).

[1] This report uses a broad definition of *upcoding* that includes fraudulent and non-fraudulent coding. This definition is often used in academic studies, and we acknowledge that federal agencies and some academic studies limit the definition of *upcoding* to fraudulent coding.

We predicted the probability of a stay being assigned to the highest-severity MS-DRG based on FY2018 coding patterns, controlling for patient characteristics, health at the time of admission, payer type, and hospital characteristics. The difference between observed and predicted rates of the highest-severity MS-DRGs in subsequent years is interpreted as an upper bound on the growth of upcoded stays. The study also assessed whether upcoding was smaller at vertically integrated hospitals by examining variation in upcoding growth between stays that occurred within hospitals of the Kaiser Permanente health system, California's dominant system and insurer, and other hospitals. Additionally, the study assessed whether upcoding was greater at hospitals with higher commercial prices. Lastly, we examined whether upcoding disproportionately impacted patients residing in lower-income areas and estimated the relationship between upcoding and OOP spending.

Key Findings

Growth in MS-DRG Upcoding

- The share of commercial hospital inpatient stays assigned to the highest-severity MS-DRG increased from 24.7 percent in FY2018 to 31.1 percent in FY2023. Sixty-one percent of this increase was explained by changes in patient health and demographics, which suggests that up to 39 percent of the increase could be associated with upcoding.
- Nearly all (95 percent) of potential upcoding growth was concentrated in just 15 high-volume base MS-DRGs, with Heart Failure and Shock having the largest increase.
- For MA inpatient stays, there was no robust evidence that upcoding contributed to the growth of high-severity MS-DRGs. However, there was significant growth in upcoding for a subset of high-volume base MS-DRGs.
- We conducted several sensitivity analyses to test the robustness of our results, in particular because of the potential for the coronavirus disease 2019 (COVID-19) public health emergency (PHE) to affect patient health in ways that were unobserved in our model. The results were robust to the exclusion of all stays among patients who had any inpatient stay with a COVID-19 diagnosis. Furthermore, to determine if unobserved temporal changes in patient health biased our results, we conducted a sensitivity analysis that used the prior year as the baseline for each analyzed year (rather than FY2018 for all years) and found the results were robust to this specification.

Impact of Upcoding on Hospital Payments

- For commercial inpatient stays, upcoding was associated with up to a 1.0 percent (95 percent confidence interval [CI]: 0.6–1.4 percent) increase in MS-DRG payment weights in FY2023. Applying this increase to all commercial stays in California (including self-funded plans) translates to up to $535 million in additional payments to hospitals in FY2023 relative to FY2018. We found no overall significant impact of upcoding on payments to hospitals from MA plans.

Upcoding at Kaiser and Non-Kaiser Hospitals

- The overall growth in potential upcoding for commercial hospital stays was isolated to non-Kaiser hospitals, for which an additional 3.6 percent (95 percent CI: 2.6–4.7 percent) of stays were upcoded in FY2023 compared to FY2018. There was no statistically significant growth in upcoding at Kaiser hospitals.
- These results suggest that upcoding mainly occurred at hospitals that are not vertically integrated. Non-integrated hospitals likely have a greater incentive to upcode, as their payments primarily come from outside their organization, while vertically integrated hospitals frequently receive payment from their organization's own premium revenue.

Patient Affordability

- Upcoding was likely associated with higher OOP spending for MA stays. MA patients with a low probability of being coded to the highest-severity MS-DRG had higher OOP spending when they were coded to the highest severity level. For MA stays that had a less than 50 percent probability of being coded to the highest-severity MS-DRG but that were coded to the highest severity, OOP spending was higher for four of the top five base MS-DRGs (as ranked by volume of upcoded stays). OOP spending was $121 (95 percent CI: $81–$160) higher for Heart Failure and Shock stays, which was the most upcoded base MS-DRG. We found no significant impact of upcoding on OOP spending for commercial stays.
- The increase in MA OOP spending represents roughly a 45 percent rise compared to the average MA stay in FY2023 ($227). Because dually eligible MA enrollees often face limited OOP responsibility, these impacts primarily accrue to the non–dually eligible.
- For MA stays, there was higher growth in upcoding for patients residing in the lowest-income quartile of ZIP codes. These ZIP codes likely included larger percentages of MA enrollees who were dually eligible than other ZIP codes, which could result in a financial impact on California's Medicaid program. We did not find significant differences in upcoding by ZIP code income for commercial stays.

Conclusions

The findings suggest that upcoding likely contributed to increases in California hospital payments for commercial stays and that upcoding may financially impact MA patients. The concentration of upcoding in a small number of MS-DRGs and among lower-income populations highlights the need for targeted oversight and policy intervention, which could include enhanced auditing and monitoring of high-risk MS-DRGs and hospitals. These actions could align incentives and reduce the financial rewards of upcoding.

Contents

About This Report iii
Summary iv
Figures and Tables viii
Chapter 1. Introduction 1
Chapter 2. Approach 3
Medicare Severity Diagnosis Related Groups 3
Analytic Sample 3
Analysis 5
Chapter 3. Findings 11
Increase in Highest-Severity MS-DRGs 11
Growth in MS-DRG Upcoding 12
Chapter 4. Discussion 23
Growth in Upcoding and Impacts on Hospital Payments 23
Patient Out-of-Pocket Spending 24
Limitations 25
Conclusion 26
Appendix A. Technical Appendix 27
Section 1. Analytic Sample Construction 27
Section 2. Elixhauser Comorbidity Risk of 30-Day Readmission Index 34
Section 3. Regression Specification and Bootstrapped Confidence Intervals 35
Appendix B. Supporting Findings 37
Abbreviations 44
References 45

Figures and Tables

Figures

Figure 2.1. Example of MS-DRG Severity Levels....3
Figure 3.1. Hospital Stays with and without the Highest-Severity MS-DRG and Length of Stay for All Stays....11
Figure 3.2. Upcoded Hospital Stays as a Percentage of All Hospital Stays Relative to FY2018 .13
Figure 3.3. Increase in Upcoded Hospital Stays as a Percentage of All Stays for the Top 15 Base MS-DRGs, FY2023 Relative to FY2018 15
Figure 3.4. Commercial and MA Upcoded Hospital Stays by Base MS-DRG, FY2023 Relative to FY2018 16
Figure 3.5. Increase in MS-DRG Payment Weights Attributed to Growth in Upcoding Relative to FY2018 17
Figure 3.6. Upcoded Hospital Stays as a Percentage of All Hospital Stays at Kaiser and Non-Kaiser Hospitals, FY2023 Relative to FY2018 18
Figure 3.7. Increase in Upcoded Hospital Stays as a Percentage of All Stays by Average Commercial Price, FY2023 Relative to FY2018 19
Figure 3.8. Upcoded Hospital Stays as a Percentage of All Hospital Stays by Household Income, FY2023 Relative to FY2018 20
Figure 3.9. Impact of Upcoding on Out-of-Pocket Spending in FY2023, Top Five Base MS-DRGs 22
Figure B.1. Upcoded Hospital Stays as a Percentage of All Hospital Stays Relative to FY2018, Using Each Prior Year as Baseline....40
Figure B.2. Upcoded Hospital Stays as a Percentage of All Hospital Stays Relative to FY2018, Excluding Stays for Patients Who Ever Had COVID-19 during an Inpatient Stay 41
Figure B.3. Upcoded Hospital Stays as a Percentage of All Hospital Stays Relative to FY2018, Including Stays in Which the Patient Died or Was Discharged to Hospice....42
Figure B.4. Upcoded Hospital Stays as a Percentage of All Hospital Stays Relative to FY2018, Using the Last Nine Months of Each Year....42
Figure B.5. Upcoded Hospital Stays as a Percentage of All Hospital Stays, FY2023 Relative to FY2018, Top Five Base MS-DRGs....43

Tables

Table 2.1. Percentage of Hospital Stays with a COVID-19 Diagnosis 6
Table A.1. Criteria Used to Exclude Providers from Analytic Sample 28
Table A.2. Count of Provider Types in Final Sample 29
Table A.3. Base MS-DRGs Excluded from the Final Analytic Sample 29
Table A.4. Universe of Hospital Stays Compared to Final Analytic Sample 32
Table A.5. Summary Statistics of Inpatient Hospital Stays 33
Table B.1. Point Estimates and Confidence Intervals for Overall Growth in Upcoding (Figure 3.2) and Impact on Payment (Figure 3.5) 37
Table B.2. Point Estimates and Confidence Intervals for Top 15 Base MS-DRGs (Figure 3.3), Kaiser and Non-Kaiser Hospitals (Figure 3.6), Commercial Price per Hospital Stay (Figure 3.7), and ZIP Code Level Demographics (Figure 3.8) 38
Table B.3. Point Estimates and Confidence Intervals for Upcoding's Impact on Out-of-Pocket Spending (Figure 3.9) 39

Chapter 1. Introduction

In the U.S., hospital inpatient stays are frequently reimbursed using Medicare Severity Diagnosis Related Groups (MS-DRGs), with payment tied to clinical complexity. Under this payment model, hospitals may be incentivized to systematically assign patients to higher-severity MS-DRGs to increase reimbursement—a practice known as *upcoding*—for example, by adding fraudulent secondary diagnoses or by increasing coding intensity of clinically supported diagnoses that had historically gone undocumented (Levin et al., 2024).[2] While the latter results in more accurate coding, it results in higher payments and payment inefficiencies if higher severity MS-DRGs have a healthier mix of patients than when payment rates were set. Recent evidence suggests that MS-DRG upcoding contributes to higher hospital spending. One study found that MS-DRG upcoding resulted in up to an additional $14.6 billion in hospital payments in 2019 relative to 2011, including $5.8 billion from commercial insurers and $4.6 billion from Medicare (Crespin et al., 2024).

States are seeking to curb health care spending. Reducing upcoding could support this objective. In California, hospital care spending, which accounts for 37 percent of total health spending, increased by nearly 30 percent between 2018 and 2023, reaching approximately $150 billion annually (Wilson, 2023). Increased spending in California prompted the state to establish the Office of Health Care Affordability, which is tasked with ensuring care remains affordable and accessible. To assess whether MS-DRG upcoding is present in the state and its impact on payment, we utilized the California Health Care Payments Database (HPD), which is the state's newly released all-payer claims database. Information on where upcoding is prevalent can help guide state policies to reduce payment distortions and promote efficient resource allocation.

We assessed the growth in upcoding and impacts on spending for inpatient hospital stays for commercial and Medicare Advantage (MA) health plan enrollees between 2018 and 2023. Following previous academic studies, we assessed upcoding as a combination of potentially fraudulent and non-fraudulent coding activities without distinguishing between them (Crespin et al., 2024; Cook and Averett, 2020; Dafny, 2005). Although MS-DRGs were designed for Original Medicare payment, we did not have access to Original Medicare claims for this study. Since other payers frequently pay for inpatient hospital stays using MS-DRGs or a similar system, there is an incentive to upcode outside of Original Medicare. However, other payment arrangements between payers and hospitals exist, such as per diem rates, which could diminish this incentive. Additionally, commercial rates for inpatient services are usually higher than

[2] This report uses a broad definition of *upcoding* that includes fraudulent and non-fraudulent coding. This definition is often used in academic studies, and we acknowledge that federal agencies and some academic studies limit the definition of *upcoding* to fraudulent coding.

Original Medicare payments (RAND, undated), which may increase the incentive to upcode in the commercial population.

The incentives to upcode MS-DRGs likely vary across hospitals. In particular, the California hospital and health insurer markets are dominated by Kaiser Permanente, a vertically integrated health system and insurer that operates over 40 hospitals throughout the state and has approximately 50 percent market share in the commercial large group market and 43 percent share in the MA market (Emerson, 2024; Rakshit, Ortaliza, et al., 2025). Vertically integrated organizations may face fewer incentives to upcode MS-DRGs because they frequently pay for hospital stays through their own health plan revenue. To examine this possibility, we assessed whether MS-DRG upcoding was lower at Kaiser hospitals compared to other hospitals.

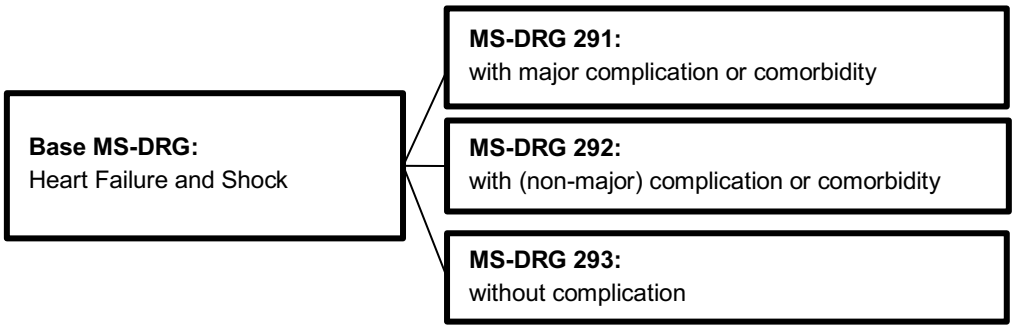
Information on upcoding can support policies to promote health care affordability and accessibility. Beyond its implications for overall health care spending, MS-DRG upcoding may increase financial burdens for patients through increased out-of-pocket (OOP) spending; higher-severity MS-DRGs have higher prices (i.e., allowed amounts) than less severe MS-DRGs, and therefore patients may have higher OOP spending if they have not reached their deductible or because their plan benefit design includes coinsurance for hospital stays. Additional financial strain from upcoding may lead more patients with complex health care needs to delay or forgo necessary care, contributing to adverse health consequences. Therefore, we assessed the extent to which upcoding increased patients' OOP spending and whether upcoding disproportionately impacted patients residing in ZIP codes with lower household incomes.

Chapter 2. Approach

Medicare Severity Diagnosis Related Groups

When a patient is discharged after a hospital stay, they are assigned to an MS-DRG based on a combination of principal and secondary diagnoses as well as procedure codes. In general, MS-DRGs sharing the same principal diagnosis are grouped under the same *base MS-DRG*. As of federal fiscal year (FY) 2023,[3] each of 767 individual MS-DRGs was associated with one of 335 base MS-DRGs. The severity level of an MS-DRG is determined by secondary diagnoses categorized as complications or comorbidities (see Figure 2.1). Base MS-DRGs may have one, two, or three severity levels. The Centers for Medicare & Medicaid Services assigns each MS-DRG a payment weight, which reflects its average resource use among Original Medicare patients.

Figure 2.1. Example of MS-DRG Severity Levels



Analytic Sample

The California HPD is a research database that includes patient claims (medical and pharmacy), member enrollment, and provider information submitted by California payers (California Department of Health Care Access and Information [HCAI], undated-b). We used the HPD to access all MA and most commercial hospital stays between federal FY2018 and FY2023.[4,5]

[3] This federal fiscal year runs from October 1 through September 30.

[4] We used the federal fiscal year for all analyses in this study because it aligns with MS-DRG updates. In contrast, the California fiscal year runs from July 1 through June 30.

[5] Because the first year of available HPD data is calendar year 2018, our dataset included only the last nine months of FY2018. Original Medicare data were available only to state agencies. We did not request Medi-Cal data (California's Medicaid program) due to additional data restrictions associated with accessing these records.

The MA stays include those by enrollees who are dually eligible for Medicare and Medicaid; however, these individuals are not identifiable from the non–dually eligible in the data. Approximately 23 percent of MA enrollees in California were dually eligible as of 2023 (California Department of Health Care Services, 2023).

The HPD commercial data include all fully insured health plans with 40,000 or more covered lives. Self-funded plans and smaller fully insured plans may voluntarily submit data (HCAI, undated-a). In California, approximately 56 percent of commercially insured enrollees were in fully insured plans in each year between FY2018 and FY2023 compared to the national average of about 42 percent (Kaiser Family Foundation, undated).

We first extracted all hospital stays in the HPD, limiting them to stays with an acute inpatient hospital place of setting.[6] We excluded stays in which the patient died or was discharged to hospice, as these cases likely represented patients whose high-severity coding was clinically accurate. These data included approximately 4.9 million stays between FY2018 and FY2023. Using taxonomy codes, specialty codes, and provider names, we found that for approximately 1 percent of stays, the provider of record did not correspond to an acute inpatient hospital, a medical center, or medical group.[7] These providers included, for example, residential treatment facilities and skilled nursing facilities. We excluded these providers because they do not typically use Inpatient Prospective Payment System MS-DRGs to bill for services (see Appendix A, Section 1, for methodology to select hospitals). We also excluded long-term care hospitals because there was ambiguity on whether their stays in data were paid for using Long-Term Care Diagnosis Related Groups, which have different payment weights than acute inpatient MS-DRGs. We further restricted the sample to:

- stays at California providers with at least 25 hospital stays in FY2018[8]
- stays for base MS-DRGs with at least two severity levels, and which were not revised during the study through the addition or deletion of an MS-DRG that would change the severity ratings categories (see Table A.3 for excluded MS-DRGs)
- stays with complete information on patient and stay characteristics (payer, age, sex, and residence ZIP code)[9]

---

[6] This extraction included critical access hospitals. Although critical access hospitals are not paid via MS-DRG by Original Medicare, commercial and MA payers may still pay them on a MS-DRG basis.

[7] The universe of inpatient stays included nearly 2,500 unique providers (identified using provider IDs). Our final analytic sample included stays from 377 providers, which algins with the California Health Care Foundation's count of 337 general acute care hospitals (Joynt, 2022). Our final analytic sample included 20 providers that appeared by name not to be a hospital or a medical center (mostly medical groups), but otherwise met our inclusion criteria. These providers accounted for approximately 2 percent of stays.

[8] FY2018 was used as the base year for model estimation, and we restricted our analysis to hospitals with at least 25 stays to avoid statistical noise from hospitals with few stays.

[9] The missing rates for patient and stay characteristics were relatively low after implementing the other exclusion criteria. Age, sex, and payer were each missing for less than 0.1 percent of stays. A ZIP code was missing for approximately 4 percent of stays and was more likely to be missing for older patients (the average patient age for stays with a missing ZIP code was 71 years) and more likely to be missing for MA stays than commercial stays.

The final analytic sample included 2.8 million stays for 251 base MS-DRGs. Compared with the universe of stays in the HPD, those in the final analytic sample included patients who were older (mean age of 61.5 years in the final sample versus 50.3 years among all stays), more likely to be male (50.5 percent versus 42.7 percent), and more likely to be enrolled in MA (51.5 percent versus 38.6 percent) (see Table A.4). Table A.5 provides descriptive statistics for the analytic sample.

Analysis

We followed the methodology used by Crespin et al. (2024) to estimate the growth in upcoding between FY2019 and FY2023 compared to the base year of FY2018. This approach estimates upcoding of MS-DRGs to the highest severity level and does not distinguish between fraudulent (i.e., adding diagnoses that are not clinically supported) and non-fraudulent coding activities (e.g., adding clinically supported diagnoses that were not historically documented). For each base MS-DRG, we used a linear probability model to estimate the probability of being coded to the highest-severity MS-DRG using FY2018 hospital stays. The model included controls for observable characteristics of the stay and patient. Specifically, the explanatory variables we used were patient characteristics (age and sex), demographic characteristics of the patient's ZIP code of residence as of the 2020 Decennial Census (median household income and percentage of the total population that is non-White), payer type (commercial or MA), health at admission, length of stay (days), and hospital fixed effects.[10] We used the Elixhauser Comorbidity risk of 30-day readmission index to control for patient health at admission (Healthcare Cost and Utilization Project, 2022). The index sums weights that are indicative of risk associated with specific pre-existing conditions. Conditions included in the index have limited overlap with those included as MS-DRG complications and comorbidities (see Appendix A, Section 2 for further discussion).

We applied the parameters (i.e., the regression coefficients for the explanatory variables) from the FY2018 baseline model to hospital stays in each subsequent year to estimate, for each stay, the predicted probability of it being assigned the highest-severity MS-DRG based on FY2018 coding patterns. We summed the predicted probabilities (i.e., the predicted number of stays with the highest-severity MS-DRG) and compared this sum to the observed number of stays with the highest-severity MS-DRG, both overall and by base MS-DRG. The difference between the observed and predicted number of stays with the highest-severity MS-DRG represents the number of stays with the highest-severity MS-DRG unexplained by the model, and serves as an upper bound on the number of upcoded stays relative to the base year. We then calculated the percentage of upcoded stays (relative to the base year) as a percentage of all stays.

[10] Within the HPD, 14 Kaiser hospitals located in southern California had the same provider identifier for nearly all of their stays, and we could not identify the specific Kaiser hospital for these stays. Therefore, we grouped these hospitals together for the analysis (e.g., one hospital fixed effect for these hospitals).

We calculated 95 percent confidence intervals (CIs) using a hospital-clustered bootstrap with 200 resamples. Appendix A, Section 3 provides further detail regarding the regression specifications, prediction calculations, and bootstrapping approach.

To assess the effect of upcoding on payment, we estimated the increase in MS-DRG payment weights using the predicted count of upcoded stays (e.g., the number of observed stays at the highest MS-DRG severity level minus the expected number of stays at the highest MS-DRG level estimated from the model). For each base MS-DRG, we calculated the change in payment weights as the increase in upcoding multiplied by the difference between the weight for the highest-severity MS-DRG and the weight for the second-highest-severity MS-DRG.[11] We then divided the increase in weights by the sum of the observed weights to approximate the percentage increase in payment associated with upcoding.

Accounting for the Coronavirus Disease 2019 Diagnoses

The International Classification of Diseases, 10th Revision (ICD-10) diagnosis code for the coronavirus disease 2019 (COVID-19) was implemented in April 2020. This code (U07.1) is recognized as a major complication and comorbidity under the MS-DRG system; therefore, a patient admitted with COVID-19 or who contracts it during their stay is coded to the highest-severity MS-DRG. Table 2.1 shows the percentage of stays in the analytic sample with a COVID-19 diagnosis. Two base MS-DRGs accounted for the majority of COVID-19 cases—Respiratory Infections and Inflammations (56 percent) and Septicemia or Severe Sepsis without Mechanical Ventilation (MV) 96+ Hours (20 percent).

Table 2.1. Percentage of Hospital Stays with a COVID-19 Diagnosis

	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
Percentage of hospital stays with a COVID-19 diagnosis (U07.1)	0.0%	0.0%	3.0%	10.7%	7.4%	4.3%

SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: FY2018 includes the last nine months of the year (January 2018 through September 2018).

The baseline sample (FY2018) occurred before the COVID-19 public health emergency (PHE). Without accounting for the addition of COVID-19 as a major complication and comorbidity, the model would overestimate the growth in upcoding, as it would compare pre-PHE and PHE stays based on health status excluding COVID-19. For this reason, we treated stays with U07.1 as accurately coded (i.e., by setting the probability of being in the highest-

[11] Using the second-highest MS-DRG payment weight means that the analysis likely underestimates the impact on payment because MS-DRGs with three severity levels could have been upcoded from the lowest severity to the highest severity level.

severity MS-DRG to 1).[12] If hospitals were fraudulently using COVID-19 diagnoses to upcode patients, our results would underestimate the growth in upcoding.[13] Outside of the two high-volume base MS-DRGs with the majority of COVID-19 diagnoses, this adjustment has little impact on our results, as no other base MS-DRG had a frequency of COVID-19 greater than 1.0 percent.

Sensitivity Analysis

We conducted several sensitivity analyses to test the robustness of the main results. First, temporal changes could lead to an overestimation of upcoding due to unobserved changes in hospital stays and patient mix. There is the potential for advancements in technology and quality to bias results, especially if these advancements reduce length of stays. Additionally, changes in patient health could lead to an overestimation of upcoding if the average severity of stays increased in ways unobserved in our measure of health at admission. Of particular concern during the study period is the impact of the COVID-19 PHE on the average health of the patient mix. Healthier patients were more likely to avoid inpatient stays, especially during the peak of the PHE in FY2020 and FY2021, which increased in-hospital mortality and patient acuity at the start of the PHE (Birkmeyer et al., 2020; Smulowitz et al., 2024). Furthermore, COVID-19 may have impacted unobserved patient health because some patients who had COVID-19 experienced short- and long-term effects, such as an increased risk of heart failure, which is one of the highest-volume base MS-DRGs (Olumuyide, Agwuegbo, and Ahmed, 2024).

To address these concerns, we first estimated a model that used the prior year as the baseline. This model minimizes the impact of temporal changes by basing predictions of MS-DRG severity on prior year coding patterns.[14] If changes over time led the main model to overestimate the growth in upcoding, then we would expect this model to yield a smaller estimate.

To address the concern that COVID-19 health impacts could lead to an overestimation of upcoding, we estimated a model that excluded all hospital stays from any patient who ever had

---

[12] In sensitivity analysis, we expanded our indicator of COVID-19 to include other ICD-10 diagnosis codes, and we found no substantial changes in our results (data not shown). These ICD-10 codes included B94.8 Sequelae of other specified infectious and parasitic diseases, B97.29 Other coronavirus as the cause of diseases classified elsewhere, J12.82 Pneumonia due to coronavirus, and Z20.828 Contact with and (suspected) exposure to other viral communicable diseases.

[13] A 2023 audit by the Office of the Inspector General, U.S. Department of Health and Human Services, found that coding associated with COVID-19 in inpatient settings of Original Medicare enrollees complied with federal requirements in 98 percent of sampled cases (Office of the Inspector General, 2023).

[14] We excluded stays with COVID-19 from these baseline estimates because they would likely lead to an underestimation of upcoding within the non-COVID-19 stays as the percentage of COVID-19 stays declined over time (i.e., the model would predict more stays with the highest MS-DRG severity for non-COVID-19 stays because all COVID-19 stays were coded to the highest severity level). Therefore, we estimated the growth in upcoding for the non-COVID-19 stays and added the COVID-19 stays back into the estimates as accurately coded stays when estimating the growth in upcoding. This exclusion of COVID-19 patients from the baseline estimations primarily impacts the base MS-DRGs for Respiratory Infections and Inflammations and Septicemia or Severe Sepsis without MV 96+ Hours because the share of COVID-19 stays for all other MS-DRGs was less than 1.0 percent.

an inpatient stay with COVID-19 in our data (including non-COVID-19 stays from before or after the patient had a COVID-19 stay). The excluded stays in this sensitivity analysis likely represent the most severe COVID-19 cases. If worse health from COVID-19 led to an overestimation of upcoding, then we would expect that excluding these patients would reduce the upcoding estimate. We acknowledge that this is an imperfect sensitivity analysis because patients who had COVID-19 and did not seek treatment or were managed in outpatient settings are still included in the sample.

While our main analysis excluded stays in which the patient died or was discharged to hospice, this exclusion could lead to biased results. Nationally, the use of hospice increased between 2011 and 2023 without a commensurate increase in mortality risk (Law et al., 2026). In California, the number of inpatient stays discharged to home or facility hospice care increased by 12 percent between 2018 and 2023 (HCAI, undated-d). If there were fewer severely ill patients in the later years of our sample due to growth in discharges to hospice over time, this could lead to an underestimation of upcoding. Conversely, if inpatient mortality declined over time for certain base MS-DRGs, then more of the highest-severity patients would survive and remain in the sample over time. We addressed this concern in two ways. First, we used the prior-year-baseline analysis described above to examine whether temporal changes in patient mix impacted our results. Second, we estimated a version of the model that included stays in which the patient died or was discharged to hospice.

Lastly, we conducted the main analysis on a fiscal year basis to align with updates to the MS-DRGs; however, the HPD data is on a calendar year basis. Therefore, we lacked the first three months of the fiscal year for our FY2018 baseline. This could bias our results if there is seasonality in the data, such as a disproportionate share of certain types of patients or stays during the first three months of the fiscal year. To address this concern, we estimated a version of the model using the last nine months for all years in the data.

Upcoding at Kaiser and Non-Kaiser Hospitals

Vertically integrated organizations likely face fewer incentives to upcode MS-DRGs because the health plan often routes premium revenue to hospitals while keeping the money within a single organization. Non-integrated hospitals have greater incentive to upcode because their revenue comes from outside the organization. To examine this possibility, we estimated whether the growth in upcoding was lower in hospitals that are part of California's dominant health system, Kaiser Permanente, compared to other hospitals. Kaiser, which is a vertically integrated organization, is California's largest health insurer and health care provider, enrolling nearly 10 million Californians and operating over 40 hospitals throughout the state (Emerson, 2024; Rakshit, Ortaliza, et al., 2025).

Impact of Commercial Prices on Upcoding

Prior studies found that upcoding increased through the 2010s and suggested that growth in commercial prices has incentivized upcoding (Ho, Tapaneeyakul, and Russell, 2023; Crespin et al., 2024). Many hospitals negotiate prices to be a percentage of Original Medicare allowed amounts (Cooper et al., 2019). Hospitals that negotiate higher prices may have a large price differential between higher severity MS-DRGs and lower severity MS-DRGs and therefore could gain more revenue from upcoding.

We estimated whether upcoding growth was higher at hospitals with higher commercial prices. We calculated a case-mix-adjusted average commercial price per stay for each hospital overall and for each base MS-DRG. To adjust for case-mix, we used the Elixhauser Comorbidity risk of 30-day readmission index (normalized to a mean of 1) to measure health at admission. For each hospital, we calculated the average commercial stay price and divided it by its average risk of 30-day readmission index. We then categorized hospitals into quartiles of mean case-mix adjusted price per stay and estimated whether the growth in upcoding was statistically different across the quartiles.

Upcoding and Affordability

To assess whether hospital stay upcoding affects the affordability of care, we estimated the impact of upcoding growth on OOP spending. For each stay, we calculated OOP spending as the sum of copayments, coinsurance amounts, and deductible payments. We categorized hospital stays by their predicted probability of being assigned to the highest-severity MS-DRG, and within each stratum, we compared the observed OOP spending for stays coded to the highest-severity MS-DRG with those not coded to the highest-severity MS-DRG.

We focused on how OOP spending changed among hospital stays with a low probability of being coded to the highest-severity MS-DRG within individual, high-volume base MS-DRGs. Stays with a low predicted probability of having the highest-severity MS-DRG but that were nonetheless coded to the highest-severity MS-DRG are seemingly more likely to be an upcoded stay than stays with a higher probability. We compared OOP spending for these stays to OOP spending for stays with a similar probability of having the highest-severity MS-DRG that were not coded to the highest-severity MS-DRG. In this way, we compared OOP spending for likely upcoded stays to stays that were not upcoded among similar patients.

The hospital stays for MA enrollees include enrollees who are dually eligible for Medicaid. As Medicaid assists dually eligible individuals with Medicare cost-sharing, upcoding should have limited impacts on financial burden for dually eligible MA patients. For example, a Dual Eligible Special Needs Plan cannot impose cost-sharing that is greater than the cost-sharing permitted by a state's Medicaid agency (Postman, 2018). Accordingly, our estimates of the OOP spending impacts of upcoding for MA stays should be more reflective of the impacts for non–dually eligible MA patients.

To further assess impacts on affordability, we determined whether patients of lower socioeconomic status are disproportionately affected by upcoding. We sorted California ZIP codes into quartiles based on median household income and categorized each stay using the patient's ZIP code of residence. We assessed whether the growth in upcoding was different across income quartiles.

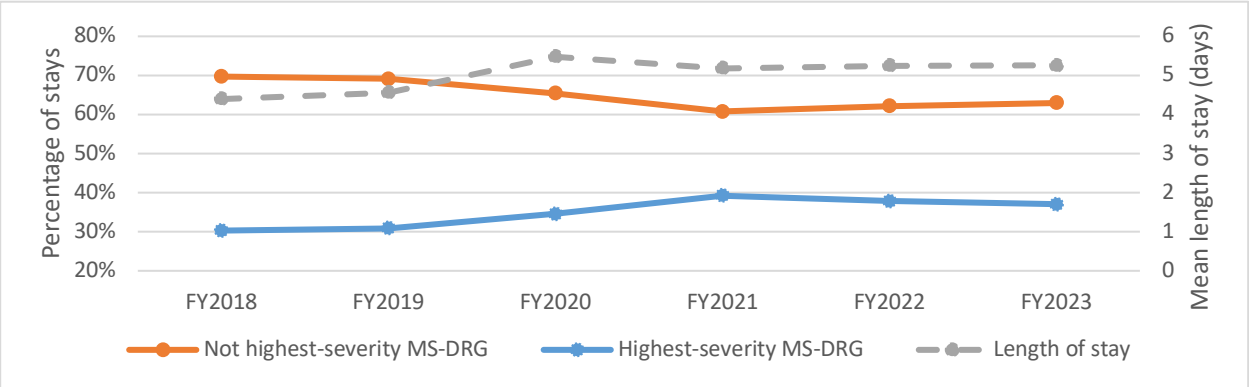
Chapter 3. Findings

Increase in Highest-Severity MS-DRGs

Between FY2018 and FY2023, the share of hospital stays (commercial and MA combined) assigned to the highest-severity MS-DRG increased from 30.3 percent to 37.0 percent (see Figure 3.1). This growth occurred primarily between FY2019 and the height of the COVID-19 PHE in FY2021. From FY2021 to FY2023, the share of hospital stays with the highest-severity MS-DRG remained relatively stable, but did not return to pre-PHE levels.

A similar pattern was observed for the mean length of stay, which increased from 4.4 days in FY2018 to 5.3 days in FY2023. This increase diverges from studies of prior periods, which found that length of stay was relatively stable during the 2010s in both all-payer and Original Medicare populations (Office of the Inspector General, 2021; Crespin et al., 2024), although those studies were not specific to California. The mean Elixhauser Comorbidity risk of 30-day readmission index, used to measure health at admission and based primarily on pre-existing health conditions, increased by 9 percent over the study period (data not shown), although it was more stable in the later years of the study, increasing by approximately 3 percent from FY2021 to FY2023 and only 1 percent between FY2022 and FY2023. These findings suggest that, on average, the health of patients admitted to the hospital worsened during the study period, which likely contributed to the increase in stays assigned to the highest-severity MS-DRG.

Figure 3.1. Hospital Stays with and without the Highest-Severity MS-DRG and Length of Stay for All Stays



SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: Includes hospital stays from 251 base MS-DRGs. Base MS-DRGs with a single MS-DRG and base MS-DRGs that were added, deleted, or affected by the addition or deletion of other base MS-DRGs are excluded. All years are federal fiscal years (October 1 through September 30).

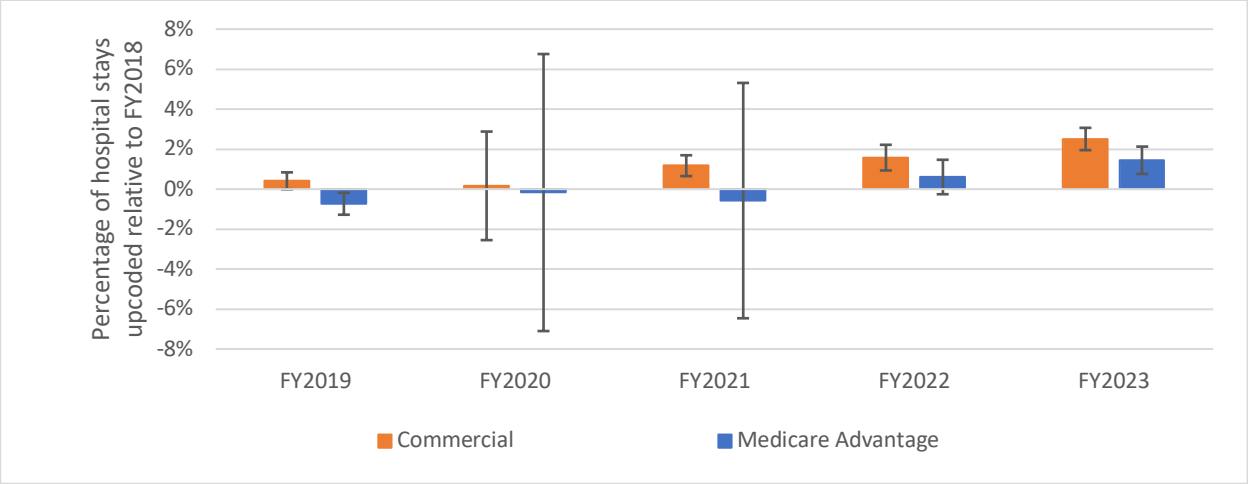
Although patient health, as measured by length of stay and health at admission, worsened on average, there was variation across base MS-DRGs. For example, for Septicemia or Severe Sepsis without MV 96+ Hours (the base MS-DRG with the highest volume of inpatient stays), the Elixhauser Comorbidity risk of 30-day readmission index was nearly unchanged, while for Heart Failure and Shock (the second-highest-volume base MS-DRG), it decreased by 6 percent between FY2018 and FY2023. However, average length of stay increased for both base MS-DRGs. Conversely, the risk of 30-day readmission index grew by 16 percent for Acute Myocardial Infarction (AMI), Discharged Alive, the fifth-highest-volume base MS-DRG.

Growth in MS-DRG Upcoding

Figure 3.2 presents the growth in MS-DRG upcoding, expressed as the percentage of potentially upcoded hospital stays (i.e., observed minus predicted stays at the highest-severity MS-DRG) relative to all hospital stays in the analytic sample. For each year, the percentage of upcoded stays represents the increase in stays upcoded relative to FY2018; however, this result is in relative terms—our model cannot estimate the total number of potentially upcoded stays (i.e., the number of upcoded stays in FY2018, if any, plus the number of upcoded stays between FY2018 and subsequent years).

There was no significant growth in upcoding in FY2019 or FY2020 for commercial stays; however, the percentage of potentially upcoded stays was significantly higher in each year from FY2021 through FY2023 relative to FY2018. In FY2023, an additional 2.5 percent (95 percent CI: 1.9–3.1 percent) of commercial hospital stays were potentially upcoded relative to FY2018. (Point estimates and 95 percent CIs for our key results are presented in Tables B.1 through B.3.)

Figure 3.2. Upcoded Hospital Stays as a Percentage of All Hospital Stays Relative to FY2018



SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: Upcoded hospital stays are defined as the observed number of hospital stays at the highest MS-DRG severity minus the predicted number of stays at the highest MS-DRG severity. Includes hospital stays from 251 base MS-DRGs. Error bars are the 95 percent confidence intervals estimated from bootstrapping 200 replications of the analysis. All years are federal fiscal years (October 1 through September 30). Point estimates and 95 percent confidence intervals for this figure are available in Table B.1.

Our model predicted that the percentage of commercial stays with the highest-severity MS-DRG would have increased by 15.8 percent, from 24.7 percent in FY2018 to 28.6 percent (95 percent CI: 27.7–29.4 percent) in FY2023. In contrast, the observed percentage of stays with the highest-severity MS-DRG in FY2023 was 31.1 percent (a 26.0 percent increase). This suggests that 61 percent of the observed growth in highest-severity stays can be explained by changes in patient demographics and health at admission. The remaining 39 percent was unexplained by our model and represents an upper bound on the growth of upcoding. In other words, up to 39 percent of the increase in commercial stays with the highest-severity MS-DRG may be attributed to upcoding.

The estimate of growth in upcoding among commercial stays from FY2018 to FY2023 was generally robust in sensitivity analysis. Our estimate was robust to using the prior year as a baseline model (2.5 percent [95 percent CI: 0.3–4.5 percent]; see Figure B.1), excluding stays of patients who ever had a COVID-19 inpatient stay (2.4 percent [95 percent CI: 1.7–3.1 percent]; see Figure B.2), including stays in which the patient died or was discharged to hospice (2.5 percent [95 percent CI: 1.9–3.1 percent]; see Figure B.3), and including only stays that occurred in the last nine months of each year to address seasonality concerns (2.2 percent [95 percent CI: 1.7–2.7 percent]; see Figure B.4). However, the estimate from using the prior year as a baseline model had larger standard errors, and for this sensitivity analysis, the growth in upcoding for commercial stays was significant only in FY2023, which implies that temporal changes in patient mix (e.g., average patient health) or hospital stays (e.g., technology and quality improvements)

may bias our results. We focused our remaining results on FY2023, when there was a robust finding that upcoding increased relative to FY2018.

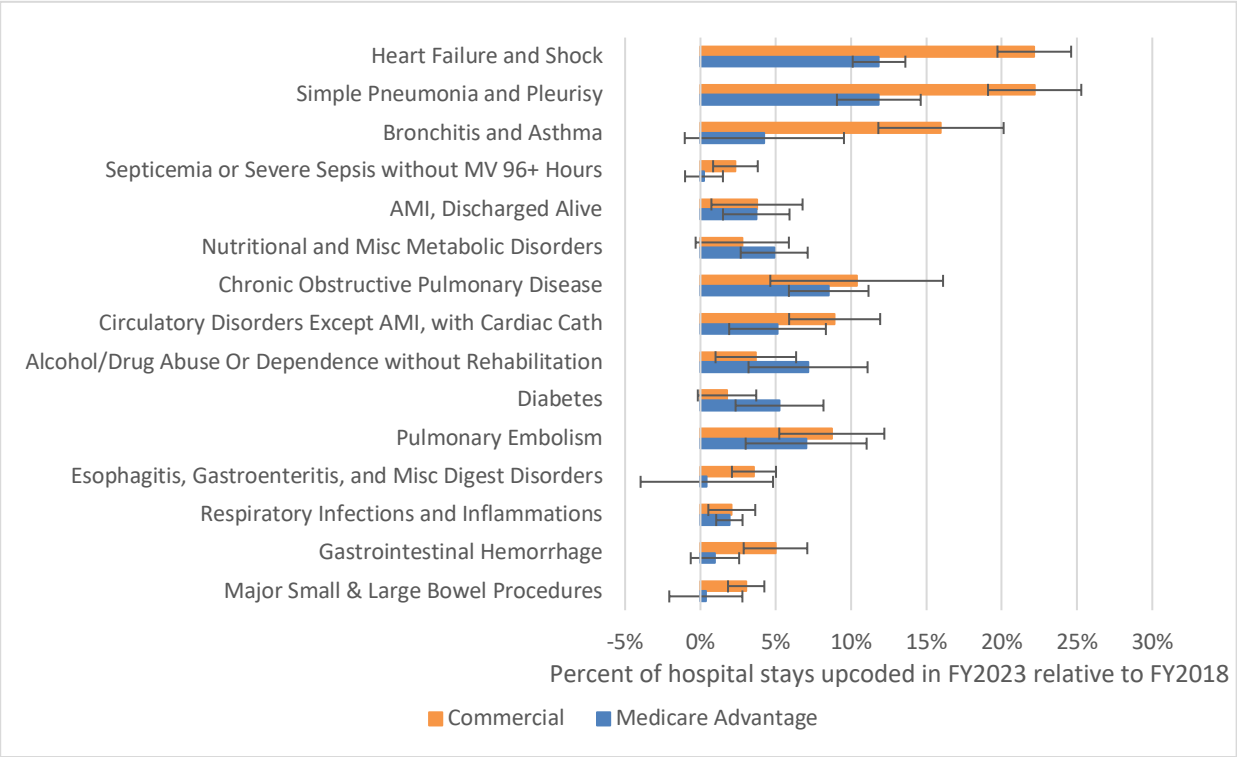
For MA stays, while the main model estimated that the percentage of potentially upcoded MA stays in FY2023 was significantly higher than in FY2018 (1.4 percent; 95 percent CI: 0.8–2.1 percent), it was not a robust finding. In particular, the percentage of potentially upcoded MA stays was not significant in any year in the prior year as a baseline model, which implies that temporal changes may be driving the main results. Furthermore, there was no significant increase in hospital payment associated with upcoding (see results below). These findings suggest that on an aggregate level (i.e., including all base MS-DRGs and stays) upcoding is likely not a driving factor of the growth in the percentage of MA stays with the highest MS-DRG severity level.

Growth in Upcoding for High-Volume Base MS-DRGs

There was substantial variation in the growth of potential upcoding across base MS-DRGs. Figure 3.3 shows the potentially upcoded hospital stays in FY2023 relative to FY2018, expressed as a percentage of all hospital stays for the top 15 individual base MS-DRGs (ranked by the volume of upcoded stays in MA and commercial combined). The base MS-DRG with the largest growth was Heart Failure and Shock. In the commercial population, up to an additional 22.2 percent (95 percent CI: 19.7–24.6 percent) of stays for this base MS-DRG were upcoded in FY2023 compared to FY2018, while in the MA population, up to an additional 11.8 percent (95 percent CI: 10.1–13.6 percent) were upcoded. The remainder of the top five most upcoded base MS-DRGs were Simple Pneumonia and Pleurisy; Bronchitis and Asthma; Septicemia or Severe Sepsis without MV for 96+ Hours; and AMI, Discharged Alive.

The top five base MS-DRGs were very common, accounting for approximately 24 percent of total inpatient stays in FY2023. They also accounted for approximately 67 percent of the potential growth in upcoding in FY2023 relative to FY2018. The top 15 base MS-DRGs represented 42 percent of total stays in FY2023 and accounted for 95 percent of the potential growth in upcoding.

Figure 3.3. Increase in Upcoded Hospital Stays as a Percentage of All Stays for the Top 15 Base MS-DRGs, FY2023 Relative to FY2018



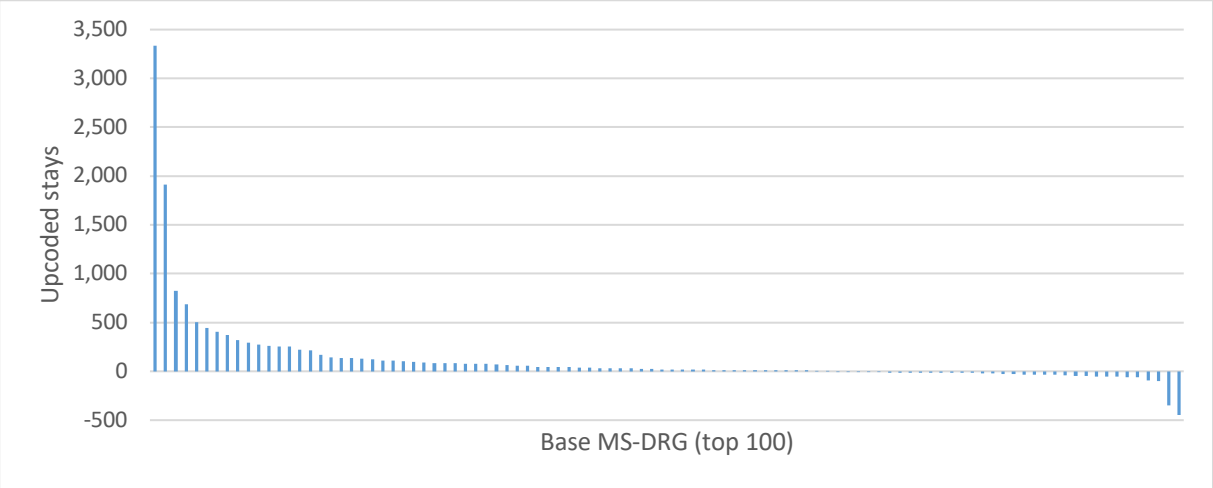
SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: cath = catheterization. Upcoded hospital stays are defined as the observed number of hospital stays at the highest MS-DRG severity minus the predicted number of stays at the highest MS-DRG severity. Includes hospital stays from the top 15 base MS-DRGs ranked by volume of upcoded stays in FY2023. Error bars are the 95 percent confidence intervals estimated from bootstrapping 200 replications of the analysis. FY2023 is the federal fiscal year (October 1 through September 30). Point estimates and 95 percent confidence intervals for this figure are available in Table B.2.

Although we found no significant growth in upcoding for MA stays when all stays were included, there was a significant increase in potential upcoding for many of the top base MS-DRGs in FY2023 (relative to FY2018). Combined, up to an additional 4.6 percent (95 percent CI: 3.8–5.7 percent) of MA stays for the top five base MS-DRGs were upcoded in FY2023 relative to FY2018 (Figure B.5). The combined growth for MA stays for the top five base MS-DRGs was robust to the specification that used the prior year as the baseline (3.0 percent [95 percent CI: 1.8–4.1 percent]) as well as the exclusion of patients who had a COVID-19 inpatient stay (4.6 percent [95 percent CI: 3.4–5.8 percent]).

Taken together with the findings on patient complexity worsening over time and the greater increase in upcoding for certain base MS-DRGs, these results suggest a bifurcation: A small set of high-volume base MS-DRGs was likely associated with significant growth in upcoding, while for the remaining base MS-DRGs, increases in patient complexity accounted for most of the change, with little or no growth in upcoding. This finding is highlighted in Figure 3.4, which

shows the distribution of growth in potentially upcoded hospital stays (observed minus predicted at the highest MS-DRG severity level) in FY2023 compared to FY2018 for the top 100 highest-volume base MS-DRGs (commercial and MA combined).

Figure 3.4. Commercial and MA Upcoded Hospital Stays by Base MS-DRG, FY2023 Relative to FY2018



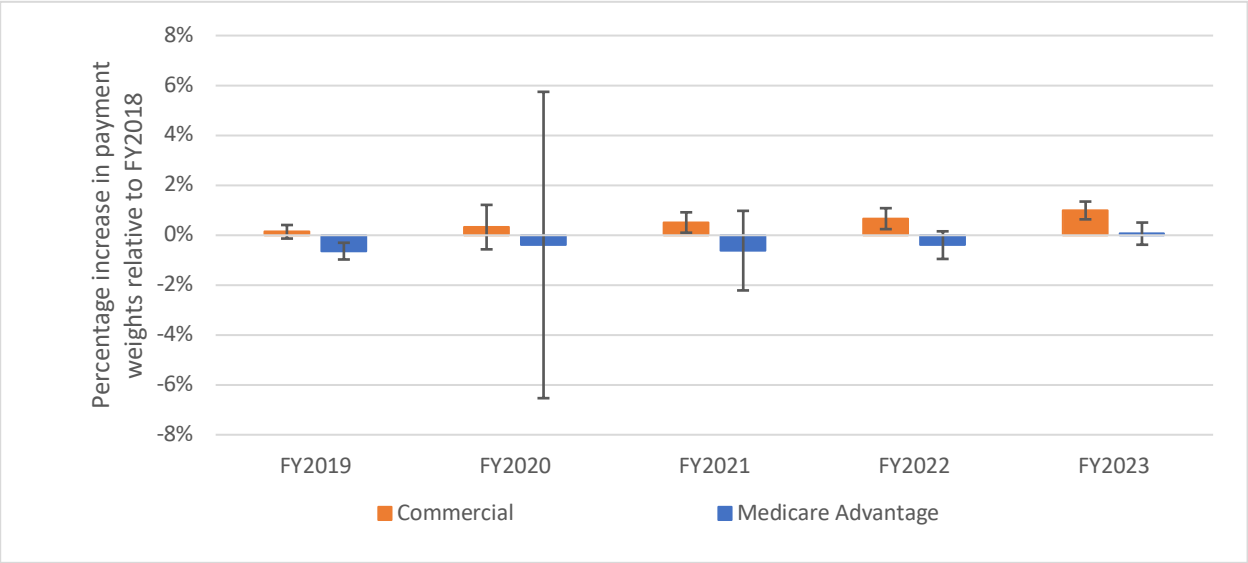
SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: Upcoded hospital stays are defined as the observed number of hospital stays at the highest MS-DRG severity minus the predicted number of stays at the highest MS-DRG severity. Includes hospital stays from the top 100 base MS-DRGs by volume, sorted from highest to lowest growth in number of upcoded stays from FY2018 to FY2023. Each bar represents one base MS-DRG. FY2023 is the federal fiscal year (October 1 through September 30).

Growth in Payments to Hospitals

We estimated the percentage increase in MS-DRG payment weights, which approximates the percentage change in payments for MS-DRGs included in the analysis (Figure 3.5). For commercial hospital stays, the growth in upcoding was associated with a significant increase in payment weights of up to 1.0 percent (95 percent CI: 0.6–1.4 percent) in FY2023 relative to FY2018.

For MA hospital stays, there was no overall significant increase in payment weights associated with growth in upcoding, even though upcoding grew within MA for some base MS-DRGs, because (1) the base MS-DRGs with a significant increase in upcoded stays (e.g., Heart Failure and Shock and Simple Pneumonia and Pleurisy) have relatively small differences in payment weights across severity levels compared to other base MS-DRGs; and (2) the increase in payment weights for base MS-DRGs with growth in upcoding was offset by base MS-DRGs that were estimated to have fewer stays with the highest-severity MS-DRG than actually occurred.

Figure 3.5. Increase in MS-DRG Payment Weights Attributed to Growth in Upcoding Relative to FY2018

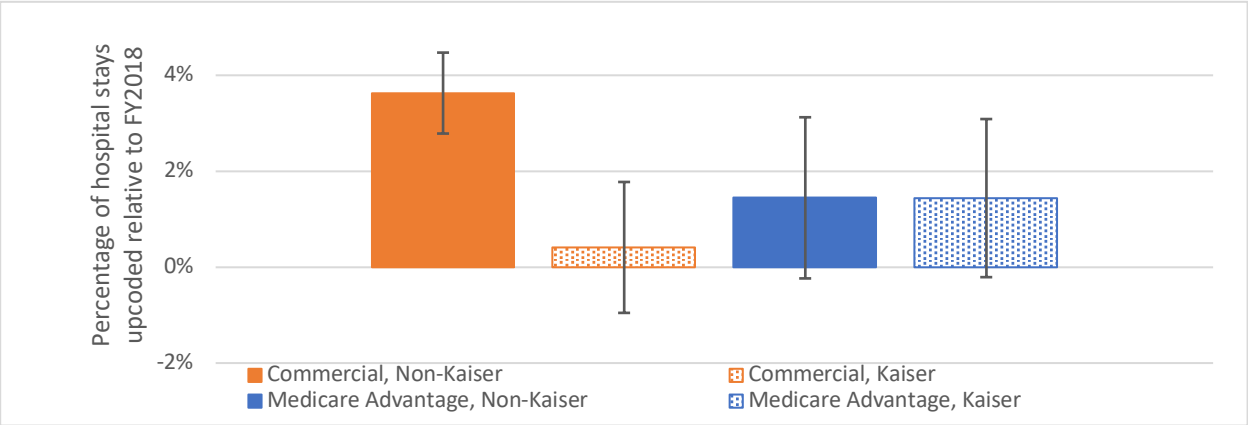


SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: The change in payment weights is estimated as the increase in upcoded stays multiplied by the difference between the weight for the highest-severity MS-DRG and the weight for the second-highest-severity MS-DRG. Includes hospital stays from 251 base MS-DRGs. Error bars are the 95 percent confidence intervals estimated from bootstrapping 200 replications of the analysis. All years are federal fiscal years (October 1 through September 30). Point estimates and 95 percent confidence intervals for this figure are available in Table B.1.

Upcoding at Kaiser and Non-Kaiser Hospitals

We also examined whether upcoding was lower in California's dominant vertically integrated health system and insurer (Figure 3.6). For commercial stays, we found that up to an additional 3.6 percent (95 percent CI: 2.6–4.7 percent) of stays were upcoded at non-Kaiser hospitals in FY2023 compared to FY2018. Upcoding was not significantly different in FY2023 compared to FY2018 for commercial stays at Kaiser hospitals. This implies that at an aggregate level, upcoding of commercial stays grew only at non-Kaiser hospitals. There was no significant increase in upcoding of MA stays at either Kaiser or non-Kaiser hospitals.

Figure 3.6. Upcoded Hospital Stays as a Percentage of All Hospital Stays at Kaiser and Non-Kaiser Hospitals, FY2023 Relative to FY2018

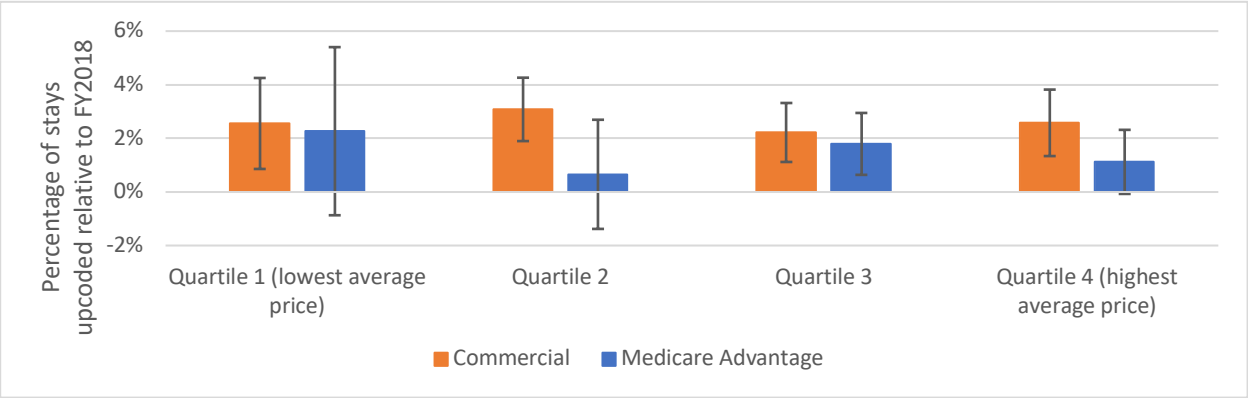


SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: Upcoded hospital stays are defined as the observed number of hospital stays at the highest MS-DRG severity minus the predicted number of stays at the highest MS-DRG severity. Includes hospital stays from 251 base MS-DRGs. Error bars are the 95 percent confidence intervals estimated from bootstrapping 200 replications of the analysis. FY2023 is the federal fiscal year (October 1 through September 30). Point estimates and 95 percent confidence intervals for this figure are available in Table B.2.

Commercial Prices

We assessed whether the growth in upcoding was larger at hospitals with higher case-mix adjusted commercial prices (Figure 3.7). We categorized hospitals into quartiles based on average price per stay across all base MS-DRGs. We did not find significant differences across quartiles. We repeated this analysis for the top five base MS-DRGs (ranked by volume of upcoded stays), both individually and combined, and similarly found no significant differences in the growth of upcoding by commercial price (data not shown).

Figure 3.7. Increase in Upcoded Hospital Stays as a Percentage of All Stays by Average Commercial Price, FY2023 Relative to FY2018



SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: Upcoded hospital stays are defined as the observed number of hospital stays at the highest MS-DRG severity minus the predicted number of stays at the highest MS-DRG severity. Includes hospital stays from 251 base MS-DRGs. Error bars are the 95 percent confidence intervals estimated from bootstrapping 200 replications of the analysis. FY2023 is the federal fiscal year (October 1 through September 30). Point estimates and 95 percent confidence intervals for this figure are available in Table B.2.

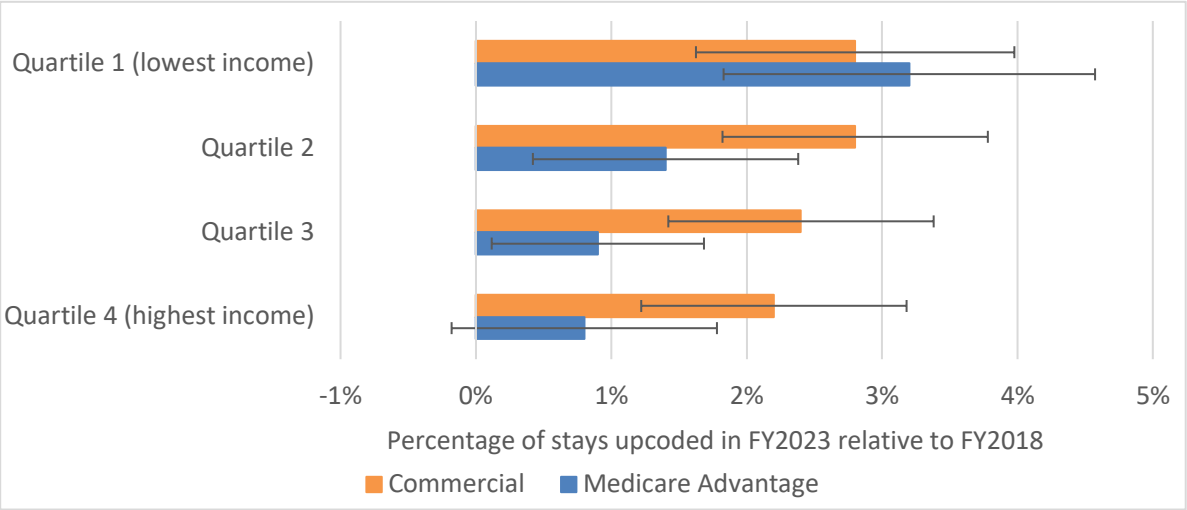
Patient Affordability

To determine whether upcoding could impact patients' affordability of care, we assessed (1) whether upcoding disproportionately impacted patients residing in lower-income areas and (2) whether upcoding affected OOP spending for patients with a low probability of being upcoded.

Impact of Upcoding by Income Level

We sorted California ZIP codes into quartiles based on median household income and examined whether there was more growth in upcoding among stays where the patient lived in lower-income ZIP codes (Figure 3.8). We found significantly more growth in potential upcoding for MA stays where the patient lived in the lowest-income ZIP codes. Specifically, an additional 3.2 percent (95 percent CI: 1.8–4.6 percent) of stays were upcoded in FY2023 relative to FY2018 among patients who lived in the lowest-income quartile, which was significantly more than the 0.9 percent (95 percent CI: 0.1–1.7 percent) and 0.8 percent (95 percent CI: -0.2–1.8 percent) increase for those living in the third and fourth income quartiles, respectively. We did not find a meaningful pattern for commercial patients.

Figure 3.8. Upcoded Hospital Stays as a Percentage of All Hospital Stays by Household Income, FY2023 Relative to FY2018



SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays. Median household income from the 2020 Decennial Census.
NOTE: Upcoded hospital stays are defined as the observed number of hospital stays at the highest MS-DRG severity minus the predicted number of stays at the highest MS-DRG severity. Analysis includes hospital stays from 251 base MS-DRGs. Error bars are the 95 percent confidence intervals estimated from bootstrapping 200 replications of the analysis. FY2023 is the federal fiscal year (October 1 through September 30). Point estimates and 95 percent confidence intervals for this figure are available in Table B.2.

Patients of lower socioeconomic status are more likely to experience prolonged health impacts from COVID-19 (Xiang et al., 2025), which could have driven the differential impacts across incomes if the health of lower-income patients worsened over time. In a sensitivity analysis excluding patients with a COVID-19 inpatient stay, the potential growth in upcoding among the lowest income quartile (2.8 percent [95 percent CI: 1.4–4.1 percent]) remained significantly higher than the growth in upcoding for the third quartile (0.5 percent [95 percent CI: -0.3–1.3 percent]), and was statistically different from the growth in upcoding for the highest income quartile (0.6 percent [95 percent CI: -0.7–2.0 percent]) but only at the 80 percent confidence level.

Impact of Upcoding on Out-of-Pocket Spending

To determine whether upcoding affected OOP spending, we assessed the difference in OOP spending among similar patients who were coded to the highest-severity MS-DRG versus those coded to a lower-severity MS-DRG within the same base MS-DRG. In this way, we compared stays with a high likelihood of being upcoded (i.e., stays with a low predicted probability of having the highest-severity MS-DRG but were nonetheless coded to the highest-severity MS-DRG) to similar stays that were not upcoded. We conducted this analysis for the top five base MS-DRGs with the highest growth in upcoded stays between FY2018 and FY2023.

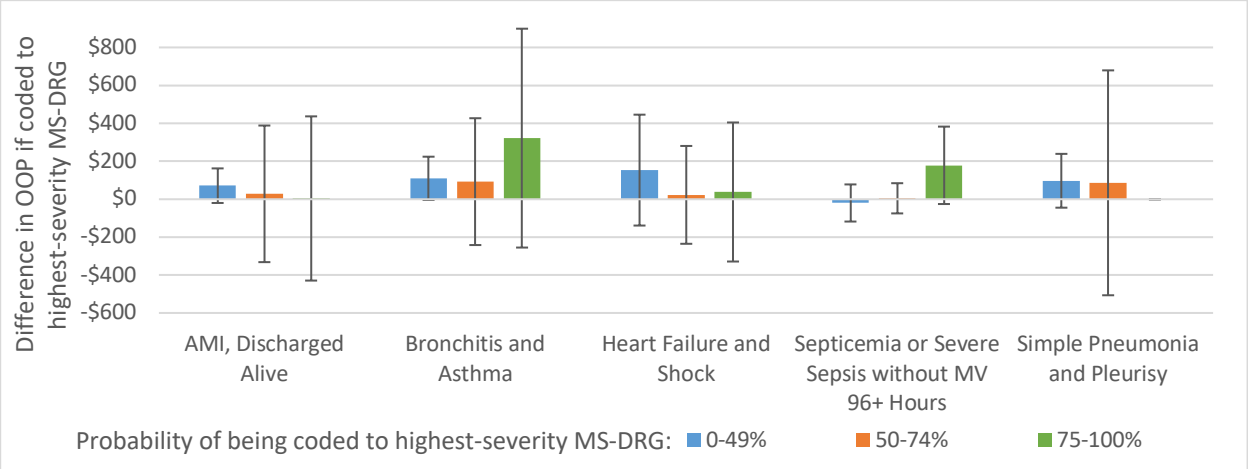
We did not find a meaningful association between upcoding and OOP spending for commercial stays. Panel A of Figure 3.9 shows that for commercial stays with various probabilities of being coded to the highest-severity MS-DRG, being coded to the highest severity did not meaningfully influence OOP spending.

However, upcoding was likely associated with higher OOP spending for MA stays. For MA stays with less than a 50 percent probability of being assigned the highest-severity MS-DRG,[15] OOP spending was higher for stays assigned to the highest MS-DRG severity level compared to stays assigned to a lower severity for four of the top five base MS-DRGs, with the exception being Bronchitis and Asthma (Panel B of Figure 3.9). For example, OOP spending was $121 (95 percent CI: $81–$160) higher for Heart Failure and Shock, and $136 (95 percent CI: $87–$186) higher for Septicemia or Severe Sepsis without MV 96+ Hours, compared to similar stays coded to a lower severity MS-DRG. Because dually eligible MA enrollees frequently have little cost-sharing responsibility, these effects are most representative of the impacts on the non–dually eligible. Among stays with a 50 percent or greater probability of having an MS-DRG with the highest severity for these base MS-DRGs, the difference in OOP spending between the stays with and without the highest MS-DRG was negative or not significantly different than $0. For these base MS-DRGs, roughly 30 percent to 40 percent of stays were coded with the highest MS-DRG severity level for the lowest probability range (<50 percent) compared to approximately 90 percent in the highest probability range (75 percent to 100 percent).

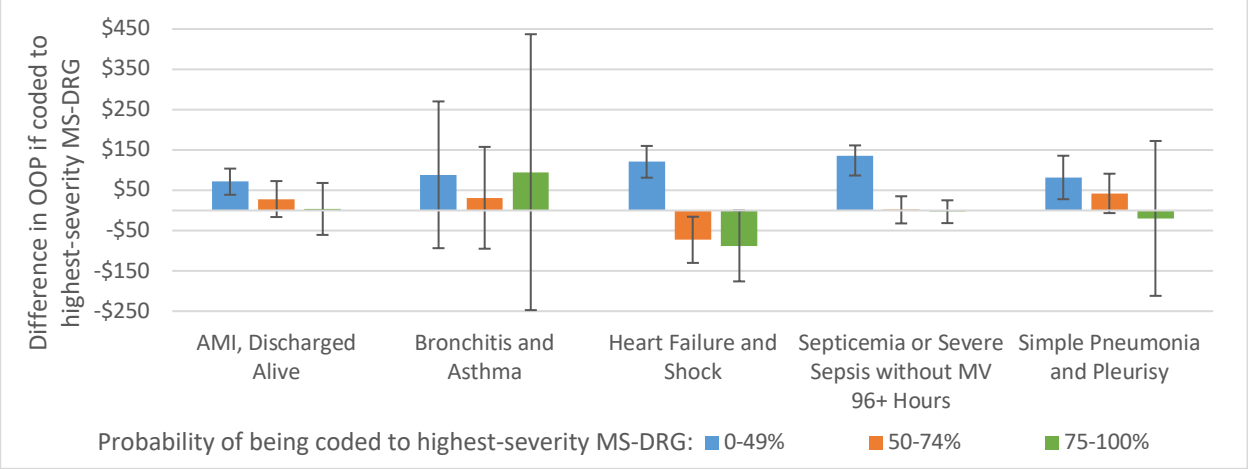
[15] Due to small sample sizes, we combined all stays with a probability of having the highest-severity MS-DRG that was less than 50 percent because there were few stays with a probability of less than 25 percent.

Figure 3.9. Impact of Upcoding on Out-of-Pocket Spending in FY2023, Top Five Base MS-DRGs

Panel A. Commercial Stays



Panel B. Medicare Advantage Stays



SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: Includes hospital stays from the top five base MS-DRGs ranked by volume of upcoded stays in FY2023. Error bars are the 95 percent confidence intervals estimated from bootstrapping 200 replications of the analysis. FY2023 is the federal fiscal year (October 1 through September 30). Point estimates and 95 percent confidence intervals for this figure are available in Table B.3.

Chapter 4. Discussion

Growth in Upcoding and Impacts on Hospital Payments

Using California HPD data for commercial and MA hospital stays from 251 base MS-DRGs, we found that 61 percent of the growth in the highest-severity MS-DRGs among commercial stays—which increased from 24.7 percent to 31.1 percent between FY2018 and FY2023—was explained by patient characteristics, including health at admission. This result indicates that up to 39 percent of the growth in highest-severity MS-DRGs for commercial stays was associated with MS-DRG upcoding. Up to an additional 2.5 percent of commercial stays in FY2023 were upcoded relative to FY2018. The growth in upcoding did not reach a statistically significant level until FY2023, however, suggesting that the growth in upcoding observed in the 2010s (Crespin et al., 2024) slowed during the COVID-19 PHE but resumed near its tail end.

We can describe the magnitude of upcoding's impacts on total inpatient hospital spending in California. The growth in upcoding from FY2018 to FY2023 was associated with a 1.0 percent increase in payment weights for commercial stays for the MS-DRGs included in our sample. Our analytic sample accounted for 56 percent of the total payment weights for all California commercial stays in the HPD from FY2018 through FY2023. After scaling our findings by this 56 percent, we estimate that the growth in upcoding in this period increased payments across all commercial stays in California by up to 0.56 percent. According to California Hospital Annual Financial Data, total commercial inpatient spending in California was approximately $95.5 billion in FY2023 (HCAI, undated-c). Extrapolating the increase in payment rates for commercial stays to the full commercial population (i.e., including stays for self-funded health plans not included in the HPD), we estimate that the growth in upcoding was associated with up to $535 million in payments to hospitals from commercial health plans in FY2023 (relative to FY2018).

At an overall level, we did not find that the increase in the highest-severity MS-DRGs for MA stays was attributable to upcoding. Based on sensitivity analysis, this could be because factors associated with hospital stays but unobserved in our data (e.g., technological advancement, quality improvement, or changes in patient mix) led to a higher percentage of stays at the highest MS-DRG severity level, rather than upcoding. Additionally, although there was significant growth among a small set of high-volume base MS-DRGs (albeit at lower rates than commercial stays), our model predicted little to no upcoding for most other base MS-DRGs.

There was significantly more upcoding growth among MA patients living in the lowest median household income ZIP codes compared to ZIP codes with higher incomes. These ZIP codes likely include larger percentages of MA enrollees who are dually eligible than in higher-income ZIP codes, which could result in increased spending on California's Medicaid program.

Some studies suggest that patients with low socioeconomic status receive worse health care, for example, because of differences in physician-patient communication between patients of different income levels (Job et al., 2024). Potentially, differences in communication across patients could result in diagnoses going undocumented. If our findings reflect better documentation for patients with low socioeconomic status, then they could have received better overall care, although the additional diagnoses could have contributed to higher payments. However, prior studies found no link between patient socioeconomic status and the accuracy of diagnoses (Bell et al., 2023; Al Alwan et al., 2019).

The growth in upcoding was driven by commercial stays in non-Kaiser hospitals. Kaiser is a vertically integrated organization comprising California's dominant health insurer and health system. Integrated organizations may have fewer financial incentives to upcode patients relative to non-integrated health systems because their hospital stays are frequently paid for through their own health plan revenue. Recent growth in vertical integration between health insurers and health systems has particularly accelerated among MA organizations, which may further explain why we found little upcoding among MA stays (Bejarano et al., 2024).

Patient Out-of-Pocket Spending

We found that upcoding was likely associated with higher OOP spending for MA stays. Patients with a low probability of being coded to the highest-severity MS-DRG had higher OOP spending when they were coded to the highest severity level. Specifically, OOP spending for an MA stay with a less than 50 percent probability of having the highest-severity MS-DRG was approximately $100 higher compared to a similar stay that did not have the highest MS-DRG severity for four of the five most upcoded base MS-DRGs. This increase represents roughly a 45 percent increase in OOP spending from the average MA stay. Relatively healthy patients who had the highest-severity MS-DRG may have had higher OOP spending because they were in a plan with coinsurance for hospital services or because they were not near their deductible. This increase is more likely to impact non–dually eligible enrollees, as the dually eligible typically face little cost-sharing responsibility.

Although $100 per stay may not be a substantial amount for all patients, the additional expenses could impact some. As of 2024, 37 percent of Americans reported they did not have enough savings to pay a $400 unexpected emergency expense, and 18 percent cannot afford an expense of $100 (Federal Reserve Board, 2025). Patient financial burdens can lead to forgone care, which worsens health outcomes and results in additional hospitalizations and resource utilization (Thomas et al., 2021; Fusco et al., 2023; Gaffney et al., 2020). About 52 percent of Californians in 2023 reported skipping or delaying care due to cost (Bailey et al., 2023). However, if the additional costs were driven primarily by patients not yet reaching their deductible, then even if they were coded to a lower MS-DRG severity level, they may incur the expense later in the year through additional cost-sharing, for example, during follow-up care.

Limitations

Our study had several limitations. In particular, we estimated the marginal increase in upcoding between FY2018 and FY2023, but we did not calculate the total amount of upcoding during the study period, as the data used were not appropriate to establish a benchmark for the level of complexity that would be observed under perfectly accurate coding. Prior studies found that the introduction of the MS-DRGs in 2007 was associated with upcoding. For example, Cook and Averett (2020) found that approximately 3 percent of Medicare payments for hospital care each year were attributable to upcoding between 2008 and 2010. These coding changes and other coding behavior after these initial changes were factored into the baseline in our study.

A further limitation is that we were unable to control for all aspects of patient health, some of which may be present only in clinical data such as electronic health records. There are some reasons why the unobserved health of the patient mix in our data would have been worse in later years of the study compared to baseline. A recent study of California hospitals found that average length of stay increased from the start of the COVID-19 PHE through 2022, aligning with the data used in this study (Melnick and Maerki, 2023). While that study cited more complex patients as one reason for the trend, it also pointed toward an increase in "administrative" days when patients need to wait to be discharged to post-acute care. Recent studies report that heart failure hospitalizations have grown since the mid-2010s for Medicare patients and recently increased for the under-65 population (Mentias et al., 2025; Agarwal et al., 2026), which could mean that heart failure patients are becoming more complex, on average. The COVID-19 PHE led to an increase in inpatient mortality and patient acuity, which was driven by patients delaying care to avoid contagion (Birkmeyer et al., 2020; Smulowitz et al., 2024), although we found an increase in upcoding only in FY2023 at the tail end of the PHE, so this occurrence likely did not impact our findings. Moreover, COVID-19 is associated with immediate and long-term health risks including heart failure, which was the base MS-DRG for which we found the largest count of potentially upcoded stays (Olumuyide, Agwuegbo, and Ahmed, 2024).

Additionally, temporal technological and quality improvements could have led to unobserved changes in the health of the patient mix or shorter stays for some base MS-DRGs, which may have led to misestimation of the growth in upcoding. For example, improvements in technology could improve mortality or allow healthier patients to be treated in outpatient settings rather than be hospitalized, which would have made our patient mix more severe over time.

We conducted several sensitivity analyses to test the robustness of our results. We found that our estimate of the growth in upcoding in FY2023 relative to FY2018 was robust when excluding all stays among patients who had at least one inpatient stay with a COVID-19 diagnosis. Although we were unable to exclude all patients who ever had COVID-19, patients with COVID-19 during inpatient stays were more likely to be severe cases than cases managed at home or in outpatient settings. If increased health risk from COVID-19 among patients was

driving our results, then removing these patients would have decreased our estimate of upcoding growth.

Furthermore, to determine if unobserved temporal changes biased our results, we conducted a sensitivity analysis that used the prior year as the baseline for each analyzed year (rather than FY2018 for all years). We found that in this sensitivity analysis there was no upcoding growth among MA stays, contrary to the main specification. We also found that in the aggregate, upcoding was not associated with increased payments in MA, suggesting that changes over time not captured by the main model were responsible for the increased use of the highest-severity MS-DRGs rather than upcoding. Our FY2023 upcoding growth estimate for commercial stays remained robust under this specification.

Given the limitations in observing all factors of patient health, we view our results as an upper bound on the growth in upcoding. A priority for future work should be to devise alternative methods to capture patient health that would better control for changes over time. For example, these methods could include creating risk scores or condition indicators that utilize claims-based information outside of inpatient claims (e.g., outpatient diagnoses or drug prescriptions) or chart-based records.

Conclusion

In this study estimating the growth of MS-DRG upcoding of MA and commercial inpatient stays in California, we found that up to 39 percent of the observed growth in the highest-severity MS-DRG commercial stays from FY2018 to FY2023 was potentially due to upcoding, as the increase was not explained by changes in patient mix or health at the time of admission. We estimated that this increase in upcoding was associated with up to $535 million in payments by commercial health plans to hospitals in FY2023. While we did not find significant overall growth in upcoding for MA stays, we did find significant growth among MA patients residing in the lowest quartile of ZIP codes based on median household income. Additionally, among MA patients, upcoding was associated with about 45 percent higher OOP spending per stay for four high-volume base MS-DRGs. These results highlight the need for policy interventions to curb upcoding and its impact on payments and OOP spending. These interventions could include enhanced auditing and monitoring of high-risk MS-DRGs and hospitals and policy reforms to reduce the financial rewards of upcoding.

Appendix A. Technical Appendix

The analysis used methodology first developed by Ho, Tapaneeyakul, and Russell (2023) in examining upcoding as a driver of commercial emergency department prices. Crespin et al. (2024) modified this methodology for hospital inpatient settings. Much of this appendix is credited to and quoted (Section 2 and Section 3) from the technical appendix of Crespin et al. (2024).

Section 1. Analytic Sample Construction

Selection of Providers

To develop the analytic sample, we obtained all hospital stays with acute inpatient place of setting from the HPD inpatient summary discharge file. We then excluded all stays that occurred at a provider outside of California (or if the provider location was unknown) and stays in which the patient died or was discharged to hospice. Among these stays, there were approximately 2,500 unique providers based on the HPD's unique provider ID. Comparatively, there are approximately 340 general acute care hospitals in California (Joynt, 2022). Using taxonomy codes, specialty codes, and provider names, we found that approximately 1,700 providers, accounting for less than 1 percent of stays, did not correspond to either an acute inpatient hospital or another provider, such as a multi-specialty medical group. These providers included, for example, residential treatment facilities and skilled nursing facilities that typically furnish longer-term services. Other providers had imaging or other specialties that were unlikely to admit patients. We opted to exclude these providers, because these providers do not typically use Inpatient Prospective Payment System MS-DRGs to bill for services. All but 22 of these providers would have been excluded regardless based on our criteria to include only providers with at least 25 stays in FY2018, which was used as the base year of the model, and only one had more than 150 stays in FY2018. Table A.1 shows the HPD variables and values we used to exclude providers. We also excluded providers flagged as long-term care hospitals because they had few stays in our sample and because of ambiguity as to whether the stays would have been paid for using Long-Term Care Diagnosis Related Groups, which have different payment weights than acute inpatient MS-DRGs. Lastly, we performed manual exclusions based on provider names to exclude any remaining providers that did not appear to be a general acute inpatient hospital or other provider that would typically furnish hospital inpatient stays.

Table A.1. Criteria Used to Exclude Providers from Analytic Sample

Taxonomy Provider Type		
Behavioral health & social service providers	Laboratories	Residential treatment facilities
Taxonomy Specialization		
Addiction medicine	Addiction psychiatry	Adolescent and children mental health
Adult day care	Air transport	Body imaging
Clinic pharmacy	Community/retail pharmacy	Diagnostic radiology
Home health	Home infusion therapy pharmacy	Hospice and palliative medicine
Institutional pharmacy	Lactation consultant	Magnetic resonance imaging
Mental health (Including community mental health center)	Methadone	Rehabilitation, comprehensive outpatient rehabilitation facility
Rehabilitation, substance use disorder	Research data abstracter/coder	Specialty pharmacy
Provider Specialty		
Ambulance	Assisted living facility	Custodial care facility
Durable medical equipment & medical supplies	Home infusion	Hospice care, community based
Hospice, inpatient	Intermediate Care Facility, Mental Illness	Meals
Nursing facility/ intermediate care facility	Portable x-ray and/ other portable diagnostic imaging supplier	Medical genetics, PH.D medical genetics
Non-emergency medical transport	Pharmacy	Prosthetic/orthotic, supplier
Religious nonmedical health care institution		

SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.

We excluded roughly 500 providers with fewer than 25 stays in FY2018, accounting for less than 1 percent of hospital stays, because of concern that low-volume hospitals would result in imprecise estimates. Our final analytic sample consisted of stays at 377 unique providers, which closely aligns with the California Health Care Foundation's count of 337 general acute care hospitals (Joynt, 2022). Our final analytic sample included 20 providers that appeared by name to not match a hospital or medical center (mostly medical groups), but that otherwise met the inclusion criteria described above. These groups may be submitting claims, for example, because they own and operate hospitals and inpatient units. These providers accounted for approximately 2 percent of stays. Table A.2 presents the frequency of provider types in the final analytic sample using taxonomy codes present in the HPD.

Table A.2. Count of Provider Types in Final Sample

		Taxonomy General Type		
		Individual or Groups (of Individuals)	Non-individual	Total
Taxonomy Provider Type	Agencies	0	2	2
	Allopathic & Osteopathic Physicians	13	0	13
	Ambulatory Health Care Facilities	0	24	24
	Eye and Vision Services Providers	1	0	1
	Hospital Units	0	24	24
	Hospitals	0	297	297
	Managed Care Organizations	0	10	10
	Other Service Providers	6	0	6
	Total	20	357	377

SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.

Exclusion of Certain Base MS-DRGs

We excluded hospital stays of 82 base MS-DRGs with a single MS-DRG because of the inability to upcode within the base MS-DRG (Table A.3). We also excluded 33 base MS-DRGs that were either newly created, deleted, or affected by the created or deleted base MS-DRGs (e.g., if a principal diagnosis code from a deleted base MS-DRG was added to an existing base MS-DRG). This study consequently excludes most base MS-DRGs related to birth and delivery due to a revision implemented in 2019 (Centers for Medicare & Medicaid Services, 2018).

Table A.3. Base MS-DRGs Excluded from the Final Analytic Sample

Base MS-DRGs excluded because they have one complication rating		
Abortion with Dilation and Curettage, Aspiration Curettage or Hysterotomy	Abortion without Dilation & Curettage	Acute Adjustment Reaction and Psychosocial Dysfunction
Admit for Renal Dialysis	Automatic Implantable Cardioverter Defibrillator Generator Procedures	Automatic Implantable Cardioverter Defibrillator Lead Procedures
Alcohol/Drug Abuse or Dependence with Rehabilitation Therapy	Alcohol/Drug Abuse or Dependence, Left Against Medical Advice	Allogeneic Bone Marrow Transplant
Angina Pectoris	Arthroscopy	Behavioral and Developmental Disorders
Cardiac Defibrillator Implant With Cardiac Cath and Major Complication and Comorbidity	Chest Pain	Chimeric Antigen Receptor T-Cell Immunotherapy
Coagulation Disorders	Concomitant Aortic and Mitral Valve Procedures	Coronary Intravascular Lithotripsy without Intraluminal Device
Craniotomy for Multiple Significant Trauma	Depressive Neuroses	Disorders of Personality and Impulse Control
Disequilibrium	Extracorporeal Membrane Oxygenation or Tracheostomy with MV >96 Hours or Principal Diagnosis	Ectopic Pregnancy

Base MS-DRGs excluded because they have one complication rating		
	Except Face, Mouth & Neck With Major Operating Room (OR) Procedure	
Extensive Burns or Full Thickness Burns with MV 96+ Hours with Skin Graft	Extensive Burns or Full Thickness Burns with MV 96+ Hours without Skin Graft	Extraocular Procedures Except Orbit
Extreme Immaturity Or Respiratory Distress Syndrome, Neonate	False Labor	Female Reproductive System Reconstructive Procedures
Fever	Full Term Neonate with Major Problems	Full Thickness Burn with Skin Graft or Inhalation Injury
Hand Procedures for Injuries	HIV with or without Other Related Condition	Inborn Errors of Metabolism
Kidney Transplant	Limb Reattachment, Hip and Femur Procedure for Multiple Significant Trauma	Lung Transplant
Major Joint and Limb Reattachment Procedure of Upper Extremity	Major Thumb or Joint Procedure	Neonate with Other Significant Problems
Neonates, Died or Transferred to Another Acute Care Facility	Neurological Eye Disorders	Neuroses Except Depressive
Non-Extensive Burns	Normal Newborn	OR Procedure with Principal Diagnoses of Mental Illness
Organic Disturbances and Mental Retardation	Other Antepartum Diagnoses with Medical Complications	Other Antepartum Diagnoses without Medical Complications
Other Circulatory System OR Procedures	Other Factors Influencing Health Status	Other Heart Assist System Implant
Other Mental Disorder Diagnoses	Pancreas Transplant	Postpartum and Post Abortion Diagnoses with OR Procedure
Postpartum and Post Abortion Diagnoses without OR Procedure	Prematurity with Major Problems	Prematurity without Major Problems
Principal Diagnosis Invalid as Discharge Diagnosis	Psychoses	Pulmonary Edema and Respiratory Failure
Radiotherapy	Respiratory Signs and Symptoms	Respiratory System Diagnosis with Ventilator Support <96 Hours
Respiratory System Diagnosis with Ventilator Support 96+ Hours	Salivary Gland Procedures	Septicemia or Severe Sepsis with MV 96+ Hours
Simultaneous Pancreas and Kidney Transplant With Hemodialysis	Simultaneous Pancreas/Kidney Transplant	Syncope and Collapse
Threatened Abortion	Tracheostomy with Mechanical Ventilation >96 Hours or Principal Diagnosis Except Face, Mouth, and Neck without Major OR	Transient Ischemia
Ultrasound Accelerated and Other Thrombolysis with Principal Diagnosis Pulmonary Embolism	Ungroupable	Urethral Stricture
Vaginal Delivery with Complicating Diagnoses	Vaginal Delivery with OR Procedure Except Sterilization and/or Dilation & Curettage	Vaginal Delivery with Sterilization
Vaginal Delivery without Complicating Diagnoses		

Base MS-DRGs excluded because of revisions		
Admit for Renal Dialysis	Allogeneic Bone Marrow Transplant	Autologous Bone Marrow Transplant
Cesarean Section	Cesarean Section with Sterilization	Cesarean Section without Sterilization
Chimeric Antigen Receptor T-Cell Immunotherapy	Cranial/Facial Procedures	Dilation & Curettage, Conization, Laparoscopy & Tubal Interruption
Ectopic Pregnancy	Endovascular Cardiac Valve Replacement	False Labor
Hip Replacement with Principal Diagnosis of Hip Fracture	Kidney Transplant	Major Head & Neck Procedures
Major Head and Neck Procedures	Major Joint Replacement or Reattachment of Lower Extremity	Other Antepartum Diagnoses with Medical Complications
Other Antepartum Diagnoses with OR Procedure	Other Antepartum Diagnoses without Medical Complications	Other Antepartum Diagnoses without OR Procedure
Other Ear, Nose, Mouth and Throat OR Procedures	Other Endovascular Cardiac Valve Procedures	Other Kidney and Urinary Tract Diagnoses
Simultaneous Pancreas and Kidney Transplant With Hemodialysis	Simultaneous Pancreas/Kidney Transplant	Threatened Abortion
Urinary Stones with Extracorporeal Shock Wave Lithotripsy	Vaginal Delivery with Complicating Diagnoses	Vaginal Delivery with Sterilization
Vaginal Delivery with Sterilization/Dilation and Curettage	Vaginal Delivery without Complicating Diagnoses	Vaginal Delivery without Sterilization/Dilation & Curettage

Comparison of Analytic Sample to Universe of HPD Hospital Stays

Along with the above exclusions, we also excluded hospital stays that had missing data (age, sex, payer, or ZIP code of residence). Table A.4 presents the total number of stays for the universe of HPD stays compared to the final sample, aggregated across all years of the analysis. Notably, the final analytic sample had more MA stays and more stays for men compared to the full universe of hospital stays in the HPD. This shift occurred primarily through the exclusion of base MS-DRGs related to birth and delivery. Table A.5 presents characteristics of the analytic sample stratified by year.

Table A.4. Universe of Hospital Stays Compared to Final Analytic Sample

	All stays in HPD inpatient summary file	Stays excluding stays not in California and stays in which the patient died or was discharged to hospice	Final analytic sample excludes providers identified as not being hospitals and providers with fewer than 25 stays in FY2018, MS-DRGs without different severities or that were revised, and stays with missing data
By Fiscal Year			
FY2018 (9 months)	714,997	614,466	354,814
FY2019	993,077	855,946	490,910
FY2020	950,738	806,624	458,610
FY2021	984,559	832,613	489,493
FY2022	1,033,791	866,628	514,485
FY2023	1,065,970	875,606	541,228
Total	5,743,132	4,851,883	2,849,540
Discharge Status			
Alive	96.2%	100.0%	100.0%
Death or hospice	3.8%	0.0%	0.0%
Base MS-DRG			
Multiple ratings	61.9%	60.4%	100.0%
Single rating	21.2%	20.5%	0.0%
Revised between 2019 and 2023	17.0%	19.1%	0.0%
Hospital Stay Location			
California	98.2%	100.0%	100.0%
Not California/unknown	1.8%	0.0%	0.0%
Payer			
Commercial	61.1%	61.9%	48.5%
Medicare Advantage	38.6%	37.9%	51.5%
Unknown	0.3%	0.2%	0.0%
Age			
Mean age (capped at 90)	50.3	49.6	61.5
Missing age	0.1%	0.1%	0.0%
Sex			
Female	57.2%	58.4%	49.5%

	All stays in HPD inpatient summary file	Stays excluding stays not in California and stays in which the patient died or was discharged to hospice	Final analytic sample excludes providers identified as not being hospitals and providers with fewer than 25 stays in FY2018, MS-DRGs without different severities or that were revised, and stays with missing data
Male	42.7%	41.6%	50.5%
Unknown	0.1%	0.1%	0.0%
Race Percent in ZIP Code			
Black	6.0%	6.1%	6.1%
Asian	15.3%	15.5%	15.0%
White	56.3%	55.9%	56.2%
Missing	4.0%	4.0%	0.0%
Median Income in ZIP Code			
ZIP Code Income	$86,940	$86,688	$85,455
Missing	4.1%	4.1%	0.0%

SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays and ZIP code tabulation area (ZCTA) level demographics from the 2020 Decennial Census. All years are federal fiscal years (October 1 through September 30).
NOTE: FY2018 includes the last nine months of the year (January 2018 through September 2018).

Table A.5. Summary Statistics of Inpatient Hospital Stays

	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
Hospital Stays	354,814	490,910	458,610	489,493	514,485	541,228
Payer (%)						
Commercial	53.2%	51.2%	50.3%	49.3%	46.0%	43.2%
Medicare Advantage	46.8%	48.8%	49.7%	50.7%	54.0%	56.8%
Sex (%)						
Female	50.1%	50.1%	49.1%	48.9%	49.3%	49.7%
Male	49.9%	49.9%	50.9%	51.1%	50.7%	50.3%
Age Group (%)						
0–17	5.4%	5.2%	4.6%	4.0%	4.4%	4.5%
18–34	7.4%	7.0%	6.8%	6.6%	6.0%	5.7%
35–49	13.0%	12.5%	12.3%	12.4%	11.5%	10.6%
50–64	27.6%	26.8%	26.9%	26.9%	24.8%	23.1%
65–79	28.9%	30.2%	31.2%	32.1%	33.8%	35.1%
80 or older	17.7%	18.3%	18.3%	18.0%	19.6%	21.2%

	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
Non-White in ZIP Code (%)						
0–25%	18.6%	18.3%	17.8%	17.5%	17.6%	18.0%
26–50%	45.4%	45.3%	45.4%	45.1%	45.1%	45.7%
51–75%	30.2%	30.4%	30.8%	31.3%	31.1%	30.4%
76–100%	5.9%	6.0%	6.0%	6.2%	6.1%	5.9%
Median Income in ZIP Code (%)						
≤$50,000	23.4%	22.9%	22.6%	22.2%	22.3%	22.2%
$50,001–$100,000	61.8%	62.3%	62.1%	62.4%	62.4%	62.8%
$100,001–$150,000	5.3%	5.1%	5.1%	4.9%	4.9%	4.6%
≥$150,001	9.5%	9.8%	10.2%	10.4%	10.5%	10.3%
Mean Allowed Amount						
Commercial	$36,147	$37,451	$39,134	$41,761	$43,234	$44,269
Medicare Advantage	$16,540	$16,462	$17,442	$17,303	$15,449	$15,582
Mean Out-of-Pocket Payment						
Commercial	$899	$885	$911	$956	$1,024	$1,024
Medicare Advantage	$399	$395	$361	$296	$253	$227

SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays and ZCTA level demographics from the 2020 Decennial Census. All years are federal fiscal years (October 1 through September 30).
NOTE: FY2018 includes the last nine months of the year (January 2018 through September 2018).

Section 2. Elixhauser Comorbidity Risk of 30-Day Readmission Index

To measure patient health at admission, we used the Elixhauser Comorbidity risk of 30-day readmission index. The Elixhauser software creates indices by weighting the risk of certain pre-existing conditions at the time of hospitalization that predict the intensity of the stay (e.g., length of stay, resources used) (Healthcare Cost and Utilization Project, 2022). While there is some concern that upcoding would also affect the Elixhauser indices, the indices generally measure pre-existing and chronic conditions, while the MS-DRG complications and comorbidities capture acute conditions related to the specific hospital stay.

We found that there was only a small overlap between the diagnoses used by the Elixhauser Comorbidity risk of 30-day readmission index and the diagnoses used to code a higher-severity MS-DRG. Of the ICD-10 codes used to flag conditions used in the Elixhauser indices, 8 percent were also an MS-DRG major complication and comorbidity. We used the risk of 30-day readmission index rather than the risk of in-hospital mortality index, because the risk of 30-day readmission index applies a weight of zero to roughly half of the conditions where there is overlap, in particular for cerebrovascular disease, thyroid disorders, hypertension, and valve disease.

Section 3. Regression Specification and Bootstrapped Confidence Intervals

Regression Specification

We measured the increase in upcoding as the difference in the observed number of hospital stays with the highest-severity MS-DRG and the predicted amount in each year between FY2018 and FY2023. This method was developed by Ho, Tapaneeyakul, and Russell (2023), who used it to estimate upcoding in emergency departments. Specifically, we first estimated the probability that a stay was coded with the highest-severity MS-DRG in FY2018 using a linear probability model regression for each of the 251 base MS-DRGs. That is, a separate regression model was estimated for each base MS-DRG to allow flexibility in the coefficients. The regression model used for base MS-DRG *m* is of the form

$$P\left(Highest\ Complication\ and\ Comorbidity\ Category_{d,m,p}\right) = \alpha_m + \beta_{m,1}Age_d + \beta_{m,2}Sex_d + \beta_{m,3}ZipCodePercentNonWhite_d + \beta_{m,4}ZipCodeMedianIncome_d + \beta_{m,5}Payer_d + \beta_{m,6}LengthOfStay_d + \beta_{m,7}PatientHealth_d + P_{m,p} + \varepsilon_{d,m,t},$$

where *d* indexes stays and *p* indexes the provider at which the stays took place. The outcome variable is an indicator equal to 1 for stays coded with the highest category and equal to 0 if coded below the highest category. Patient characteristics included age, sex, and ZIP code level measures for the percent of non-White population and the median household income among the total population in the patient's ZIP code. We derived the ZIP code level demographic measures from ZCTA characteristics from the 2020 Decennial Census, crosswalked this data to ZIP codes, and merged them with the HPD by the patient's ZIP code of residence. Payer includes the primary payer of the stay (MA or commercial). $P_{m,p}$ represents a provider fixed effect for provider *p* in in the model for base MS-DRG *m*, and ε is the idiosyncratic error term that is mean-0 conditional on the included covariates.

We applied the parameters of the model to predict the probability that each stay from FY2019 to FY2023 would be coded with the highest-severity MS-DRG. To calculate the increase in upcoding in each year (expressed as the number of stays), we took the difference between the observed and predicted number of stays with the highest-severity for each base MS-DRG:

$$Upcoding\ Increase\ Relative\ to\ 2018_{m,y} = \sum_{d \in D_m} 1(Observed\ with\ Highest\ Severity)_{d,m,y} - \sum_{d \in D_m} P(Highest\ Severity_{d,m,y}),$$

where the summation over *D* indicates summation over all stays observed in a year for base MS-DRG *m*.

Bootstrapped Confidence Intervals

To obtain confidence intervals, we estimated bootstrapped standard errors. To account for possible correlation between errors for hospital stays at the same hospital, we used a clustered bootstrap approach where each cluster was the hospital (Cameron, Gelbach, and Miller, 2008). For each bootstrap resample, we drew (with replacement) a set of providers equal to the number of hospitals in the base model analytic sample ($N = 377$), estimated the regression model, calculated the predicted number of stays in the highest complication and comorbidity category, and obtained the increase in upcoding by comparing the observed and predicted numbers of stays. We replicated this procedure 200 times. The standard deviation of the estimates from the bootstrapped samples was used as the standard error, which we used to calculate 95 percent CIs for the estimates from the base model.

Appendix B. Supporting Findings

Table B.1. Point Estimates and Confidence Intervals for Overall Growth in Upcoding (Figure 3.2) and Impact on Payment (Figure 3.5)

Fiscal Year	Total Hospital Stays	Hospital Stays with the Highest MS-DRG Severity Level (%)	Potentially Upcoded Hospital Stays as Percentage of All Stays (95 percent CI)	Percentage Growth in Payment Weights Attributed to Growth in Upcoding (95 percent CI)
Commercial				
FY2018	188,823	24.7	N/A	N/A
FY2019	251,448	25.2	0.4 (0.0–0.8)	0.1 (-0.1–0.4)
FY2020	230,538	29.8	0.2 (-2.6–2.9)	0.3 (-0.6–1.2)
FY2021	241,264	36.3	1.2 (0.7–1.7)	0.5 (0.1–0.9)
FY2022	236,891	32.8	1.6 (0.9–2.2)	0.7 (0.2–1.1)
FY2023	233,793	31.1	2.5 (1.9–3.1)	1.0 (0.6–1.4)
Medicare Advantage				
FY2018	165,991	36.7	N/A	N/A
FY2019	239,462	36.8	-0.7 (-1.3– -0.2)	-0.6 (-1.0– -0.3)
FY2020	228,072	39.3	-0.2 (-7.1–6.8)	-0.4 (-6.5–5.7)
FY2021	248,229	42.0	-0.6 (-6.5–5.3)	-0.6 (-2.2–1.0)
FY2022	277,594	42.1	0.6 (-0.3–1.5)	-0.4 (-0.9–0.2)
FY2023	307,435	41.6	1.4 (0.8–2.1)	0.1 (-0.4–0.5)

SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: Includes hospital stays from 251 base MS-DRGs. The 95 percent confidence intervals were estimated from bootstrapping 200 replications of the analysis. All years are federal fiscal years (October 1 through September 30).

Table B.2. Point Estimates and Confidence Intervals for Top 15 Base MS-DRGs (Figure 3.3), Kaiser and Non-Kaiser Hospitals (Figure 3.6), Commercial Price per Hospital Stay (Figure 3.7), and ZIP Code Level Demographics (Figure 3.8)

	Commercial		Medicare Advantage	
Category	Total Hospital Stays	Potentially Upcoded Stays as Percentage of All Stays in FY2023 (95 percent CI)	Total Hospital Stays	Potentially Upcoded Stays as Percentage of All Stays in FY2023 (95 percent CI)
Top 15 Base MS-DRGs				
Heart Failure and Shock	3,912	22.2 (19.7–24.6)	19,601	11.8 (10.1–13.6)
Simple Pneumonia and Pleurisy	3,877	22.2 (19.1–25.3)	8,328	11.8 (9.1–14.6)
Bronchitis and Asthma	4,766	16.0 (11.8–20.1)	1,033	4.2 (-1.0–9.5)
Septicemia or Severe Sepsis without MV 96+ Hours	19,081	2.3 (0.8–3.8)	41,950	0.2 (-1.0–1.5)
AMI, Discharged Alive	3,972	3.8 (0.7–6.8)	9,166	3.7 (1.5–5.9)
Nutritional and Miscellaneous Metabolic Disorders	3,155	2.8 (-0.3–5.9)	7,154	4.9 (2.7–7.1)
Chronic Obstructive Pulmonary Disease	645	10.4 (4.6–16.1)	3,852	8.5 (5.9–11.2)
Circulatory Disorders Except AMI, with Cardiac Cath	2,119	8.9 (5.9–11.9)	2,960	5.1 (1.9–8.3)
Alcohol/Drug Abuse or Dependence without Rehab	4,885	3.7 (1.0–6.4)	1,531	7.1 (3.2–11.1)
Diabetes	4,101	1.8 (-0.2–3.7)	3,579	5.2 (2.3–8.2)
Pulmonary Embolism	1,393	8.7 (5.2–12.2)	1,963	7.0 (3.0–11.0)
Esophagitis, Gastroenteritis & Miscellaneous Digest Disorders	6,377	3.6 (2.1–5.0)	5,589	0.4 (-4.0–4.8)
Respiratory Infections and Inflammations	2,570	2.1 (0.5–3.6)	9,549	1.9 (1.0–2.8)
Gastrointestinal Hemorrhage	3,058	5.0 (2.9–7.1)	7,936	1.0 (-0.6–2.6)
Major Small and Large Bowel Procedures	6,576	3.0 (1.8–4.2)	4,401	0.4 (-2.1–2.8)
Kaiser Compared to Non-Kaiser Hospitals				
Non-Kaiser	152,234	3.6 (2.6–4.7)	182,677	1.4 (-0.3–3.2)
Kaiser	81,559	0.4 (-1.4–2.2)	124,758	1.4 (-0.2–3.1)
Average Commercial Price per Hospital Stay				
Quartile 1	12,574	2.6 (0.9–4.3)	23,789	2.3 (-0.9–5.4)
Quartile 2	42,513	3.1 (1.9–4.3)	64,020	0.7 (-1.4–2.7)
Quartile 3	105,175	2.2 (1.1–3.3)	150,377	1.8 (0.6–2.9)
Quartile 4	73,521	2.6 (1.3–3.8)	68,523	1.1 (-0.1–2.3)
Median Income in ZIP Code				
Quartile 1	34,300	2.8 (1.6–4.0)	55,578	3.2 (1.8–4.6)
Quartile 2	60,748	2.8 (1.8–3.8)	82,473	1.4 (0.4–2.4)
Quartile 3	71,873	2.4 (1.4–3.4)	93,183	0.9 (0.1–1.7)
Quartile 4	66,762	2.2 (1.2–3.2)	76,129	0.8 (-0.2–1.8)

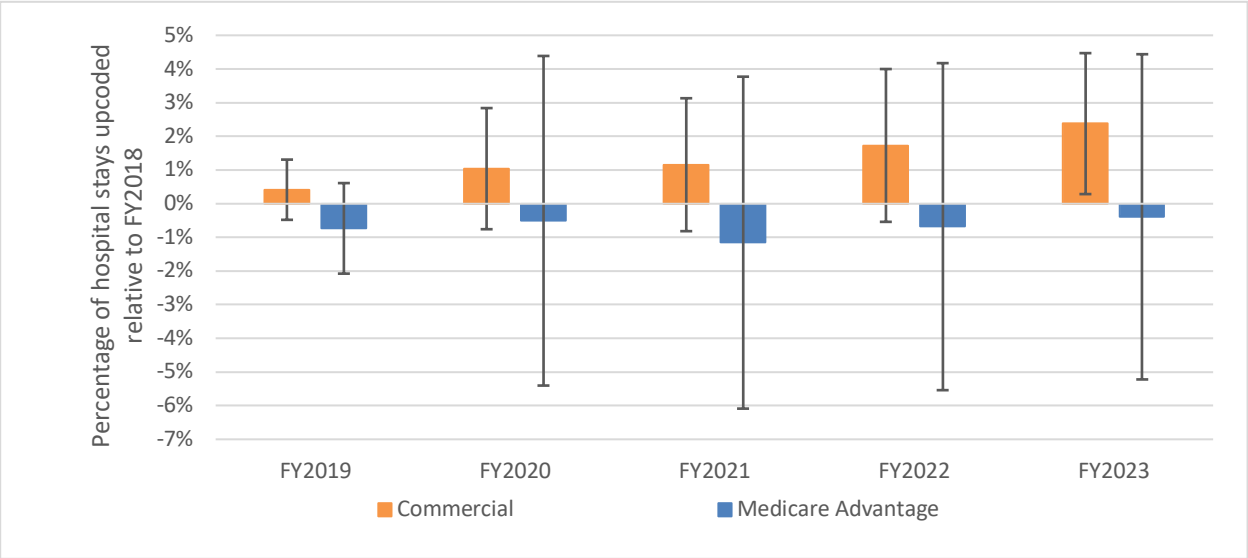
SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: Includes hospital stays from 251 base MS-DRGs (except for results specific to a base MS-DRG). The 95 percent confidence intervals were estimated from bootstrapping 200 replications of the analysis.

Table B.3. Point Estimates and Confidence Intervals for Upcoding's Impact on Out-of-Pocket Spending (Figure 3.9)

	Commercial		Medicare Advantage	
Probability of Being Coded to Highest-Severity MS-DRG	Total Hospital Stays in Probability Range with Highest-Severity MS-DRG	Difference in OOP Spending if Coded to Highest-Severity MS-DRG ($)	Total Hospital Stays in Probability Range with Highest-Severity MS-DRG	Difference in OOP Spending if Coded to Highest-Severity MS-DRG ($)
AMI, Discharged Alive				
0–49 percent	821	98 (-80–277)	1,625	71 (39–104)
50–74 percent	356	129 (-231–489)	1,587	28 (-16–73)
75–100 percent	299	66 (-367–499)	1,635	4 (-61–68)
Bronchitis and Asthma				
0–49 percent	2,071	110 (-4–224)	91	88 (-94–270)
50–74 percent	400	93 (-242–427)	320	31 (-95–158)
75–100 percent	184	322 (-255–899)	355	95 (-247–437)
Heart Failure and Shock				
0-49 percent	712	153 (-139–446)	2,319	121 (81–160)
50–74 percent	1,611	23 (-235–281)	6,698	-73 (-130– -15)
75–100 percent	1,034	38 (-329–405)	5,659	-88 (-176–0)
Septicemia or Severe Sepsis without MV 96+ Hours				
0–49 percent	3,503	-20 (-118–78)	2,183	136 (87–186)
50–74 percent	5,130	5 (-75–85)	14,316	2 (-32–35)
75–100 percent	2,642	179 (-25–383)	12,210	-3 (-31–25)
Simple Pneumonia and Pleurisy				
0–49 percent	1,639	97 (-45–239)	2,430	82 (28–136)
50–74 percent	335	86 (-507–679)	1,838	42 (-7–91)
75–100 percent	N/R	N/R	541	-20 (-212–172)

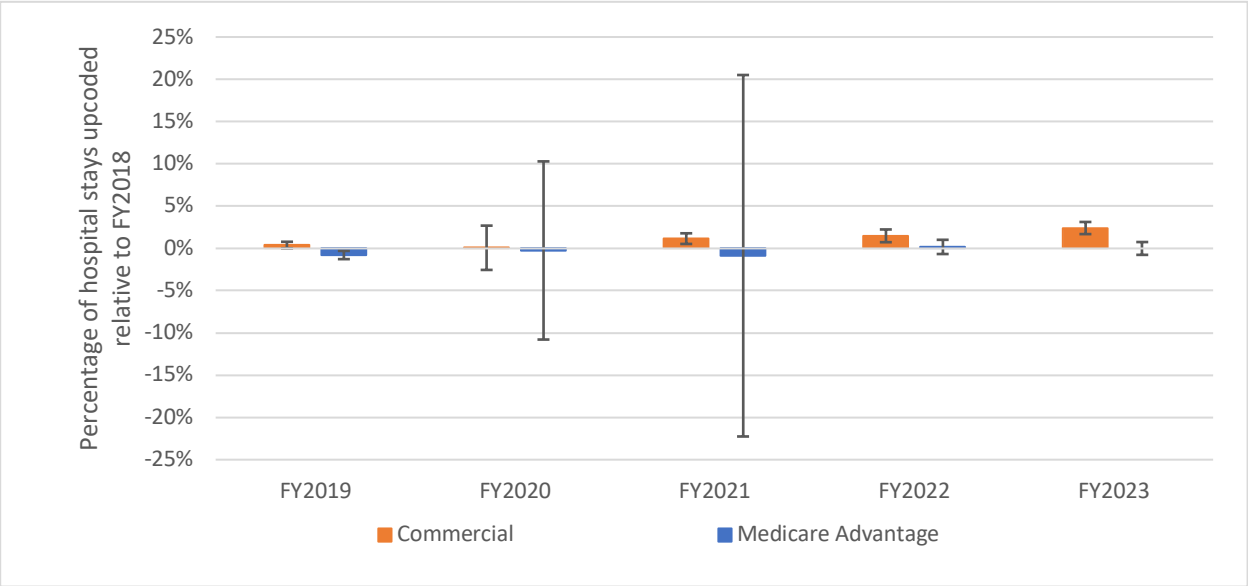
SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: The 95 percent confidence intervals were estimated from bootstrapping 200 replications of the analysis. N/R, not reported due to small cell size of 11 or fewer.

Figure B.1. Upcoded Hospital Stays as a Percentage of All Hospital Stays Relative to FY2018, Using Each Prior Year as Baseline



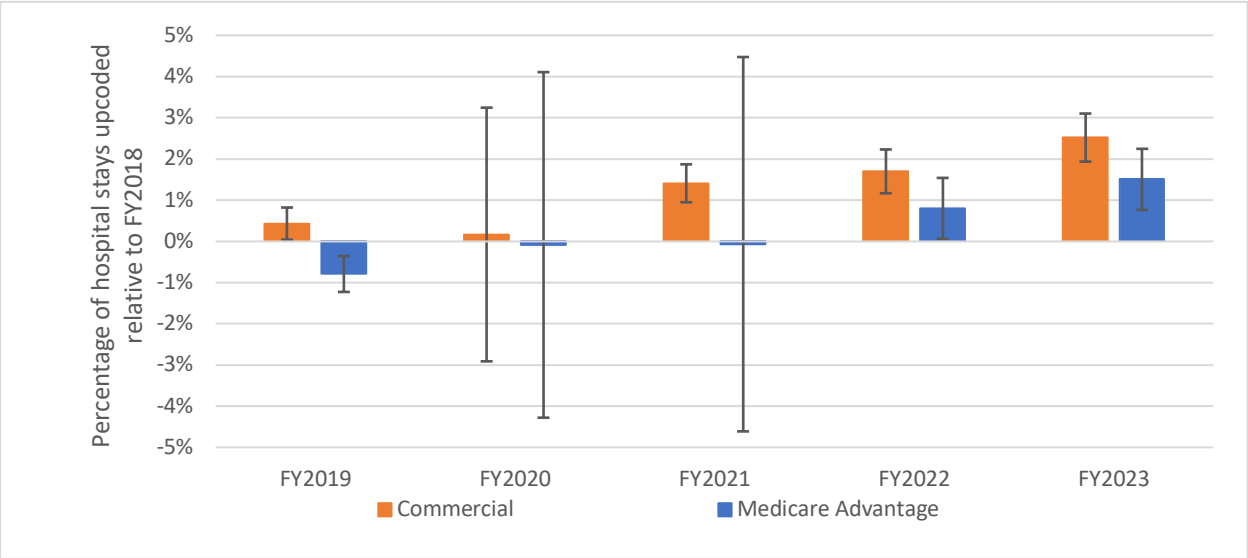
SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: For each year, we estimated the increase in upcoded stays using the prior year as the baseline. Each bar represents the cumulative increase in upcoded stays compared to FY2018. Includes hospital stays from 251 base MS-DRGs. Error bars are the 95 percent confidence intervals estimated from bootstrapping 200 replications of the analysis. All years are federal fiscal years (October 1 through September 30).

Figure B.2. Upcoded Hospital Stays as a Percentage of All Hospital Stays Relative to FY2018, Excluding Stays for Patients Who Ever Had COVID-19 during an Inpatient Stay



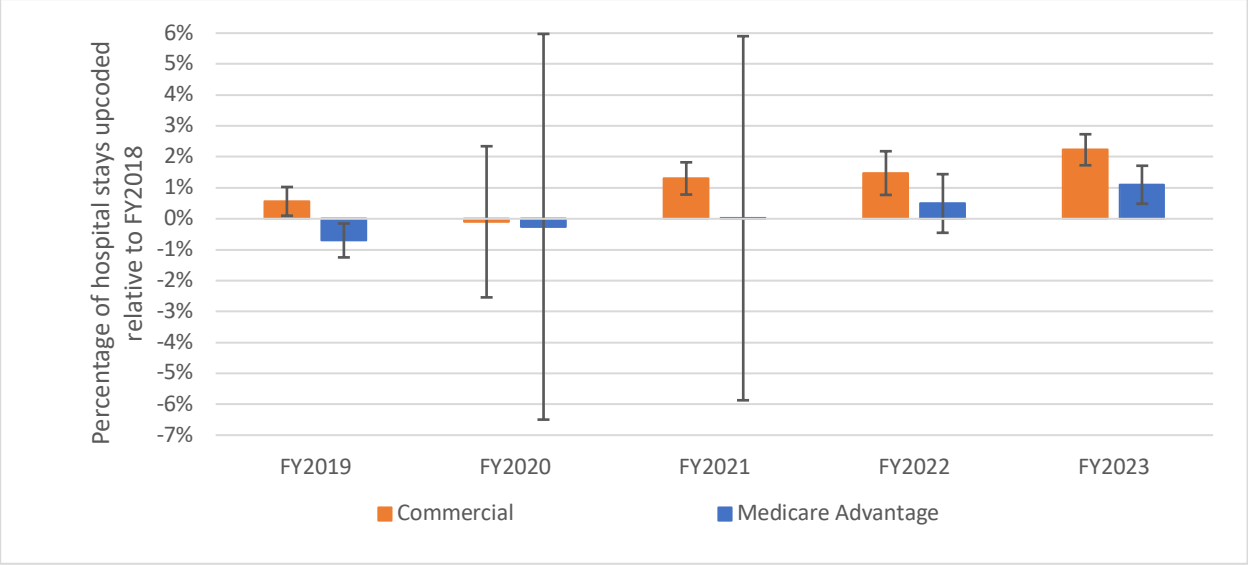
SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: Hospital stays from patients who had a COVID-19 diagnosis during an inpatient stay in the study are excluded. Stays from patients who had COVID-19 but without documentation during an inpatient stay are included. Includes hospital stays from 251 base MS-DRGs. Error bars are the 95 percent confidence intervals estimated from bootstrapping 200 replications of the analysis. All years are federal fiscal years (October 1 through September 30).

Figure B.3. Upcoded Hospital Stays as a Percentage of All Hospital Stays Relative to FY2018, Including Stays in Which the Patient Died or Was Discharged to Hospice



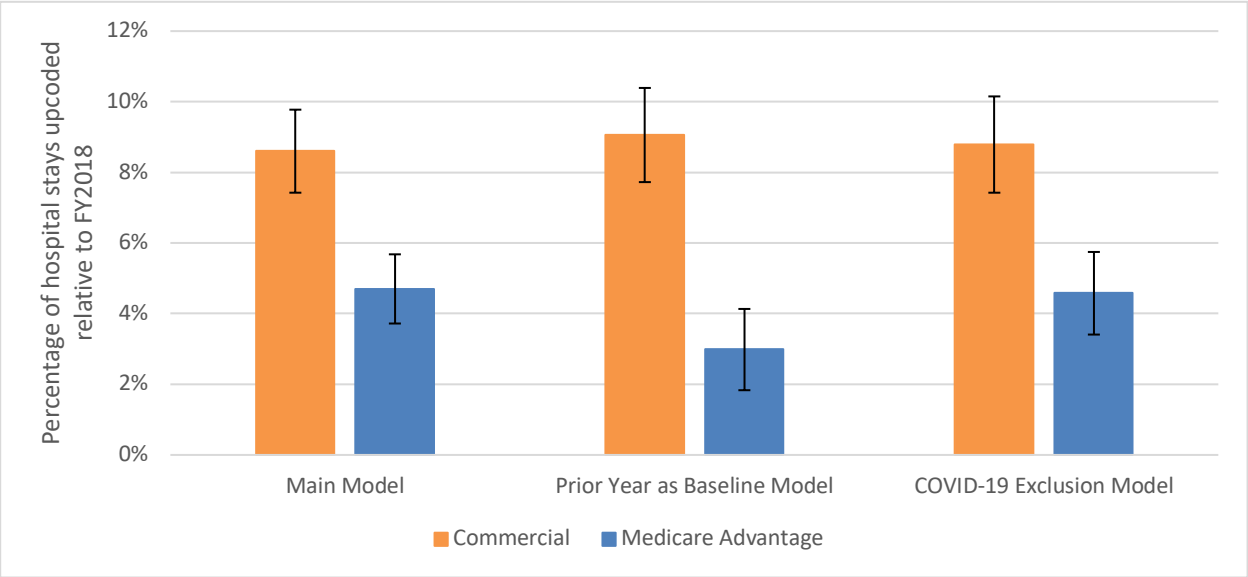
SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: Includes stays in which the patient died or was discharged to hospice. Includes hospital stays from 251 base MS-DRGs. Error bars are the 95 percent confidence intervals estimated from bootstrapping 200 replications of the analysis. All years are federal fiscal years (October 1 through September 30).

Figure B.4. Upcoded Hospital Stays as a Percentage of All Hospital Stays Relative to FY2018, Using the Last Nine Months of Each Year



SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: Excludes stays during the first three months of the fiscal year (October–December) in order to align the months of the base year (FY2018) and analyzed years. Includes hospital stays from 251 base MS-DRGs. Error bars are the 95 percent confidence intervals estimated from bootstrapping 200 replications of the analysis. All years are federal fiscal years (October 1 through September 30).

Figure B.5. Upcoded Hospital Stays as a Percentage of All Hospital Stays, FY2023 Relative to FY2018, Top Five Base MS-DRGs



SOURCE: Analysis of FY2018–FY2023 California HPD MA and commercial hospital stays.
NOTE: Includes hospital stays from top five base MS-DRGs (ranked by volume of upcoded stays in FY2023). Error bars are the 95 percent confidence intervals estimated from bootstrapping 200 replications of the analysis. FY2023 is the federal fiscal year (October 1 through September 30).

Abbreviations

AMI	acute myocardial infarction
cath	catheterization
CI	confidence interval
COVID-19	coronavirus disease 2019
FY	fiscal year
HCAI	Health Care Access and Information
HPD	Health Care Payments Database
ICD-10	International Classification of Diseases, 10th Revision
MA	Medicare Advantage
MS-DRG	Medicare Severity Diagnosis Related Group
MV	mechanical ventilation
OOP	out-of-pocket
OR	operating room
PHE	public health emergency
ZCTA	ZIP code tabulation area

References

Agarwal, M.A., S. Ebrahimian, A. Yan, P.K. Srivastava, N.J. Jackson, G.C. Fonarow, and B. Ziaeian, "National Trends and Disparities in Heart Failure Hospitalizations and Inpatient Outcomes Between 2010–2022," *JACC Heart Fail*, Vol. 14, No. 4, April 2026.

Al Alwan, I., M.E. Magzoub, A. Al Haqwi, M. Badri, S.M. Al Yousif, A. Babiker, G. Mamede, and H.G. Schmidt, "Do Poor Patients Suffer from Inaccurate Diagnoses More than Well-to-Do Patients? A Randomized Control Trial," *BMC Med Educ*, Vol. 19, No.1, 2019.

Bailey, L.R., R. Catterson, E. Alvarez, and S. Noble, "The 2023 CHCF California Health Policy Survey," California Health Care Foundation, 2023. As of May 15, 2026: https://www.chcf.org/resource/2023-chcf-california-health-policy-survey/#authors-contributors

Bejarano, G., A. Ryan, A. Trivedi, K. Offiaeli, and D. J. Meyers, "Medicare Advantage Plan and Health System Vertical Integration, 2011-2020," *JAMA Netw Open*, Vol. 7, No. 7, July 1, 2024.

Bell, S.K., J. Dong, L. Ngo, P. McGaffigan, E.J. Thomas, and F. Bourgeois, "Diagnostic Error Experiences of Patients and Families with Limited English-Language Health Literacy or Disadvantaged Socioeconomic Position in a Cross-Sectional US Population-Based Survey," *BMJ Qual Saf*, Vol. 32, No. 11, 2023.

Birkmeyer, J.D., A. Barnato, N. Birkmeyer, R. Bessler, and J. Skinner, "The Impact of the COVID-19 Pandemic on Hospital Admissions in the United States," *Health Aff (Millwood)*, Vol. 39, No. 11, November 2020.

California Department of Health Care Services, "California Dual Eligible Beneficiary Enrollment in Medicare Advantage Programs, As of July 2023," 2023. As of July 15, 2026: https://www.dhcs.ca.gov/file/july-2023-ma-enrollment-report-pdf/

California Department of Health Care Access and Information, "Health Care Payments Data (HPD)," webpage. As of May 15, 2026: https://hcai.ca.gov/data/cost-transparency/healthcare-payments/

California Department of Health Care Access and Information, "Health Care Payments Data (HPD) Frequently Asked Questions," webpage. As of May 15, 2026: https://hcai.ca.gov/data/cost-transparency/healthcare-payments/hpd-faq/

California Department of Health Care Access and Information, "Hospital Financials," webpage. As of May 15, 2026: https://hcai.ca.gov/data/cost-transparency/hospital-financials/

California Department of Health Care Access and Information, "Patient Discharge Data – Hospice Utilization—Patient Demographics, 2018–2023," webpage. As of July 14, 2026: https://data.chhs.ca.gov/dataset/hospice-utilization-patient-demographics

Cameron, A.C., J.B. Gelbach, and D.L. Miller, "Bootstrap-Based Improvements for Inference with Clustered Standard Errors," *The Review of Economics and Statistics*, Vol. 90, No. 3, 2008.

Centers for Medicare & Medicaid Services, "Fiscal Year (FY) 2019 Inpatient Prospective Payment System (IPPS) and Long-Term Care Hospital (LTCH) PPS Changes," Medicare Learning Network, 2018, webpage. As of May 15, 2026: https://www.cms.gov/newsroom/fact-sheets/fiscal-year-fy-2019-medicare-hospital-inpatient-prospective-payment-system-ipps-and-long-term-acute-0

Cook, A., and S. Averett, "Do Hospitals Respond to Changing Incentive Structures? Evidence from Medicare's 2007 DRG Restructuring," *J Health Econ*, Vol. 73, September 2020.

Cooper, Z., S.V. Craig, M. Gaynor, and J. Van Reenen, "The Price Ain't Right? Hospital Prices and Health Spending on the Privately Insured," *Q J Econ*, Vol. 134, No. 1, February 2019.

Crespin, D., M. Dworsky, J. Levin, T. Ruder, and C.M. Whaley, "Upcoding Linked to Up to Two-Thirds of Growth in Highest-Intensity Hospital Discharges in 5 States, 2011–19," *Health Aff (Millwood)*, Vol. 43, No. 12, December 2024.

Dafny, L.S., "How Do Hospitals Respond to Price Changes?," *The American Economic Review*, Vol. 95, No. 5, 2005.

Emerson, J., "The Largest Medicare Advantage Insurer by State," webpage, 2024. As of July 14, 2026: https://www.beckerspayer.com/payer/the-largest-medicare-advantage-insurer-by-state/

Federal Reserve Board, "Economic Well-Being of U.S. Households in 2024," 2025. As of July 17, 2026: https://www.federalreserve.gov/publications/files/2024-report-economic-well-being-us-households-202505.pdf

Fusco, N., B. Sils, J.S. Graff, K. Kistler, and K. Ruiz, "Cost-Sharing and Adherence, Clinical Outcomes, Health Care Utilization, and Costs: A Systematic Literature Review," *Journal of Managed Care & Specialty Pharmacy*, Vol. 29, No. 1, 2023.

Gaffney, A., A. White, L. Hawks, D. Himmelstein, S. Woolhandler, D.C. Christiani, and D. McCormick, "High-Deductible Health Plans and Healthcare Access, Use, and Financial Strain in Those with Chronic Obstructive Pulmonary Disease," *Ann Am Thorac Soc*, Vol. 17, No. 1, 2020.

HCAI—*See* California Department of Health Care Access and Information.

Healthcare Cost and Utilization Project, "Elixhauser Comorbidity Software Refined for ICD-10-CM," webpage, 2022. As of May 15, 2026: https://hcup-us.ahrq.gov/toolssoftware/comorbidityicd10/comorbidity_icd10.jsp#de

Ho, V., S. Tapaneeyakul, and H.V. Russell, "Price Increases Versus Upcoding As Drivers Of Emergency Department Spending Increases, 2012–19," *Health Aff (Millwood)*, Vol. 42, No. 8, August 2023.

Job, C., B. Adenipekun, A. Cleves, P. Gill, and R. Samuriow, "Health Professionals' Implicit Bias of Patients with Low Socioeconomic Status (SES) and Its Effects on Clinical Decision-Making: A Scoping Review," *BMJ Open*, Vol. 14, No. 7, 2024.

Joynt, J., "California Hospitals Almanac—2022 Edition," California Health Care Foundation, 2022. As of May 15, 2026: https://www.chcf.org/resource/california-hospitals-almanac/

Kaiser Family Foundation, "Share of Private Sector Enrollees Enrolled in Self-Insured Plans," undated, webpage. As of July 30, 2026: https://www.kff.org/state-health-policy-data/state-indicator/share-of-private-sector-enrollees-enrolled-in-self-insured-plans

Law, A.C., N.A. Bosch, Y. Song, A.P. Tale, J. Nelson, R.K. Wadhere, A.E. Barnato, and A.J. Walkey, "Trends in Discharge to Hospice after Critical Illness Among US Medicare Beneficiaries, 2011–2023," *Annals of the American Thoracic Society*, Vol. 23, No. 5, 2026.

Levin, J.S., D.J. Crespin, J. Kim, R.O. Reid, C.M. Whaley, and M. Dworsky, "Methodologies to Measure Upcoding in Provider Settings: A Scoping Review," RAND Corporation, RRA2683-1, 2024. As of May 15, 2026: https://www.rand.org/content/dam/rand/pubs/research_reports/RRA2600/RRA2683-1/RAND_RRA2683-1.pdf

Melnick, G. and S. Maerki, "Heading for an Acute Crisis? Utilization, Revenue, Expenses, and Margins in California's Hospitals 2019–22," California Health Care Foundation, 2023. As of May 15, 2026: https://www.chcf.org/wp-content/uploads/2023/05/HeadingAcuteCrisis.pdf

Mentias, A., N. Keshvani, M.Y. Desai, G.C. Fonarow, J.R. Teerlink, J.T. Thibodeau, A.R. Vest, and A. Pandey, "Temporal Trends in Incidence and Prevalence of Heart Failure Hospitalization Among Medicare Beneficiaries," *J Card Fail*, December 29, 2025.

Office of the Inspector General, "Trend Toward More Expensive Inpatient Hospital Stays in Medicare Emerged Before COVID-19 and Warrants Further Scrutiny," 2021. As of May 15, 2026: https://oig.hhs.gov/reports/all/2021/trend-toward-more-expensive-inpatient-hospital-stays-in-medicare-emerged-before-covid-19-and-warrants-further-scrutiny/

Office of the Inspector General, "Medicare Generally Paid Acute-Care Hospitals for Inpatient Stays for Medicare Enrollees Diagnosed with COVID-19 in Accordance with Federal Requirements," 2023. As of May 15, 2026: https://oig.hhs.gov/reports/all/2023/medicare-generally-paid-acute-care-hospitals-for-inpatient-stays-for-medicare-enrollees-diagnosed-with-covid-19-in-accordance-with-federal-requirements/

Olumuyide, E., C.C. Agwuegbo, and E.N. Ahmed, "Exploring the Heart Failure Connection in Long COVID Patients: A Narrative Review," *Cureus*, Vol. 16, No. 4, April 2024.

Postman, C., "Preventing Improper Billing of Medicare-Medicaid Enrollees in Managed Care: Strategies for States and Dual Eligible Special Needs Plans," Mathematica Policy Research, 2018. As of July 14, 2026: https://integratedcareresourcecenter.com/sites/default/files/ICRC_Prevent_Improper_Billing.pdf

Rakshit, S., J. Ortaliza, L. Cotter, M. Rae, and C. Cox, "Recent Trends in Commercial Health Insurance Market Concentration," Peterson-Kaiser Family Foundation Health System Tracker, webpage, 2025. As of May 15, 2026: https://www.healthsystemtracker.org/chart-collection/recent-trends-in-commercial-health-insurance-market-concentration/

RAND, "Hospital Price Transparency Study," webpage, undated. As of July 14, 2026: https://www.rand.org/health-care/projects/price-transparency/hospital-pricing.html

Smulowitz, P.B., A.J. O'Malley, J.M. McWilliams, L. Zaborski, and B.E. Landon, "Emergency Department Visits And Hospital Capacity In The US: Trends In The Medicare Population During The COVID-19 Pandemic," *Health Aff (Millwood)*, Vol. 43, No. 7, July 2024.

Thomas, A., J. Valero-Elizondo, R. Khera, H. J. Warraich, S. W. Reinhardt, H. J. Ali, K. Nasir, and N. R. Desai, "Forgone Medical Care Associated With Increased Health Care Costs Among the U.S. Heart Failure Population," *JACC Heart Fail*, Vol. 9, No. 10, October 2021.

Wilson, K., "California Health Care Spending Almanac—2023 Edition," California Health Care Foundation, 2023. As of May 15, 2026: https://www.chcf.org/resource/california-health-care-spending-almanac/

Xiang, J., H. Zheng, Y. Cai, S. Chen, Y. Wang, and R. Chen, "Cumulative Social Disadvantage and its Impact on Long COVID: Insights from a U.S. National Survey," *BMC Med*, Vol. 23, No. 1, April 7, 2025.