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**Maryland Model Analytics Consultant Report on
Evaluation of Maryland Medicare Spending on
Inpatient Care**

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EXECUTIVE SUMMARY

Since 2018, Maryland has had an arrangement with the Centers for Medicare & Medicaid Services (CMS) which reimburses hospitals based on a fixed global budget that covers all hospital services and among other things incents hospitals to avoid unnecessary inpatient utilization. This approach is the latest in a series of models under which Maryland hospital reimbursement has varied from national practices. These alternative reimbursement strategies have resulted in different patterns of care across a number of dimensions, particularly inpatient care. This report summarizes results of the investigation that analyzed Maryland hospitals' performance across different types of inpatient stays, and compared that performance to hospitals' performance in other states, where this arrangement is not implemented.

At a high level, while Maryland hospitals have similar patient complexity as compared to other states, for inpatient stays for most Major Diagnostic Categories (MDCs) they have higher mean and median allowed amounts per inpatient stay, and greater variation in cost. The findings are similar at more granular levels, by the Medicare Severity Diagnosis-Related Groups (MS-DRG) type (i.e., medical vs. surgical) and by the MS-DRG of the inpatient stay. Specifically, on average Maryland inpatient stays are more costly for both medical and surgical stays and across almost all MS-DRGs, as compared to other states, and there is more variation in cost for Maryland hospitalization. An analysis of the inpatient stay spending by medical and surgical DRGs and by MDC as a ratio of the mean inpatient stay spending for Maryland and other states provides a way to neutralize payment differences due to geographical factors and Maryland's all-payer system. This analysis confirms the greater variation in per stay spending for Maryland, and also highlights areas where there are the largest differences between Maryland and other states.

This report includes additional metrics about hospital spending, particularly post-discharge spending, length of stay, and severity level breakdowns. When estimating resource use by looking at the inpatient, outpatient, and Part B physician/supplier spending billed in the 30 days post-discharge, the findings demonstrate that it is higher in Maryland than in other states. Maryland hospitals have slightly longer inpatient stays for all but three MDCs. Amongst the most frequent DRG families, Maryland hospitals tend to have a lower share of stays in the highest severity MS-DRG.

Future research can build on these findings to explore nuances that are not available with the current data limitations. In particular, this analysis is limited by the 5 percent national sample, claims from three of the seven file settings, non-standardized payments, and a one-year study period (plus lookback). Enhancing the study with augmented data may provide more insights into clear differences in cost performance between hospitals in Maryland and other states. Beyond the cost of inpatient care, it may also be of interest to assess the value of care provided in hospitals in Maryland and other states by constructing and comparing quality and cost metrics to understand how costs intersect with key aspects of quality performance.

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1 INTRODUCTION

This report presents findings from an evaluation of Maryland Medicare spending on inpatient care. Section 1.1 provides background on Maryland’s unique Medicare payment model and Section 1.2 outlines the research question examined in this report.

1.1 Background

For decades, Maryland has been a testing ground for innovative payment models for the Centers for Medicare & Medicaid Services (CMS) in exchange for the state’s ability to set Medicare prices in its jurisdiction. In the 1970s, CMS gave Maryland a waiver that allowed Maryland to set prices of hospital services that Medicare paid within the state, as long as Medicare spending per hospital inpatient stay did not outpace the national rate. In 2014, CMS and Maryland agreed to shift the conditions of the waiver from limiting spending per stay to limiting total hospital spending, which resulted in Maryland shifting from paying hospitals for each service (or fee-for-service) to paying hospitals an annual global budget to incentivize decreasing avoidable or low-value hospital services.

In 2018, CMS and Maryland signed a new agreement to create the current model, the Total Cost of Care (TCOC) model. Limiting the growth of hospital spending is still a major component of the TCOC model because hospital spending accounts for an estimated 55 percent of the total Medicare spending in Maryland.¹

1.2 Research Questions

This report aims to evaluate Maryland’s performance across the types of inpatient stays, and compare the performance against patterns from the rest of the country to identify areas where Maryland deviates in terms of cost. It also seeks to provide additional information for metrics that are closely related to inpatient spending; for example, post-discharge spending and length of stay.

¹ Machta, Rachel, Gregory Peterson, Jason Rotter, Kate Stewart, Shannon Heitkamp, Isabel Platt, Danielle Whicher et al. *Evaluation of the Maryland Total Cost of Care Model: Implementation Report*. Mathematica Policy Research, 2021.

2 EVALUATION APPROACH

This section outlines the evaluation approach used to answer the research question. Section 2.1 lists the necessary data sources. Section 2.2 describes the methods to quantify the cost of inpatient stays. Section **Error! Reference source not found.** discusses the methods to examine quality of care that also consider the cost of care.

2.1 Data Sources

The study period is calendar year 2019 to avoid the disruptions to care in 2020 due to the COVID-19 pandemic. To avoid any data censoring issues and allow for claims run-out, a sufficient amount of 2018 and 2020 claims is queried. The following data sources are used:

- Chronic Condition Warehouse (CCW) Parts A and B claims
- CCW Beneficiary Cohort Enrolment Data

2.2 Cost of Inpatient Stays

This analysis compares the cost of inpatient stays in Maryland against costs of inpatient stays in other states by different levels of granularity. Specifically, this analysis examines cost by:

- Major Diagnostic Categories (MDCs): There are 25 mutually exclusive and exhaustive MDCs with diagnoses that correspond to a single organ system, and one additional MDC related to transplants and other particularly costly care (e.g., certain immunotherapies).²
- Medical vs surgical Medicare Severity Diagnosis-Related Groups (MS-DRGs): Stays can be divided into these broad categories where surgical MS-DRGs are affected by ICD-10-PCS procedure codes.³
- MS-DRG: DRGs are defined based on information including the principal diagnosis, secondary diagnoses, surgical procedures, and discharge status for patients being treated in a hospital. A severity level indicates comorbidities or complications.⁴

The distributions of cost of a stay for each type of inpatient stays are examined for Medicare beneficiaries in Maryland and for a 5% sample size of beneficiaries from all other states. To allow more direct comparisons of costs to costs incurred in other states, this analysis examines non-standardized cost, represented by the Medicare allowed amounts. The analysis did

² CMS, ICD-10-CM-PCS MS-DRG v39.1 Definitions Manual (2022) https://www.cms.gov/icd10m/version39.1-fullcode-cms/fullcode_cms/P0001.html

³ See Appendices D, E, and F in ICD-10-CM-PCS MS-DRG v39.1 Definitions Manual (2022) https://www.cms.gov/icd10m/version39.1-fullcode-cms/fullcode_cms/P0001.html

⁴ See Appendices C, G, and H in CMS, ICD-10-CM-PCS MS-DRG v39.1 Definitions Manual (2022) https://www.cms.gov/icd10m/version39.1-fullcode-cms/fullcode_cms/P0001.html

not use the payment-standardized costs that remove the impact of geographic variation and program incentive payments.

To approximate patient complexity case mix, we looked at the mean number of 3-digit diagnosis codes that occurred in the 120-day lookback period prior to the hospitalization. We looked at the 3-digit diagnosis codes rather than all diagnosis codes to capture the conditions, rather than unique subtypes of that condition, that a beneficiary had in the lookback period.

2.3 Related Metrics of Cost and Resource Use

This analysis examines other resource use metrics that can also help to identify differences in performance between Maryland and other states. These resource use metrics include: costs within 30 days of discharge, length of inpatient stay, and the breakdown of stays at each level of severity within base DRGs.

3 ANALYTIC FINDINGS

This section summarizes the analytic findings on the differences in resource use for inpatient stays in Maryland and other states, including information on all other states as a reference. Section 3.1 summarizes findings on the differences in spending between inpatient stays in Maryland and other stays with various breakdowns. Section 3.2 examines spending in the 30 days post-discharge. Sections 3.3 to 3.4 discuss results on other metrics that can help shed light on differences in inpatient care between Maryland and other states. Specifically, Section 3.3 considers length of inpatient stays, and Section 3.4 discusses the breakdown within DRGs by level of severity.

3.1 Inpatient Spending & Patient Complexity

This section provides results for analyses comparing inpatient stay spending for Maryland and other states. Sections 3.1.1 to 3.1.3 use different ways of breaking down stays: MDC, Medical vs Surgical, and MS-DRGs themselves. Section 3.1.4 provides another way of comparing spending to account for underlying payment differences between Maryland and other states, which is to compare the spending for particular types of inpatient stays as a share of the total spending for all inpatient stays for Maryland and other states.

3.1.1 Major Diagnostic Category (MDC)

Across most MDCs, while inpatient stays in Maryland have similar patient complexity case mix as compared to patient complexity in other states, Maryland has higher mean and median allowed amounts per inpatient stay and higher standard deviation, as compared to those for inpatient stays in other states. Table 1 in the data supplement provides this information along with length of stay to allow for side-by-side comparisons. For additional information on the frequency of stays by length of stay, please refer to Section 3.3.

Maryland has higher mean and median allowed amounts across all except one MDC (MDC 22 “Burns”). For several MDCs (e.g., MDC U “Ungroupable”, MDC 2 “Disease & Disorders Of The Eye”, MDC 05 “Disease & Disorders Of The Circulatory System”), Maryland has lower allowed amounts at the 10th and 25th percentile than other states, indicating that cheaper hospitalizations are less expensive in Maryland than in other states. At the 75th and 90th percentiles, for all MDCs except for MDC 22 “Burns”, the trend reverses and Maryland hospitalizations are more expensive as compared to other states. This is also reflected in the standard deviation which is higher for Maryland than for other states, indicating a greater variation of allowed amounts from the mean. Both the finding of higher mean and median allowed amounts and greater variation in cost are expected as Maryland's rate setting system pays higher inpatient rates than IPPS and pays them on a per service basis rather than based on

the DRG of the stay, so that Maryland's payments are more sensitive to the actual services delivered.

For MDC 22 “Burns”, the only MDC where Maryland has lower allowed amounts as compared to allowed amounts for other states, the mean inpatient stay allowed amount is \$36,402 for Maryland and \$55,392 for other states. Maryland also has lower allowed amounts across the distribution and a much lower standard deviation (\$56,888 vs. \$97,453), indicating less variation. There is little detail available about MS-DRGs within this MDC due to the suppression of small cell sizes once broken down to this level of granularity.

The patient complexity case mix is generally similar across MDCs. For almost all MDCs, there is a difference of +/- 2 3-digit diagnosis codes, and for 9 MDCs the average number of the 3-digit diagnosis codes is the same for inpatient stays in Maryland and other states. For inpatient stays with MDC 14 “Pregnancy, Childbirth & the Puerperium” and MDC 25 “Human Immunodeficiency Virus Infections”, Maryland has a more complex patient case-mix with 4-5 more 3-digit diagnoses than other states (20 vs. 16 3-digit diagnoses for MDC 14, and 34 vs. 29 3-digit diagnoses for MDC 25).

3.1.2 Medical and Surgical MS-DRGs

We stratified hospitalizations based on whether the MS-DRG of the stay was surgical or medical to see if there are systematic differences or trends in either type of inpatient stays. Maryland has a higher mean allowed amount per inpatient stay as compared to other states overall (\$24,077 vs. \$18,362, or 31% greater), and for both medical MS-DRGs (\$17,704 vs. \$12,655, or 40% greater) and surgical MS-DRGs (\$42,380 vs. \$32,236, or 31% greater). Maryland also has greater variation than other states, as reflected in the higher standard deviation overall and across both MS-DRG types.

Overall and for medical MS-DRGs, Maryland has lower allowed amounts than other states at the 10th percentile (i.e., for cheaper hospitalizations). Across the rest of the distribution the trend reverses, where allowed amounts for Maryland inpatient stays are higher than those in other states. For stays with surgical MS-DRGs, allowed amounts are higher in Maryland than in other states across the entire distribution.

The patient complexity, represented by the mean number of 3-digit diagnoses codes in the 120-day lookback period, is the same for inpatient stays with medical MS-DRGs (29 3-digit diagnoses) and slightly higher for stays in Maryland than in other states overall (28 vs. 27 3-digit diagnoses) and for surgical MS-DRGs (24 vs. 23 3-digit diagnoses). Please find more detail in Table 2, below.

Table 2. Inpatient Stay Allowed Amounts by Medical and Surgical MS-DRGs

MS-DRG Type	State	# of Stays	Mean # of Prior 3-Digit DGNs	Distribution of Stay's Allowed Amounts					
				Mean	Percentiles				
					10	25	50	75	90
All	Maryland	210,950	28	\$24,077	\$5,306	\$7,700	\$13,037	\$24,783	\$48,680
	Other States	435,868	27	\$18,362	\$5,761	\$7,472	\$11,256	\$18,334	\$35,472
	% (MD/ Other States)			131%	92%	103%	116%	135%	137%
Medical	Maryland	156,473	29	\$17,704	\$4,830	\$6,728	\$10,200	\$17,540	\$33,414
	Other States	308,828	29	\$12,655	\$5,415	\$6,640	\$8,977	\$12,966	\$22,008
	% (MD/ Other States)			140%	89%	101%	114%	135%	152%
Surgical	Maryland	54,477	24	\$42,380	\$12,088	\$16,450	\$25,728	\$46,003	\$83,715
	Other States	127,040	23	\$32,236	\$11,114	\$13,528	\$19,563	\$34,635	\$60,587
	% (MD/ Other States)			131%	109%	122%	132%	133%	138%

3.1.3 Medicare Severity Diagnosis Related Groups (MS-DRG)

Comparisons of inpatient spending at the MS-DRG level provides a more granular level of detail. As expected, given the MDC-level results, Maryland has higher mean allowed amounts for inpatient stays across almost all MS-DRGs as compared to other states. There are however six MS-DRGs that have lower mean allowed amounts shown in Table 3, below. Note that all have low counts with the number of Maryland stays below 200 in each of the MS-DRGs. While there is an empirical difference of means, the only difference of statistical significance at the 0.05 significance level is for MS-DRG 895 Alcohol/Drug Abuse or Dependence w Rehabilitation Therapy. That MS-DRG also has lower allowed amounts for Maryland than other states consistently across the points of the distribution examined.

Table 3. MS-DRGs where Maryland’s Mean Inpatient Stay Allowed Amount is Lower than the Mean for Other States

MS-DRG	State	# of Stays	Mean # of Prior 3-Digit DGNs	Distribution of Stay's Allowed Amounts					
				Mean	Percentiles				
					10	25	50	75	90
250 Perc Cardiovasc Proc W/O Coronary Artery Stent W MCC	Maryland	69	28	\$25,157	\$11,775	\$16,731	\$20,128	\$24,635	\$47,472
	Other States	218	27	\$25,441	\$14,969	\$15,912	\$18,354	\$24,465	\$50,202
	% (MD/ Other)			99%	79%	105%	110%	101%	95%
307 Cardiac Congenital & Valvular Disorders W/O MCC	Maryland	97	25	\$10,837	\$3,710	\$5,224	\$7,879	\$12,578	\$20,684
	Other States	146	28	\$11,558	\$5,382	\$6,064	\$6,978	\$8,518	\$16,778
	% (MD/ Other)			94%	69%	86%	113%	148%	123%
405 Pancreas, Liver & Shunt Procedures W MCC	Maryland	98	32	\$75,981	\$27,888	\$40,064	\$51,121	\$94,126	\$139,750
	Other States	186	31	\$79,916	\$31,199	\$34,626	\$43,997	\$99,158	\$173,720
	% (MD/ Other)			95%	89%	116%	116%	95%	80%
717 Other Male Reproductive System O.R. Proc Exc Malignancy W CC/MCC	Maryland	62	20	\$17,352	\$8,663	\$10,748	\$12,315	\$18,089	\$23,772
	Other States	74	25	\$19,177	\$11,623	\$12,470	\$14,290	\$18,867	\$33,660
	% (MD/ Other)			90%	75%	86%	86%	96%	71%
894 Alcohol/Drug Abuse Or Dependence, Left AMA	Maryland	88	32	\$5,739	\$2,698	\$3,519	\$4,485	\$6,233	\$11,729
	Other States	208	25	\$6,228	\$3,648	\$4,054	\$4,594	\$5,344	\$8,238
	% (MD/ Other)			92%	74%	87%	98%	117%	142%

MS-DRG	State	# of Stays	Mean # of Prior 3-Digit DGNs	Distribution of Stay's Allowed Amounts					
				Mean	Percentiles				
					10	25	50	75	90
895 Alcohol/Drug Abuse Or Dependence W Rehabilitation Therapy	Maryland	178	20	\$8,465	\$7,250	\$7,253	\$7,277	\$9,014	\$9,042
	Other States	394	19	\$11,280	\$7,253	\$7,280	\$9,598	\$11,953	\$13,717
	% (MD/ Other)				75%	100%	100%	76%	75%

3.1.4 Inpatient Stay Spending for MDCs and MS-DRGs Compared to the Mean Across All Stays

A limitation of the spending comparisons in Sections 3.1.1 to 3.1.3 is that since these are not standardized costs, those results include differences due to geographic or payment policy factors. As such, we conducted another analysis that aims to neutralize underlying differences by looking at the spending for particular inpatient stays in Maryland and in other states as a ratio of the mean stay's inpatient spending in Maryland and other states, respectively. This can show relative differences in the amount of inpatient spending for different types of inpatient care for Maryland, compared to other states.

Table 4, below, shows the distribution of these ratios for all inpatient stays and by medical and surgical MS-DRGs. Overall, Maryland has greater variation in the spending for inpatient stays than other states, with a ratio of 0.22 at the 10th percentile and 2.02 at the 90th percentile, compared to other states where the corresponding figures are 0.31 and 1.93, respectively. Maryland has a larger share of medical stays than other states. Amongst medical MS-DRGs, while Maryland's mean ratio for the stay allowed amount relative to the overall mean inpatient stay allowed amount is higher at the mean than for other states (0.74 vs 0.69), this reverses at the median (0.42 vs 0.49). This suggests that the spending for Maryland's medical stays is skewed to the right end of the distribution which has the effect of pulling up the mean. The pattern is similar for surgical MS-DRGs, except the difference is much less pronounced, as shown by the difference of a lower magnitude between the ratios in Maryland and other states at the 90th percentile.

Table 4. Distribution of Ratio of Stay's Allowed Amounts to Stay's Mean Inpatient Stay Allowed Amount for Maryland and Other States

MS-DRG Type	State	# of Stays	% of Stays	Distribution of Ratio of Stay's Allowed Amounts to State's Mean IP Stay Allowed Amount					
				Mean	Percentiles				
					10	25	50	75	90
All	Maryland	210,435	100.0%	1.00	0.22	0.32	0.54	1.03	2.02
	Other States	435,868	100.0%	1.00	0.31	0.41	0.61	1.00	1.93
Medical	Maryland	156,473	74.2%	0.74	0.20	0.28	0.42	0.73	1.39
	Other States	308,828	70.9%	0.69	0.29	0.36	0.49	0.71	1.20
Surgical	Maryland	54,477	25.8%	1.76	0.50	0.68	1.07	1.91	3.48
	Other States	127,040	29.1%	1.76	0.61	0.74	1.07	1.89	3.30

We also examined the ratios by MDC, first looking at the MDCs with the largest shares of inpatient stays. Table 5, below, shows the four MDCs which each have at least 10% of inpatient stays. For respiratory and musculoskeletal MDCs, Maryland spends more than other states, relative to their respective mean per inpatient stay spending, and the variation at the right tail of the distribution (i.e., for the most expensive stays) seems to pull up the mean, similar to the findings for medical MS-DRGs described above. For the circulatory and infectious diseases MDCs, the opposite is true.

Table 5. Distribution of Ratio of Stay’s Allowed Amounts to Stay’s Mean Inpatient Stay Allowed Amount for Maryland and Other States for MDCs with at least 10% of Stays

MDC	State	# of Stays	% of Stays	Distribution of Ratio of Stay's Allowed Amounts to State's Mean IP Stay Allowed Amount					
				Mean	Percentiles				
					10	25	50	75	90
04 Diseases & Disorders of the Respiratory System	Maryland	26,471	12.5%	0.83	0.23	0.31	0.46	0.81	1.58
	Other States	53,020	12.2%	0.75	0.32	0.40	0.50	0.75	1.41
05 Diseases & Disorders of the Circulatory System	Maryland	40,126	19.0%	1.04	0.21	0.31	0.53	1.14	2.28
	Other States	90,246	20.7%	1.12	0.30	0.41	0.61	1.21	2.29
08 Diseases & Disorders of the Musculoskeletal System & Connective Tissue	Maryland	27,025	12.8%	1.20	0.33	0.55	0.82	1.36	2.33
	Other States	59,878	13.7%	1.17	0.40	0.63	0.80	1.23	2.22
18 Infectious & Parasitic Diseases, Systemic or Unspecified Sites	Maryland	20,558	9.7%	1.16	0.26	0.38	0.62	1.21	2.33
	Other States	46,357	10.6%	1.19	0.41	0.60	0.73	1.18	2.25

We then examined MDCs where the magnitude of the difference in the ratio of the stay’s allowed amount to the mean allowed amounts is the greatest on average between Maryland and other states. Of the six MDCs with the largest differences, ranging from 0.16 (19 “Mental Disease & Disorders”) to 1.51 (22 “Burns”), three MDCs had less than 1,000 stays in Maryland so are omitted from Table 6, below (Pre-MDC, 13 “Diseases & Disorders of the Female Reproductive System”, 22 “Burns”). The table also does not include MDC 23 “Factors Influencing Health Status & Other Contacts with Health Services” as there is a high degree of heterogeneity within the range of MS-DRGs included in this MDC. As such, we focused on two MDCs: MDC 17 “Myeloproliferative Diseases & Disorders, Poorly Differentiated Neoplasms” and MDC 19 “Mental Diseases & Disorders”. The results for both of these MDCs show a similar trend to the preceding tables where Maryland has lower spending relative to the state average from the 10th to 50th percentiles, and then higher at the 75th and 90th percentiles when compared to other states. Interestingly, for MDC 17, there is a lot of variation across the distribution for both Maryland and other states, and as compared with other MDCs.

Table 6. Distribution of Ratio of Stay's Allowed Amounts to Stay's Mean Inpatient Stay Allowed Amount for Maryland and Other States for MDCs 17 and 19

MDC	State	# of Stays	% of Stays	Distribution of Ratio of Stay's Allowed Amounts to State's Mean IP Stay Allowed Amount					
				Mean	Percentiles				
					10	25	50	75	90
17 Myeloproliferative Diseases & Disorders, Poorly Differentiated Neoplasms	Maryland	1,418	0.7%	2.45	0.33	0.49	0.96	2.29	4.81
	Other States	3,196	0.7%	1.96	0.49	0.65	1.06	1.97	3.91
19 Mental Diseases & Disorders	Maryland	6,671	3.2%	0.78	0.20	0.29	0.45	0.82	1.62
	Other States	4,714	1.1%	0.62	0.35	0.42	0.48	0.58	1.00

3.2 30-day Post-Discharge Spending

We analyzed the spending in the 30 days after discharge from a hospitalization to neutralize the impact of the higher inpatient costs in Maryland that would dominate a metric that includes costs from admission through to 30-days post-discharge. In the post-discharge period, we examined the allowed amounts for inpatient, outpatient, and Part B physician/supplier claims. This is shown in Table 7, below.

The mean spending in these settings in the 30-day post-discharge period is slightly higher in Maryland than in other states overall (\$11,893 vs. \$10,048), as shown in Table 7, below. The difference between these means are statistically significant for each MS-DRG type at a 0.05 significance level. The magnitude of the difference is similar for medical and surgical MS-DRGs: the mean allowed amount for medical MS-DRGs is \$12,062 for Maryland vs. \$10,312 for other states, and the corresponding figures for surgical MS-DRGs are \$11,405 vs. \$9,406. One caveat is that these metric does not neutralize the impact that the higher costs of hospitalizations in Maryland would have on the 30-day post discharge spending.

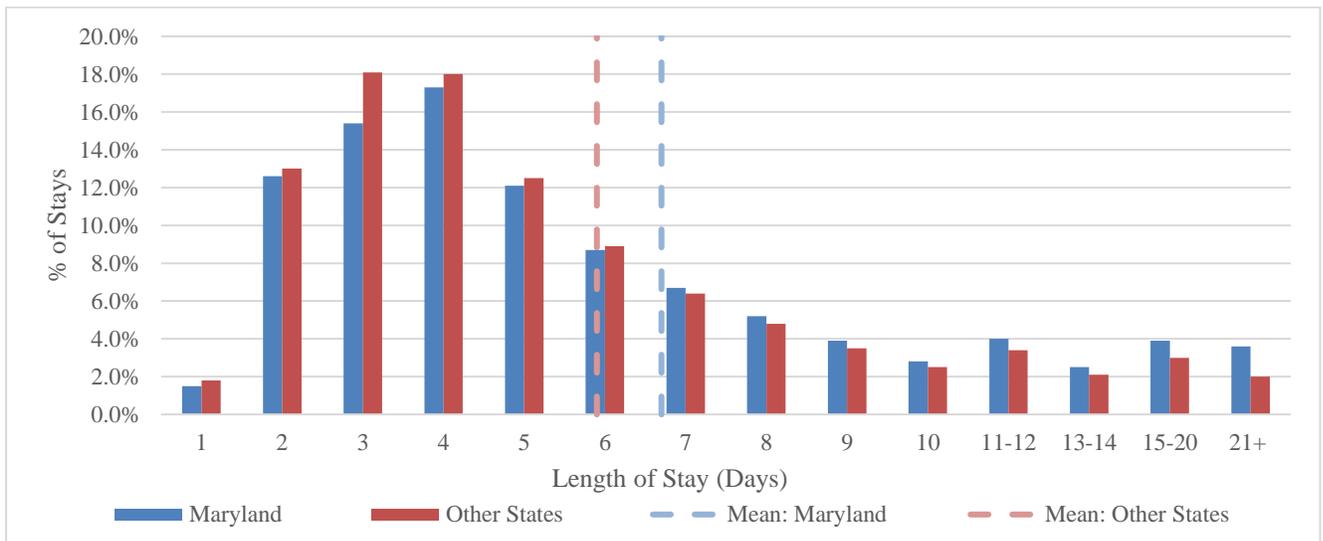
Table 7. Inpatient, Outpatient, Part B Physician/Supplier claims spending in 30 Days Post-Discharge

MS-DRG Type	State	# of Stays	Distribution of Inpatient, Outpatient, and Part B Physician/Supplier Claims Spending in the 30 days Post-Discharge					
			Mean	Percentiles				
				10	25	50	75	90
All	Maryland	210,950	\$11,893	\$0	\$519	\$4,901	\$13,531	\$28,418
	Other States	435,868	\$10,048	\$27	\$443	\$3,998	\$12,464	\$24,957
	% (MD/Other states)		118%	-	117%	123%	109%	114%
Medical	Maryland	156,473	\$12,062	\$0	\$498	\$4,613	\$13,856	\$29,348
	Other States	308,828	\$10,312	\$0	\$435	\$3,832	\$13,034	\$25,873
	% (MD/Other states)		117%	-	115%	120%	106%	113%
Surgical	Maryland	54,477	\$11,405	\$58	\$592	\$5,578	\$12,702	\$25,707
	Other States	127,040	\$9,406	\$68	\$467	\$4,404	\$11,205	\$22,674
	% (MD/Other states)		121%	85%	127%	127%	113%	113%

3.3 Length of Stay

We analyzed the length of inpatient stays to see whether there are any systematic differences or trends that suggest that hospitalizations in Maryland are longer, potentially reflecting differences in patient case mix. Figure 1, below, shows the frequency of lengths of stay for Maryland and other states, along with the means. Maryland inpatient stays tend to be longer than other states: the longest stays of 21 days or more make up 3.6% of all of Maryland’s stays, compared to 2.0% for other states.

Figure 1. Frequency of Lengths of Stay for Maryland and Other States



This trend is the same for medical and surgical stays. Please find more information on the frequencies of stays by length of stay between Maryland and other states in Table 8, and the mean length of stay in Table 9, below.

Table 8. Frequencies of Stays by Length of Stay (in Days), Overall and for Medical and Surgical Stays

Length of Stay (Days)	Overall		Medical Stays		Surgical Stays	
	Maryland (%)	Other States (%)	Maryland (%)	Other States (%)	Maryland (%)	Other States (%)
1	1.5	1.8	1.7	2.0	0.9	1.2
2	12.6	13.0	10.8	11.2	17.6	17.4
3	15.4	18.1	16.2	18.8	13.1	16.5
4	17.3	18.0	18.2	19.3	16.9	15.0
5	12.1	12.5	12.8	13.5	9.8	10.1
6	8.7	8.9	9.1	9.4	7.7	7.6
7	6.7	6.4	6.9	6.6	6.2	6.0
8	5.2	4.8	5.2	4.8	5.1	4.9
9	3.9	3.5	3.8	3.4	3.9	3.8
10	2.8	2.5	2.7	2.4	2.9	2.8
11-12	4.0	3.4	3.8	3.1	4.4	4.0
13-14	2.5	2.1	2.3	1.8	3.1	2.8

Length of Stay (Days)	Overall		Medical Stays		Surgical Stays	
	Maryland (%)	Other States (%)	Maryland (%)	Other States (%)	Maryland (%)	Other States (%)
15-20	3.9	3.0	3.4	2.4	5.2	4.4
21+	3.6	2.0	3.0	1.4	5.1	3.7

Table 9. Mean Length of Stay

Mean LOS	Overall		Medical Stays		Surgical Stays	
	Maryland	Other States	Maryland	Other States	Maryland	Other States
Mean LOS	6.7 days	5.9 days	6.5 days	5.6 days	7.2 days	6.6 days

When comparing the frequency of lengths of stay by MDCs, we see the following trends for the four MDCs with the most differences in the lengths of stay (i.e., the MDCs with several bins where the differences in length of stay between Maryland and other states are above 2%, and where none of the bins are censored due to small cell values):

- For MDC 1 “Disease & Disorders Of The Nervous System” (Figure 2), Maryland has lower frequencies of shorter stays (1-5 days) than other states; then the trend reverses, and Maryland has higher frequencies of longer stays (i.e., stays that are longer than 9 days).
- For MDC 19 “Mental Diseases & Disorders” (Figure 3), the trends are similar where Maryland has lower frequencies of shorter stays (1-5 days) than other states. The trend reverses for longer stays (starting with 13-day stays), with the more pronounced differences for the stays that are 21 days and longer (14.9% in Maryland vs. 6.5% in other states)
- For MDC 20 “Alcohol/Drug Use & Alcohol/Drug Induced Organic Mental Disorders” (Figure 4), the frequency of shorter stays is slightly higher in Maryland than in other states, with the biggest difference for 4-day stays (27.7% vs. 17.5%, respectively).
- For MDC 24 “Multiple Significant Trauma” (Figure 5), the share of longer stays (13 days and longer) is higher in Maryland than in other states.

For the frequencies of lengths of stay for all MDCs, please refer to Table 10 in the data supplement.

Figure 2. Frequency of Lengths of Stay within MDC 1 “Disease & Disorders Of The Nervous System”

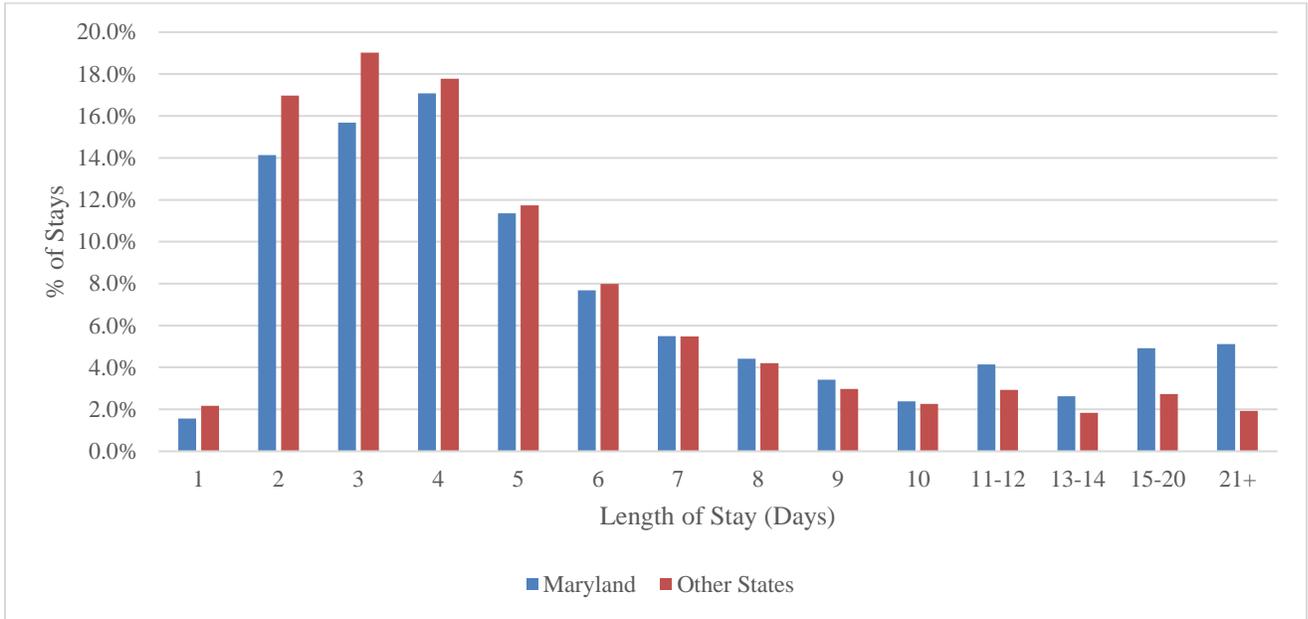


Figure 3 Frequency of Lengths of Stay within MDC 19 “Mental Diseases & Disorders”

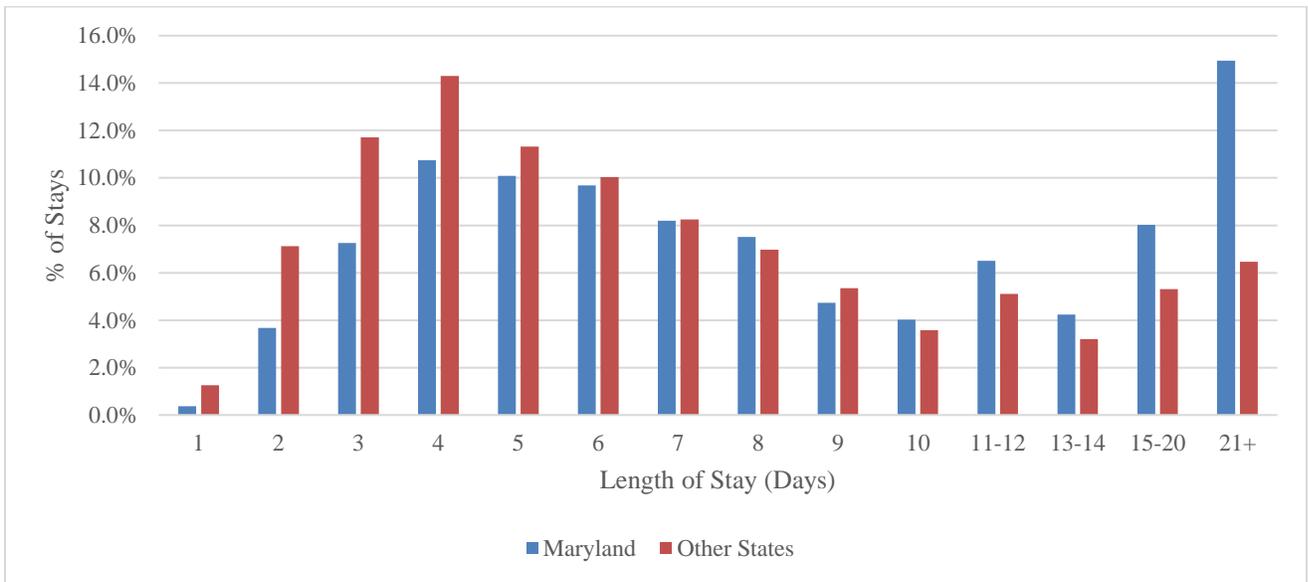


Figure 4 Frequency of Lengths of Stay within MDC 20 “Alcohol/Drug Use & Alcohol/Drug Induced Organic Mental Disorders”

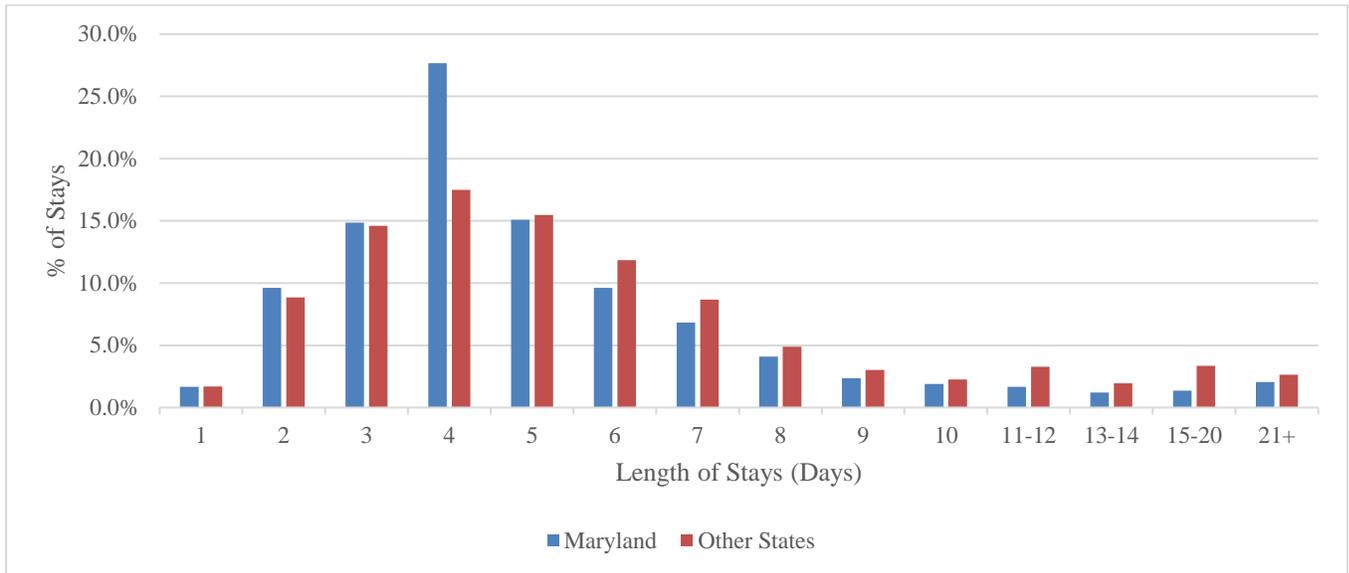
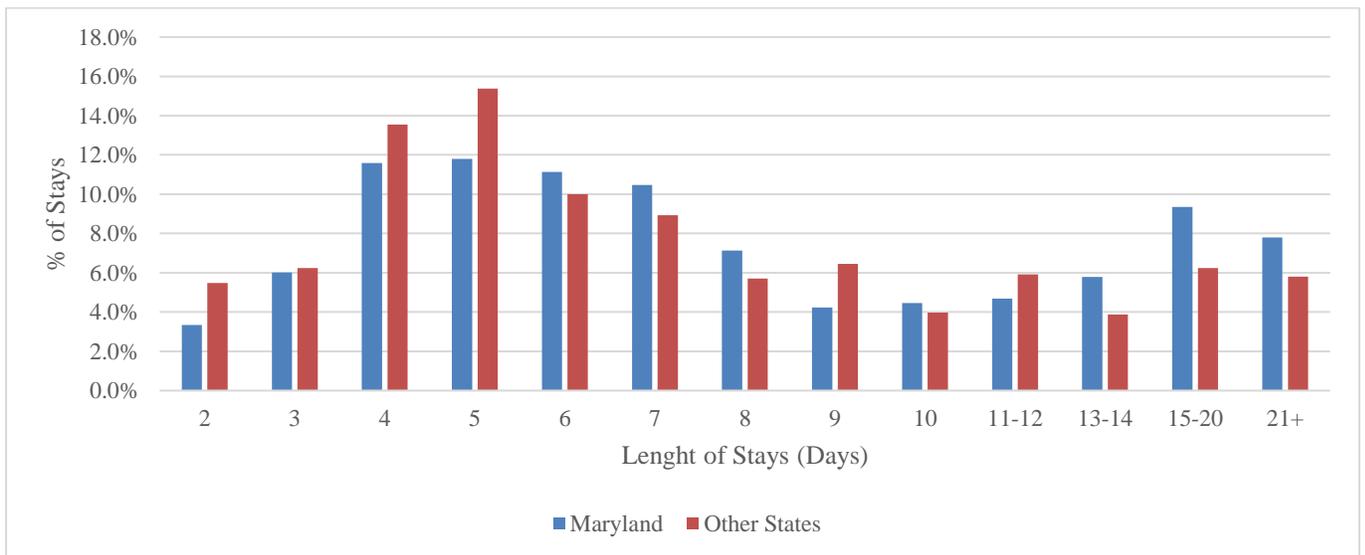


Figure 5 Frequency of Lengths of Stay within MDC 24 “Multiple Significant Trauma”



We also examined the share of stays which are 1 to 2 days by MDC. In general, Medicare guidance for inpatient care covered under Part A is that it is appropriate to admit patients when they are expected to need two or more midnights of medically necessary care.⁵ Maryland overall

⁵ CMS, Medicare Benefit Policy Manual. Chapter 1 - Inpatient Hospital Services Covered Under Part A. <https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/downloads/bp102c01.pdf>, page 5

has a lower share of stays with 1 or 2-day stays. The MDCs below are those where Maryland has a higher share of 1 to 2 day-stays than other states with more than a 1 percentage point difference:

- 09 Diseases and Disorders of the Skin, Subcutaneous Tissue and Breast
 - 12.0% of Maryland’s stays within this MDC were 1-to-2 days long, compared to 10.6% for other states
- 12 Diseases and Disorders of the Male Reproductive System
 - 34.8% (Maryland), 25.2% (other states)
- 14 Pregnancy, Childbirth, and the Puerperium
 - 10.8% (Maryland), 8.4% (other states)

Note that the way observation stays are handled in Maryland and other states might have an impact on the frequencies of short stays described above. It is common practice in Maryland to use the observation status for anticipated short term admissions (general rule of 24 hours or less, but often exceed the 24-hour mark, but not usually more than 2 days). It is also known that Maryland often times does not convert these observation stays to inpatient admissions when the stay surpasses 24 or even 48 hours, where in similar situations in other states those patients would be more likely to be admitted. Therefore, it is possible that Maryland has fewer shorter inpatient stays (in general and as compared to other states) because it is common in Maryland to use the observation status for anticipated short term admission and also for patients to be kept in observation stays for longer periods of times, which leads to the fact that some of those short (1- or 2-day) stays that would have been initiated in fact never occur.

3.4 Severity Level of Inpatient Stays, by MS-DRG

We examined the breakdown of stays at each severity level within base DRGs to assess whether there are notable differences in practice patterns. The Office of Inspector General (OIG) found that hospitals increasingly billed for inpatient stays at the highest severity level from FY 2014 to FY 2019, and that there are indications that these stays are vulnerable to inappropriate billing practices, such as upcoding.⁶ While we do not have the data available to compare across years, we analyzed the share of inpatient stays falling into each MS-DRG severity level within the 10 most frequently billed Base DRGs. This is shown in Table 12, below. The hypothesis is that if the rates of people having more severe conditions, as represented by MS-DRGs with CC/MCC, are similar across the country, then we would expect the percentage of MS-DRGs

⁶ Office of Inspector General, “Trend Toward More Expensive Inpatient Hospital Stays in Medicare Emerged Before COVID-19 and Warrants Further Scrutiny”, (February 2021), <https://oig.hhs.gov/oei/reports/OEI-02-18-00380.pdf>

with those levels of complexity to be comparable in Maryland and other states. For 8 of the 10 most frequently billed MS-DRGs across all states (including MS-DRGs 064, 193, 291, 377, 469, 682, 689, and 871), Maryland had a smaller share of stays falling into the highest severity level compared to other states. Six of these MS-DRGs had a difference greater than 3 percentage points, with two MS-DRGs having a difference of around 15 percentage points (MS-DRG 193 and 689). This could indicate that Maryland inpatient stays are less vulnerable to upcoding than inpatient stays in other states. However, this analysis needs to be enhanced by exploring other indicators such as changes in share of stays at different severity levels over time, length of stay over time, the diagnoses present on the inpatient claim, and concentration within hospitals.

Table 12. Share of Inpatient Stays at Different Severity Levels within Base DRGs for the 10 Most Frequently Billed MS-DRGs across All States

MS-DRG	MS-DRG Description	Maryland		Other States		Difference in Share of Stays at Highest Severity (percentage points)
		# of Stays	% of Stays within Base DRG	# of Stays	% of Stays within Base DRG	
064	Intracranial Hemorrhage Or Cerebral Infarction W MCC	1,940	32.2%	3,619	35.7%	-3.5
065	Intracranial Hemorrhage Or Cerebral Infarction W CC Or Tpa In 24 Hrs	3,144	52.2%	4,977	49.1%	
066	Intracranial Hemorrhage Or Cerebral Infarction W/O CC/MCC	941	15.6%	1,543	15.2%	
190	Chronic Obstructive Pulmonary Disease W MCC	3,785	60.5%	5,933	59.3%	1.2
191	Chronic Obstructive Pulmonary Disease W CC	1,835	29.3%	3,021	30.2%	
192	Chronic Obstructive Pulmonary Disease W/O CC/MCC	637	10.2%	1,044	10.4%	
193	Simple Pneumonia & Pleurisy W MCC	2,247	38.7%	7,334	54.1%	-15.4
194	Simple Pneumonia & Pleurisy W CC	2,929	50.5%	5,033	37.1%	
195	Simple Pneumonia & Pleurisy W/O CC/MCC	623	10.7%	1,200	8.8%	
291	Heart Failure & Shock W MCC Or Peripheral Extracorporeal Membrane Oxygenation (ECMO)	8,063	69.7%	19,091	79.3%	-9.6
292	Heart Failure & Shock W CC	2,798	24.2%	3,831	15.9%	
293	Heart Failure & Shock W/O CC/MCC	703	6.1%	1,156	4.8%	
308	Cardiac Arrhythmia & Conduction Disorders W MCC	1,423	34.4%	3,342	33.2%	1.2
309	Cardiac Arrhythmia & Conduction Disorders W CC	1,808	43.7%	4,109	40.8%	
310	Cardiac Arrhythmia & Conduction Disorders W/O CC/MCC	909	22.0%	2,625	26.1%	
377	G.I. Hemorrhage W MCC	1,356	29.4%	3,247	32.8%	-3.4
378	G.I. Hemorrhage W CC	2,688	58.3%	5,933	60.0%	
379	G.I. Hemorrhage W/O CC/MCC	566	12.3%	705	7.1%	
469	Major Hip And Knee Joint Replacement Or Reattachment Of Lower Extremity W MCC Or Total Ankle Replacement	470	5.6%	1,240	5.9%	-0.3
470	Major Hip And Knee Joint Replacement Or Reattachment Of Lower Extremity W/O MCC	7,859	94.4%	19,704	94.1%	
682	Renal Failure W MCC	1,831	40.0%	5,011	43.5%	-3.5
683	Renal Failure W CC	2,475	54.0%	5,820	50.5%	
684	Renal Failure W/O CC/MCC	276	6.0%	697	6.0%	
689	Kidney & Urinary Tract Infections W MCC	1,286	25.4%	3,988	39.5%	-14.1
690	Kidney & Urinary Tract Infections W/O MCC	3,768	74.6%	6,118	60.5%	
871	Septicemia Or Severe Sepsis W/O Mv >96 Hours W MCC	12,011	72.4%	28,941	77.0%	

MS-DRG	MS-DRG Description	Maryland		Other States		Difference in Share of Stays at Highest Severity (percentage points)
		# of Stays	% of Stays within Base DRG	# of Stays	% of Stays within Base DRG	
872	Septicemia Or Severe Sepsis W/O Mv >96 Hours W/O MCC	3,975	23.9%	7,130	19.0%	

4 LIMITATIONS

This section discusses the limitations of the current analysis and provides suggestions for future research that would provide more comprehensive information on the resource use at hospitals in Maryland and other states.

Analyses use allowed amounts, rather than payment-standardized allowed amounts. Non-standardized Medicare allowed amounts do not remove variation in payments due to factors unrelated to care decisions, such as geographic differences, add-on payments to teaching hospitals, or incentive payments.⁷ Thus, these analyses must be interpreted with caution when comparing Maryland allowed amounts to that of other states, given the differences in payment systems. Future research could add comparisons by payment standardized amounts and test the extent to which differences observed using allowed amounts is neutralized once standardization is applied.

Analyses are conducted on a limited data sample. Using a 100% sample of administrative claims data would address any concerns about sampling biases from using a 5% sample. It would also allow for more granular breakdowns, such as at the MS-DRG level, as there would be fewer instances of small cell suppression. Data from multiple years would allow for comparisons over time to compare trends for Maryland and other states.

The number of diagnosis codes is an imprecise proxy for patient complexity. Diagnosis codes vary greatly in severity, meaning that the number of 3-digit diagnosis codes may have a weak relationship with the costs of inpatient care. For example, many frequently billed diagnosis codes are for common conditions like hypertension, high cholesterol, and sleep disorders. Future research could use an algorithm for patient complexity like CMS Hierarchical Condition Categories (HCCs) which focus on conditions that are expected to impact costs and which has been widely used by the CMS since 2004. Other algorithms could include CCW's condition categories for chronic health, mental health, and potentially disabling chronic conditions. More robust indicators of patient complexity could then be used to understand how this is reflected in inpatient costs.

Analyses into cost can be paired with quality metrics to examine the value of care. There are many additional metrics that could be tested to investigate potential concerns that lower costs are correlated with lower quality care. Metrics could be broad, like 30-day all-cause readmission rates or mortality rates, or focused on particular high-volume MS-DRGs where complications or other outcomes could be specified to only capture services that are highly likely

⁷ CMS, Payment Standardization Methodology. <https://resdac.org/articles/cms-price-payment-standardization-overview>

to be related to the initial hospitalization using service and diagnosis codes (e.g., unplanned readmission algorithm).

5 CONCLUSION

This report explores hospital spending for Maryland, compared to other states. Overall, as expected, inpatient stays in Maryland are more expensive than inpatient stays in other states when examining allowed amounts only. Other analyses examined aspects of care that are not directly reflecting the higher unit costs per stays, with the following key findings:

- Medical MS-DRGs make up a larger share of total volume of inpatient stays in Maryland than in other states.
- When examining the ratio of stay allowed amount to the mean allowed amount per stay for Maryland and other states, Maryland has a higher ratio on average than other states. However, at the median Maryland's ratio is lower than for other states.
- Maryland generally has higher 30-day post-discharge spending for inpatient, outpatient, and Part B physician/supplier claims than other states.
- Maryland has a higher length of stay on average across all inpatient stays than other states. This higher average reflects that Maryland has a greater share of very long inpatient stays than other states. However, Maryland also a smaller share of stays that are less than 3 days in duration than other states.
- Amongst the most common DRGs, Maryland has a lower share of inpatient stays with the highest severity level within base DRGs than other states.

Future research could further explore resource use differences between Maryland and other states by enhancing analyses. In particular, controlling for differences in patient case mix can provide more specific comparisons. These cost comparisons are based on allowed amounts, so it remains to be seen how these analyses compare using payment standardized costs that neutralizes cost differences unrelated to resource use. Such analyses would require access to standardized payments.