Removing a Constraint on Hospital Utilization: A Natural Experiment in Maryland

Noah S. Kalman, MD; Bradley G. Hammill, MS; Robert B. Murray, MA, MBA; and Kevin A. Schulman, MD

ABSTRACT

Objectives

To limit growth in hospital utilization in the 1990s, Maryland required payers to reimburse excess hospital volume at lower case rates. In 2001, this policy changed and excess volume was paid at full case rates. We investigated the impact of this policy change on hospital utilization and finances.

Study Design

We conducted interrupted time-series analyses of hospital-level annual inpatient admissions, outpatient equivalent volume, equivalent admissions, operating revenue, operating costs, and operating profit.

Methods

We analyzed each time series for 45 acute care hospitals in Maryland using a segmented regression model, allowing for changes in level and slope of the trend in 2001, when the payment policy was changed. To incorporate trends for all hospitals, we fit these models as hierarchical generalized linear models.

Results

We observed significant changes in inpatient admissions, outpatient equivalent volume, and operating costs. Following the policy change, trends in inpatient admissions and outpatient equivalent volume had significant 1-year increases of 7.7% and 17.1%, respectively. The annual growth rate for inpatient admissions increased significantly, from 0.8% to 2.4%. The growth rate for outpatient equivalent volume increased from 3.2% to 4.7%, but this change was not statistically significant. Trends in operating costs had significant 1-year increases of 7.6% and an annual growth rate that increased significantly from 4.8% to 8.4%, exceeding the annual growth rate for utilization.

Conclusions

Hospitals responded to changes in payment by accelerating the increase in service volume. The observed increase in utilization coincided with substantial inflation in operating costs that cannot be easily eliminated.

Am J Manag Care. 2014;20(6):e191-e199

CMS designed inpatient diagnosis-related group-based payments and outpatient payments to cover the cost of an average admission. Such costs include the variable or direct patient care costs (nurse staffing, medications, etc) as well as fixed or nonpatient care costs (building operation and maintenance, administrative staff, etc).[1] Although direct costs increase for every admission, fixed nonpatient care costs are less sensitive to changes in patient volume. The marginal profitability of every additional patient encounter within this payment structure incentivizes hospitals to increase service volume.[2] Studies have examined the effect of overall increases and decreases in payment rates on hospital behavior. However, it is unclear whether directly addressing the marginal profitability of increasing patient volume influences hospital behavior.

Maryland has a unique hospital payment regulation scheme. Through a CMS waiver, the Maryland Health Services Cost Review Commission (HSCRC) sets inpatient and outpatient hospital payment rates paid by Medicare, Medicaid, and all commercial payers in Maryland. The Maryland system embodies the same incentives as Medicare's inpatient prospective payment system: the HSCRC sets case-rate constraints based on diagnosis-related groups with the goal of incentivizing hospital efficiency and quality.[3]

Unlike Medicare, the HSCRC attempted to limit growth in hospital costs by making a distinction between payments for baseline patient volume and payments based on changes in patient volume. Under the HSCRC payment adjustment policy in the 1990s, payers reimbursed hospitals 85% of the case rate for additional patient volume above the previous year's volume to more closely approximate the variable, direct costs of patient care (although it did not precisely calculate fixed or marginal costs of care in the assessment). In the case of a hospital with 110 admissions in a given year compared with 100 admissions in the previous year, the Commission would direct payers to provide 100% of the case rate for the first 100 patients but to provide only 85%

Take-Away Points

Payment of full case rates to hospitals in Maryland was associated with significant acceleration in the growth of inpatient and outpatient utilization and operating costs.

- Previous payment policy in Maryland better reflected hospitals' mix of fixed and variable costs and limited the incentive to increase service volume.
- The policy's repeal made reimbursement for incremental volume more generous, similar to Medicare's current payment structure.
- Policy makers may consider the previous payment policy as a useful method to limit hospital cost growth nationally.

of the case rate for the additional 10 admissions. (Conversely, the HSCRC would compensate hospitals with 15% of the payment rate for reductions in patient volume to contribute to fixed costs.) This policy also applied to hospital outpatient services. By reducing the profitability of incremental patient volume, the formula was expected to reduce the incentive to increase utilization at the hospital level.

Beginning in 2001, the HSCRC eliminated this payment adjustment component of the reimbursement scheme. Hospitals subsequently received full case rates for incremental increases in patient volume, identical to the current Medicare system. This policy change should have provided an incentive for hospitals to increase patient volume, because incremental volume would now be reimbursed at 100% of the case rate. In this paper, we explore trends in hospital utilization and finances in Maryland before and after this payment change. We hypothesized that hospital revenues, costs, and profits would increase following the payment adjustment repeal.

METHODS

Data Sources

We used data from the HSCRC Disclosure of Hospital Financial and Statistical Information, an annual report that compiles mandatory reporting data from Maryland hospitals. We obtained hospital-level financial and statistical information for fiscal years 1991 through 2008.[4]

Study Population

The study population consisted of hospitals in Maryland that reported uninterrupted data to the HSCRC between fiscal years 1991 and 2008. One additional hospital, which opened in fiscal year 1994, was included. Hospitals that closed or merged with other hospitals in this time period were excluded from the analysis. Hospitals that joined hospital systems within the state were included if they retained a unique hospital identifier. Four hospitals that had been subject to a form of global capitation in the 1990s, rather than case-based constraints with the 85% payment adjustment policy, were excluded.

Outcomes

The primary outcomes of interest were hospital-level trends in annual inpatient admissions, outpatient equivalent volume, equivalent admissions, operating revenue, operating costs, and operating profit (Table 1).

In a subgroup analysis, we divided hospitals into high-occupancy (≥55% occupancy in fiscal year 2000) and low-occupancy (<55% occupancy in fiscal year 2000) categories at the time of the policy change to examine whether capacity constraints were associated with hospitals' responses to the new incentive.

Statistical Analysis

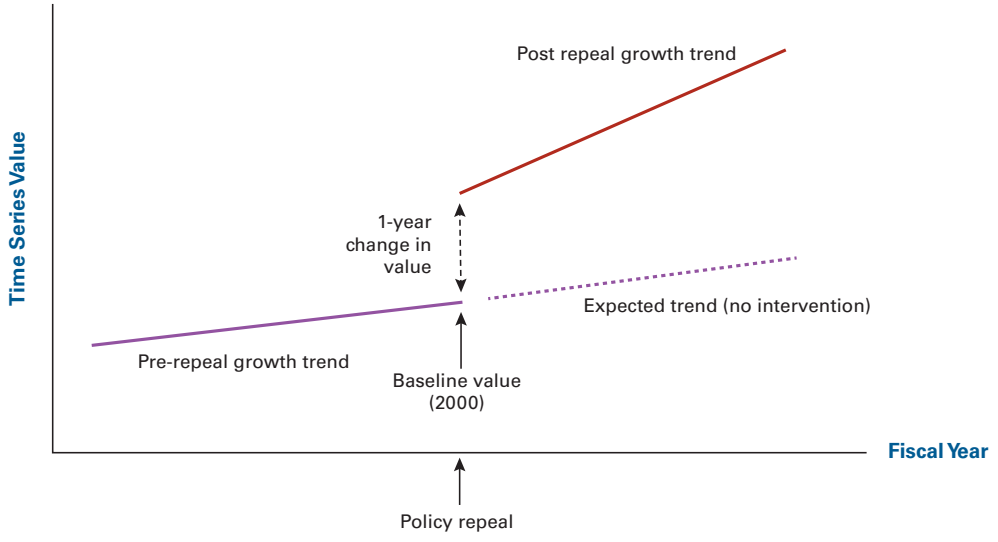
Each hospital's time series was interrupted by the repeal of the payment adjustment policy effective July 1, 2000 (ie, the beginning of fiscal year 2001). We analyzed these interrupted time-series data using a segmented regression analysis which assumed that hospitals adjusted their behavior in the first year following the regulatory change. To estimate the level and slope of the trend line both before and after the policy change, we included fiscal year, an indicator for the postrepeal period, and an interaction between these 2 variables as explanatory variables in each model.

We estimated the statistical models using hierarchical generalized linear model methods. Due to the skewed nature of the time-series values across hospitals, we specified a log link with gamma distributed errors to estimate the model effects on an exponential growth, or relative, scale.[5] This approach enabled comparisons among hospitals on the same scale, regardless of time-series quantity. Use of hierarchical methods was necessary for simultaneous analysis of time-series data across multiple hospitals. Specifically, we allowed for random variation by hospital around the intercept and around each explanatory parameter. This approach had the effect of accounting for the autocorrelation between time-series values within each hospital over time. It also resulted in conditional, or within-hospital, estimates of effect. We report the parameter estimates for each explanatory variable for the average hospital. For subgroup analyses, we estimated the regression models after adding a group indicator and fully interacting that indicator with the other variables described above.

Table 1. Explanation of Time Series Used in the Analysis

Variable	Explanation
Inpatient admissions	Inpatient hospital admissions. Admissions include infants transferred to neonatal intensive care units and exclude uncomplicated deliveries.
Outpatient equivalent volume	A statistic formulated by the Maryland Health Services Cost Review Commission to normalize outpatient volume with inpatient volume. The statistic is calculated in either of the following 2 ways: (1) outpatient charges / mean charge per inpatient admission; or (2) equivalent admissions—inpatient admissions.
Equivalent admissions	A statistic formulated by the Maryland Health Services Cost Review Commission to which the volume adjustment policy is applied. It equals the number of inpatient admissions plus a conversion of outpatient visits into equivalent admissions calculated as follows: (1) inpatient admissions × (total outpatient and inpatient charges / total inpatient charges); or (2) inpatient admissions + outpatient equivalent volume.
Operating revenue	All regulated and unregulated patient care revenue realized by hospitals, as well as other net revenue. Operating revenue is calculated by reducing total outpatient and inpatient charges by contractual allowances, charity care, bad debts, and payer denials. Other net revenue is associated with day-to-day hospital operations, such as cafeteria, research, etc.
Operating costs	All costs associated with regulated and unregulated inpatient and outpatient care, plus costs associated with day-to-day hospital operations.
Operating profit	Profit (or loss) from ordinary, normal recurring regulated operations. It does not include profit or loss from unregulated operations.

Figure 1. Structure of Interrupted Time Series[18]



The solid lines represent regression trends. The dashed line represents the projected trend without the policy change.

RESULTS

A total of 45 hospitals met the inclusion criteria. There were 23 hospitals classified as high occupancy and 22 hospitals classified as low occupancy. For each time series, we reported for the average hospital the fiscal year 2000 value (baseline value), the 1-year change in this value following the policy change, the growth rates before and after the policy change, and the change in growth rate (Figure 1[18]).

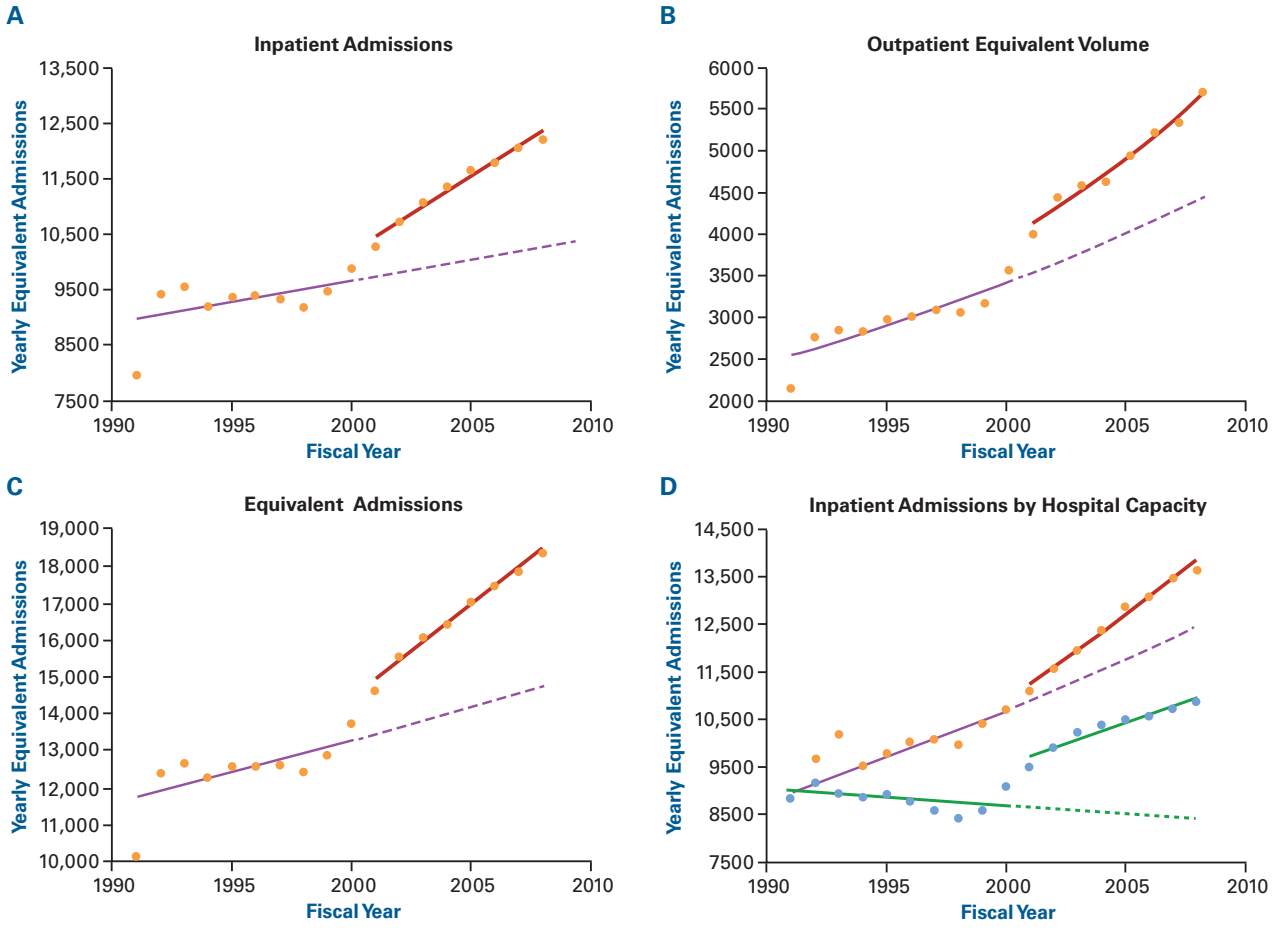
Hospital Utilization

With the repeal of the payment adjustment policy, the trend in inpatient admissions had a significant 1-year increase in value of 7.7% and a significant acceleration in yearly growth from 0.8% to 2.4% (Table 2 and Figure 2, Panel A).

Table 2. Regression Analysis: Coefficient Estimates for the Average Hospital in Maryland

	Relative Growth Model	
Time Series and Parameter	**Estimate (95% CI)**	***P***
Equivalent admissions		
Baseline value (2000), No.	13,464 (11,006-16,470)	<.001
One-year change in value with policy repeal, %	11.1 (8.2-14.2)	<.001
Pre-repeal growth rate, %	1.4 (0.6-2.1)	<.001
Postrepeal growth rate, %	3.1 (1.9-4.3)	<.001
Change in growth rate, %	1.7 (0.8-2.6)	<.001
Inpatient admissions		
Baseline value (2000), No.	9734 (7857-12,058)	<.001
One-year change in value with policy repeal, %	7.7 (4.3-11.2)	<.001
Pre-repeal growth rate, %	0.8 (–0.1 to 1.7)	.07
Postrepeal growth rate, %	2.4 (1.1-3.7)	<.001
Change in growth rate, %	1.5 (0.6-2.5)	.003
Outpatient equivalent volume		
Baseline value (2000), No.	3525 (2829-4393)	<.001
One-year change in value with policy repeal, %	17.1 (11.2-23.4)	<.001
Pre-repeal growth rate, %	3.2 (2.1-4.4)	<.001
Postrepeal growth rate, %	4.7 (2.8-6.6)	<.001
Change in growth rate, %	1.4 (–0.1 to 3.0)	.07
Operating revenue		
Baseline value (2000), No.	93,794 (75,154-117,058)	<.001
One-year change in value with policy repeal, %	4.2 (1.4-7.1)	.004
Pre-repeal growth rate, %	5.3 (4.5-6.1)	<.001
Postrepeal growth rate, %	8.7 (7.6-9.9)	<.001
Change in growth rate, %	3.3 (2.5-4.1)	<.001
Operating costs		
Baseline value (2000), No.	88,045 (70,453-110,029)	<.001
One-year change in value with policy repeal, %	7.6 (4.9-10.4)	<.001
Pre-repeal growth rate, %	4.8 (4.1-5.4)	<.001
Postrepeal growth rate, %	8.4 (7.4-9.4)	<.001
Change in growth rate, %	3.5 (2.7-4.2)	<.001
Operating profit (percentage of operating revenue)		
Baseline value (2000), No.	6.3 (5.1-7.4)	<.001
One-year change in value with policy repeal, %	–3.1 (–4.4 to –1.8)	<.001
Pre-repeal growth rate, %	0.5 (0.1-0.8)	.006
Postrepeal growth rate, %	0.3 (–0.2 to 0.8)	.21
Change in growth rate, %	–0.2 (–0.6 to 0.2)	.36
Operating profit		
Baseline value (2000), No.	7231 (5564-9397)	<.001
One-year change in value with policy repeal, %	–48.1 (–57.2 to –37.2)	<.001
Pre-repeal growth rate, %	14.8 (12.2-17.5)	<.001
Postrepeal growth rate, %	14.6 (10.8-18.6)	<.001
Change in growth rate, %	–0.2 (–3.9 to 3.7)	.92

Figure 2. Time Series of Hospital Utilization Outcomes



Panel A shows the yearly geometric mean (dots) and the time series (solid and dashed lines) of inpatient admissions.
Panel B shows the yearly geometric mean (dots) and the time series (solid and dashed lines) of outpatient equivalent volume.
Panel C shows the yearly geometric mean (dots) and the time series (solid and dashed lines) of equivalent admissions (inpatient plus outpatient equivalent volume).
Panel D shows the yearly geometric mean (orange and blue dots) and the time series (purple solid and dashed line and green solid and dashed line) of inpatient admissions. Orange and purple data points represent high-occupancy hospitals (occupancy ≥ 55% in fiscal 2000). Blue and green data points represent low-occupancy hospitals (occupancy <55% in fiscal year 2000).
Source: Authors' calculations.

Similarly, the trend in outpatient equivalent volume experienced a significant 1-year increase in value of 17.1% and a nonsignificant acceleration in yearly growth from 3.2% before repeal to 4.7% following repeal (Table 2 and **Figure 2, Panel B**). The trend in equivalent admissions, the metric used by the HSCRC to benchmark yearly change in patient volume, had a significant 1-year increase in value of 11.1% and a significant increase in its growth rate from 1.4% to 3.1% (Table 2 and **Figure 2, Panel C**).

With the payment adjustment policy repeal, the trend in inpatient admissions for low-occupancy hospitals saw a significant 1-year increase in value of 12.6%, and high-occupancy hospitals had a nonsignificant 1-year increase in value of 3.2% (**Table 3** and **Figure 2, Panel D**). After adjustment for hospital occupancy category, there was a significant difference in the 1-year increase in value between low- and high-occupancy hospitals. There was no occupancy effect in outpatient equivalent volume or equivalent admissions (Table 3).

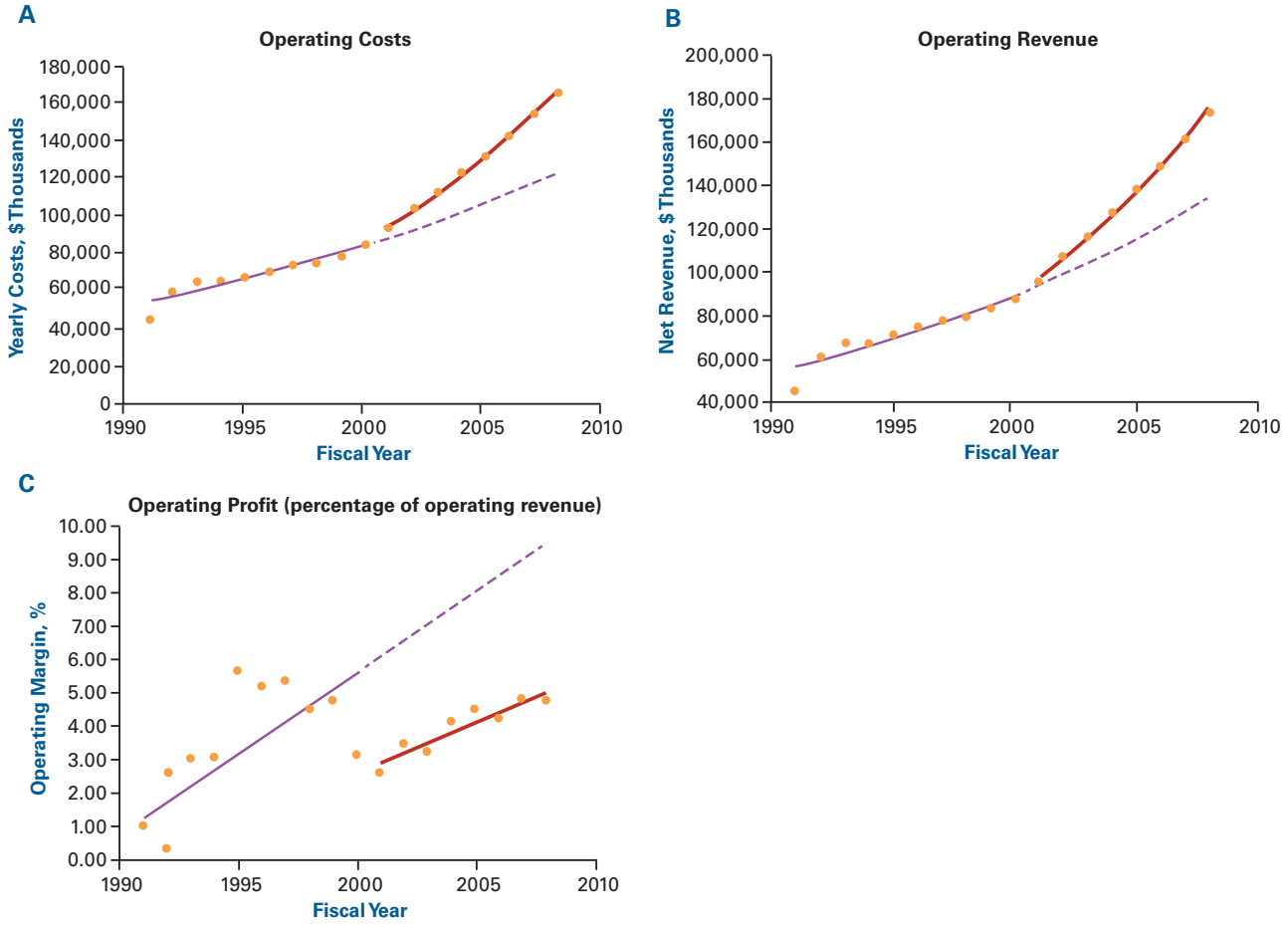
Hospital Finances

Trends in operating revenue and operating costs had significant 1-year increases in value of 4.2% and 7.6%, respectively (Table 2). The operating revenue yearly growth rate, which had previously outpaced the growth in operating costs (5.3% vs 4.8%), converged after the policy change (8.7% vs 8.4%) (Table 2 and **Figure 3, Panels A** and **B**).

Table 3. Regression Analysis: Coefficient Estimates for High-Occupancy and Low-Occupancy Hospitals in Maryland

Time Series and Parameter	High-Occupancy Hospitals		Low-Occupancy Hospitals		
	Estimate (95% CI)	*P*	Estimate (95% CI)	*P*	*P*
Equivalent admissions					
Baseline value (2000), No.	14,934 (10,357-21,533)	<.001	12,086 (10,015-14,586)	<.001	.29
One-year change in value with policy repeal, %	7.9 (4.7-11.3)	<.001	14.5 (9.5-19.8)	<.001	.02
Pre-repeal growth rate, %	2.4 (1.1-3.7)	<.001	0.3 (–0.3 to 0.9)	.25	.004
Postrepeal growth rate, %	3.9 (1.9-5.8)	<.001	2.3 (1.0-3.7)	.002	.17
Change in growth rate, %	1.5 (0.0-2.9)	.05	2.0 (0.7-3.2)	.004	.59
Inpatient admissions					
Baseline value (2000), No.	10,899 (7449-15,946)	<.001	8651 (6965-10,745)	<.001	.28
One-year change in value with policy repeal, %	3.2 (–0.4 to 6.9)	.08	12.6 (6.9-18.5)	<.001	.003
Pre-repeal growth rate, %	2.0 (0.4-3.7)	.02	–0.4 (–0.9 to 0.2)	.17	.005
Postrepeal growth rate, %	3.0 (0.7-5.4)	.01	1.7 (0.5-2.9)	.006	.31
Change in growth rate, %	1.0 (–0.7 to 2.7)	.23	2.1 (1.0-3.2)	<.001	.27
Outpatient equivalent volume					
Baseline value (2000), No.	3738 (2450-5702)	<.001	3317 (2850-3860)	<.001	.59
One-year change in value with policy repeal, %	14.8 (5.5-24.9)	.003	19.6 (12.0-27.8)	<.001	.43
Pre-repeal growth rate, %	4.3 (2.5-6.2)	<.001	2.1 (0.8-3.5)	.004	.05
Postrepeal growth rate, %	5.9 (3.1-8.7)	<.001	3.5 (0.8-6.3)	.01	.21
Change in growth rate, %	1.5 (–0.6 to 3.6)	.15	1.3 (–1.0 to 3.8)	.25	.92
Operating revenue					
Baseline value (2000), No.	113,015 (78,519-162,666)	<.001	77,198 (59,954-99,402)	<.001	.08
One-year change in value with policy repeal, %	3.6 (–0.6 to 8.1)	.09	4.7 (0.8-8.8)	.02	.70
Pre-repeal growth rate, %	6.5 (5.3-7.7)	<.001	4.0 (3.3-4.8)	<.001	<.001
Postrepeal growth rate, %	9.7 (8.1-11.5)	<.001	7.7 (6.2-9.2)	<.001	.06
Change in growth rate, %	3.1 (1.9-4.2)	<.001	3.5 (2.3-4.8)	<.001	.59
Operating costs					
Baseline value (2000), No.	106,250 (73,694-153,188)	<.001	72,356 (56,099-93,322)	<.001	.08
One-year change in value with policy repeal, %	7.2 (3.7-10.9)	<.001	8.0 (3.6-12.5)	<.001	.79
Pre-repeal growth rate, %	5.9 (4.9-6.8)	<.001	3.7 (3.0-4.3)	<.001	<.001
Postrepeal growth rate, %	9.1 (7.7-10.6)	<.001	7.6 (6.3-9.0)	<.001	.11
Change in growth rate, %	3.1 (2.1-4.1)	<.001	3.8 (2.7-5.0)	<.001	.33
Operating profit (percentage of operating revenue)					
Baseline value (2000), No.	6.1 (4.2-7.9)	<.001	6.1 (4.4-7.8)	<.001	>.99
One-year change in value with policy repeal, %	–3.4 (–5.7 to –1.1)	.005	–2.8 (–4.8 to –0.7)	.01	.60
Pre-repeal growth rate, %	0.6 (0.1-1.2)	.02	0.3 (–0.2 to 0.8)	.18	.30
Postrepeal growth rate, %	0.5 (–0.2 to 1.3)	.13	0.0 (–0.6 to 0.7)	.89	.29
Change in growth rate, %	–0.1 (–0.7 to 0.5)	.75	–0.3 (–0.8 to 0.3)	.30	.69
Operating profit					
Baseline value (2000), No.	8502 (5656-12,782)	<.001	6120 (4292-8726)	<.001	.19
Relative change from baseline, %	–52.2 (–64.9 to –35.1)	<.001	–44.6 (–57.6 to –27.6)	<.001	.43
Pre-repeal growth rate, %	16.1 (12.5-19.9)	<.001	13.4 (9.9-17.0)	<.001	.27
Postrepeal growth rate, %	19.4 (13.6-25.6)	<.001	10.1 (5.6-14.8)	<.001	.007
Change in growth rate, %	2.8 (–3.0 to 9.0)	.33	–2.9 (–7.6 to 2.0)	.22	.10

Figure 3. Time Series of Hospital Financial Outcomes



Panel A shows the yearly geometric mean (dots) and the time series (solid and dashed lines) of operating costs (patient and non-patient care).
Panel B shows the yearly geometric mean (dots) and the time series (solid and dashed lines) of operating revenue (patient and non-patient care).
Panel C shows the yearly geometric mean (dots) and the time series (solid and dashed lines) of the ratio of operating profit and operating revenue.

In the case of operating profit trends as a percentage of operating revenue, there was a significant 1-year decrease in value of 3.1%, and the yearly growth rate had a nonsignificant deceleration from 0.5% before repeal to 0.3% following repeal (Table 2 and Figure 2, Panel C). Estimates of the changes in financial time series did not substantially differ between high- and low-occupancy hospitals.

DISCUSSION

Hospital Utilization

Our findings are consistent with anecdotal evidence that both inpatient admissions and outpatient equivalent volume in Maryland grew substantially after the repeal of the payment adjustment policy. From these results, we can infer that the policy change, which altered financial incentives to hospitals, affected hospital behavior.

Recent research has shown that hospital utilization correlates positively with payment.[9,10] Research has also shown that hospitals facing larger Medicare payment cuts under the 1997 Balanced Budget Act had lower growth in per beneficiary inpatient admissions[6] and reduced volume of hospital outpatient services than hospitals facing smaller cuts,[7] and decreased treatment intensity for previously well-compensated services.[8] Conversely, when additional patient volume appeared to become more profitable in Maryland, hospitals responded with increases in hospital service volume for both inpatients and outpatients. Our results and other analyses of hospital utilization responses to changes in payment indicate that the hospital utilization supply curve has a positive slope.

The effects of the policy change are put into sharp relief by the significant 9.4% difference in the 1-year in-

crease in value in inpatient admissions between low- and high-occupancy hospitals (Figure 2, Panel D). Growth in inpatient admissions in high-occupancy hospitals was potentially limited by capacity constraints; however, low-occupancy hospitals did not have such constraints. The lack of capacity constraints may explain the larger 1-year increase in value in outpatient equivalent volume regardless of occupancy status. In absolute terms, the increase in outpatient volume following the repeal of the payment adjustment policy equaled that of inpatient volume, despite an inpatient-outpatient volume ratio of approximately 70 to 30 in 2000.

Additional factors may have influenced the growth in hospital utilization. The repeal of the payment adjustment, negotiated by the HSCRC with hospitals and payers in Maryland, was undertaken in exchange for tight overall case-rate inflation for 2001 through 2003. Similarly tight case-rate updates had been implemented in 1999 and 2000 in response to the 1997 Balanced Budget Amendment. Although these small rate updates limited per case cost growth, it likely enhanced the relative profitability of additional patient volume (because incremental volume has no fixed costs to cover) compared with the profitability of baseline patient volume. Indeed, inpatient and outpatient volume grew faster in 1999 and 2000 than in 1997 and 1998. Generous case-rate increases from 2004 through 2007, combined with a strong economy that expanded the potential demand for hospital services, further increased the profitability of additional patients. For outpatient services in particular, the repeal of a small ambulatory surgery constraint program released a restriction on outpatient service growth. Overall, these factors could have provided extra inducement for hospitals to admit and treat more patients.

Hospital Finances

Commensurate with the increase in hospital utilization, the rate of growth in hospital operating revenue and operating costs accelerated with full case rates. Operating revenue growth outpaced utilization growth, which would be expected given case-rate inflation approved by the HSCRC on top of larger patient volumes. That operating costs had greater increases than operating revenue demonstrated that hospitals' cost inflation exceeded case-rate inflation. Such cost increases in response to more generous payments are consistent with converse research indicating that hospitals reduced operating costs in response to payment cuts.[11-14]

Contrary to expectations, operating profit trends had a significant 1-year decrease in value of nearly 50% post policy repeal, and operating profit trends as a percentage of operating revenue had a significant 1-year decrease in value of 3.1%. These results can be attributed to the extremely tight overall case rate updates between 1999 and 2003. Although the tight updates did initially impact operating profits, operating profit as a percentage of operating revenue returned to historical levels over time (**Figure 3**, **Panel C**).

Limitations

The HSCRC data allow comparisons of trends over many years, increasing the statistical power of the data. Furthermore, the database maintains consistent reporting fields over the 18-year period. Although it is a relatively small state, Maryland has a range of hospital types, including academic medical centers, community hospitals, and safety net hospitals in both rural and urban areas.

Our analysis did not include other state or national trends as a control group for the observed change, nor did it explicitly control for population growth, macroeconomic trends, or changes in insurance coverage or health status. However, the growth in admissions nationally remained relatively constant,[15] diminishing the likelihood that a national policy change or national business cycle had an impact. Furthermore, population growth in Maryland remained relatively constant, indicating that population growth did not account for the increase in admissions.[16] This limits the likelihood that changes in the time series are attributable to endogenous factors not recorded in the analysis.

Certain reported hospital-level measures, specifically operating revenue, operating costs, and operating profit, included hospital operations unrelated to direct patient care. This made the analysis of the impact of the policy change more difficult. In addition, the reported effects of the policy change may not be uniform across all hospitals, because hospitals varied in their response to the policy change. The inclusion of some hospitals in multihospital health systems could have further altered the observed financial impact.

Lastly, the HSCRC reintroduced the 85% payment adjustment policy in 2009. Although hospital volume has recently declined, we were unable to assess whether the reinstatement of the payment adjustment policy had a statistically significant impact on hospital behavior, given the policy's recent reimplementation. Future research is required to examine this effect once sufficient time points have been reported.

Policy Implications

In the 1990s, Maryland's 85% payment adjustment policy limited the financial incentive of case-based payment systems for hospitals to increase utilization. With

the policy change to reimburse full case rates for increases in hospital services, hospitals unsurprisingly responded to this incentive change by increasing utilization, operating revenue, and operating costs faster than baseline growth. Policy makers should be concerned that Maryland's payment incentives in the 2000s, which mirror those of Medicare, led to changes in hospital infrastructure and strategy that have long-term consequences. In the 8 years with full case rates, hospital operating costs in Maryland more than doubled. If the baseline operating cost trajectory had remained the same, hospital operating costs in the state would have been 25% lower in 2008.

On a national level, efforts to bend the healthcare cost curve, such as bundled payments and accountable care organizations, rely on financial incentives to change behavior. However, Medicare has focused on containing costs without understanding hospitals' underlying cost structure. Indeed, neither of these new programs addresses the incentives created by the current average cost-based payment system. Policy makers may consider Maryland's payment adjustment policy as a potential tool to address these incentives.

CONCLUSIONS

The 1990s Maryland payment adjustment policy intended to deliver payments that more accurately reflected hospitals' mix of fixed and variable costs and to limit the incentive for hospitals to increase service volume.[17] The policy's repeal made reimbursement for incremental volume more generous, similar to Medicare's current payment structure. We observed significant acceleration in the growth trends of inpatient and outpatient utilization, as well as operating costs, associated with full case rates. The payment adjustment policy of the 1990s appeared to restrict the growth in hospital costs in Maryland and may prove a useful method to limit hospital cost growth nationally.

Acknowledgments

Damon M. Seils, MA, Duke University, provided editorial assistance and prepared the manuscript. Mr Seils did not receive compensation for his assistance apart from his employment at the institution where the study was conducted.

Author Affiliations: Duke Clinical Research Institute, Duke University, Durham, North Carolina (NSK, BGH, KAS); Department of Medicine, Duke University School of Medicine, Durham, NC (NSK, KAS); Global Health Payment, LLC, Towson, MD (RBM).

Source of Funding: This work was supported internally by departmental funds.

Author Disclosures: The authors report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

Authorship Information: Concept and design (NSK, BGH, RBM, KAS); acquisition of data (NSK); analysis and interpretation of data (NSK, BGH, RBM, KAS); drafting of the manuscript (NSK); critical revision of the manuscript for important intellectual content (NSK, BGH, RBM, KAS); statistical analysis (NSK, BGH); supervision (KAS).

Address correspondence to: Kevin A. Schulman, MD, Duke Clinical Research Institute, PO Box 17969, Durham, NC 27715. E-mail: kevin.schulman@duke.edu.

REFERENCES

1. Iglehart JK. Medicare begins prospective payment of hospitals. *N Engl J Med.* 1983;308(23):1428-1432.
2. Robinson JC. Theory and practice in the design of physician payment incentives. *Milbank Q.* 2001;79(2):149-177, III.
3. Murray R. Setting hospital rates to control costs and boost quality: the Maryland experience. *Health Aff (Millwood).* 2009;28(5):1395-1405.
4. Maryland Health Services Cost Review Commission. HSCRC Policy Documents and Reports: Annual Reports. Baltimore, Maryland; 2012. http://www.hscrc.state.md.us/pdr_annualReports.cfm. Accessed July 11, 2013.
5. Manning WG, Basu A, Mullahy J. Generalized modeling approaches to risk adjustment of skewed outcomes data. *J Health Econ.* 2005;24(3):465-488.
6. White C. How do changes in Medicare hospital payment rates affect the volume of services? Paper presented at: Issues in Medicare Payment Policy. AcademyHealth Annual Research Meeting; June 12-14, 2011; Seattle, WA.
7. He D, Mellor J. Hospital volume responses to Medicare's outpatient prospective payment system: evidence from Florida; 2012. Social Science Research Network website. http://ssrn.com/abstract=2039135. Accessed July 11, 2013.
8. Lindrooth RC, Bazzoli GJ, Clement J. The effect of reimbursement on the intensity of hospital services. *South Econ J.* 2007;73(3):575-587.
9. Dafny LS. How do hospitals respond to price changes? *Am Econ Rev.* 2005;95(5):1525-1547.
10. Ginsburg PB. Can hospitals and physicians shift the effects of cuts in Medicare reimbursement to private payers? *Health Aff (Millwood).* 2003;suppl Web Exclusives:W3-472-W3-479.
11. Feder J, Hadley J, Zuckerman S. How did Medicare's prospective payment system affect hospitals? *N Engl J Med.* 1987;317(14):867-873.
12. Bazzoli GJ, Lindrooth RC, Hasnain-Wynia R, Needleman J. The Balanced Budget Act of 1997 and US hospital operations. *Inquiry.* 2004;41(4):401-417.
13. Lindrooth RC, Bazzoli GJ, Needleman J, Hasnain-Wynia R. The effect of changes in hospital reimbursement on nurse staffing decisions at safety net and nonsafety net hospitals. *Health Serv Res.* 2006;41(3, pt 1):701-720.
14. Zhao M, Bazzoli GJ, Clement JP, Lindrooth RC, Nolin JM, Chukmaitov AS. Hospital staffing decisions: does financial performance matter? *Inquiry.* 2008;45(3):293-307.
15. TrendWatch Chartbook 2012: Trends Affecting Hospitals and Health Systems. Table 3.1: Trends in inpatient utilization in community hospitals, 1990-2010; Washington, DC; 2012. American Hospital Association website. http://www.aha.org/research/reports/tw/chartbook/2012/table3-1.pdf. Accessed July 11, 2013.
16. Maryland population. Maryland Manual On-Line; Annapolis, Maryland; 2012. Maryland State Archives website. http://www.msa.md.gov/msa/mdmanual/01glance/html/pop.html. Accessed July 11, 2013.
17. Final Staff Recommendation and Discussion Document Regarding the FY 2012 HSCRC Hospital Payment Update; Baltimore, Maryland; 2011. Maryland Health Services Cost Review Commission website. http://www.hscrc.state.md.us/documents/HSCRC_PolicyDocumentsReports/ApprovedPolicyPapersStaffRecommendations/2011/04/FinalStaffRecFY2012HospPaymentUpdate.pdf. Accessed July 11, 2013.
18. MacDougall C, Polk RE. Antimicrobial stewardship programs in health care systems. *Clin Microbiol Rev.* 2005;18(4):638-656. ■