August 2017

Evaluation of the Maryland All-Payer Model

Second Annual Report

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RTI INTERNATIONAL

EVALUATION OF THE MARYLAND ALL-PAYER MODEL
SECOND ANNUAL REPORT

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CMS Contract Number HHSM-500-2010-00021I, Task Order HHSM-500-T0013

August 2017

This project was funded by the Centers for Medicare & Medicaid Services under contract no. HHSM-500-2010-00021I, Task Order HHSM-500-T0013. The statements contained in this report are solely those of the authors and do not necessarily reflect the views or policies of the Centers for Medicare & Medicaid Services. RTI assumes responsibility for the accuracy and completeness of the information contained in this report.

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LIST OF ABBREVIATIONS

ACA	Patient Protection and Affordable Care Act
ACO	Accountable care organization
ACSC	Ambulatory care sensitive condition
AHA	American Hospital Association
AHRF	Area Health Resource File
APR	All-patient refined
CAH	Critical access hospital
CAH2	Method II critical access hospital
CCN	CMS Certification Number
CCW	Chronic Condition Data Warehouse
CEO	Chief executive officer
CG	Comparison group
CI	Confidence interval
CMS	Centers for Medicare & Medicaid Services
CMMI	Center for Medicare & Medicaid Innovation
CPT	*Current Procedural Terminology*
CRISP	Chesapeake Regional Information System for our Patients
CY	Calendar year
DHMH	Maryland Department of Health and Mental Hygiene
D-in-D	Difference-in-difference
DRG	Diagnosis-related group
DSH	Disproportionate share hospital
ED	Emergency department
EMR	Electronic medical record
ESRD	End-stage renal disease
FFS	Fee-for-service
FQHC	Federally qualified health center
FY	Fiscal year
GBR	Global Budget Revenue
GLM	Generalized linear model
GSP	Gross state product
HCAHPS	Hospital Consumer Assessment of Healthcare Providers and Services
HCC	Hierarchical Condition Category
HCIA	Health Care Innovation Awards
HCPCS	*Healthcare Common Procedure Coding System*
HPSA	Health professional shortage area
HRSA	Health Resources and Services Administration
HSA	Hospital service area
HSCRC	Health Services Cost Review Commission
IBR	Intern-to-bed ratio
ICU	Intensive care unit
IME	Indirect medical education
IPPS	Inpatient Prospective Payment System
IT	Information technology

LPM	Linear probability model
LOS	Length of stay
MACRA	Medicare Access & CHIP Reauthorization Act of 2015
MHAC	Maryland Hospital-Acquired Condition
MHCC	Maryland Health Care Commission
OP	Outpatient
OPPS	Outpatient Prospective Payment System
ORD	Office of Research and Demonstrations
PAC	Post-acute care
PAU	Potentially avoidable utilization
PBPM	Per beneficiary per month
PCP	Primary care physician
PCMH	Patient-centered medical home
PPC	Potentially preventable complication
PPS	Prospective payment system
PQI	Prevention quality indicator
QBR	Quality-based reimbursement
RHC	Rural health clinic
RRIP	Readmission Reduction Incentive Program
SHIP	State Health Improvement Process
SIM	State Innovation Models
SNF	Skilled nursing facility
STAC	Short-term, acute-care
TAVR	Trans-catheter aortic valve replacement
TIN	Taxpayer Identification Number
TPR	Total Patient Revenue
UCC	Uncompensated care

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EXECUTIVE SUMMARY

On January 1, 2014, Maryland implemented its All-Payer Model for hospitals, which shifted the state's hospital payment structure to an all-payer, annual, global hospital budget that encompasses inpatient and outpatient hospital services. Maryland's All-Payer Model builds on the state's all-payer hospital rate setting system, which had operated since the 1970s. The All-Payer Model operates under an agreement with the Centers for Medicare & Medicaid Services (CMS) that exempts Maryland hospitals from Medicare's Inpatient Prospective Payment System (IPPS) and Outpatient Prospective Payment System (OPPS). Under the agreement with CMS, Maryland must limit per capita total hospital cost growth for both Medicare and all payers and generate $330 million in Medicare savings over 5 years.

MARYLAND ALL-PAYER MODEL SNAPSHOT

- Hospitals varied considerably in their engagement with making changes to adapt to the new model
- Maryland's All-Payer Model reduced both total expenditures and total hospital expenditures for Medicare beneficiaries without shifting costs to other parts of the health care system outside of the global budgets
- Hospital expenditure savings for Medicare were achieved by reducing expenditures for outpatient emergency department and other hospital outpatient department services
- Inpatient admissions declined, but there were no savings in Medicare expenditures for inpatient hospital services
- Maryland hospitals have reduced avoidable utilization among Medicare beneficiaries, but made less progress in improving care continuity
- Maryland hospitals have been able to operate within global budgets without adverse effects on their financial status
- Maryland's all-payer rate-setting system eliminates cross-subsidization among payers

This report describes findings from the first 2 years of the evaluation of the All-Payer Model, conducted by RTI International. The report covers 2 1/2 years of the implementation of the All-Payer Model, focusing on the most recent year (July 2015–June 2016) and outcomes for 2 years for fee-for-service Medicare beneficiaries (January 2014–December 2015). Key expenditure and utilization findings for the Medicare population are summarized in ***Table ES-1***. The first 2 years of the Maryland All-Payer Model evaluation showed success in achieving some goals of the model, but ongoing challenges in achieving others. The successes are particularly notable because hospitals varied considerably in the extent to which they had made changes to adapt to the All-Payer Model. The findings in this report represent only a partial picture of All-Payer Model impacts because they mainly reflect the Medicare population, whereas the All-Payer Model is intended to affect hospital utilization for all Maryland residents. Future reports will provide a more complete picture of model impacts by expanding analyses to include outcomes for Medicaid and commercially insured beneficiaries.

Table ES-1
Changes in utilization and expenditures for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

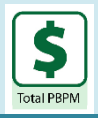
Outcome	Baseline period adjusted outcome, Maryland	Baseline period adjusted outcome, comparison group	Implementation period adjusted outcome, Maryland	Implementation period adjusted outcome, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Aggregated regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Changes in utilization								
All-cause acute inpatient admissions per 1,000 population	41.5	44.6	35.4	39.0	−1.5 (−1.8, −1.1)	−8,950 (−10,740, −6,563)	−3.5	0.000
ED visits that did not lead to a hospitalization per 1,000 population	66.7	61.4	70.7	63.5	2.1 (1.7, 2.4)	12,530 (10,143, 14,320)	3.1	0.000
ACSC admissions per 1,000 population	6.1	6.7	5.0	5.7	−0.5 (−0.7, −0.4)	−2,983 (−4,177, −2,387)	−8.2	0.000
Unplanned readmissions within 30 days of discharge per 1,000 discharges	152.8	154.1	138.3	144.3	−4.7 (−7.5, −2.0)	−1,207 (−1,926, −514)	−3.1	0.004
DRG weight per admission	1.572	1.544	1.648	1.608	0.012 (0.0052, 0.019)	N/A	0.8	0.005
Changes in expenditures ($)								
Total PBPM	950.94	919.47	928.48	913.55	−16.60 (−20.77, −12.43)	−293,483,452 (−367,207,909, −219,758,994)	−1.8	0.000
Total hospital PBPM	527.77	452.78	517.13	453.41	−11.32 (−14.54, −8.10)	−200,134,498 (−257,063,216, −143,205,781)	−2.1	0.000
Inpatient facility PBPM	394.03	348.18	378.33	332.01	0.44 (−2.55,3.43)	7,779,079 (−45,083,301, 60,641,460)	0.1	0.821
Outpatient ED PBPM	25.40	19.93	26.40	25.11	−4.20 (−4.45, −3.94)	−74,254,849 (−78,674,781, −69,658,120)	−16.5	0.000

(continued)

Table ES-1 (continued)
Changes in utilization and expenditures for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted outcome, Maryland	Baseline period adjusted outcome, comparison group	Implementation period adjusted outcome, Maryland	Implementation period adjusted outcome, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Aggregated regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Other hospital outpatient department PBPM	108.36	84.69	112.41	96.31	−7.57 (−8.47, −6.66)	−133,835,526 (−149,747,279, −117,746,975)	−7.0	0.000

NOTES: ACSC = ambulatory care sensitive condition; ED = emergency department; PBPM = per beneficiary per month; N/A = not applicable. A logistic regression model was used to obtain estimates of the difference in probability of use for inpatient admissions, ED visits, ACSC admissions, and 30-day unplanned readmissions. The probability of any admission, probability of ED visit, and probability of ACSC admission estimates are multiplied by 1,000 to obtain an approximate rate per 1,000 beneficiaries. A generalized linear model with an identity link and normal distribution was used to obtain estimates for differences in expenditures. For continuous outcomes estimated using linear models, the regression-adjusted difference-in-differences (D-in-D) may not match exactly with the D-in-D calculated from the adjusted means because of rounding. For binary outcomes estimated using nonlinear models, the regression-adjusted D-in-D is calculated as the average treatment effect *on the treated*, whereas the D-in-D derived from the adjusted means represents the average treatment effect. As a result, the regression-adjusted D-in-D and the D-in-D calculated from the adjusted means will differ. A *negative* value corresponds to a *greater decrease* or a *smaller increase* in probability of use or expenditures after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in probability of use or expenditures in Maryland relative to the comparison group. Aggregated results for 30-day unplanned readmissions were obtained by multiplying the per admission change by the total number of admissions for Maryland beneficiaries in the All-Payer Model period (Q1 2014–Q4 2015), N=256,782. Aggregated results for the utilization beneficiary-level measures were obtained by multiplying the per-member change by the total number of person-quarters used for utilization measures for Maryland beneficiaries in the All-Payer Model period (Q1 2014–Q4 2015), N=5,966,604. The expenditure measures were obtained by multiplying the per-member-per-month change by the total number of person-months, N=17,679,726.



Maryland's All-Payer Model reduced both total expenditures and total hospital expenditures for Medicare beneficiaries

- During the first 2 years of All-Payer Model implementation, per beneficiary Medicare expenditures in total and for hospital services overall declined for Maryland beneficiaries relative to a matched comparison group. The relative decline in both total and hospital expenditures means it is unlikely that the model is reducing hospital costs by shifting costs to other parts of the Maryland health care system outside of the global budgets.

For further information on total expenditures and hospital expenditures, see Section 4.

- Total per beneficiary per month (PBPM) expenditures for Medicare beneficiaries declined by $16.60 more in Maryland than in the comparison group, resulting in an aggregate $293 million savings to Medicare during the first 2 years of the model.

- Total hospital PBPM expenditures declined by $11.32 in Maryland relative to the comparison group, resulting in an aggregate $200 million reduction in Medicare spending on hospital services.

Hospital expenditure savings for Medicare were achieved by reducing expenditures for outpatient emergency department and other hospital outpatient department services

- Outpatient emergency department (ED) expenditures grew more slowly in Maryland than in the comparison group, reducing PBPM expenditures in Maryland by $4.20 relative to the comparison group and reducing aggregate expenditures by $74 million. Expenditures for other hospital outpatient department services also grew more slowly in Maryland than in the comparison group, resulting in savings of $7.57 PBPM and an aggregate expenditure reduction of almost $134 million.

For further information on outpatient hospital utilization and expenditures, see Section 4.

- Outpatient ED expenditure savings resulted from a decrease in the payment per ED visit in Maryland relative to the comparison group, not a reduction in the ED visit rate, which increased by 2.1 more visits per 1,000 beneficiary quarters in Maryland. During site visits, hospitals reported some investment in reducing ED use, however, the consensus was that more time was needed for changes by patients and clinicians to occur that would alter care-seeking patterns. This finding also corroborates stakeholder perceptions that most Maryland hospitals have been slow to implement community partnerships that could help shift ED use to community physicians. The increase in the ED visit rate could reflect reductions in admissions of people seen in the ED.

Maryland's All-Payer Model reduced inpatient admissions, but there were no savings in Medicare expenditures for inpatient hospital services

- Inpatient admissions declined by 1.5 more admissions per 1,000 Medicare beneficiary quarters in Maryland relative to the comparison group, resulting in 8,950 fewer admissions for Medicare beneficiaries in Maryland during the first 2 year of the All-Payer Model. However, the reduction in inpatient utilization did not translate into expenditure reductions. Although PBPM expenditures for inpatient services declined during the first 2 years of the All-Payer Model in Maryland, this did not differ from the reduction in the comparison group over the same period.

For further information on inpatient hospital utilization and expenditures, see Sections 4 and 6.

- The absence of savings despite the reduction in admissions reflects faster growth in the payment per admission in Maryland than in the comparison group. The payment per admission could increase if the avoided admissions are less-severe cases, which is consistent with reports by hospital leaders that Maryland hospitals are shifting routine and lower-intensity cases to nonhospital settings. Although we found a greater increase in admission severity, as measured by diagnosis-related group weight, in Maryland than in the comparison group during the first 2 years of the All-Payer Model, after controlling for changes in case mix the payment per admission still increased more in Maryland than in the comparison group.

- The increase in the case-mix adjusted payment per admission suggests that hospital payment rates grew more rapidly in Maryland than in the IPPS, which was confirmed by analyses that showed a modest widening of the differential between inpatient payment rates in Maryland and the IPPS following implementation of the All-Payer Model. This could result from differences between the rate updates in Maryland's all-payer rate-setting system and in the IPPS, as well as rate adjustments that hospitals are permitted to make within prescribed limits to regain some of the lost revenue from decreased utilization in order to meet their global budgets.

Maryland hospitals have reduced avoidable utilization among Medicare beneficiaries

- There were greater decreases in admissions for ambulatory care sensitive conditions (ACSCs) for Medicare beneficiaries in Maryland than in the comparison group, resulting in 2,983 fewer admissions for ACSCs during the first 2 years of the All-Payer Model. This could reflect efforts described in hospital site visits to shift routine and lower-intensity services to nonhospital settings.

For further information on avoidable utilization, see Section 5.

- All-cause readmissions declined more in Maryland than in the comparison group after implementation of the All-Payer Model. In aggregate, there were 1,207 fewer 30-day readmissions for Maryland Medicare beneficiaries in the implementation period. Although reducing readmissions has been a hospital target nationwide for several years, the relatively larger decline in Maryland suggests that the focus on this in the All-Payer Model is yielding positive results. The most common strategy adopted by hospitals in response to the All-Payer Model, including those that had made minimal efforts to adapt to the new system, was to increase investment in care continuity and management, discharge planning, and treatment adherence. In addition, changes to global budget update policies strengthened incentives to reduce readmissions.

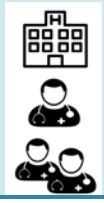
- There were significant reductions relative to the comparison group in the rate of ED visits after hospital discharge, although the rate increased over time in both Maryland and the comparison group. This relative reduction in post-discharge ED visits could also reflect hospitals' focus on discharge planning and treatment adherence.

Hospitals have made less progress in improving care continuity

- There was no change in the postdischarge follow-up visit rate in Maryland following implementation of the All-Payer Model, either in absolute terms or relative to the comparison group.

For further information on care continuity, see Section 5.

- Although hospitals described care continuity as a focus, they provided few examples of hospitals developing partnerships with community physicians other than purchasing physician practices. In the second year of All-Payer Model implementation, hospitals were beginning to discuss the need to strengthen and redefine relationships with outpatient and post-acute care providers and some hospitals described new collaborations with other hospitals and with post-acute care providers.



Maryland's All-Payer Model reduced expenditures for hospital services without shifting costs to other parts of the health care system outside of the global budgets, although there were some changes in site of care

- The relative decline in both total expenditures and hospital expenditures indicates that the savings on hospital services were not offset by expenditure increases for non-hospital services.

For further information on spillover effects, see Section 7.

- There was no evidence that the All-Payer Model has led to unbundling of inpatient services for Medicare patients by shifting costs to preadmission or postdischarge periods.

- Maryland hospitals were not more likely to transfer costly patients to other acute care or post-acute care providers following implementation of the All-Payer Model. Although there was a slight increase in transfers of Medicare patients to post-acute care settings in the second year of the All-Payer Model, this change was not concentrated among more severe cases that are expected to be more costly.

- The likelihood of a Medicare beneficiary having a primary care visit increased in Maryland following the implementation of the All-Payer Model in absolute terms and relative to the comparison group. Although primary care visits increased in all sites of care, relative to the comparison group primary care visits in Maryland shifted away from hospital outpatient departments to non-hospital settings, including physician offices and health centers.

- It does not appear that Medicare beneficiaries had to seek care elsewhere because of restricted access to Maryland hospitals. The share of Maryland Medicare beneficiary admissions to out-of-state hospitals and the share of Maryland hospital admissions from out-of-state Medicare beneficiaries did not change after the All-Payer Model implementation.

Maryland hospitals have been able to operate within global budgets without adverse effects on their financial status

- Maryland hospitals face penalties if their revenues vary from their global budget beyond a narrow 0.5 percent corridor, which creates strong incentives to manage volume and revenue to meet the target budget. Almost 80 percent of Maryland hospitals had revenues within 0.5 percent of their global budget, and this percentage did not change over time. However, certain types of hospitals were less likely than others to remain within the budget corridor, including smaller hospitals, hospitals with high disproportionate share hospital percentages, hospitals not affiliated with hospital systems, and hospitals that did not have experience with global budgets prior to the implementation of the All-Payer Model.

For further information on hospital financial performance, see Section 3.

- Although each hospital's rates are established as part of Maryland's rate-setting process, hospital are permitted to adjust their rates within prescribed limits to remain within their budgets. During site visits, hospital finance leaders described rate modifications as a critical tool for operating within global budgets, and analyses showed that hospitals made frequent adjustments to the rates charged during the year. However, average rates charged during the course of the year were closer to rate order amounts than the rates charged in the individual quarters, suggesting that hospitals made offsetting rate increases and decreases in response to short-run volume fluctuations to ensure that they remained in compliance with their annual global budgets.

- Operating margins increased after implementation of the All-Payer Model for most types of hospitals, as well as for all Maryland hospitals combined. During site visits, hospital leaders described initiatives to improve the efficiency of their operations, such as increasing precision in nurse staffing levels, enhancing use of physician assistants, cross-training staff to work in different divisions to adapt more nimbly to changes in patient census, negotiating more aggressively with suppliers, and consolidating service lines across hospitals within a system.

Maryland's all-payer rate-setting system eliminates cross-subsidization among payers

- Both before and after implementation of the All-Payer Model, Medicare payment rates were substantially higher under Maryland's all-payer rate-setting system than they would have been under the IPPS, ranging from 32 to 39 percent higher for the same mix of admissions. Because of these higher rates, Medicare payments for inpatient admissions in Maryland averaged $831 to $871 million higher per year than they would have been under the IPPS.

For further information on the comparison of all-payer rate-setting with IPPS, see Section 8.

- For the commercially insured population the weighted average payment differential ranged from 11 to 15 percent lower in Maryland than in the comparison group for the same case mix. Applying these estimated payment differentials from a limited set of commercial insurers in Maryland to all commercially insured admissions in the state, commercial insurer payments for inpatient admissions averaged $433 million less per year in Maryland under all-payer rate setting than in other states.

SECTION 1
INTRODUCTION

1.1 Background on the All-Payer Model

Maryland has operated an all-payer hospital rate-setting system since the mid-1970s, and it is the only state in the nation that is exempt from Medicare's Inpatient Prospective Payment System (IPPS) and Outpatient Prospective Payment System (OPPS). Until the All-Payer Model[1] took effect in 2014, Maryland maintained this exemption from IPPS/OPPS by meeting the requirement that cumulative growth in Medicare inpatient payments per admission since January 1981 remain below cumulative growth nationally. However, in recent years, the cost per admission began growing at a faster rate in Maryland than in the rest of the nation, leading to concerns that, absent a change in this cost trajectory, Maryland's longstanding waiver could be in jeopardy. Furthermore, the focus on cost per admission was poorly aligned with other health care delivery system reforms under way in Maryland and nationally that focus on comprehensive, coordinated care across delivery settings.

In response to these concerns, Maryland proposed a new hospital payment model that would shift the emphasis from controlling payments per inpatient admission to controlling total payments for hospital services. On January 1, 2014, Maryland implemented its All-Payer Model for hospitals, which transitioned the state's hospital payment structure to an all-payer, annual, global hospital budget that encompasses inpatient and outpatient hospital services. Maryland has adopted the All-Payer Model as the first step toward a population-based payment model that would hold hospitals responsible for use of all health care services by the populations they serve.

Under its new agreement with the Centers for Medicare & Medicaid Services (CMS), Maryland must do the following:

- Limit all-payer per capita inpatient and outpatient hospital cost growth to the previous 10-year growth in gross state product (GSP), set at 3.58 percent annually for the first 3 years of the model, with an opportunity to adjust the rate for Years 4 and 5 on the basis of more recent data.

- Generate $330 million in savings to Medicare over 5 years based on the difference in the Medicare per-beneficiary total hospital cost growth rate between Maryland and that of the nation overall.

- Reduce its 30-day readmission rate to the unadjusted national Medicare average over 5 years.

[1] In this evaluation we use All-Payer Model to refer to the new hospital payment system implemented in January 2014. We refer to Maryland's prior system as all-payer rate setting.

- Reduce the rate of potentially preventable complications by nearly 30 percent over 5 years.

- Limit the annual growth rate in per-beneficiary total cost of care for Maryland Medicare beneficiaries to no greater than 1.0 percentage point above the annual national Medicare growth rate in that year.

- Limit the annual growth rate in per-beneficiary total cost of care for Maryland Medicare beneficiaries to no greater than the national growth rate in at least 1 of any 2 consecutive years.

- Submit an annual report demonstrating its performance along various population health measures.

By July 2014, all 46 general acute-care hospitals in the state[2] were operating under a global budget, with global budgets encompassing 95 percent of hospital revenue. The state committed to moving from a model that has spending targets focused only on hospital services to a population-based model with a total per capita cost of care spending test by Year 6 of the model.

Most hospitals in the state operate under the Global Budget Revenue (GBR) model; 10 rural hospitals continue to operate under the Total Patient Revenue (TPR) model.[3] The GBR and TPR models are largely indistinguishable, other than the definition of a hospital's market area, which is the basis for establishing the expected patient volume on which the annual budget is based. Hospitals under GBR typically operate in competitive markets and have service areas that overlap with those of other hospitals. Therefore, the GBR model includes a methodology for defining hospital market area and market share, as well as a policy for adjusting hospital budgets for shifts in market share. This is less relevant for the TPR model, as hospitals in rural areas have more clearly defined and separated hospital catchment areas.

Under the Maryland All-Payer Model, the Health Services Cost Review Commission (HSCRC) establishes an annual global budget, or allowed revenues, for each hospital. The annual budget is built from allowed revenues during a base period (2013) (Maryland Department of Health and Mental Hygiene, 2013), which are adjusted for future years using a number of factors, both hospital specific and industry wide. Each year the hospital's global budget is updated to reflect an allowed rate of hospital cost inflation; approved changes in the hospital's volume based on changes in population demographics and market share; and additional

[2] An additional general acute-care hospital, Holy Cross Germantown, opened in October 2014.

[3] Although TPR has been an option since the early years of Maryland's original waiver, for many years it was adopted by only one hospital. A second hospital transitioned to TPR in fiscal year (FY) 2008, and eight more transitioned in FY 2011. The following hospitals operate under TPR: Meritus Medical Center, University of Maryland at Dorchester, Garrett County Memorial Hospital, Western Maryland Regional Medical Center, University of Maryland Shore Medical Center at Chestertown, Union Hospital of Cecil County, Carroll Hospital Center, University of Maryland Shore Medical Center at Easton, Calvert Memorial Hospital, and McCready Memorial Hospital.

adjustments related to reductions in potentially avoidable utilization (PAU), quality performance, and uncompensated care (UCC). The factors used to set hospital budgets were described in detail in the First Annual Report on the evaluation of the All-Payer Model.

The HSCRC then sets rates for services that Maryland hospitals use to bill all payers so that total payments (based on expected utilization) will just match the global budget. Public payers (Medicare and Medicaid) are allowed a 6 percent discount on charges, which was also in force before the implementation of the All-Payer Model. As under Maryland's previous hospital payment system, each hospital bills payers for services provided using the hospital's service-specific rates. Unlike the previous system, the global budget establishes a ceiling on hospital revenues. With the exception of certain hospitals,[4] the global budget cap applies to services provided to both Maryland residents and nonresidents. In addition to services provided to nonresidents at hospitals with an exemption for nonresident services, hospitals are permitted nonregulated revenues for other specified services (for example, home health, outpatient renal dialysis, and skilled nursing facility services).

Hospitals have an incentive to ensure that revenues do not fall short of or exceed their budgets. To the extent that actual utilization deviates from projected utilization and hospital revenues vary from the global budget, a one-time adjustment to the approved budget for the following year is made to compensate hospitals for charges less than the approved budget (underages) and to recoup charges in excess of approved revenues (overages). However, hospital revenues are expected to conform closely to the global budgets, and penalties are applied to the portion of overages and underages that exceeds 0.5 percent of the hospital budget to discourage patterns of overcharging or undercharging.

The HSCRC recognized that actual utilization is unlikely to perfectly match the projected utilization on which the global budget is based. To compensate for some amount of deviation from the underlying utilization assumptions, hospitals are permitted to adjust their rates during the course of the year to reach their global budgets. However, there are limits on the size of adjustments that are permitted, and rate adjustments must be applied uniformly to all services. Hospitals are permitted to vary their charges from the approved rates by plus or minus 5 percent without permission. Up to 10 percent variation is allowed but requires permission from the HSCRC. The HSCRC will consider variation beyond 10 percent under special circumstances—for example, to avoid penalizing hospitals for reductions in PAU and to provide continued support for investments required to achieve these reductions. The HSCRC monitors hospitals' charges and service volume using monthly reports to ensure compliance with the global budget of each hospital. Although there is no specified penalty for charge adjustments greater than the allowed percentage, if the charges in a rate center vary from the approved rate by more than the allowed percentage over the entire rate year, a noncompliance penalty is applied to the hospital's budget in the subsequent year.

[4] In FY 2014, the exception applied to four hospitals: University of Maryland Medical Center, Johns Hopkins Hospital, Johns Hopkins Bayview, and Johns Hopkins Suburban. The University of Maryland Medical Center Shock Trauma Center had a separate revenue cap, which also excluded services to Maryland nonresidents. Beginning in FY 2015, the University of Maryland facilities dropped their nonresident exemption.

1.2 Conceptual Framework for the All-Payer Model Evaluation

Figure 1 portrays the conceptual framework for the evaluation of Maryland's All-Payer Model. The first box shows key features of Maryland's model, including hospital global budgets, all-payer rate setting, and the quality-based reimbursement (QBR) and Maryland Hospital Acquired Conditions (MHAC) programs. Maryland's strategy for achieving the goals of its agreement with CMS incorporates a number of complementary health system reform efforts, including development of the state's health information exchange (the Chesapeake Regional Information System for our Patients [CRISP]); the State Health Improvement Process, which has led to the development of local population health initiatives; activities under the state's State Innovation Models Model Design award and a number of Health Care Innovation Awards; and workforce development initiatives through development of innovative medical education strategies. Delivery models such as patient-centered medical homes and accountable care organizations (ACOs) are also expected to support the goals of the All-Payer Model. The remaining boxes describe outcomes of the All-Payer model, organized around the main domains of the evaluation. The middle box displays key implementation issues for the All-Payer Model, such as hospital budget updates, changes in rates charged by hospitals to meet their budget targets, hospital infrastructure investments to meet goals of the All-Payer Model, and hospital participation in community initiatives. The right-hand box shows expected impacts of the model on hospital financial performance; hospital market dynamics and hospital service mix; quality of care, including population health; health care utilization, including spillover effects on non-hospital providers; and health care costs.

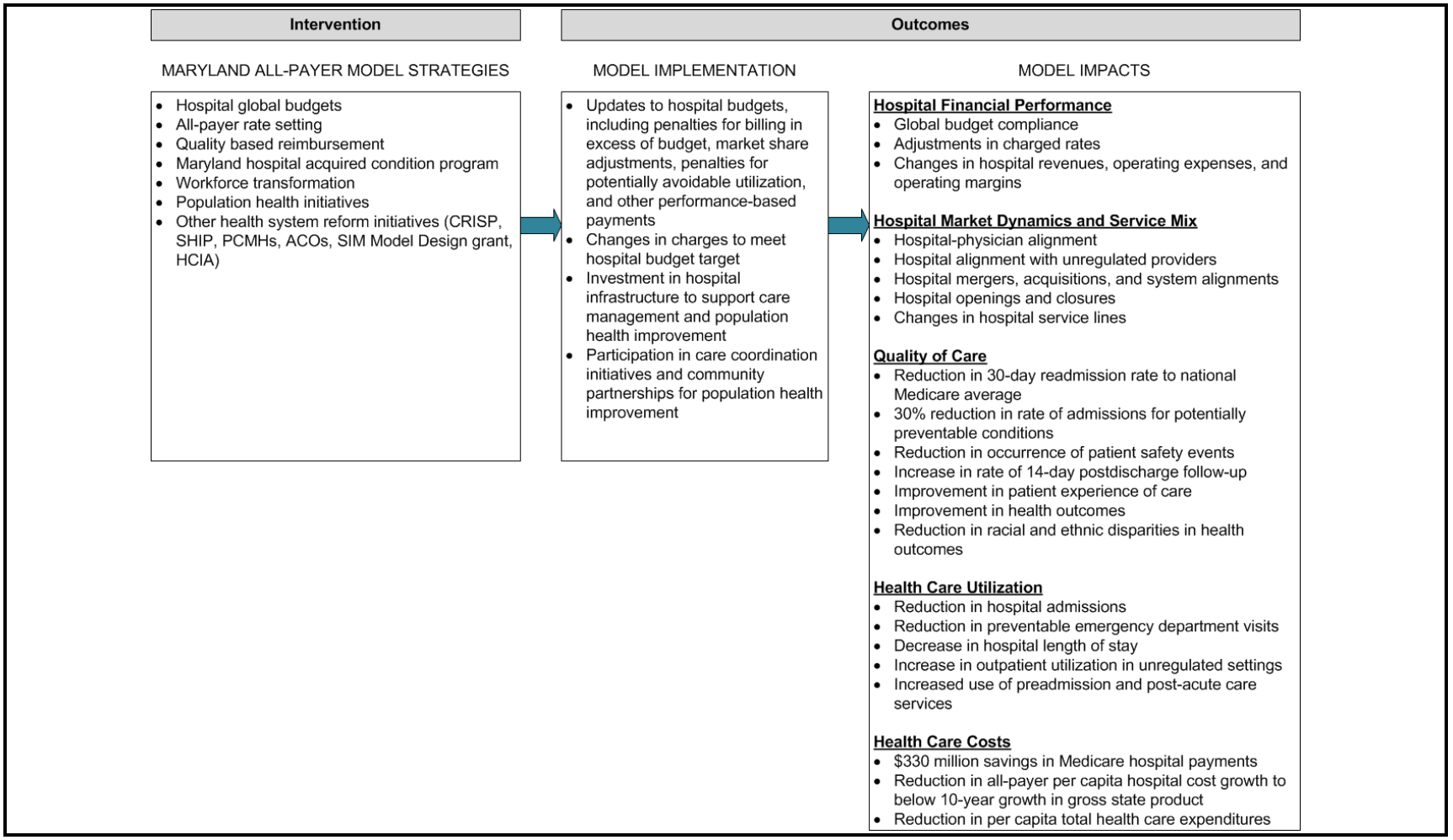
The adoption of Maryland's All-Payer Model changed hospital incentives from the state's previous hospital payment system in several key ways:

- The old system set limits on costs per admission, but it only weakly limited the volume of admissions. Global hospital budgets provide incentives to limit both volume and costs per admission.

- The old system applied only to inpatient services and did not limit outpatient hospital expenditures. The new global budgets encompass both inpatient and outpatient revenues, which creates incentives to limit overall hospital expenditures and provides flexibility for shifting services between hospital inpatient and outpatient settings.

- Tests under the old waiver were based only on experience in the Medicare population. The All-Payer Model includes a test that applies to the overall Maryland population, as well as tests specific to the Medicare population. Through the global hospital budget, the new model provides incentives to limit hospital expenditure growth for the overall population.

Figure 1
Conceptual framework for Maryland All-Payer Model evaluation



ACO = accountable care organization; CRISP = Chesapeake Regional Information System for our Patients; HCIA = Health Care Innovation Awards; PCMH = patient-centered medical home; SHIP = State Health Improvement Process; SIM = State Innovation Models.

While global budgets are new to hospitals under the All-Payer Model (except for hospitals already operating under TPR), some of the pay-for-performance aspects of the All-Payer Model (QBR, MHACs) were components of Maryland's hospital payment system under the previous hospital payment system. However, the adjustments to hospital budget updates for reductions in PAU under the All-Payer Model may create stronger incentives to reduce potentially preventable complications (PPCs) among admitted patients as defined by MHAC policy. The Readmission Reduction Incentive Program (RRIP) provides financial incentives to Maryland's hospitals to meet the readmission reduction goal in Maryland's agreement with CMS. The unit of payment under the All-Payer Model is also unchanged from the previous payment system; however, the introduction of global budgets creates incentives to limit service volume that did not exist under the previous hospital payment system. Rate adjustments for UCC are also unchanged from the previous system, although there have been some modifications to reflect the impact on UCC of insurance coverage expansions as a result of the Patient Protection and Affordable Care Act (ACA). However, uncompensated care is not expected to change in response to the All-Payer Model.

The All-Payer Model differs from IPPS/OPPS in several fundamental ways, including participation by Medicaid and commercial payers, in addition to Medicare; limits on hospital revenues through the global budget; and the unit of payment for hospital services. On the other hand, although the pay-for-performance initiatives and adjustments for UCC vary somewhat between the All-Payer Model and IPPS/OPPS, these are more subtle differences and may have less marked impacts on outcome differences between Maryland and other states.[5]

1.3 Overview of Evaluation Design

The evaluation of the Maryland All-Payer Model addresses a broad set of design, implementation, and outcome issues, organized in 10 domains:

- **Design and implementation of the new model:** What are the key features of the All-Payer Model? How are global budgets and other features of the All-Payer Model operationalized? How are they modified over time? How do hospitals and hospital systems respond to the new model?

- **Hospital financial performance:** Do trends in hospital revenue, operating expenses, and operating margins change after implementation of the All-Payer Model? Do these trends differ by type of hospital (e.g., bed size, teaching status, whether the hospital operates under GBR or TPR, whether the hospital is part of a system)? To what extent do hospitals adjust their rates during the year to remain within their budgets? To what extent do hospitals experience penalties as a result of revenue variation from their approved budget?

- **Service utilization and expenditures:** Do trends in inpatient utilization and expenditures, emergency department (ED) utilization and expenditures, hospital

[5] A detailed comparison of the All-Payer Model with Maryland's previous waiver and Medicare's prospective payment systems is included in the First Annual Report on the evaluation of the All-Payer Model.

outpatient department expenditures, professional service expenditures, and total expenditures per capita change after implementation of the All-Payer Model? Do changes in trends differ by payer (Medicare, Medicaid, and commercial insurance)? How do changes in per capita utilization and expenditure trends in Maryland compare with trends for populations in comparable hospital market areas in other states?

- **Service mix:** How does hospital patient mix change after the implementation of the All-Payer Model? How does utilization of specific hospital services and revenue centers change? Do the changes differ by payer? How does the change in Maryland compare with changes for hospitals and populations in comparison hospital market areas? What are the impacts of the model on adoption of new technology?

- **Quality of care:** How do care coordination, avoidable or reducible utilization, and health outcomes change after the implementation of the All-Payer Model? How does the change in Maryland compare with changes for populations in comparison hospital market areas?

- **Spillover effects:** Does the All-Payer Model result in the avoidance of complex or costly inpatient cases, unbundling of inpatient care, shifts in ED and outpatient clinic services to nonregulated settings, or increases in border crossing by both Maryland residents and nonresidents in obtaining inpatient care? Do these consequences differ by payer? How do changes in Maryland compare with changes for hospitals and populations in comparison hospital market areas?

- **Comparison with IPPS:** How do inpatient payment rates for Medicare, Medicaid, and commercial insurers in Maryland compare with payment rates in other states? Are Medicare and Medicaid payment rates higher in Maryland than in other states as a result of all-payer rate setting? Are payment rates for commercial insurers lower in Maryland than in other states as a result of higher Medicare and Medicaid payment rates and explicit adjustments for UCC in Maryland?

- **Comparison of the All-Payer Model with other state innovations:** How do outcomes of the Maryland All-Payer Model compare with those under other health care transformation innovation initiatives?

This Annual Report uses only Medicare data for the claims-based analyses. Data for the Medicaid and commercial populations will be incorporated in future reports.

The evaluation of the Maryland All-Payer Model is based on a mixed-methods design, using both qualitative and quantitative methods and data to assess both the implementation and the outcomes of the model. Qualitative and quantitative analyses are complementary components of the evaluation, in many cases addressing the same issues from alternative perspectives. Qualitative analyses are used to provide insight into barriers and facilitators to implementing the new hospital payment model; hospital and other provider responses to the new model, including efforts to improve care coordination and quality of care delivered; unintended consequences of the model and impacts on market power; and impacts on the health care workforce.

1.3.1 Qualitative Analysis

The RTI evaluation team conducted two types of qualitative data collection—telephone interviews with key informants and in-person hospital site visits comprising individual interviews and focus groups. Interviews were conducted with senior hospital leaders, including chief executive, financial, medical, and nursing officers, as well as upper-level managers responsible for case management, population health, or quality of care. Focus groups were conducted with physicians and with nurses and care management personnel. Key informants selected for telephone interviews included payers; state officials; and representatives of physician, hospital, and post-acute care (PAC) organizations. Ten hospitals were selected for in-person site visits. Additional detail on the qualitative methods is in ***Appendix A***.

1.3.2 Quantitative Analysis

Quantitative analyses used a difference-in-differences (D-in-D) design, comparing changes in trends from a 3-year baseline period to the first 2 years after implementation of the Maryland All-Payer Model for selected outcomes for fee-for-service (FFS) Medicare beneficiaries in Maryland, with matched comparison hospitals and market areas. The comparison group for the evaluation was drawn from outside Maryland because the model is implemented statewide; however, identifying an appropriate comparison group is challenging because Maryland has had different hospital regulatory and payment policies than the rest of the country for decades. It is unlikely that a single state provides the ideal comparison; therefore, we selected the comparison population from multiple states and hospital market areas to avoid biasing results in a particular way because of limitations in the selected comparison area. We used a two-stage comparison group selection method that began with selecting hospitals closely resembling each Maryland hospital based on hospital and county characteristics using genetic matching. Following comparison group selection, we constructed annual person-level propensity score weights to balance Maryland and comparison group residents on individual and market area characteristics. In addition, we created hospital service area (HSA)[6] weights that were combined with the propensity score weights in outcome regression models to account for comparison hospitals that were matched with multiple Maryland hospitals. The detailed methods for constructing the comparison group and propensity score analysis are included in ***Appendix B***.

We used Part A and Part B Medicare claims data to derive outcomes for FFS Medicare beneficiaries from 2011–2015. Each data source used for the analysis is described in detail in ***Appendix C***. All outcome measure specifications are included in ***Appendix D***. For each quarterly observation period, we restricted the sample to FFS beneficiaries who were alive at the beginning of the observation period and enrolled in both Part A and Part B for at least 1 month of the period. We estimated quarterly fixed effects models and we combined quarterly estimates to produce yearly and overall estimates.

[6] HSAs are local markets for receipt of hospital care defined in the *Dartmouth Atlas of Health Care*. Each HSA is a collection of contiguous ZIP codes in which the plurality of residents receive most of their hospital care from hospitals in that area (*Dartmouth Atlas of Health Care 1999*, n.d.).

All the population-based regression models were estimated with the beneficiary quarter as the unit of analysis. All admission- or visit-level outcomes used the admission or visit as the unit of analysis, with observations assigned to a quarter based on date of service. For the utilization outcomes, we converted quarterly utilization counts into binary outcomes (1 = any use) and used weighted logistic regression models in this report. For continuous outcomes, we used weighted generalized linear models with a normal distribution and identity link.

To account for baseline differences between Maryland and the comparison group, the D-in-D models included an interaction term between the Maryland indicator and a linear time trend.[7] The models also controlled for person-level variables (age, gender, race, dual Medicare-Medicaid eligibility status, original reason for Medicare entitlement based on disability, presence of end-stage renal disease, Hierarchical Condition Category [HCC] risk score, number of chronic conditions) and county-level variables (urban/rural; percentage of population uninsured, with high school and college educations, and living in poverty; and supply of hospital beds and primary care providers). In addition, admission-level and hospital-level models control for the individual hospital characteristics.

All regression models were estimated using weights. Person-level models were weighted by the propensity score times the fraction of time the person was enrolled in insurance times the HSA weight; admission-level and ED visit-level models were weighted by the propensity score times the HSA weight. In addition, all person-level models and admission-level models in ***Section 5*** took into account nested clustering at the beneficiary and ZIP code levels to account for multiple observations per person and per ZIP code. Hospital-level models and admission-level models in ***Sections 4, 6,*** and ***7*** took into account clustering at the hospital level.

The full description of quantitative methods is detailed in ***Appendix A***.

[7] There were statistically significant differences in baseline trends for several of the selected payment and utilization outcomes; 7 of the 12 measures we assessed had a statistically significant difference in their baseline trend at the $p<0.05$ level, and one additional outcome had a difference at the $p<0.10$ level. Nonetheless, the magnitude of the differences was generally quite small, and the statistical significance may be due in part to the large sample size. In other words, we have the power to detect very small changes in trends between Maryland and the comparison group over the baseline period. Although baseline trends did appear similar, we concluded that we cannot assume that Maryland and the comparison group were on the same trajectory before the implementation of the All-Payer model. Despite the relatively small changes in trends over the baseline period, we opted to take a conservative approach that allows us to generate impact estimates that net out the potential baseline differences between Maryland and the comparison group. To do this, we included an interaction term between the Maryland indicator and a linear time trend in the final model. The linear time trend controls for differences between Maryland and the comparison group over time. As such, the D-in-D interaction term measures the deviation of the difference between Maryland and the comparison group in the post period from the trend line. This model specification allows for differences in estimates in Maryland and the comparison group during the baseline period, and it allows for a straightforward interpretation of the D-in-D coefficient.

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SECTION 2
HOW ARE HOSPITALS IMPLEMENTING THE MARYLAND ALL-PAYER MODEL?

Key Takeaways for Hospital Implementation of the All-Payer Model

- There is a tension between the need for midcourse refinements in All-Payer Model policies and the need for policy stability. The global budgeting methodology is complex and continues to be refined through adjustments aimed at improving the accuracy and perceived fairness of the overall model. At the same time, hospital leaders expressed frustration regarding the frequency and timing of policy revisions by the HSCRC. There appears to be considerable tension between the need to refine the model as lessons are learned and the need to create some stability in policies around which hospitals can operate and plan.
- Hospitals varied considerably in the extent to which they had adapted to the new model. Some "fully engaged" hospitals reported major changes in the way they do business, with substantial investments in targeted staffing, increased emphasis on data analysis, partnerships with physicians and other health care providers, and strategies to better manage high-cost patients. "Minimally engaged" hospitals appeared to have made few changes in the way they operate.
- Although each hospital has designed its own strategy to operate under fixed revenues given their circumstances, there were common approaches. The most common strategy was to increase hospital resources for care continuity and management, discharge planning, and treatment adherence. Even hospitals characterized as minimally engaged had made at least some investments in these areas, though not at the same level observed in fully engaged hospitals.
- We found inconsistency in whether hospitals used data analysis as a critical tool. Use of data was a key marker of fully engaged hospitals. These hospitals all invested in dedicated data analysis staff and actively analyzed both internal and external data sources to monitor performance on quality metrics, expenditures, and utilization.

This section of the report describes the implementation of key features of Maryland's All-Payer Model during the first 30 months of operation. We discuss perspectives on the All-Payer Model's policies and their implementation, gathered through the second round of key informant interviews conducted in April 2016, and stakeholder discussions and focus groups conducted during site visits conducted from May through August 2016.

Information presented from stakeholder interviews and focus group discussions simply provides context from varied viewpoints. In some cases, participants in the stakeholder and focus group discussions may have reported to us perspectives that represent departures from—or potential misperceptions of—All-Payer Model policy and how it is being implemented. These perspectives are described without correction as they represent the understanding of hospitals and other key stakeholders. However, we do provide additional information in footnotes in the few instances that a clearly inaccurate perspective is noted.

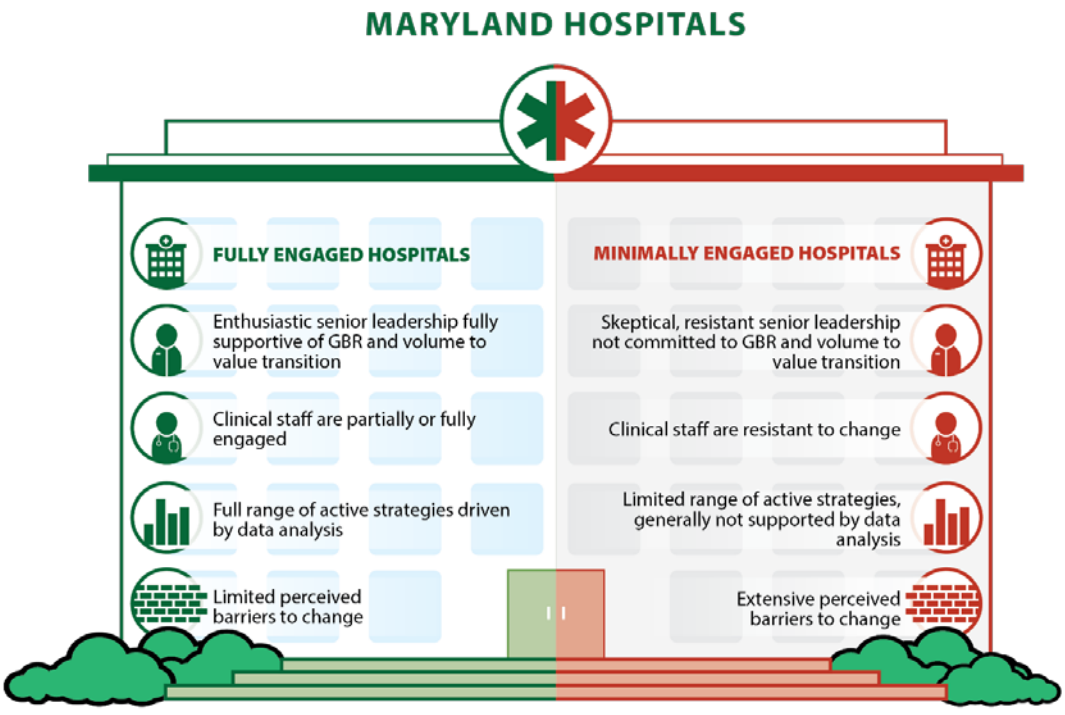
2.1 Overview of Stakeholder Perspectives on All-Payer Model Implementation

This section describes perspectives on implementation of the All-Payer Model, which are drawn from the 10 round 2 site visits conducted in 2016; accompanying focus groups with physicians, nursing staff, and other clinical staff; and a series of key informant interviews with Maryland health care stakeholders (including payers; state officials; and representatives of physicians, hospitals, and PAC organizations).

2.1.1 Hospital Engagement

Generally, hospital and other stakeholders perceived continued forward movement in implementation of the All-Payer Model, with progress toward reducing hospital utilization and slowing the growth of health care expenditures. However, compared with the previous year, optimism regarding the All-Payer Model had waned to some degree as implementation challenges had become more apparent. The pace of forward movement appeared to vary by hospital and hospital system. We noted continued variation in the progress that hospitals have made in adapting to global budgets. Of the hospitals visited in the second round of site visits, about half could be characterized as "fully engaged" in identifying and implementing strategies to operate under a global budget model. The other half exhibited either minimal engagement in implementing strategies to operate under global budgets or outright resistance to global budgets. ***Figure 2*** contrasts the responses to global budgets between fully engaged and minimally engaged hospitals.

Figure 2
Variation in Maryland hospital responses to global budgets



SOURCE: RTI International.

The strategies developed by fully engaged hospitals were multifaceted and touched multiple areas of operations within the hospitals. These hospitals had chief executive officers (CEOs) who were generally enthusiastic about and fully supportive of the global budget model; at a minimum, they fully accepted that some form of fixed resources is an inevitable future direction of health care. Clinical, financial, and operational hospital leaders in these fully engaged organizations were similarly enthusiastic and able to cite specific strategies implemented, under development, and planned. These fully engaged hospitals were also characterized by significant investments in mining and analyzing multiple sources of internal and external data to identify opportunities for improved quality performance, increased efficiency, and monitoring of strategies.

Discussions with hospitals characterized as minimally engaged focused on the considerable barriers they faced to change and to implementing global budget strategies. These hospitals seemed to be trying to maintain a "business as usual" approach as much as possible. Leaders in these hospitals described extensive barriers, including lack of seed money to support initiatives, lack of alignment with physicians, lack of data, and lack of vision from the CEO and other key senior hospital leaders. These hospitals appeared to be implementing only the minimum strategies necessary to operate under global budgets (generally, some level of increase in staffing for care management or case management, discharge planning, or both) under the expectation that the new model will fail and be repealed.

Multiple stakeholders outside hospitals also reported variation, as some, but not all, hospitals were adopting strategies to moderate utilization and reduce readmission rates. Investments in care coordination—such as hiring care and case managers, social workers, and discharge planners—continued and were the most common "default" strategy. Nonhospital stakeholders observed that more engaged hospitals are investing in patient after-care clinics and developing data analytic capabilities to identify high-risk patients.

We conducted a correlation analysis to determine whether there was a relationship between the level of hospital engagement and success in meeting the hospital's global budget in 2016 for the 20 hospitals included in the first 2 rounds of site visits.[8] We found a weak ($r = 0.29$) correlation, indicating that level of engagement is not, by itself, a sufficient indicator of a hospital's ability to successfully control costs relative to its revenue target. However, our analysis is limited by the small number of hospitals we were able to categorize, which represented less than half of Maryland hospitals, and by the limitations of the qualitative methods through which we collected engagement information. We also acknowledge that ability to meet global budget targets may be driven by many factors (including prior experience with global budgets through participation in the TPR program, geographic location, population mix, and market competition). It is also possible that active engagement in specific strategies to improve care coordination and outcomes takes more time to impact total hospital expenditures than we are able to detect at this point in the evaluation. We will consider revisiting this analysis

[8] Hospitals were classified as engaged, semi-engaged, or not engaged. Success in meeting the hospital's global budget was defined as the percentage difference between actual and budgeted revenues for FY 2016.

in future years of the evaluation to look for relationships between active engagement by hospitals and relative success in meeting financial or quality metrics.

Despite the variation in hospital responses to global budgets, our interviews with stakeholders, hospital leaders, and clinical staff members featured common themes and topics that were considered important, although their perspectives and viewpoints may have differed. The word-cloud in ***Figure 3*** displays the top 50 topics that were discussed during the second year of stakeholder and hospital key informant interviews, ranked by the frequency with which they appeared in our conversations. The five most prominent topics during our discussions were patients, hospitals, care, doctors, and nursing; other common, but less frequently occurring, topics or phrases were data (6th), readmissions (17th), community (19th), medications (24th), and volume (28th).

Figure 3
Top 50 topics discussed in round 2 qualitative data collection

NOTES: Word size denotes frequency, with larger fonts indicating words that were used more often; the color of each word varies to make words visually distinct from each other in the graphic but does not signify any relation to frequency of use.

SOURCE: RTI analysis of site visit, focus group, and key informant interview data.

The sections that follow provide further detail on the perspectives of hospital leaders, provider focus group participants, and nonhospital stakeholders on hospitals' implementation of the All-Payer Model to date, as well as on several implementation issues raised by stakeholders. These implementation issues—which were consistent themes in the site visits, provider focus

groups, and nonhospital stakeholder interviews—range from concerns over existing policies, politics, and legal restrictions that apply to hospitals statewide to complicating factors unique to certain providers and markets.

2.1.2 Hospital Activities and Strategies

Site visit interviews, stakeholder interviews, and focus group discussions provided conflicting feedback on the degree to which hospital systems are (1) beginning to implement specific strategies to operate under global budgets and (2) using data to identify opportunities and monitor outcomes as well as to coordinate care with the state's physicians and nonacute care providers. Some stakeholders reported that a subgroup of hospitals have made modest investments in their internal systems but their attempts to coordinate care or develop partnerships with other community providers have been limited. Because of these nominal investments in community partnerships, several Maryland stakeholders conveyed a sense that some hospitals are continuing "business as usual" and are unable to move away from their previous business model, which focused on volumes rather than on value. At the same time, stakeholders also recognized that some hospitals have been more proactive than others, for example, by establishing integrated clinical networks, tailoring patient care to focus on chronic conditions, or placing care managers in their EDs. A provider at one of these hospitals commented, "I think [hospital leaders] have a forward looking vision and that they spend a lot of time having meetings to try to figure out which direction [the hospital is] going in and making sure that we actually have a direction."

Variation in the pace of hospitals' adoption of strategies for change may signal further opportunities for transforming clinical behavior, particularly among the GBR hospitals, which faced a shorter implementation timeline than the TPR hospitals. TPR hospitals, which had more time to develop and refine strategies that work under a fixed revenue model, appear more sophisticated and advanced than the later-implementing GBR hospitals. Stakeholders report, however, that GBR hospitals vary, with some making more progress than others on identifying and implementing strategies to operate under global budgeting. One provider noted, "[Some hospitals are] just throwing stuff at the wall, seeing what sticks." Highlighting the variation in responses, another provider conversely shared stories of physicians using a national database to "identify best practices and also opportunities for improvement."

Common approaches in hospitals that had active strategies to operate under global budgets are described below. We list the most common strategies first, followed by approaches used by some of the fully engaged hospitals. This summary represents the strategies described by multiple hospitals during hospital site visit discussions with 10 hospitals. As such, it is not intended to be an exhaustive list; rather, these reflect the perspectives of 10 hospitals.

Improving care continuity and management, discharge planning, and treatment adherence—The most common strategy for adapting to the new model was to increase, at least minimally, hospital resources for care continuity and management, discharge planning, and treatment adherence. These activities appear to be the "default" strategies employed by hospitals. Even hospitals that we characterize as minimally engaged had made at least some investments in these areas, though not at the same level we observed in fully engaged hospitals. Hospital leaders and providers were often unclear whether these investments in increased staff were successful in

changing patient behavior—particularly around using the ED for primary care—though the consensus was that more time was needed to allow changes by patients and clinicians to occur.

According to one provider, "The biggest part of [model implementation is] getting the hospitals to change the way the physicians practice and change the way the hospital practices, but it doesn't change the way the patient lives."

Some hospitals were working to develop ways to better manage high-cost patients and those with behavioral health issues. Many of these initiatives are funded through grants from the HSCRC[9] or other funding sources outside of hospital's global budget (such as community-based social bridge programs or coordination with Meals on Wheels). One hospital described funding a "Wellness Van" using community donations to help address social service needs and reduce unnecessary ED use. Other hospitals were developing initiatives to focus on chronic diseases such as diabetes, congestive heart failure, and chronic obstructive pulmonary disease.

The sidebar describes the most commonly cited investments hospitals have made to improve care continuity and management, discharge planning, and treatment adherence.

Implementing active management strategies—Fully engaged hospitals tended to have at least one established management strategy to involve their staff in the move toward increased value. These

INVESTING IN IMPROVEMENTS

Care management

- Hiring additional staff for care coordination (triaging and appropriate placement)
- Hiring additional staff for care management (follow-ups, medication adherence, patient education)
- Hiring additional staff for transitions of care (discharge planning, PAC services)
- Increasing focus on establishing follow-up care plans
- Enhancing the emphasis and focus on pain management

Discharge planning

- Hiring additional staff in hospital units to begin planning for discharge upon admission
- Hiring additional staff to work with families to identify discharge options
- Hiring additional staff to prompt physician and other clinical staff to keep inpatient treatment moving toward planned discharge time and date

Patient education and support

- Disseminating customized or available preoperation educational materials to patients and families
- Establishing patient and family advisory committees

Pharmacy

- Hiring additional pharmacy technicians to explain prescriptions
- Offering bedside delivery of prescriptions
- Routinely providing 30-day supplies of medicine (at no additional cost when necessary) to patients upon discharge to improve medication compliance and reduce pharmacy-related readmissions
- Conducting patient follow-up calls delivered by pharmacy technicians
- Hiring and deploying community health workers and increasing use of home visitation services (for both follow-up care and triaging or primary care)
- Establishing and supporting patient-caregiver initiatives that provide post-discharge information and resources to patients and families to reduce ED visits and readmissions

[9] In FY 2016, the HSCRC awarded selected hospitals grants to implement care coordination initiatives. Grants were awarded to 9 initiatives that included 25 hospitals. Initiatives received between $1.1 million and $7.7 million, with the amount of funding generally increasing with the number of partnering hospitals.

strategies were also consistent with leadership visions of increased accountability, continuous quality improvement, and higher engagement of all staff in a shared vision for the organization. Many of these strategies are consistent with concepts that informed and influenced the ACA and the national movement toward pay for performance (Berwick and Hackbarth, 2012; Merguerian et al., 2015). Specific management strategies included Six-Sigma, LEAN, Toyota's Kata, and 5South, which focus on reducing waste and streamlining processes of care. We also observed adoption of huddles, group meetings, and Gemba Rounds[10] to improve communication and generate innovations across all levels of staff and particularly to improve Hospital Consumer Assessment of Healthcare Providers and Services (HCAHPS) performance.

Active management strategies seemed to be welcomed by clinical hospital staff. One nurse commented, "I think [the implementation of Gemba rounds] also has helped the bedside nurses. They don't have to wait as long for orders or changes to happen because they have that physician at that time of the Gemba round…. It stops four or five more phone calls that they would have to wait and play that phone tag back and forth with things."

Enhancing hospital focus on behavioral health—All hospitals in the round 2 site visits identified, to some degree, the challenge that patient behavioral health issues presented in their attempts to control unnecessary utilization, particularly in EDs, and to improve efficiency. The consensus from hospital leaders was that they had insufficient tools and community resources to manage the growing demand for behavioral health services. More highly engaged hospitals were attempting to expand their internal or community capacity, or both, in behavioral health by building new clinics or units and expanding use of telemedicine. Some engaged hospitals were also working to incorporate behavioral health into their ED triage and care coordination activities. A few hospitals had received or applied for additional funding from the HSCRC to focus on this issue or were expanding partnerships in this area using other resources.

Changing hospital administrative and organizational structures—Some hospitals described making investments in administrative systems to enhance clinical and financial monitoring. Most hospitals that did not have detailed cost accounting systems reported that they could not operate under the new model without these systems and were working to put them in place. Although all hospitals had already implemented an electronic medical record (EMR) system, many were replacing, modifying, or upgrading them, sometimes at significant cost. Relative to the first round of hospital site visits, hospital leaders seemed to be placing greater emphasis on making the most of these systems, generally with a future intent to use these data for organizational self-assessment. Examples of specific EMR-based projects included hot-spotting and identifying frequent ED and hospital users; probing for physician outliers in care quality, service frequency, or cost; and assessing returns on investments in various strategies. Another hospital administrative strategy was improving intake assessments and documentation, generally with the aim of improving coding to increase identification of conditions that are present on admission and to reduce incorrectly labeled hospital-acquired conditions. Improved coding and documentation also provide clinical teams with better information to manage patient care.

[10] http://theleanthinker.com/2009/01/28/walking-the-gemba/

Shifting service sites—A number of hospital leaders described shifting routine or lower intensity services to alternative, nonhospital sites of care. In most cases, these shifts were driven by systematic identification of services that were inefficiently and unnecessarily provided in the hospital setting. This appears to be part of the process of "right sizing" hospital care. As an example, some hospitals were establishing separate or enhanced general outpatient, discharge, and primary care clinics to decrease costs and provide more effective care. When possible, these alternative sites were located in nonregulated space.[11] Related to this strategy, large hospital systems were also coordinating service lines across organizational facilities. For example, cardiac services would be consolidated in one system hospital, and orthopedic care would be consolidated in another. Some hospital leaders reported movement toward hospital system consolidation. The remaining independent, non-affiliated hospitals told us that global budgets and the new model offered resources and flexibility that helped them remain independent, but increased consolidation of competing hospitals presented a challenge.

Establishing and enhancing a variety of partnerships—Many hospitals expressed a commitment to establishing or enhancing clinical partnership arrangements. Many, but not all, hospitals were also reconsidering their relationships with outpatient and PAC service providers (e.g., primary care providers, skilled nursing facilities [SNFs], nursing homes, long-term care hospitals, rehabilitation organizations) either by establishing new contractual arrangements (such as through ACOs) or by establishing clear preferred provider networks and leveraging their power to refer patients to certain providers. One provider noted, "[Hospital leadership has] figured it out and they're reaching out and meeting with each nursing home and saying, 'If you want to be our preferred provider, you're going to have to change.'" Staff in a few of the hospitals discussed increased coordination within their own ACOs. One hospital was paying for physician coverage at SNFs as a strategy to improve patient care and reduce readmissions.

Whereas site visit discussions identified these examples of partnerships between hospitals and between hospitals and PAC facilities, we heard few examples of hospitals developing partnerships with physician-based organizations. When collaboration was noted, the most common strategy was purchasing physician practices, rather than developing partnerships. This result is consistent with feedback from stakeholders that suggested that hospitals have not developed the kinds of partnerships with physician organizations that were expected in response to the new model and the eventual move to a total cost of care model. Also, many physician focus group participants were less aware of and engaged in the behavior changes consistent with the new model.

Hospitals commonly modified relationships with suppliers by negotiating prices, evaluating variation in products, and assessing resource utilization by staff. A few hospitals mentioned partnering with other hospitals, either within their hospital system or outside of it, to enhance their purchasing power.

[11] The HSCRC has regulatory authority over care that is provided in "regulated" space, defined as care provided on the geographic campus of the inpatient hospital facility. Nonregulated space refers to facilities not located on the campus of the inpatient hospital facility. Services provided in the off-campus facilities are not subject to the regulations of the HSCRC.

Another related strategy was for a small group of hospitals to combine self-insured employee risk pools to create administrative efficiencies and spread risk. These hospitals saw improved financial management of their own self-insured health plans as a way to save money and free up resources to invest in cost containment and other hospital initiatives. Also under this broad category of strategies, a few hospitals were using their self-insured employee groups as a way to experiment with patient education and behavior change incentives.

Some stakeholders raised concerns about hospitals' ability to partner with smaller community providers that are not affiliated with a larger organization or system and have limited resources and minimal experience managing risks. This is particularly a concern in the state's PAC sector. Maryland's PAC providers exist in a very stratified and uncoordinated market. Nearly half of the state's nursing facilities are independent, and the state lacks any mechanism to track or influence home health care providers.

Although stakeholders agreed that most Maryland hospitals have been slow to implement community partnerships, there appears to be a difference in the pace of progress between urban and rural hospitals. Stakeholders considered urban hospitals to be less advanced in integrating community partners because they operate in overlapping service areas where it is more difficult to determine which populations they are responsible for or how they would benefit from a potential community partnership. For example, because patients have multiple options for care in urban areas such as Baltimore, urban hospitals may be reluctant to invest in providing mobile clinic services because they fear they may benefit a competitor hospital's patients more than their own. In contrast, rural hospitals are considered to have made more progress in integrating community health care providers because they operate in well-defined markets and because many rural hospitals have prior experience in developing these strategies under the TPR model.

Hospitals close to the Maryland border also faced unique challenges. Hospital leadership and clinicians in these markets were keenly aware of strategies used by competing hospitals over the state line to attract patients and build volume in ways not feasible in Maryland. Clinicians, in particular, reported that opportunities to grow volume in new and emerging technologies were being pursued by their out-of-state competitors, reducing their opportunities to attract patients. These clinicians felt that both their incomes and ability to offer patients the most innovative care were harmed by the new model. Hospital leadership in these markets described difficulty recruiting physicians. They reported that physicians viewed practicing in suburban or rural Maryland as unappealing when compared to Pennsylvania, Delaware, and Virginia because of the greater regulation and lower salaries in Maryland. Hospital leaders and clinicians in these markets told us that physicians come to practice in Maryland only if they have existing family or other ties to the state.

Enhancing clinical staff management—Many hospitals were making investments in clinical staff management and education. Some of these initiatives involved greater monitoring of staff performance. Strategies to educate staff about the move from volume to value included identifying physician champions (in some cases with new leadership designations) to communicate the emphasis on quality metrics and quality improvement initiatives, the All-Payer Model, and reducing readmissions. Another strategy was increased precision in nurse staffing levels by adjusting nurse hours on a daily basis in response to changes in occupancy rates to reduce costs when possible. Nursing and nonphysician staff also were empowered in some

hospitals to play a more active role in patient care. An example was increased use of nurse-driven protocols to reduce *C. difficile* infections and septicemia. We heard about an increase in the use of standardized protocols for clinical care; protocols for length of stay, Foley catheter use and removal, and central line use were most common. Some hospitals were also developing new labor force options, including enhanced use of physician assistants and cross-training staff to work in different divisions, such as across separate obstetrics and gynecology departments, to facilitate moving staff on the basis of changing patient censuses and needs.

Some of the enhanced clinical management strategies seemed to be aimed at addressing morale problems among physicians and other clinical staff. The changes occurring in response to global budgets appeared to have had a somewhat negative effect on clinical staff morale. Staff told us that they are required to do more with fewer resources (staff and time) and that they spend more time charting and checking boxes. As one physician highlighted, "So [the model is a] fundamentally flawed system… from a provider standpoint because you're not putting the patient first, you're putting the dollar first." Also, many physicians said their ideas for improved patient care were often quashed because of lack of funding. Fully engaged hospitals were more likely to report strategies to address staff morale, including adding staff resources and increasing staff representation in strategic decision making.

2.1.3 Use of Data

The five fully engaged hospitals visited in the second round of site visits were actively analyzing both internal and external data sources to monitor performance on quality metrics, expenditures, and utilization. These sites all invested in dedicated data analysis staff, ranging from individual hospital teams led by a data analyst in a hospital leadership role to data analytic support shared across a hospital system. Regardless of the investment, sites were able to customize reports as needed, identify trends and performance by individual physicians or specialty groups, and track hospital performance on Maryland-specific metrics in near real time. Engaged hospitals agreed that receiving additional data from CMS about nonhospital service use would help them control total cost of care. These hospitals tended to focus on what they could do to analyze the data they already had, even if the data were sometimes characterized as less than ideal. Physicians and other clinical providers in these five engaged hospitals were more likely to describe data analyses to monitor clinical performance or other evidence-based strategies, although clinical staff were not uniformly aware or accepting of resulting changes in hospital policy driven by these findings. Even in this subgroup of hospitals, some resistance to making changes in clinical protocols on the basis of revenue limitations was evident.

However, some hospital leaders and some nonhospital stakeholders reported that Maryland's providers still lack much of the patient-level data they need to effectively coordinate care and eventually comply with total cost of care metrics. Hospitals that cited this lack of data were the least likely to have made investments to use the data available to them. These stakeholders consistently identified the absence of comprehensive health care data as a major impediment, particularly as the state moves into the total cost of care phase of the All-Payer Model. Maryland's health information exchange (the CRISP) provides some health care data to providers and state regulators, but only for hospitals and participating physician practices, laboratories, and radiology centers; other than the CRISP, stakeholders cited a lack of access to information for all payers and all providers, including Medicare beneficiary data and data from

SNFs, home health providers, and other nonacute care facilities. Without comprehensive data from all payers and all providers, these hospital leaders and stakeholders questioned whether providers and regulators would be able to control the total cost of care. In particular, they noted that hospitals do not have adequate data to target interventions to high-risk populations or to assess costs, quality, and outcomes of their potential partner organizations. Furthermore, market-wide trends, such as shifting care to nonacute care settings, have made it more critical for hospitals to have data from all providers if they are to be held responsible for total cost of care.

KEY GLOBAL BUDGET METHODOLOGY UPDATES FOR FY 2017

- Total Revenue Update: 2.16 percent for first 6 months; 2.72 percent for second 6 months if specified conditions are met
- Market shift adjustments made semi-annually
- New plus 0.20 percent adjustment for the rising cost of new prescription drugs
- Additional infrastructure adjustments awarded to 9 initiatives, which included 25 hospitals, ranging from $1.1 million to $7.7 million
- Maximum QBR performance reward remains at 1 percent, but the maximum penalty rises to 2 percent
- RRIP methodology modified to assess hospital performance based on the better of target attainment or improvement; maximum RRIP reward increased to 1 percent and penalties will be introduced, with the maximum penalty set at 2 percent
- PAU savings reduction capped at the statewide average reduction
- Additional population health adjustment for selected hospitals

Stakeholders reported that the HSCRC had requested expanded and more direct access to Medicare beneficiary data through an amendment to the state's current agreement with CMS for the All-Payer Model. However, at the time our stakeholder interviews were conducted, respondents believed that CMS (and potentially other federal agencies) would require several more months to review this request.[12] Even if the state's request for Medicare data is approved, stakeholders felt that usable information from the data would not be available until significantly later in the model implementation because it can take several months to properly clean and process new data sets.

2.1.4 Perceptions of HSCRC Policy Making

The global budgeting methodology is highly complex and continues to be refined as the All-Payer Model implementation progresses. This complexity has led to some tension between hospitals and the HSCRC policy makers regarding the timing and details of the methodology. A brief summary of policy updates for FY 2017 in presented in the text box.

In general, each hospital's global budget is based on annually defined total revenue that is unique to the hospital. Total revenue is updated each year by an amount that applies to all hospitals to account for cost increases. These total revenue amounts (and annual updates to hospital rates) are modified through a series of hospital-specific payment and performance

[12] As of the writing of this report, progress has been made toward approval for increased sharing of data from CMS.

adjustments that either increase or decrease the amount of the global budget.[13] The adjustment policies are updated and refined annually. The policy updates and refinements are an attempt to improve the accuracy and overall fairness of the global budgets and rates, as well as to ensure that Maryland meets the terms of its agreement with CMS. However, they also contribute to the complexity and year-to-year fluidity of the methodology.

Achieving clarity, transparency, and timeliness in the complex policies and procedures overseen by the HSCRC was another major challenge cited by hospital leadership and stakeholders. The common theme expressed was that the new model methodology is overly complex, that policies shift and change with only limited advance notice, and that final policies are often not established until well into implementation periods. Common feedback across from hospitals and other stakeholders was that "the rules of the game are constantly in flux." Hospital leaders universally expressed some inability to plan for and fully comply with HSCRC policies because policy details were not known until well into the affected implementation period.

Specific policies were also cited as being problematic. Some hospital leaders and stakeholders reported rising frustration among hospital organizations regarding details of certain policies, primarily the market shift adjustment, which did not exist under the previous hospital payment system. The market shift adjustment is intended to compensate for major shifts in the populations treated at individual hospitals operating under GBR; this is important because overall global budgets are based on projections of the populations who will seek care at specific facilities. The market shift adjustment methodology was finalized in September 2015, well into the implementation of the All-Payer Model. Initially, market shift adjustments were made annually. The following concerns were raised about the market shift adjustments:

- Financial resources do not follow market shifts as quickly as needed.
- Market shift adjustments do not accurately account for changes in severity and resource intensity.
- The market shift adjustment is not fair or administratively feasible and should be replaced with a simpler adjustment that scales volume increases by PAU.
- There are no statutory time frames for negotiating global budgets; the current process, which takes many months, forces hospitals to operate under significant uncertainty.

As of July 1, 2016, market shift adjustments will be made semi-annually to redistribute resources among hospitals on a timelier basis. This change aims to address growing concern about the need for financial relief among hospitals experiencing increases in market share.

Concerns regarding readmission rate reduction requirements in the RRIP and incorporation of prevention quality indicators (PQIs) in the PAU definition were also noted by most hospital leaders.

[13] A comprehensive review of the global budgeting methodology can be found in the First Annual Report.

Through FY 2016, the RRIP program was based on annual improvement targets to be met by all hospitals regardless of their readmission rates. Some hospital leaders disagreed with the requirement for all hospitals to achieve the same percentage reduction in readmissions, citing frustration that high-performing hospitals with low readmission rates had to achieve the same level of improvement as poor-performing hospitals. These hospital leaders contended that some readmissions are inevitable, and hospitals with low readmission rates do not have the same opportunity to continually lower rates relative to hospitals with high readmission rates. Providers echoed this concern: "If [the hospital] started at a higher place we're expected to make the exact same amount of improvement as a hospital who starts at a lower place, and I feel that we should be rewarded for having started at a better place, not punished for it." Beginning in FY 2017, and in response to hospitals' concerns, the HSCRC has modified the RRIP methodology to assess hospital performance relative to either the statewide reduction target or improvement in the hospital's individual readmission rates. Specifically, the methodology has been modified to assess hospital performance based on the better of either attainment or improvement. Hospitals with low readmission rates may face a stagnant or even increasing readmission rate, but if that rate continued to be lower than the statewide 25th percentile, they would not be subject to penalties under the FY 2017 RRIP policy. In FY 2016, hospitals could receive a reward of up to 0.5 percent for exceeding the reduction target, but no penalties were applied for failing to meet it. To further incentivize reductions in readmissions, for FY 2017 the maximum reward will be increased to 1 percent and penalties will be introduced, with the maximum penalty set at 2 percent.

The All-Payer Model global budget setting process incorporates reductions in allowed volume growth that are based on the percentage of a hospital's revenue associated with PAU, with the goal of incentivizing reductions in services that could be avoided—either unnecessary admissions or extra inpatient services that are necessary because of inappropriate care. The definition of PAU is updated annually, a source of frustration for hospitals. The HSCRC expanded the PAU definition for FY 2017 to align with the definition used in the market shift adjustment policy, which includes readmissions and PQIs. Hospital leaders, however, perceived that the incorporation of PQI metrics in the PAU definition "came out of nowhere" and the metrics were applied retroactively. Concerns centered on the perception that these metrics were developed for nonreimbursement purposes and are therefore inappropriate for application as part of the global budget methodology. The timing and methodology of the PQI metrics was offered as prime example of a flawed metric applied with no discussion or advance notice. Additional modifications to the PAU methodology have also been made to increase the expected savings from avoidable utilization. The annual PAU savings amount, which was set at 0.20 percent of total hospital revenues in FY 2014 through FY 2016, increased to 0.45 percent in FY 2017. To protect hospitals whose patients have a higher rate of socioeconomic burden, beginning in FY 2017 the state will cap the PAU savings reduction at the statewide average reduction.

Providers also emphasized concern about the inclusion of HCAHPS scores in the QBR metrics. The QBR is the longest-standing pay-for-performance component of Maryland's All-Payer Model. A hospital's QBR score is determined by measuring patient experience, safety/complication rates and clinical outcomes such as mortality and readmissions. In part to address hospital concerns regarding the methodology, HSCRC changed the payment adjustments for FY 2017 to a point-based scale instead of using hospitals' relative rankings. This change is

designed to provide hospitals with more predictable revenue adjustments based on their performance. The maximum reward in FY 2017 will remain at 1 percent, but the maximum penalty will rise to 2 percent to increase the incentive for hospitals to improve HCAHPS scores, which in FY 2016 continued to be low compared with those in the rest of the nation. Many providers agreed that patient satisfaction was an important aspect of care and, in some cases, care quality; however, being able to improve patient satisfaction as part of hospital care provision was an ongoing challenge, despite these modifications in policy. One provider observed, "Patients are rating [the hospital] based on the Wi-Fi that they have." Also, in the wake of a growing opioid epidemic in Maryland, many providers shared stories about the negative impact a refusal to prescribe unnecessary pain killers to a drug seeker can have on their satisfaction scores.

Another perspective we heard from many hospital leaders and physician focus group participants related to the pace of change required by the new model, which felt too rapid and unrealistic. Hospital leaders and physicians sensed that the HSCRC lacked understanding of the time and financial resources necessary to make these changes. This was not, however, a universal perspective. One hospital leader told us that there would never be sufficient lead time for comfortable change. As this leader put it, "The direction of the ACA, the shift from volume to value… these were very clear. Every consultant was talking about this years ago. Were we all waiting for a gun to be pointed at our heads? Well, here's the gun."

We also heard widespread concern about what will happen under the next phase of the model implementation. Most hospital leaders, clinicians, and stakeholders were aware that the agreement between the state and CMS requires moving to a second phase that will expand hospitals' financial accountability to the total costs of care. Many stakeholders were uneasy about this concept, particularly in the absence of information about what it will look like.

Although respect for and confidence in HSCRC staff remained more or less intact (and in some cases was quite high), patience with the complexity and evolving nature of some policies was in shorter supply than a year ago. As one hospital leader noted, "Last year we were in a honeymoon phase. Now things are really difficult."

2.1.5 Hospital Financial Capacity

Under current policy, most hospitals receive funds for future investments through the infrastructure adjustment, which is built into the calculation used to determine a yearly budget. Hospitals receive a fraction of a percentage increase in their global budget for infrastructure investment, and prior year infrastructure investment allotments become part of a hospital's base global budget that future year budgets are based on. In FY 2016, the HSCRC also awarded selected hospitals grants to implement care coordination initiatives. The HSCRC reviewed 22 proposals and included an increase in FY 2017 hospital revenues for 9 initiatives, which included 25 hospitals. Initiatives received between $1.1 million and $7.7 million, with the amount of funding generally increasing with the number of partnering hospitals. However, health care provider stakeholders, clinicians, and hospital leaders raised concerns that the infrastructure adjustment and grants may still not provide all hospitals the financial resources they perceive are needed to make the investments necessary to operate effectively under the All-Payer Model. One reason for this concern is that it takes time for funds to accumulate and reach a critical mass because they are tied to utilization payments.

Providers were also concerned that hospitals will not have sufficient funds to properly manage population health and invest in initiatives such as behavioral health interventions, gainsharing partnerships, or improved data infrastructure. The perception of insufficient funding is important because a central expectation of Maryland's agreement with CMS is that an all-payer model accountable for the total cost of care creates incentives for population health improvements. Maryland is required to monitor the state's population health performance against various national population health measures and to report this performance to CMS annually. HSCRC has recently taken some action to provide additional resources for population health improvement with the inclusion of up to $10 million in FY 2017 hospital rates to provide hospitals with funds to hire and train workers from geographic areas of high economic disparities and unemployment to fill new positions related to care coordination, population health, health information technology (IT), and consumer engagement. To date, Garrett Regional Medical Center and the Baltimore Population Health Workforce Collaborative (a partnership of 9 hospitals in the Baltimore region) have received these funds and begun implementing population health workforce initiatives.

Provider stakeholders also emphasized that the unexpected growth of certain services and their associated costs—for example, the increase in oncology care costs due to the shift in oncology services from nonacute care to acute care settings and rapid increases in oncology drug costs—may compromise hospitals' ability to invest in population health as they find it increasingly difficult to maintain their current services. Possibly in response to this concern, for FY 2017, the HSCRC included a new 0.20 percent adjustment for the rising cost of new drugs.

Perceptions of financial capacity in Maryland hospitals varied. Leaders in the five fully engaged hospitals were less likely to cite lack of funding as a limiting factor in how they operated under global budgets; we did note, however, that these five operated in more affluent markets and were more likely to say that they had supplementary sources of revenue, including major charitable donors. Hospitals we characterized as less engaged or more resistant to global budgets all cited lack of financial capacity as the major barrier to making investments related to the new model. They perceived that the HSCRC was holding back money through lower-than-expected rate updates to build up a statewide cost savings buffer, perform for CMS, and preserve the All-Payer Model agreement, rather than protecting the interests of hospitals and patients. This group of hospitals also tended to perceive that limited rate updates made critical elements of success under global budgeting all but out of reach. Such elements included implementing or upgrading EMR systems; investing in additional care, case, and discharge planners; and hiring hospitalists, certain types of specialists, and ED physicians necessary to ensure coverage.

A common theme in physician and other clinical provider focus groups was that global budgets limit investments in new medical technology and, hence, stifle clinical innovation. For instance, many physician focus group participants believed that global budgets are to blame for hospital leaders' discouraging trans-catheter aortic valve replacement (TAVR) procedures at their facilities. Other physicians cited lack of investments in and support for other specific procedures. As one physician participant noted, "I think [the All-Payer Model] stifles ingenuity; it stifles newer technologies because [hospitals] are evermore mindful of the cost of those things and how that's going to change hospital payments." In some hospitals, leaders seemed to agree with the perspectives of their clinicians, noting that the global budget model was limiting their

ability to bring needed care to their communities. In most cases, however, hospital leadership and even some providers took a broader view and saw global budgeting as a model in which financial tradeoffs are inevitable and necessary when considering new investments in medical innovation. For example, one hospital leader commented, "New initiatives and creative ideas are no longer always possible. We've lost our entrepreneurial spirit. Before it was making the case based on whether it served our patients. Now we have to find the money from something else and prove why something is successful." In the view of one physician, "The hospital is looking really close at budgets now, so when [physicians] need a resource that [they] think would make a difference, it's very difficult to get that through.… It doesn't mean [that] everything doesn't get through." Another hospital leader told us, "We want providers to innovate but we want to do it smartly. We can't support every new technology…. There has to be a level of accountability." This tension between physicians' desire to have access to new technology and the hospital leaders' greater deliberation and restrictions in decisions about adoption was common among the hospitals.

Some stakeholders, hospital leaders, and clinicians noted that the new model places major new burdens on hospitals' clinical and financial management of patients without corresponding responsibilities for patients (who are sometimes noncompliant) or any additional financial contribution by private insurance payers. Of particular concern was the perception that private insurers in Maryland benefit from far lower rates for services than are paid in other states, yet bear little or no burden for managing patient behavior. As one hospital leader told us, "Payers have gotten a free ride on all of this." Stakeholders from private insurers, conversely, reported that care and case management was being supported financially by the major private payers through on-site insurer representatives in most hospitals.

2.1.6 Hospital and Clinician Incentive Alignment

Most hospital leaders, focus group clinicians, and stakeholders said that some mechanism for aligning physician and hospital financial incentives will be important for the future success of the All-Payer Model. Although they have had some success with physicians practicing as hospitalists or in practices owned by hospital organizations, hospitals struggle to achieve their goals of reducing volume when working with community physicians who are still paid largely on the basis of the volume of services they provide. We heard numerous examples of physician reimbursement contracts that continue to be productivity based. According to one physician, "[Physicians and hospitals are] not aligned in the sense that the physicians want to bring more patients into the hospital… and the hospital wants less patients in the hospital."

Misalignment of financial incentives has led some hospital organizations to purchase physician practices, thereby bringing more physicians under their direct control. This in turn raised concerns among some stakeholders that global budgets will push Maryland toward a hospital-employed physician model.

Leaders from rural and suburban hospitals also reported that the misalignment of physician incentives is further complicated by relatively low physician reimbursement in Maryland. These hospitals reported that they are trying to maintain sufficient specialist and primary care physician access in their communities while simultaneously attempting to shift the behavior of physicians toward value and away from volume. Physicians in these areas perceived

that their average compensation is already lower than it would be in surrounding states and that hospitals are now looking to limit the volume of care provided, with little or no interest in investing in new technologies or building business in cardiac, orthopedic, cancer, and other lines of service that might provide new revenue streams. The result, according to both hospital leaders and physicians in these rural and suburban areas, is a contracting and rapidly aging supply of physicians willing to work for lower pay under what appear to be greater restrictions and no opportunity for entrepreneurship.

The Medicare Access & CHIP Reauthorization Act of 2015 (MACRA) was perceived as adding to providers' concerns about financial misalignment and general uncertainty about the future of health care in Maryland. Many providers questioned how MACRA will change payments and how (if at all) these changes will be different in Maryland relative to other states. As one hospital leader told us, "My fear is when MACRA happens, and the doctors will be capitated, they will all want to be employed. What will happen when this world changes and how can we support the rest of the providers we don't already employ?" Others view the implementation of MACRA in the Maryland context as a major concern for the physician workforce: "The combination of ACA and MACRA has essentially made small private groups in the State of Maryland very, very challenging."

2.1.7 Monitoring and Modifying Rates

Hospital leaders were all keenly aware of their global budget, all-payer rates, and annual update factors. There was consensus that annual update factors were lower than expected. Some hospital leaders told us they had expected annual rate updates that were closer to the 3.58 percent target annual all-payer growth rate for hospital services during the first 3 years of the new model agreement. There was clearly an unmet expectation that annual rate increases would be higher than under the previous model. Hospital leaders reported grave concerns about an anticipated 1 percent rate update for FY 2017; ultimately, the HSCRC announced a 3.36 percent update that, with adjustments, resulted in a net 2.16 percent update for the first 6 months of FY 2017. A provision for a higher increase for the second half of the year, which would bring the overall FY 2017 update to a net of 2.72 percent, was also proposed by the HSCRC. Although hospital leaders were relieved that the update would be higher than anticipated, some were skeptical that hospitals would be able satisfy the requirements to realize the 2.72 percent update.

We asked hospital finance leaders about their practices in monitoring volume and modifying their service line rates as a management strategy for operating under global budgets. All but one of the hospitals we visited reported that they monitor their own volumes at least monthly in the first half of the year, making updated projections for volume in the remaining months. In later months, approaching the end of the fiscal year, hospitals report monitoring volume weekly and sometimes even daily. Hospital finance leaders also told us that they consider rate modifications (within the 5% corridors allowed without HSCRC approval) a critical tool in managing under the global budget methodology, one that is likely to continue throughout the life of the project. Some finance leaders reported that rate modifications were continuing, but becoming less frequent, but others told us that this type of rate fluctuation was just part of the model. Most hospital finance leaders reported that these rate modifications were more common toward the end of the fiscal year as hospitals tried to end the fiscal period as close to their

budgets as possible. An analogy used by one hospital financial officer to describe this process was "landing a cargo plane on a short carrier runway."

2.2 Discussion

The round 2 site visits and focus groups gave us insight into the evolving process of implementing the new Maryland model. The following themes emerged from these discussions.

Tension between midcourse refinements and policy stability—Many of the hospital leaders and stakeholders we spoke with provided feedback on specific elements of the new model that should be refined. For example, we heard a number of comments regarding elements of the quality and other performance metrics, the market shift adjustment, and the annual rate updates. At the same time, we heard a consistent message of frustration from hospital leaders regarding the frequency and timing of policy revisions by the HSCRC. Many hospital leaders, even those who were very supportive of the new model, felt that the specifics of policies changed too often, were less than transparent, and were sometimes applied retroactively. Common feedback from hospital leaders was that they "didn't know the rules of the game" and therefore couldn't respond effectively. However, it was also clear from our discussions that many stakeholders—including the Maryland insurance industry and physician, hospital, and other health care provider advocacy groups—have a voice in the policy making process. There appears to be considerable tension between the need to refine the model as lessons are learned and the need to create some stability in policies around which hospitals can operate and plan.

Inconsistent implementation among Maryland hospitals—As was the case in the First Annual Report, we continued to find considerable variation in adaptation to the new model among hospitals. Some hospitals reported major changes in the way they do business, with substantial investments in targeted staffing, increased emphasis on data analysis, partnerships with physicians and other health care providers, and strategies to better manage high-cost patients. But others appeared to have made few changes and in some cases seemed to be operating on the assumption that the new model—with its change from volume to value—will be repealed.

For the time being, despite this variation in behavior, the state is meeting targets and improvement metrics, although there is concern that growth in the total cost of care for Medicare beneficiaries in Maryland exceeded the national average in 2015. It is unclear whether inconsistency in the extent to which hospitals have made more fundamental changes in the way they do business will jeopardize the state's ability to continue meeting the terms of the agreement with CMS.

The responsibility of the hospital—Underlying many of our discussions with hospital leaders and advocates was the question: Why are Maryland hospitals being held responsible for changing health care? The point made by many was that the new model, and particularly its planned future phases, holds hospitals accountable for the entire health care system without sufficient control or authority over all the stakeholders. The hospitals' inability to change behavior of noncompliant patients was a particularly sore point. We often heard frustration from health care clinicians about their inability to get patients to take medications, follow simple post-discharge instructions, and take responsibility for their own care. Similarly, hospital leaders

offered accounts of attempts—some successful, but some not—to form partnerships with physicians, PAC providers, and providers in other clinical settings to work together toward goals of more coordinated, higher value care.

A few stakeholders recognized that the reason hospitals have been given this responsibility in Maryland is simply a matter of practicality. The state and the HSCRC have greater regulatory control over hospitals than over other providers and they are simply using the policy levers available to them. In addition, some hospital leaders conceded that they are their communities' most administratively and financially capable organizations for this role.

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SECTION 3
HOSPITAL FINANCIAL PERFORMANCE

Key Takeaways for Hospital Financial Performance

- Maryland hospitals face significant penalties if their revenues vary from their global budget beyond a narrow 0.5 percent corridor, creating strong incentives to meet the target budget. Almost 80 percent of Maryland hospitals had revenues within this corridor and this percentage did not change over time. However, some types of hospitals were less likely than others to remain within the budget corridor. These hospitals may have had less sophisticated strategies for adapting to global budgets, either because they had less experience with operating under a global budget or they had fewer resources to invest in developing strategies.
- Hospitals adjust the rates charged frequently during the course of the year to remain within their budgets. Hospital finance leaders described rate modifications as a critical tool for operating within global budgets.
- Maryland hospitals have been able to operate within global budgets without adverse effects on their financial status. Despite constraints on hospital revenues imposed by global budgets, operating margins increased after implementation of the All-Payer Model for most types of hospitals, as well as for all Maryland hospitals combined. Hospital initiatives to improve operating efficiency of their operations may contribute to hospitals' robust financial status.

3.1 Research Questions

A central goal of the Maryland All-Payer Model is controlling growth in hospital service expenditures and utilization in both inpatient and outpatient settings. Hospitals face penalties if their revenues vary from their allowed annual revenue (or global budget) beyond a narrow 0.5 percent corridor, which creates strong incentives to manage volume and revenue to meet the target budget. The All-Payer Model retained Maryland's long-standing rate-setting system, and the HSCRC sets the rates each hospital can charge for its services (defined by rate center). The HSCRC recognized that the utilization assumptions underlying hospital budgets are unlikely to be met exactly. Therefore, hospitals are permitted to vary the rates charged during the year to compensate for some amount of natural fluctuation from the utilization assumptions on which their budgets are set. However, rates may change only within prescribed corridors (up to 5% without permission and up to 10% with permission from the HSCRC), and any rate changes must be applied uniformly to all rate centers. The HSCRC controls hospital revenues directly though the budget-setting process. Depending on how the HSCRC sets budget updates, trends in hospital revenues may change over time. The mix of hospital revenue sources could also change. Incentives to reduce readmissions and preventable hospital complications could reduce inpatient revenues. The impact on outpatient service revenues is less clear. Incentives to shift services from inpatient to outpatient settings could increase outpatient revenues. At the same time, reductions in unnecessary ED use could reduce outpatient revenues. Because global budgets strictly control hospital revenues and penalize hospitals for certain types of avoidable utilization, hospital operating margins could increase or decrease under the All-Payer Model depending on

the amount budgets are increased over time and how hospitals are able to manage their volume and operating expenses. This section describes hospital compliance with global budgets and approved rates, as well as trends in hospital revenue, costs, and operating margins before and after the implementation of the All-Payer Model. Specifically, our analyses addressed the following questions:

- Have Maryland hospitals been able to operate within their global budgets?
- Did hospitals adjust their rates to remain within their global budgets?
- How did hospital financial performance change after implementation of the All-Payer Model?

A description of the methods used in these analyses is in ***Appendix A***.

3.2 Results

3.2.1 Have Maryland Hospitals Been Able to Operate within Their Global Budgets?

- Overall, hospital global budgets grew by 2.6 percent from FY 2014 to FY 2015. Growth slowed to 1.8 percent from FY 2015 to FY 2016. Despite the slowing growth, almost 80 percent of Maryland hospitals had revenues within 0.5 percent of their global budget, and this percentage did not change over time. However, there was a trend toward an increasing number of hospitals varying from their budgets by more than 2 percent.
- Some types of hospitals were less likely than others to remain within the budget corridor. Information collected in hospital site visits suggested that GBR hospitals had adopted less sophisticated strategies to adapt to global budgets than TPR hospitals that have more experience with global budgets, which may contribute to their greater challenges with budget compliance. Smaller hospitals may experience greater volatility in their patient volume (and, hence, revenue) and these hospitals also may have fewer resources to invest in developing strategies for operating under global budgets.

Table 1 displays the global budgets for FY[14] 2014, FY 2015, and FY 2016 by hospital. Overall, budgets increased by 4.7 percent from FY 2014 to FY 2016. In total, hospital budgets grew by 2.0 percent from FY 2015 to FY 2016. This growth represents a reduction relative to the 2.7 percent growth between FY 2014 and FY 2015. The differential was due to the large increase in the budget for the University of Maryland Medical Center in FY 2015. This reflects the inclusion beginning in FY 2015 of revenues for out-of-state patients in the hospital's global budget, which were excluded from its budget in FY 2014. Excluding the University of Maryland Medical Center, hospital budgets grew by 1.9 percent from FY 2014 to FY 2015.

[14] Maryland's state fiscal year runs from July 1 through June 30.

Table 1
Maryland hospital global budgets, FY 2014–2016

Hospital name	FY 2014, $	FY 2015, $	Percent change, FY 2014–2015	FY 2016, $	Percent change, FY 2015–2016
All Maryland hospitals	**14,685,680,644**	**15,079,235,514**	**2.7**	**15,383,053,525**	**2.0**
Anne Arundel Medical Center	553,115,271	563,439,445	1.9	575,862,770	2.2
Atlantic General Hospital	101,754,333	102,666,124	0.9	105,331,074	2.6
Bon Secours Hospital	129,643,966	127,585,212	−1.6	119,754,987	−6.1
Calvert Memorial Hospital	142,402,619	144,671,999	1.6	146,902,750	1.5
Carroll Hospital Center	252,621,323	254,832,546	0.9	254,860,256	0.0
Doctors' Community Hospital	221,771,821	226,150,921	2.0	232,593,700	2.9
Edward McCready Memorial Hospital	15,715,821	15,153,481	−3.6	15,896,470	4.9
Fort Washington Hospital	46,796,285	48,546,599	3.7	48,553,970	0.0
Frederick Memorial Hospital	338,085,814	345,677,609	2.2	363,295,150	5.1
Garrett County Memorial Hospital	45,163,111	44,535,999	−1.4	48,299,954	8.4
Greater Baltimore Medical Center	427,071,053	433,177,253	1.4	440,676,263	1.7
Holy Cross Hospital	472,185,907	482,542,953	2.2	503,866,472	4.4
Howard County General Hospital	281,634,848	286,680,087	1.8	296,451,089	3.4
Johns Hopkins Bayview Medical Center	554,499,811	566,052,477	2.1	582,515,050	2.9
Johns Hopkins Hospital	1,636,470,792	1,664,165,537	1.7	1,712,242,490	2.9
Laurel Regional Hospital	122,799,110	123,487,059	0.6	105,488,310	−14.6
MedStar Franklin Square Medical Center	485,365,423	490,414,524	1.0	505,913,246	3.2
MedStar Good Samaritan Hospital	299,617,955	302,450,591	0.9	289,725,742	-4.2
MedStar Harbor Hospital	204,950,821	206,891,159	0.9	194,447,130	-6.0
MedStar Montgomery Medical Center	167,907,266	174,201,069	3.7	175,436,191	0.7
MedStar Southern Maryland Hospital Center	260,984,437	261,930,578	0.4	273,373,788	0.4
MedStar St. Mary's Hospital	161,151,064	167,521,822	4.0	177,099,442	5.7
MedStar Union Memorial Medical Center	415,215,133	419,083,569	0.9	426,607,435	1.8
Mercy Medical Center	487,981,390	495,628,440	1.6	512,227,340	3.4
Meritus Medical Center	304,582,765	313,184,783	2.8	322,062,641	2.8
Northwest Hospital Center	250,019,982	254,842,172	1.9	258,934,499	1.6
Peninsula Regional Medical Center	416,052,547	422,028,699	1.4	430,192,502	1.9
Prince George County Hospital	261,425,366	263,731,420	0.9	285,557,392	8.3
Shady Grove Adventist Hospital	376,588,971	389,097,142	3.3	389,761,831	0.2
Sinai Hospital of Baltimore	702,036,456	719,067,827	2.4	733,240,242	2.0
St. Agnes Hospitals	410,965,902	420,102,137	2.2	430,482,775	2.5
Suburban Hospital	257,152,521	261,422,362	1.7	266,773,484	2.0
Union Hospital of Cecil County	157,033,246	156,915,598	−0.1	159,687,427	1.8
University of Maryland Baltimore Washington Medical Center	393,555,942	404,295,047	2.7	414,873,752	2.6
University of Maryland Charles Regional Medical Center	144,514,525	147,995,649	2.4	149,055,308	0.7

(continued)

Table 1 (continued)
Maryland hospital global budgets, FY 2014–2016

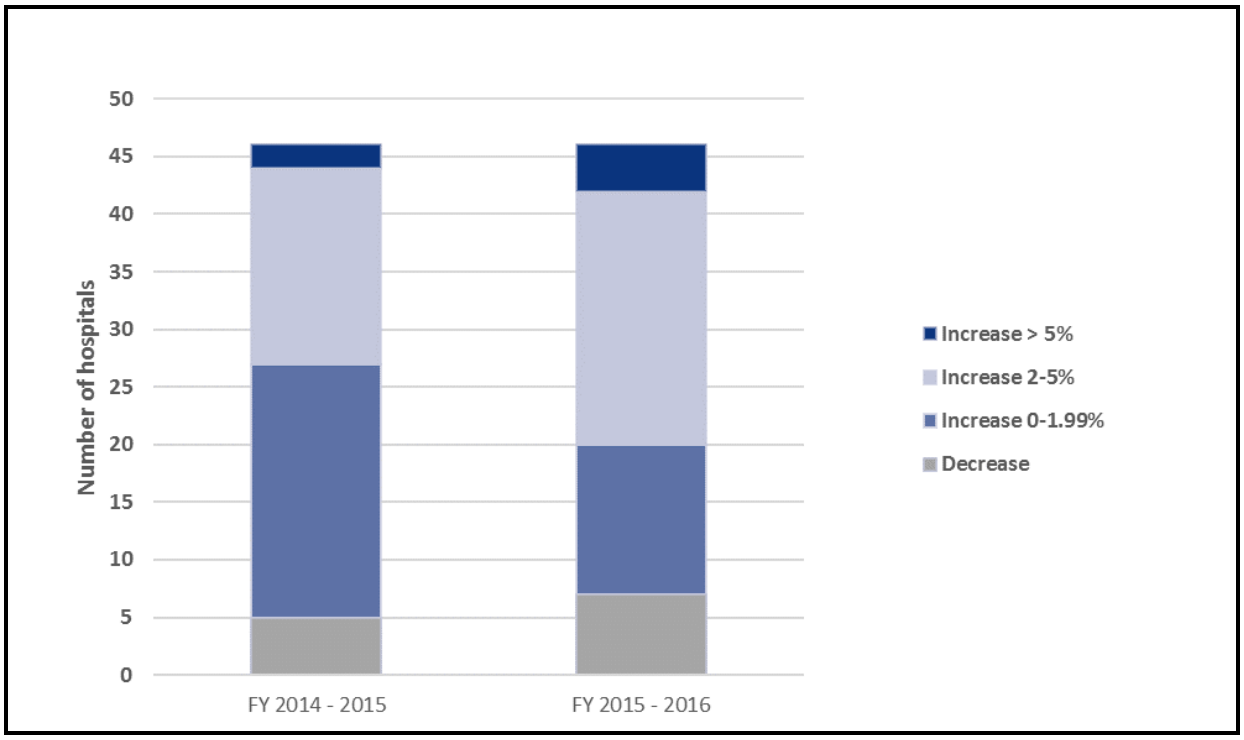
Hospital name	FY 2014, $	FY 2015, $	Percent change, FY 2014–2015	FY 2016, $	Percent change, FY 2015–2016
University of Maryland Dorchester	59,041,893	56,231,528	−4.8	51,475,815	−8.5
University of Maryland Harford Medical Center	103,938,097	104,409,474	0.5	104,324,139	−0.1
University of Maryland Medical Center	1,192,843,953	1,325,699,532	11.1	1,344,923,243	1.5
University of Maryland Medical Center Midtown	221,712,408	227,964,551	2.8	232,664,051	2.1
University of Maryland Rehabilitation & Orthopedic Center	118,349,207	120,213,142	1.6	122,591,881	2.0
University of Maryland Shore Medical Center at Chestertown	61,107,776	61,769,326	1.1	56,729,524	−8.2
University of Maryland Shore Medical Center at Easton	187,789,174	192,678,547	2.6	199,399,415	3.5
University of Maryland St. Joseph Medical Center	362,064,196	391,842,706	8.2	403,356,597	2.9
University of Maryland Upper Chesapeake Medical Center	305,743,020	319,410,477	4.5	331,625,488	3.8
Washington Adventist Hospital	254,864,220	256,326,454	0.6	262,159,414	2.3
Western Maryland Regional Medical Center	319,393,103	322,519,888	1.0	325,761,036	1.0

NOTE: The FY 2014 global budget for University of Maryland Medical Center did not include revenues for patients who resided outside of Maryland; revenues for out-of-state patients were included in the hospital's global budget in subsequent years.

Thirty-six of the 46 hospitals' budgets increased in both time periods, and only two hospitals' budgets decreased in both years. Six hospitals had a smaller budget in FY 2016 than FY 2014, with reductions ranging from 3 percent to more than 14 percent. Laurel Regional Hospital, whose budget decreased by almost 15 percent in FY 2016, was in the process of downsizing and converting to an outpatient facility. This transition was not related to the implementation of the All-Payer Model.

Changes in hospital budgets from year to year varied substantially among hospitals. ***Figure 4*** shows the number of hospitals by the change in their budget over the two periods. There was more variability in budget changes from FY 2015 to FY 2016 compared to FY 2014 to FY 2015. Seven hospitals had budget reductions from FY 2015 to FY 2016, and five had reductions from FY 2014 to FY 2015. Four hospitals had a greater than 5-percent increase in their budget from FY 2015 to FY 2016; only two had an increase of this magnitude in the earlier period. Among hospitals with an increase up to 5 percent, these hospitals were more likely to increase by less than 2 percent from FY 2014 to FY 2015, whereas they were more likely to have a 2- to 5-percent increase from FY 2015 to FY 2016.

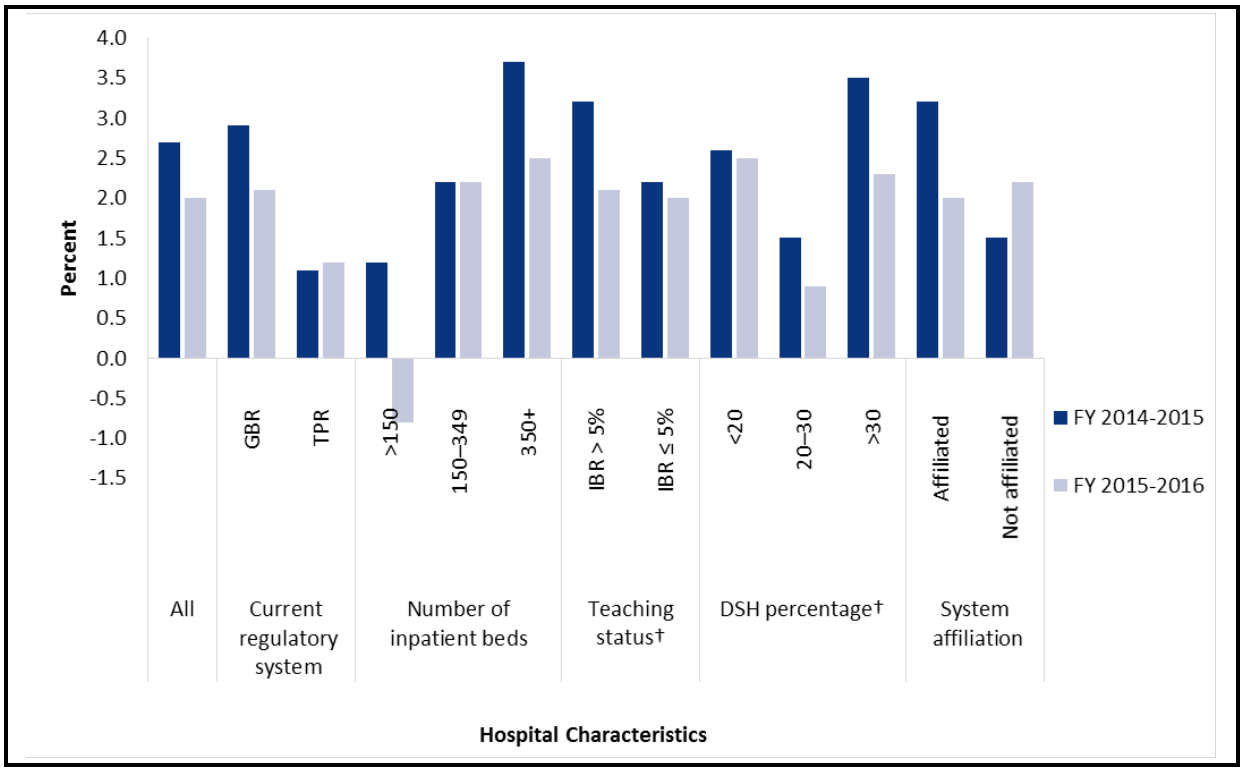
Figure 4
Number of Maryland hospitals by change in global budget, FY 2014–2015 and FY 2015–2016



NOTE: Holy Cross Germantown Hospital opened in FY 2015, but it is excluded from these analyses because it did not operate under a global budget during the time period covered.

Figure 5 shows the percent change in hospital budgets over time by hospital characteristic. In both time periods, budgets increased more for GBR hospitals versus TPR hospitals, for medium and large hospitals versus small hospitals, and for hospitals with low or high disproportionate share hospital (DSH) percentages versus hospitals with medium DSH percentages. The much larger growth from FY 2014 to FY 2015 as compared to FY 2015 to FY 2016 for GBR hospitals, large hospitals, teaching hospitals, hospitals with a high DSH percentage, and affiliated hospitals is an artifact of the large increase in the budget for the University of Maryland Medical Center described above. After removing the University of Maryland Medical Center, the budgets of these hospitals grew somewhat faster from FY 2015 to FY 2016. Similarly, the reduction in budgets for small hospitals and the slower growth for hospitals with moderate DSH percentages from FY 2015 to FY 2016 was caused by the substantial decrease in Laurel Hospital's budget due to downsizing.

Figure 5
Percentage change in Maryland hospital global budgets by hospital characteristic, FY 2014–2015 and FY 2015–2016



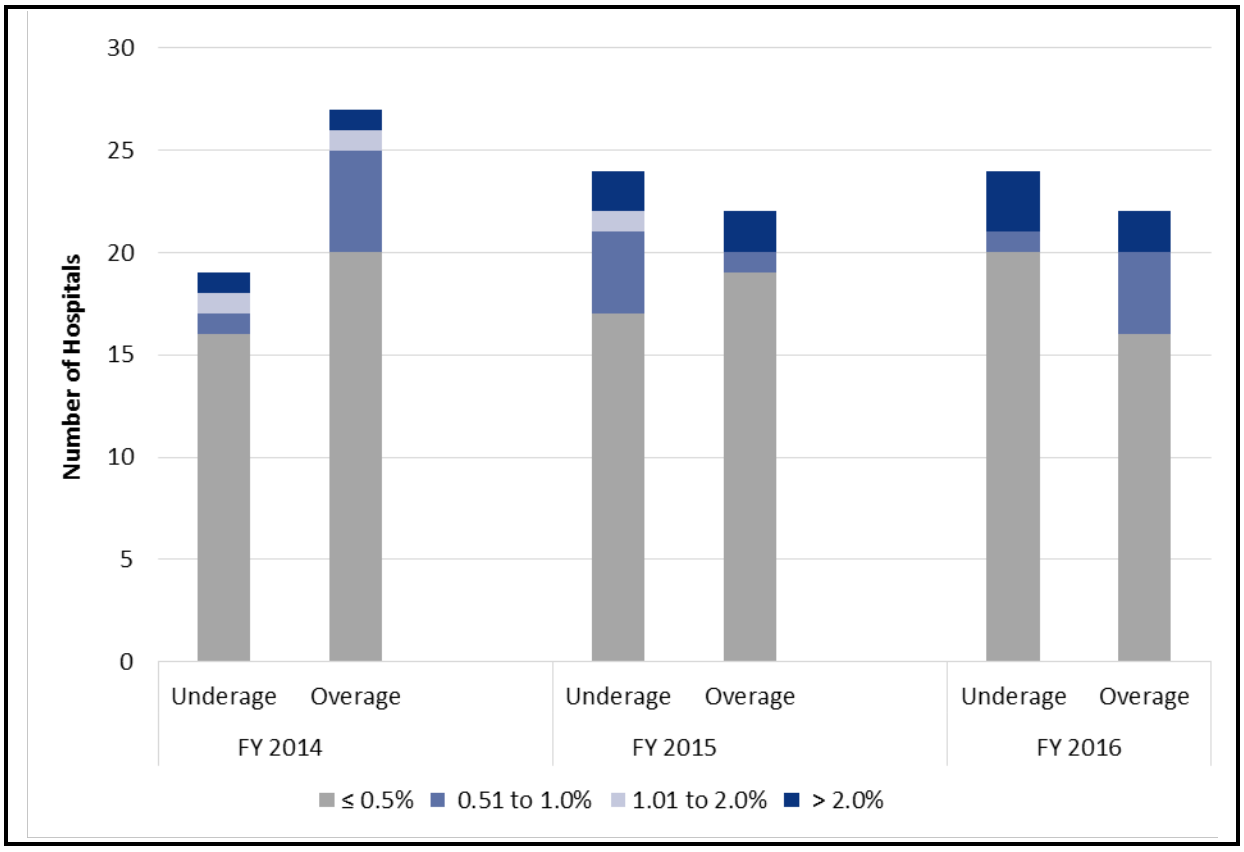
NOTES: Holy Cross Germantown Hospital opened in FY 2015, but it is excluded from these analyses because it did not operate under a global budget during the time period covered. † IBR and DSH percentages were based on data from the 2015 Medicare Impact File. Data for the University of Maryland Medical Center at Dorchester are reported under the University of Maryland Shore Medical Center at Easton in the Medicare Impact file. Therefore, teaching status and DSH percentage for these hospitals were based on their combined information in the Impact file. DSH = disproportionate share hospital; GBR = Global Budget Revenue; IBR = intern-to-bed ratio; TPR = Total Patient Revenue.

Maryland hospitals whose revenues vary from their approved budgets by more than 0.5 percent are subject to penalties that depend on the percent variation and on whether revenues exceed or fall short of the approved budget. ***Figure 6*** displays the number of hospitals by the categories of revenue variation used to determine penalties.[15] The number of hospitals that had revenues within 0.5 percent of their global budgets—36—was unchanged in FY 2014, FY 2015, and FY 2016, although the individual hospitals were not the same every year. Hospitals were

[15] For charges that differ from the budget amount by up to 0.5 percent, the full amount is debited from (overage) or credited to (underage) the budget for the following year. For the portion of any overage or underage falling between 0.51 and 1 percent, a 20 percent penalty is applied. In the case of an underage, the hospital is credited only 80 percent of the amount in the following year budget; in the case of an overage, the full amount of the overage plus an additional 20 percent is deducted from the next year's budget. Similarly, for charges over 1 percent, a 50 percent penalty is applied to the portion of the overage that is greater than 1 percent. For any portion of an underage between 1.01 and 2 percent, a 50 percent penalty is applied, and a 100 percent penalty is applied to the portion of an underage in excess of 2 percent.

more likely to have an overage than an underage in FY 2014, whereas the likelihood for both was similar in FY 2015 and FY 2016. There was no consistent trend over the 3 years in whether hospitals outside the 0.5 percent budget corridor underran their budget or overran it; however, there was a trend toward an increasing number of hospitals varying from their budgets by more than 2 percent. In FY 2016, six hospitals had revenues that were more than 0.5 percent greater than their budgets, with two hospitals exceeding their budgets by more than 2 percent. Four hospitals had revenues that were more than 0.5 percent less than their budgets, three of which fell short of their approved budget by more than 2 percent.

Figure 6
Number of hospitals by percent variation of revenues from budget, all Maryland hospitals, FY 2014, FY 2015, and FY 2016

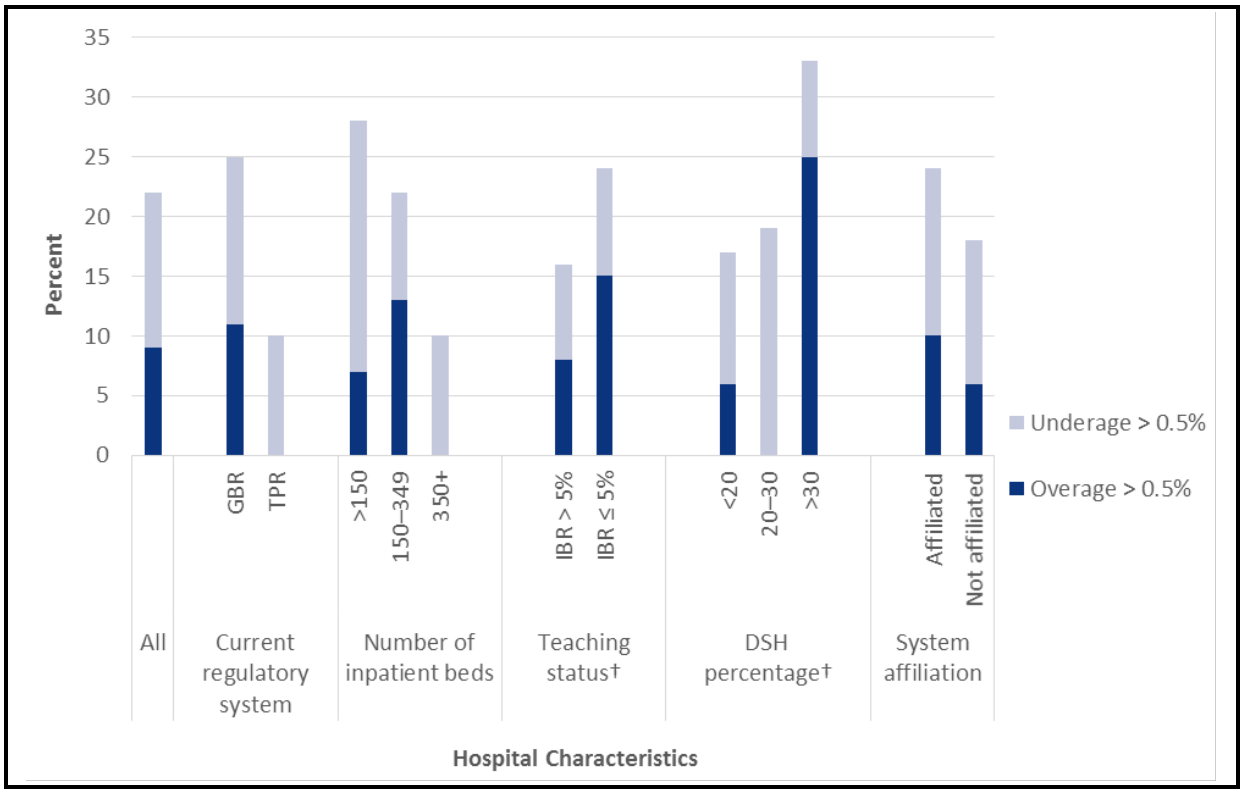


NOTE: Holy Cross Germantown Hospital opened in FY 2015, but it is excluded from these analyses because it did not operate under a global budget during the time period covered.

Compliance with the 0.5 percent budget corridor varied by hospital characteristics. ***Figure 7*** shows the percentage of hospitals whose revenues varied from their budget by more than 0.5 percent in FY 2016 for all Maryland hospitals and by hospital characteristic. Overall, 22 percent of hospitals had more than 0.5 percent variation. In FY 2016, GBR hospitals, small hospitals, nonteaching hospitals, high-DSH hospitals, and affiliated hospitals each were more likely than their counterparts to vary from their budget by more than 0.5 percent. In FY 2016, 25 percent of GBR hospitals had revenues outside 0.5 percent, whereas 10 percent of TPR hospitals

had revenues that fell outside the 0.5 percent corridor. Of hospitals with fewer than 150 beds, 29 percent had revenues that varied from their budgets by more than 0.5 percent, compared with 22 percent of medium-sized hospitals (150–349 beds) and 11 percent of large hospitals (350 or more beds). Nonteaching hospitals were less likely to comply with their budgets—24 percent of nonteaching hospitals compared with 15 percent of teaching hospitals. One-third of high-DSH hospitals varied outside the 0.5 percent budget corridor, compared with 19 percent of hospitals with moderate DSH percentage and 17 percent with low DSH percentage. Affiliated hospitals were somewhat more likely than nonaffiliated hospitals to vary from their budget by more than 0.5 percent—18 percent of nonaffiliated hospitals and 24 percent of affiliated hospitals. Among the types of hospitals that were more likely to have revenue variation outside the 0.5 percent corridor, all except high DSH percentage hospitals were more likely to overrun their budget. GBR hospitals were about equally likely to have an overrun as they were to have an underrun. Appendix Table E-1 shows more detailed information on the number of hospitals by the magnitude of revenue variation by hospital characteristic for FYs 2014–2016.

Figure 7
Percentage of hospitals with greater than 0.5 percent variation of revenues from budget, all Maryland hospitals and by hospital characteristic, FY 2016



NOTES: Holy Cross Germantown Hospital opened in FY 2015, but it is excluded from these analyses because it did not operate under a global budget during the time period covered. † IBR and DSH percentages were based on data from the 2015 Medicare Impact File. Data for the University of Maryland Medical Center at Dorchester are reported under the University of Maryland Shore Medical Center at Easton in the Medicare Impact file. Therefore, teaching status and DSH percentage for these hospitals were based on their combined information in the Impact file. DSH = disproportionate share hospital; GBR = Global Budget Revenue; IBR = intern-to-bed ratio; TPR = Total Patient Revenue.

Ten hospitals received penalties in FY 2016, six for exceeding their budgets and four for falling short of their budgets. The largest variance was an underrun of more than 9 percent. The number of hospitals subject to a penalty increased from FY 2015 when seven hospitals received penalties, two for exceeding their budgets and five for falling short of their budgets. However, the total number of hospitals with greater than 0.5 percent budget variance was the same in both years; three hospitals with budget variances greater than 0.5 percent in FY 2015 did not receive a penalty. The HSCRC did not apply penalties in FY 2014. Only two hospitals had penalties in both FY 2015 and FY 2016; both hospitals had a budget shortfall in FY 2015 and a budget overrun in FY 2016. Of the hospitals with penalties in FY 2016, nine operated under GBR (five with an overage, and four with an underage), and one (with an underage) operated under TPR. Penalties applied to these hospitals totaled almost $33 million, ranging from $2,552 to $18,298,062. However, most of the penalties were still under review as of October 2016. The hospital with the largest penalty was given an interim revenue target for the first quarter of FY 2017 that would allow it to pay back overcharges; penalties may not be applied if the target is met.

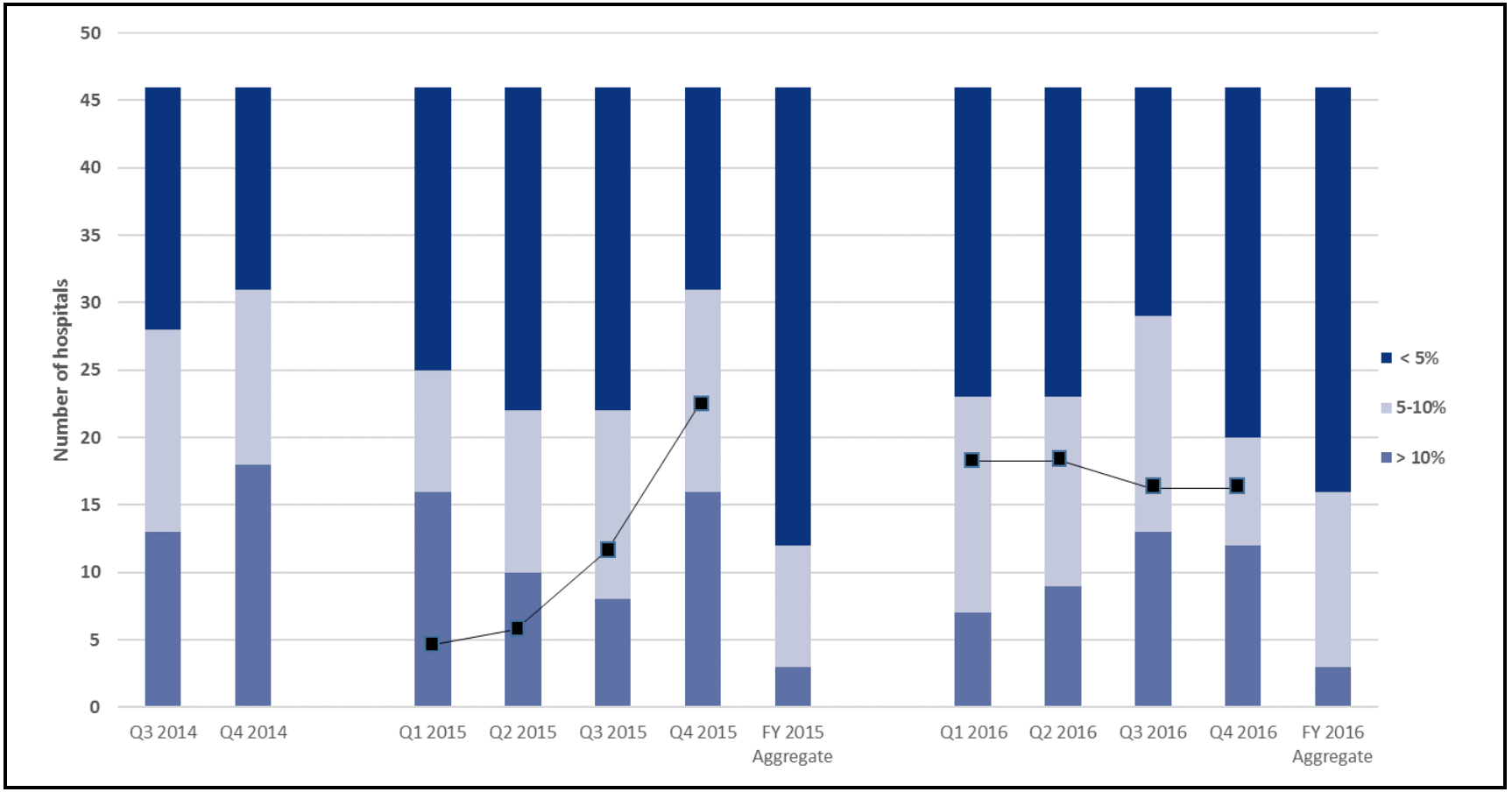
3.2.2 Did Hospitals Adjust Their Rates to Remain within Their Global Budgets?

- Depending on the quarter, about two-fifths to two-thirds of Maryland hospitals charged rates that varied from their rate order by more than 5 percent. During site visits, hospital finance leaders described rate modifications as a critical tool for operating within global budgets.
- Hospitals adapted to the requirement to request permission to vary charges by more than 5 percent from the approved rate order, and most hospitals that did so requested permission early in FY 2016. Nonetheless, in FY 2016 many hospitals had greater than 10 percent rate variation, and more than half the hospitals were assessed a penalty for rate noncompliance in FY 2016, although in some cases the amounts were modest.
- Average rates charged over the course of the year were closer to rate order amounts than the rates charged in the individual quarters, suggesting that hospitals made offsetting rate increases and decreases in response to short-run volume fluctuations to ensure that they remained in compliance with their annual global budgets.

Figure 8 reports by quarter and for the fiscal year in aggregate the number of hospitals with charged rates that varied from their rate orders by less than 5 percent, 5 to 10 percent, and more than 10 percent for medical/surgical acute services. In addition, for each quarter of FY 2015 and FY 2016, we show the number of hospitals that received permission to vary their rates by more than 5 percent. Hospitals that received this permission could vary their rates above or below the approved rate order.[16]

[16] All hospitals that requested permission for this rate variation received approval in FY 2015. In FY 2016 two hospitals' requests for rate variation were not approved. In both cases, HSCRC made adjustments to the hospital's global budget, which eliminated the need to vary rates beyond the 5 percent corridor. The number of hospitals with permission to vary their rates beyond 5 percent is not shown for FY 2014 because hospitals were not required to request permission during that year.

Figure 8
Number of hospitals with permission to vary rates by percent difference between charged rates and the hospital rate order for inpatient medical/surgical acute services by quarter, Q3 of FY 2014 through Q4 of FY 2016



NOTE: In fiscal years, Q1 = January–March, Q2 = April–June, Q3 = July–September, and Q4 = October–December. Squares indicate the number of hospitals with permission to vary rates by more than 5 percent in each quarter. Hospitals were not required to request this permission in Q3 and Q4 2014.

Hospitals' charged rates commonly differed from their established rate orders by more than 5 percent. Depending on the quarter, 20 to 31 of the 46 hospitals charged rates that varied from their rate order by more than 5 percent, and at least half of the hospitals did so in 7 of the 10 quarters since the start the All-Payer Model. In FY 2015, the number of hospitals with rate adjustments was largest in the last quarter, an expected pattern if hospitals seek to adjust their revenues at the end of the year to account for actual utilization during the year to meet their budget targets. In FY 2016, however, the largest number of hospitals with adjustments beyond 5 percent was in the third quarter of FY 2016.

In both FY 2015 and FY 2016, the average rates charged over the course of the year were closer to established rates than in individual quarters.[17] On average over the course of both years, only three hospitals charged rates for medical/surgical acute services that differed from their rate order by more than 10 percent. In individual quarters, however, a much larger number—depending on the quarter, 8 to 16 hospitals in FY 2015 and 7 to 13 hospitals in FY 2016—charged rates for medical/surgical acute services that differed from their rate orders by more than 10 percent. This suggests that there were offsetting rate increases and rate decreases over the course of both FY 2015 and FY 2016.

The number of hospitals granted permission for greater than 5 percent variation from the approved rate order was fairly small in the early quarters of FY 2015 and increased sharply by the fourth quarter, to 21. The numbers were more constant during FY 2016, and about one-third of hospitals requested permission for rate variation in the first quarter of the year. In both years, about 45 percent of hospitals received permission to exceed the 5 percent rate corridor at some point in the year. Except for one hospital granted permission for up to 15 percent variation for all of FY 2016 and one granted permission for 15 percent variation in the last quarter of that year, all hospitals received permission for up to 10 percent rate variation.

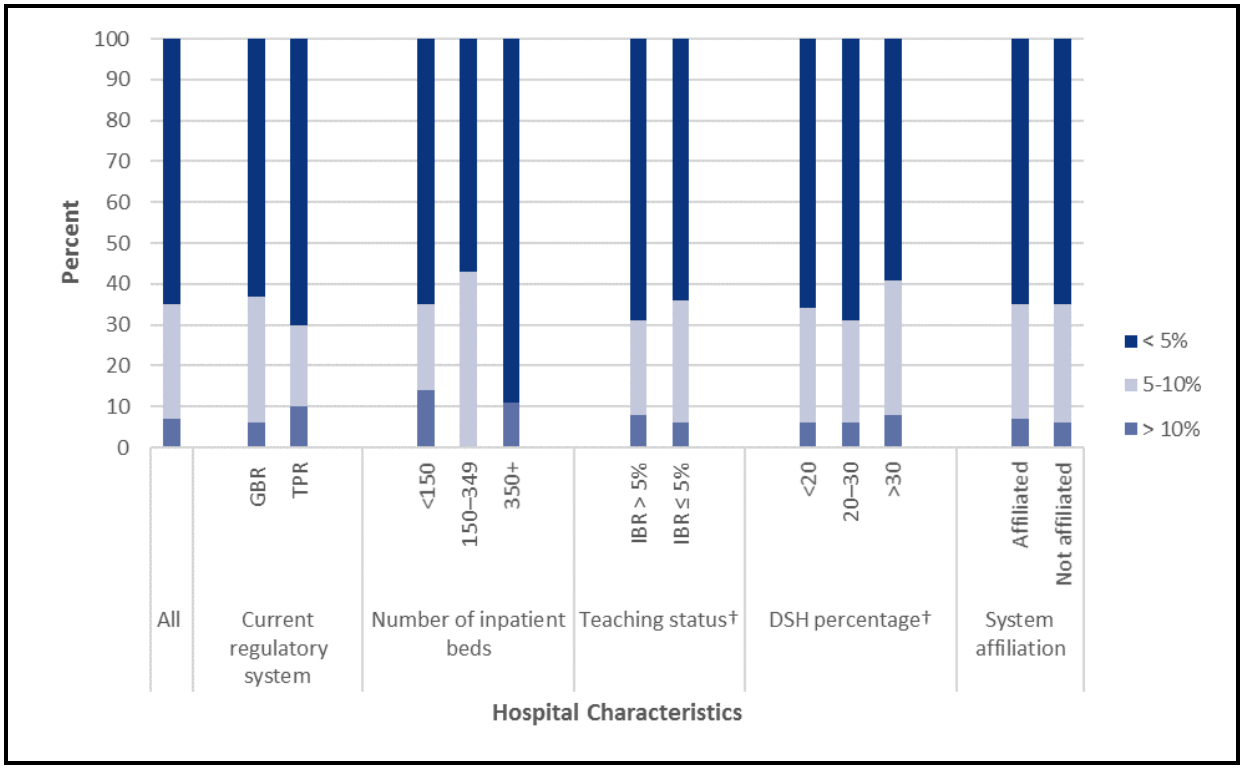
Particularly in the earlier quarters of FY 2015, when few hospitals had requested permission, the number of hospitals whose charged rates exceeded the 5 percent corridor was far greater than the number with permission to do so. The number of hospitals that varied their charged rates by greater than 5 percent was also more than the number with permission in all quarters of FY 2016; however, the gap was smaller than in FY 2015. Furthermore, although many hospitals charged rates that exceeded their rate orders by more than 10 percent, no hospitals were given permission to do so in FY 2015 and only two were given permission in FY 2016 (one for only one quarter of the year). There is no penalty applied on a quarterly basis for noncompliance with approved rates, but if a rate charged exceeds the approved rate for a quarter, the hospital is notified of the potential compliance issue. If the rates charged in a rate center vary from the approved amount by more than the allowed corridor over the entire rate year, a noncompliance penalty is applied to the hospital's budget in the subsequent year, regardless of whether the hospital was in compliance with its global budget. For FY 2016, 28 hospitals were assessed penalties ranging from $165 to $2,264,280, for a total of more than $17 million.

[17] We do not report aggregate results for FY 2014 because the analyses included only two quarters of that year.

Appendix Table E-2 shows the number of hospitals with charged rates that varied from their rate orders by 5 to 10 percent and more than 10 percent for clinic services and outpatient emergency services, as well as medical/surgical acute services. Although rate adjustments are required to be applied uniformly to all rate centers, we did not find this to be the case, particularly in FY 2014 and FY 2015. In FY 2016, rate adjustments were more similar, although still not uniform, across the three rates centers, particularly in aggregate over the course of the year.

Figure 9 shows the percentage of hospitals with rate variations of less than 5 percent, 5 to 10 percent, and greater than 10 percent for inpatient medical/surgical acute services in aggregate during FY 2016 by hospital characteristic. Appendix Table E-3 shows this information by quarter for FY 2014 through FY 2016. Thirty-five percent of all Maryland hospitals varied from their rates by 5 percent or more over the course of FY 2016 in aggregate. This percentage varied somewhat by hospital characteristic, but the differences were modest, generally within a range of 10 percentage points. The exception was large hospitals—only 11 percent had rate variation outside the 5 percent corridor during FY 2016 overall. It appears that large hospitals were more likely than others to have offsetting rate increases and rate decreases over the course of the year because the percentage during individual quarters was not markedly different from that for other types of hospitals (see Appendix Table E-3).

Figure 9
Percentage of hospitals by percent difference between charged rates and the hospital rate order for inpatient medical/surgical acute services by hospital characteristic, FY 2016 aggregate



NOTES: Holy Cross Germantown Hospital opened in FY 2015 and is excluded from these analyses. † IBR and DSH percentages were based on data from the 2015 Medicare Impact File. Data for the University of Maryland Medical Center at Dorchester are reported under the University of Maryland Shore Medical Center at Easton in the Medicare Impact File. Therefore, teaching status and DSH percentage for these hospitals were based on their combined information in the Impact file. DSH = disproportionate share hospital; GBR = global budget revenue; IBR = intern-to-bed ratio; TPR = total patient revenue.

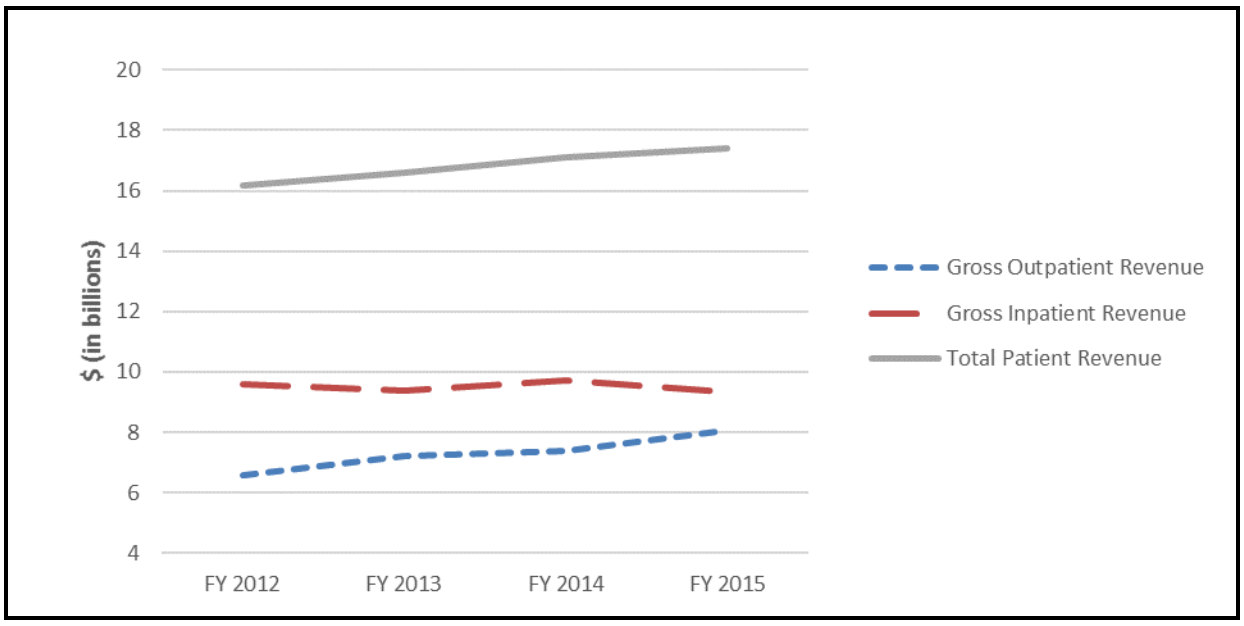
3.2.3 How Did Hospital Financial Performance Change after Implementation of the All-Payer Model?

- Total patient revenues have increased steadily but at varying rates since the start of the All-Payer Model. Inpatient revenues are a declining share of hospital revenues, falling from 59 percent of gross patient revenues in FY 2012 to 54 percent in FY 2015. The shift from inpatient to outpatient services is consistent with hospital efforts described during site visits to establish new outpatient clinics and move unneeded care out of inpatient settings. However, it may also reflect broader market trends rather than a response to the All-Payer Model.
- Despite constraints on hospital revenues imposed by global budgets, hospital operating margins increased after implementation of the All-Payer Model. During site visits, hospital leaders described a range of initiatives to improve the efficiency of their operations that may contribute to the increasing margins. Although there is considerable variability in operating margin by hospital characteristic, the operating margin grew for nearly all types of hospitals.

Figure 10 presents the trend for all Maryland hospitals in total gross patient revenue and gross revenue for inpatient and outpatient services, before and after the implementation of the All-Payer Model. Gross patient revenue increased by 7.4 percent, from $16.2 billion in FY 2012 to $17.4 billion in FY 2015. Gross revenues have increased steadily, but at varying rates since the start of the All-Payer Model, by 2.5 percent from FY 2012 to FY 2013, by 3.1 percent from FY 2013 to FY 2014, and by 1.7 percent from FY 2014 to FY 2015. Revenues increased from FY 2012 to FY 2015 for all types of hospitals (Appendix Table E-4). Large hospitals and hospitals with a high DSH percentage had the greatest growth in revenue, both about 11 percent, but the faster growth occurred mainly from FY 2012 to FY 2013—before implementation of the All-Payer Model.

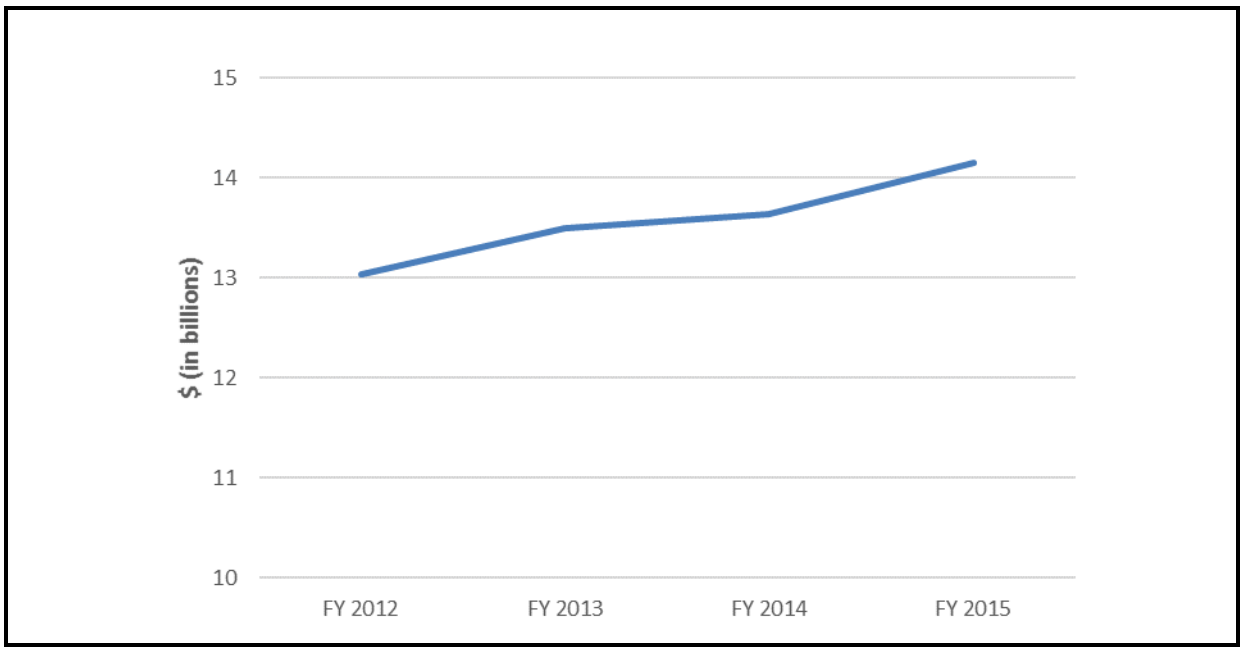
As shown in ***Figure 10***, trends for gross inpatient and outpatient revenues differed considerably and outpatient services accounted for a growing share of hospital revenues. Although inpatient services continued to account for the bulk of hospital revenues, inpatient services decreased from about 59 percent of gross revenues in FY 2012 to about 54 percent in FY 2015. Whereas inpatient revenues decreased by 2.8 percent from FY 2012 to FY 2015, outpatient revenues increased by 22.4 percent. There was no clear change in the trend for either type of service after the implementation of the All-Payer Model. Inpatient revenues decreased from FY 2012 to FY 2015 for all types of hospital except TPR hospitals, (less than 1% increase), large hospitals (2% increase), and high-DSH hospitals (3% increase) (Appendix Table E-5). Similarly, outpatient revenues increased for all types of hospitals from FY 2012 to FY 2015 (Appendix Table E-6). Teaching hospitals had the greatest growth at 30 percent. Moderate-DSH and large hospitals also had high growth of outpatient services revenue relative to other hospital types with 29 percent and 27 percent growth, respectively.

Figure 10
Gross patient revenue (in billions), all Maryland hospitals, FY 2012–FY 2015



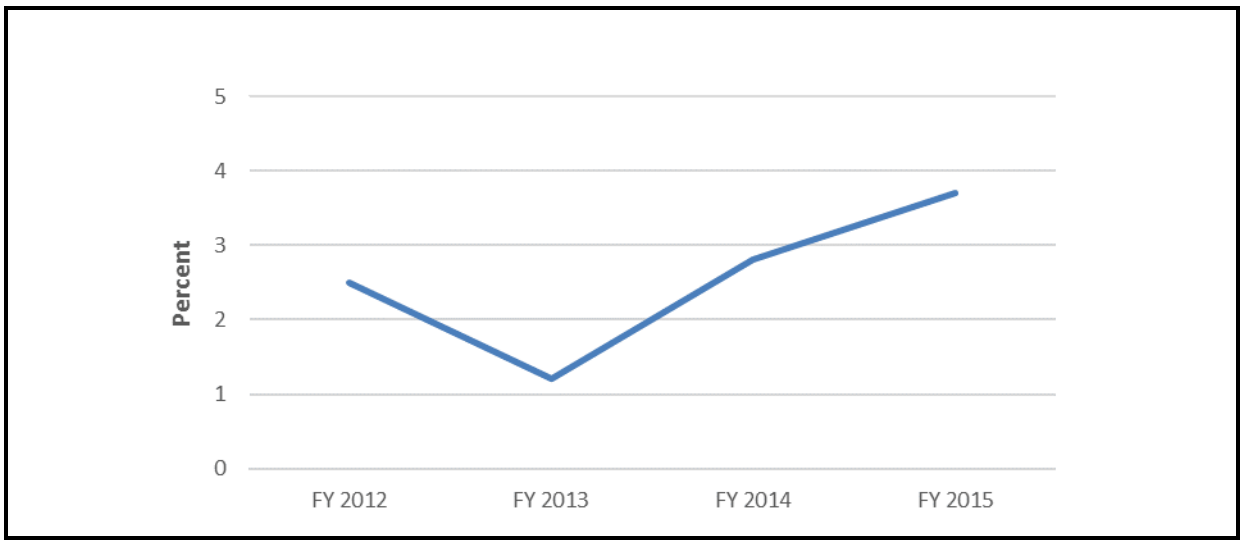
Total operating expenses for all Maryland hospitals grew slightly more rapidly than patient revenue, increasing by 8.5 percent from $13.0 billion in FY 2012 to $14.1 billion in FY 2015 (***Figure 11***). Operating expenses increased steadily over this time, although there was minimal growth from FY 2013 to FY 2014. Appendix Table E-7 shows trends in operating expenses by hospital characteristics. Large hospitals, teaching hospitals, high-DSH hospitals, and hospitals affiliated with a hospital system all had growth greater than 10 percent.

Figure 11
Total operating expenses (in billions), all Maryland hospitals, FY 2012–FY 2015



The All-Payer Model does not appear to have undermined the financial condition of Maryland hospitals. The operating margin for all Maryland hospitals combined increased after the implementation of the All-Payer Model (***Figure 12***), from 2.5 percent in FY 2012 to 3.7 percent in FY 2015. After decreasing to 1.2 percent in FY 2013, the operating margin grew in each of the two following years. Although there is considerable variability in operating margin by hospital characteristic, the operating margin grew from FY 2012 to FY 2015 for all types of hospitals except large hospitals (350 or more beds; Appendix Table E-8). Operating margins increased from the first to the second year of the All-Payer Model (FY 2014 to FY 2015) for nearly all types of hospitals, but they declined by a small amount (0.1%) for teaching hospitals and hospitals with a medium DSH percentage.

Figure 12
Operating margin percentages, all Maryland hospitals, FY 2012–FY 2015



3.3 Discussion

Although the overall rate of increase in hospital budgets slowed from FY 2015 to FY 2016 compared with the change from FY 2014 to FY 2015, hospitals were equally likely to remain within their budgets. However, in FY 2016 as in earlier years, some types of hospitals were less likely than others to remain within the 0.5 percent budget corridor. For example, in all 3 years, GBR hospitals were less likely than TPR hospitals to do so. Information collected in hospital site visits suggested that GBR hospitals had adopted less sophisticated strategies to adapt to global budgets than TPR hospitals that have longer experience with global budgets, which may contribute to their greater challenges with budget compliance. Since the implementation of the All-Payer Model, smaller hospitals have also been consistently less likely to operate within their budgets. There may be greater volatility in their patient volume (and, hence, revenue) because of their smaller size, but these hospitals also may have fewer resources to invest in developing strategies for operating under global budgets. Hospitals with high DSH percentages were also less likely to remain within their budgets and may have had less capacity to respond to the new demands of global budgets.

In FY 2016, hospitals continued to adjust the rates charged frequently during the course of the year to remain within their budgets. During site visits, hospital finance leaders described rate modifications as a critical tool for operating within global budgets. Although finance leaders reported that rate modifications were more common toward the end of the fiscal year as hospitals adjusted their revenues to hit their budget targets based on actual utilization during the year, unlike the first six quarters of the All-Payer Model, the number of hospitals with rate adjustments was fairly constant across the four quarters of FY 2016. Like in FY 2015, average rates charged over the course of the year in FY 2016 were closer to rate order amounts than the rates charged in the individual quarters. It appears that there continued to be volatility in charged rates during the course of the year as hospitals made frequent rate adjustments in response to short-run

volume fluctuations to ensure that they remained in compliance with their annual budgets. Hospitals adapted to the requirement to request permission to vary charges by more than 5 percent from the approved rate order, and most hospitals that did so requested permission early in FY 2016 rather than waiting until the end of the year as they did in FY 2015. Nonetheless, in FY 2016 many hospitals had greater than 10 percent rate variation, although this permission had not been granted, and more than half of the hospitals were assessed a penalty for rate noncompliance in FY 2016, although in some cases the amounts were modest. We also continued to find evidence that hospitals did not comply with the requirement to change rates for all rate centers in tandem.

Although total patient revenue in Maryland hospitals grew after implementation of the All-Payer Model, inpatient services account for a declining share and outpatient services are an increasing share. The shift from inpatient to outpatient services is consistent with hospital efforts described during site visits to establish new outpatient clinics and move unneeded care out of inpatient settings. However, it may also reflect broader market trends rather than a response to the All-Payer Model; other analyses showed that the proportion of Medicare revenue from inpatient admissions increased in Maryland hospitals after implementation of the All-Payer Model, while it remained flat in comparison hospitals (see ***Section 6***).

Despite constraints on hospital revenues imposed by global budgets, hospital operating margins increased after implementation of the All-Payer Model. This was the case for most types of hospitals, as well as for all Maryland hospitals combined. During site visits, hospital leaders described initiatives to improve the efficiency of their operations, such as increasing precision in nurse staffing levels, enhancing use of physician assistants, cross-training staff to work in different divisions in order to adapt more nimbly to changes in patient census, negotiating more aggressively with suppliers, and consolidating service lines across hospitals within a system.

SECTION 4
WHAT WAS THE IMPACT OF THE MARYLAND ALL-PAYER MODEL ON SERVICE UTILIZATION AND EXPENDITURES?

Key Takeaways for Service Utilization and Expenditures

- During the first 2 years of All-Payer Model implementation, per beneficiary Medicare expenditures in total and for hospital services overall declined more for Maryland beneficiaries relative to the comparison group. The relative decline in both total and hospital expenditures indicates that the model is reducing hospital costs without shifting costs to other parts of the Maryland health care system outside of the global budgets.
- Inpatient admissions declined more for Maryland Medicare beneficiaries than for the comparison group in the first 2 years of the All-Payer Model, but the payment per admission increased more in Maryland. The reduction in admissions could be related to Maryland hospitals' shifting routine and lower intensity services to nonhospital settings or to hospital programs that aim to improve care management.
- In contrast, the rate of outpatient ED visits decreased less for Maryland Medicare beneficiaries relative to the comparison group in the first 2 years of the model, but the payment per outpatient ED visit decreased in Maryland relative to the comparison group. Outpatient ED per beneficiary per month (PBPM) expenditures also increased less in Maryland relative to the comparison group. The increase in the ED visit rate is consistent with the declining admission rates if it reflects hospitals' success in reducing admissions of people seen in the ED. Although hospitals reported at least some investment in reducing ED use, the consensus was that more time was needed for changes by patients and clinicians to occur in order to see measurable differences in ED use. In addition, stakeholders reported that most Maryland hospitals have been slow to implement community partnerships that could help shift ED use to community physicians.

4.1 Research Questions

As hospitals respond to global budgets and other features of the Maryland All-Payer Model, utilization and expenditures for hospital services should change in response. In particular, inpatient admissions and outpatient ED use, which are the basis for PAU adjustments, are expected to decline. In addition to reducing the number of hospital admissions and ED visits, length of stay (LOS) for hospital admissions may also decline. On the other hand, LOS might increase if incentives to reduce hospital admissions increase case-mix severity.

Although the All-Payer model has stronger incentives to limit per capita hospital spending, these incentives are dampened in several ways. Perhaps most fundamentally, physician services are outside of the All-Payer Model. Unlike hospitals, physicians, who are compensated based on a FFS system, continue to have incentives to increase their patient volume, including

admitting patients to the hospital. The lack of alignment between physician and hospital incentives may limit hospitals' ability to control utilization, as physicians are drivers of hospital admissions. However, the All-Payer Model may also encourage other health system reform initiatives that better align physician and hospital incentives, such as ACOs, other gainsharing arrangements between hospitals and physicians, and meaningful health information exchange. Such reforms are expected to reduce utilization. Maryland is moving to a model that focuses on per capita total cost of care, which makes alignment of physician and hospital incentives even more critical. Anticipation of the eventual transition to a total-cost-of-care model may further encourage broader health system reforms.

Furthermore, hospital budgets are derived using base period revenues (and, hence, utilization), adjusted for a number of factors. Hospitals must bill for services to receive their budgeted revenue. If utilization decreases, hospitals can increase rates within a prescribed range to recover some of the lost revenue. The incentives to reduce utilization in order to retain savings are relatively limited and hospitals have an incentive to provide enough services to receive their full budget and maintain the market share on which future budgets will be set. However, penalties associated with PAU and QBR are intended to ensure that the "right" services are provided. Although incentives to reduce utilization below the levels on which the budget is based are limited, penalties for billing in excess of the hospital's budget create a strong disincentive to increase utilization.

Reductions in inpatient admissions and ED visits are expected to lead to overall reductions in hospital spending. Because hospital services are so expensive, reductions in hospital expenditures should cause total expenditures to also decrease. However, to the extent that nonhospital services are substituted for hospital services, the impact on total expenditures will be less than the savings from reduced hospital expenditures.

To assess the consequences of the All-Payer Model for utilization and expenditures, we addressed the following research questions:

- How did trends in utilization of and expenditures for hospital inpatient and ED services, as well as total expenditures for hospital and nonhospital services, change in Maryland after the implementation of the All-Payer Model relative to the comparison group?

- How did trends in beneficiary cost-sharing liability for hospital inpatient, ED, hospital outpatient department, and professional services,[18] as well as the total cost-sharing liability for all hospital and nonhospital services, change in Maryland after the implementation of the All-Payer Model relative to the comparison group?

[18] Includes physician and all other professional claims submitted on a CMS−1500 claim form in the carrier file (i.e., the physician/supplier Part B claims file).

4.2 Results

4.2.1 How Did Trends in Total and Total Hospital Expenditures Change in Maryland Medicare Beneficiaries after the Implementation of the All-Payer Model Relative to the Comparison Group?

- Overall total PBPM expenditures for Medicare beneficiaries declined by $16.60 more in Maryland relative to the comparison group after 2 years of the Maryland All-Payer Model. Likewise, total hospital PBPM expenditures declined by $11.32 more in Maryland relative to the comparison group.
- The relative decline in both total and hospital expenditures indicates that the model is reducing hospital costs without shifting costs to other parts of the Maryland health care system outside of the global budgets.

Figures 13 and ***14*** provide unadjusted quarterly average total and total hospital PBPM expenditures. Total hospital PBPM includes payments for inpatient facility, outpatient ED, and other hospital outpatient department services.

- For Medicare beneficiaries, average total PBPM expenditures were similar and remained fairly constant over the baseline and implementation periods for Maryland and the comparison group (***Figure 13***). Maryland consistently had slightly higher total PBPM expenditures than the comparison group throughout the baseline and All-Payer Model periods.

- Average total hospital PBPM expenditures were consistently higher in Maryland than in the comparison group (***Figure 14***). Total hospital expenditures exhibited seasonal variation, but there was a slight overall downward trend over the baseline and implementation periods.

Figure 13
Average total PBPM expenditures for first quarter 2011 through fourth quarter 2015 for Medicare beneficiaries in Maryland and the comparison group

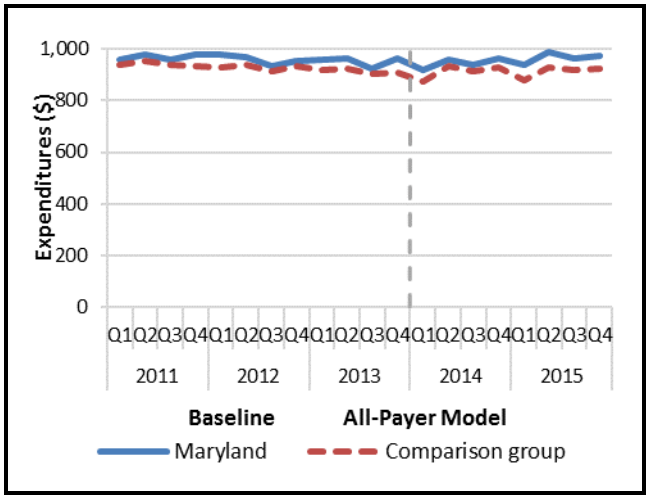
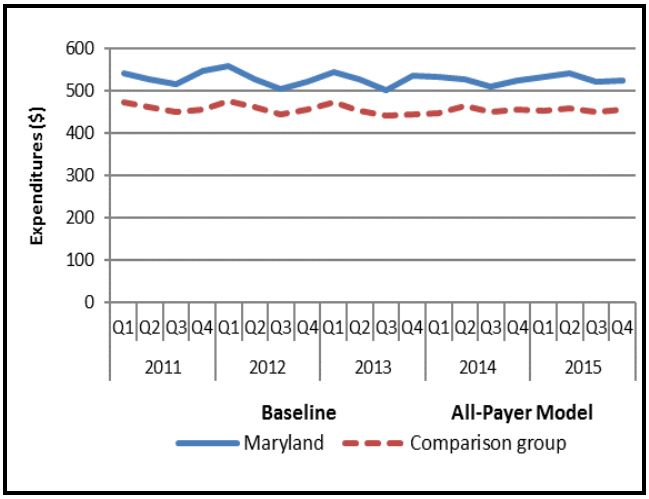


Figure 14
Average total hospital PBPM expenditures for first quarter 2011 through fourth quarter 2015 for Medicare beneficiaries in Maryland and the comparison group



NOTE: PBPM = Per beneficiary per month.

Table 2 presents the results of the D-in-D regression analyses for total and total hospital PBPM expenditures. The plots in ***Figures 15*** and ***16*** include 90 percent and 95 percent confidence intervals (CIs) around the estimated quarterly effects for the change in total and total hospital PBPM expenditures.

- Total PBPM expenditures declined statistically significantly more in Maryland than in the comparison group in the first and second years of All-Payer Model implementation and in the 2 years overall. The decrease in total expenditures from the baseline period over the first 2 years was $16.60 PBPM more in Maryland than in the comparison group ($p<0.001$). Results were similar in both implementation years.

- The decrease in total expenditures was driven in part by reductions in total hospital expenditures, which decreased in Maryland from the baseline period but remained fairly constant in the comparison group in the first 2 years of All-Payer Model implementation overall. Over the first 2 years, total hospital expenditures decreased by $11.32 PBPM in Maryland relative to the comparison group ($p<0.001$). Total hospital expenditures in Maryland decreased statistically significantly relative to the comparison group in both Year One and Year Two, and the magnitude of the difference grew over time.

- The decrease in total PBPM and total hospital expenditures was larger in Maryland than in the comparison group in all quarters of the All-Payer Model period except quarter 1. The difference in the change for both measures was statistically significant in quarters 2, 3, 4, 7, and 8; total hospital expenditures was also statistically significant in quarter 1. There was no consistent pattern in the magnitude of the difference for either measure over time (***Figures 15*** and ***16***).

Table 2
Difference in the pre-post change in total expenditures for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

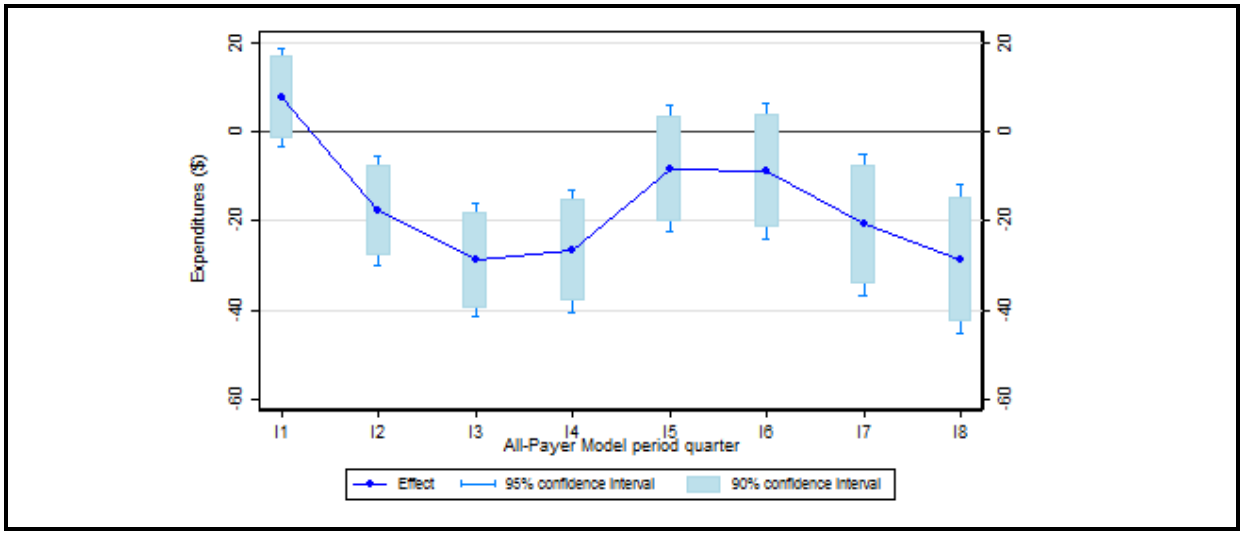
Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	Implementation period adjusted mean, Maryland	Implementation period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Total PBPM ($)							
Year One	950.94	919.47	932.96	917.89	−16.43 (−21.66, −11.19)	−1.7	0.000
Year Two	950.94	919.47	924.00	909.21	−16.78 (−23.28, −10.27)	−1.8	0.000
Overall	950.94	919.47	928.48	913.55	−16.60 (−20.77, −12.43)	−1.8	0.000
Total hospital PBPM ($)†							
Year One	527.77	452.78	521.26	455.64	−9.38 (−13.42, −5.34)	−1.8	0.000
Year Two	527.77	452.78	512.99	451.18	−13.26 (−18.26, −8.26)	−2.5	0.000
Overall	527.77	452.78	517.13	453.41	−11.32 (−14.54, −8.10)	−2.1	0.000

NOTE: PBPM = per beneficiary per month. A generalized linear model with an identity link and normal distribution was used to obtain estimates of the difference in expenditures. The same baseline period is used for the difference-in-differences (D-in-D) estimate for all implementation periods, so the adjusted mean is the same for each year and for the implementation period overall. For continuous outcomes estimated using linear models, the regression-adjusted D-in-D may not match exactly with the D-in-D calculated from the adjusted means because of rounding. A *negative* value for the regression-adjusted D-in-D corresponds to a *greater decrease* or a *smaller increase* in an outcome after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in an outcome in Maryland than in the comparison group. The relative difference is the D-in-D estimate as a percentage of Maryland's baseline period adjusted mean. The total weighted N for all PBPM models is 31,187,726.

† Total hospital PBPM includes payments for inpatient facility, outpatient ED, and other hospital outpatient department services.

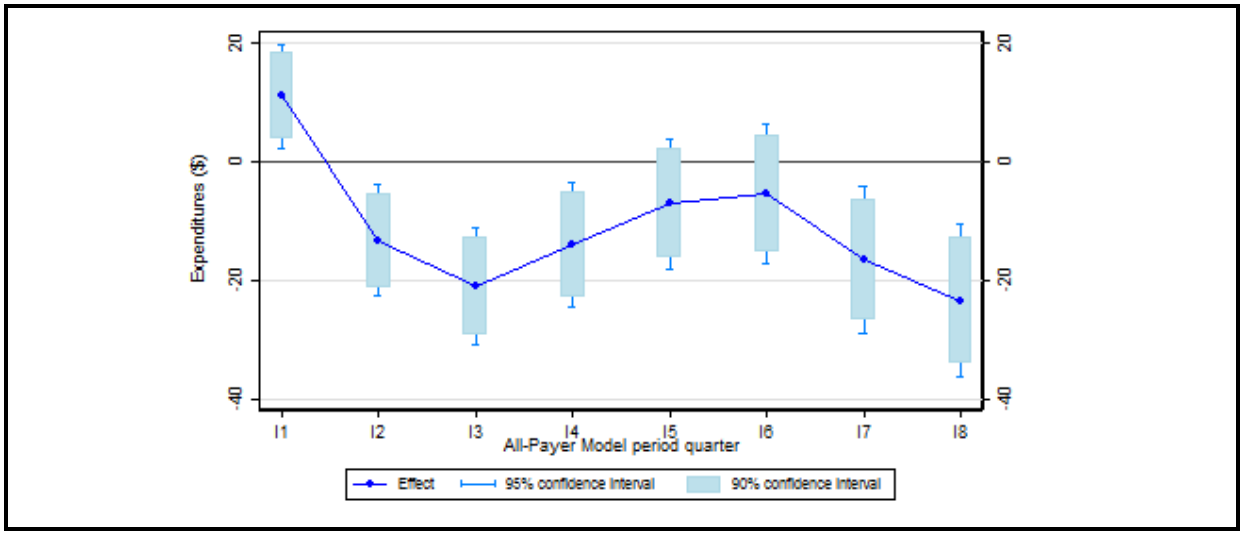
SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Figure 15
Difference in the pre-post change in total PBPM expenditures for Medicare beneficiaries in Maryland and the comparison group, first eight quarters of Maryland All-Payer Model implementation



NOTE: PBPM = per beneficiary per month. Bars indicate 90 percent CIs, and lines that extend beyond the bars indicate 95 percent CIs. CIs that do not cross the origin on the x-axis indicate statistically significant effect estimates; CIs that cross the origin denote statistically insignificant effects.

Figure 16
Difference in the pre-post change in total hospital PBPM expenditures for Medicare beneficiaries in Maryland and the comparison group, first eight quarters of Maryland All-Payer Model implementation



NOTE: PBPM = per beneficiary per month. Bars indicate 90 percent CIs, and lines that extend beyond the bars indicate 95 percent CIs. CIs that do not cross the origin on the x-axis indicate statistically significant effect estimates; CIs that cross the origin denote statistically insignificant effects.

4.2.2 How Did Trends in Hospital Inpatient Utilization and Expenditures Change in Maryland Medicare Beneficiaries Relative to the Comparison Group after the Implementation of the All-Payer Model?

- Inpatient admissions declined by 1.5 more admissions per 1,000 Medicare beneficiaries for Maryland relative to the comparison group in the first 2 years of the All-Payer Model. The relative decline could be related to Maryland hospitals' shifting routine and lower-intensity services to nonhospital settings, as reported by hospital leaders, or it could also be due in part to hospital programs to moderate utilization by improving care management.
- However, payment per admission increased by $368 more in Maryland. This may suggest that Medicare patients who are admitted in Maryland are sicker and require more resource-intensive care or it could be due to hospitals adjusting rates to regain some of the lost revenue from a decrease in utilization as permitted in order to meet their global budgets.
- During the first 2 years of implementation, the change in overall inpatient facility PBPM expenditures and LOS did not differ between Maryland and the comparison group.

Figures 17 and ***18*** show, for Maryland and the comparison group, the unadjusted rate of inpatient admissions per 1,000 Medicare beneficiaries and inpatient expenditures by quarter.

- The rate of acute inpatient admissions for Medicare beneficiaries was similar in Maryland and the comparison group throughout the baseline and implementation periods. The rate decreased during the baseline period and then leveled out during the implementation period for both Maryland and the comparison group (***Figure 17***).

- Average inpatient facility PBPM expenditures were consistently higher in Maryland than in the comparison group (***Figure 18***). Throughout the baseline and implementation period, average inpatient facility PBPM expenditures declined slightly for both groups.

Figure 17
All-cause acute inpatient admissions per 1,000 Medicare beneficiaries for first quarter 2011 through fourth quarter 2015 in Maryland and the comparison group

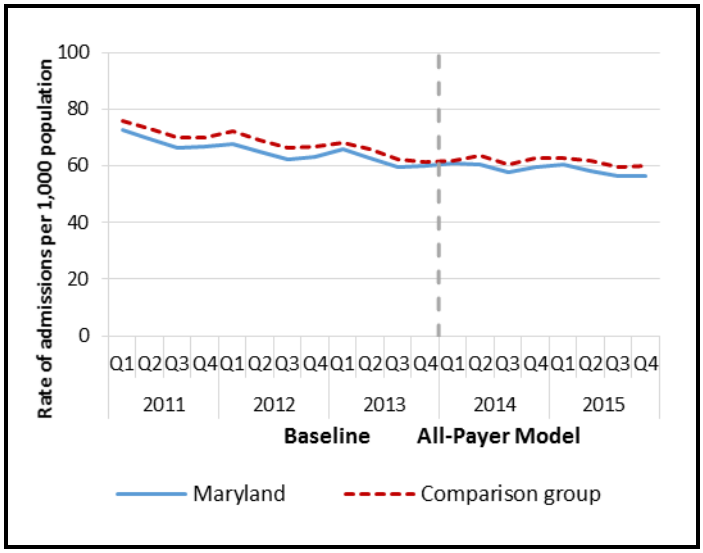


Figure 18
Average inpatient facility PBPM expenditures for first quarter 2011 through fourth quarter 2015 for Medicare beneficiaries in Maryland and the comparison group

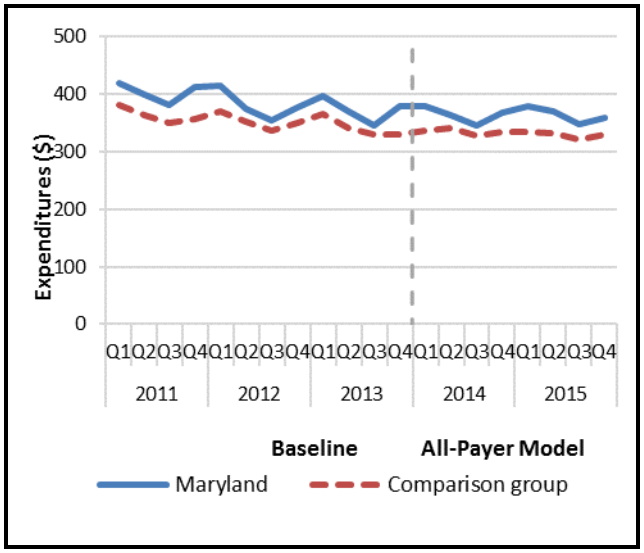


Table 3 shows the results of the D-in-D regression analyses for the quarterly rate of inpatient use per 1,000 Medicare beneficiaries, inpatient LOS, inpatient expenditures, and payments per inpatient admission for Maryland relative to the comparison group. The plots in ***Figures 19*** and ***20*** include 90 percent and 95 percent CIs around the estimated quarterly effects for the change in the inpatient admission rate and the change in the inpatient facility expenditures, respectively.

- The quarterly inpatient admission rate decreased from the baseline period in both Maryland and the comparison group during the first 2 years of the All-Payer Model implementation, but it decreased more in Maryland. The difference in the change was statistically significant; however, the magnitude of the relative difference was small. During the first 2 years of the All-Payer Model implementation period overall, the inpatient admission rate decreased by 1.5 admissions per 1,000 Medicare beneficiaries more in Maryland than in the comparison group ($p<0.001$). The magnitude of the difference grew over most of the first eight quarters of the All-Payer Model implementation (***Figure 19***).

- The average inpatient LOS increased more for Maryland beneficiaries than for comparison group beneficiaries in the first year of the All-Payer Model implementation, but the difference was small (0.048 days, $p<0.10$). There were no statistically significant differences in the change in LOS in Year Two or the first 2 years overall.

- The increase from the baseline period in the payment per inpatient admission was larger in Maryland than in the comparison group in the first 2 years after implementation of the All-Payer Model. During the first 2 years overall, the average payment in Maryland increased by $368 relative to the comparison group ($p<0.001$). The increase in Maryland was larger than in the comparison group in both years and the difference increased from Year One to Year Two.

- There was no significant difference in the change in inpatient facility PBPM expenditures in either year or overall. The difference between Maryland and the comparison group in the decrease in inpatient facility PBPM expenditures fluctuated over the first eight quarters of the All-Payer Model implementation (***Figure 20***). The decrease was statistically significantly smaller in Maryland relative to the comparison group in quarters 1 and 5 of the All-Payer Model period, and the decrease was statistically significantly larger in Maryland in quarter 3 of the All-Payer Model period.

Table 3
Difference in the pre-post change in inpatient utilization and expenditures for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	Implementation period adjusted mean, Maryland	Implementation period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
All-cause acute inpatient admissions per 1,000 population							
Year One	41.5	44.6	36.6	39.7	−0.5 (−0.8, −0.1)	−1.1	0.049
Year Two	41.5	44.6	34.1	38.4	−2.4 (−2.9, −2.0)	−5.8	0.000
Overall	41.5	44.6	35.4	39.0	−1.5 (−1.8, −1.1)	−3.5	0.000
Acute inpatient length of stay							
Year One	6.47	6.24	6.52	6.25	0.048 (0.0075, 0.088)	0.7	0.050
Year Two	6.47	6.24	6.43	6.20	0.0067 (−0.041, 0.054)	0.1	0.828
Overall	6.47	6.24	6.48	6.22	0.027 (−0.0036, 0.058)	0.4	0.146
Inpatient facility PBPM ($)							
Year One	394.03	348.18	381.59	336.42	−0.67 (−4.46,3.11)	−0.2	0.782
Year Two	394.03	348.18	375.08	327.61	1.55 (−3.09, 6.19)	0.4	0.594
Overall	394.03	348.18	378.33	332.01	0.44 (−2.55,3.43)	0.1	0.821

(continued)

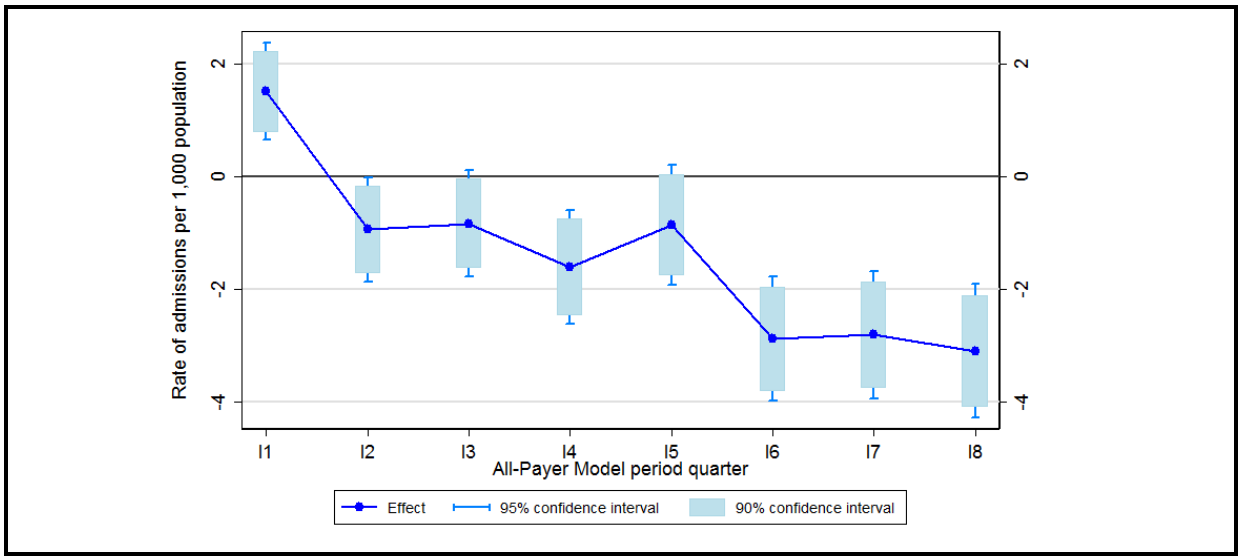
Table 3 (continued)
Difference in the pre-post change in inpatient utilization and expenditures for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	Implementation period adjusted mean, Maryland	Implementation period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Payment per inpatient admission ($)							
Year One	13,749.95	10,664.24	14,415.38	11,153.54	177.26 (78.45, 276.06)	1.3	0.0032
Year Two	13,749.95	10,664.24	14,942.58	11,295.18	562.88 (442.73, 683.02)	4.1	0.0000
Overall	13,749.95	10,664.24	14,678.98	11,224.36	367.91 (290.29, 445.52)	2.7	0.0000

NOTE: A logistic regression model was used to obtain estimates of the differences in probability of an acute inpatient admission. The probability of any admission estimate is multiplied by 1,000 to obtain an approximate rate per 1,000 beneficiaries. A generalized linear model with an identity link and normal distribution was used to obtain estimates of the difference in length of stay. The same baseline period is used for the difference-in-differences (D-in-D) estimate for all implementation periods, so the adjusted mean is the same for each year and for the implementation period overall. For continuous outcomes estimated using linear models, the regression-adjusted D-in-D may not match exactly with the D-in-D calculated from the adjusted means because of rounding. For binary outcomes estimated using nonlinear models, the regression-adjusted D-in-D is calculated as the average treatment effect *on the treated*, whereas the D-in-D derived from the adjusted means represents the average treatment effect. As a result, the regression-adjusted D-in-D and the D-in-D calculated from the adjusted means will differ. A *negative* value for the regression-adjusted D-in-D corresponds to a *greater decrease* or a *smaller increase* in an outcome after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in an outcome in Maryland than in the comparison group. The relative difference is the D-in-D estimate as a percentage of Maryland's baseline period adjusted mean. The total weighted N for the inpatient admission rate model is 31,627,441. The total weighted N for the acute inpatient length of stay model is 2,564,942. The total weighted N for all PBPM models is 31,187,726.

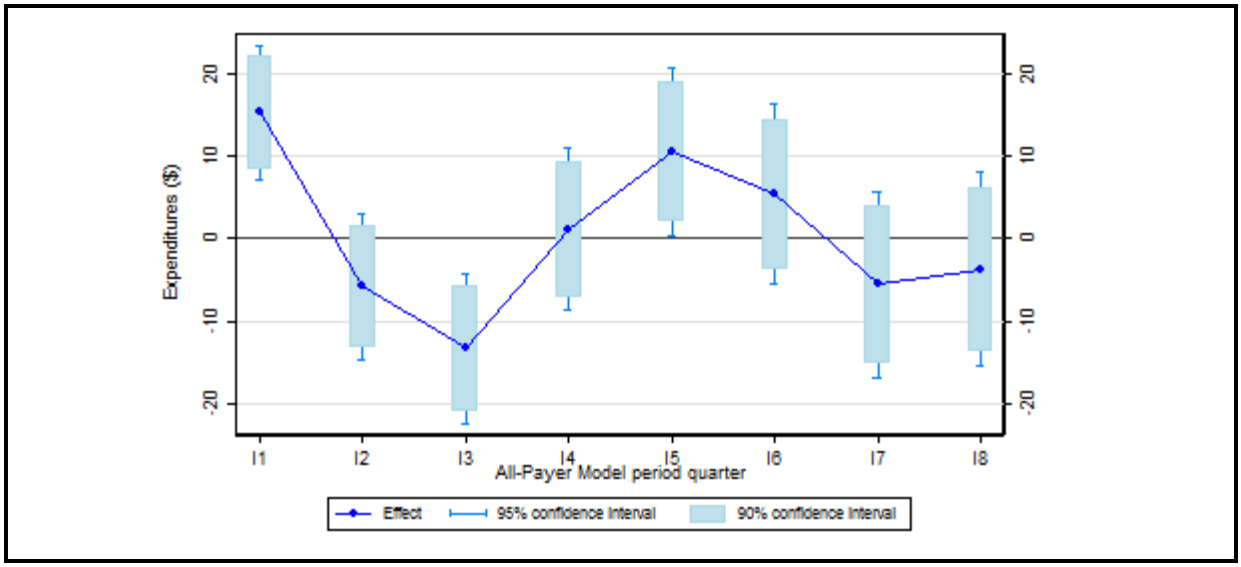
SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Figure 19
Difference in the pre-post change in all-cause acute inpatient admissions per 1,000 Medicare beneficiaries in Maryland and the comparison group, first eight quarters of Maryland All-Payer Model implementation



NOTE: Bars indicate 90 percent CIs, and lines that extend beyond the bars indicate 95 percent CIs. CIs that do not cross the origin on the x-axis indicate statistically significant effect estimates; CIs that cross the origin denote statistically insignificant effects.

Figure 20
Difference in the pre-post change in inpatient facility PBPM expenditures for Medicare beneficiaries in Maryland and the comparison group, first eight quarters of Maryland All-Payer Model implementation



NOTE: PBPM = per beneficiary per month. Bars indicate 90 percent CIs, and lines that extend beyond the bars indicate 95 percent CIs. CIs that do not cross the origin on the x-axis indicate statistically significant effect estimates; CIs that cross the origin denote statistically insignificant effects.

4.2.3 How Did Trends in Outpatient Emergency Department Utilization and Expenditures Change in Maryland Medicare Beneficiaries after the Implementation of the All-Payer Model Relative to the Comparison Group?

- The rate of outpatient ED visits for Medicare beneficiaries increased by 2 more visits per 1,000 Medicare beneficiaries in Maryland than in the comparison group. There was no significant difference in the change in the rate of observation stays in the first 2 years overall. The increase in the ED visit rate could reflect hospitals' success in reducing admissions of people seen in the ED. Although during site visits hospitals reported at least some investment in reducing ED use, the consensus was that more time was needed to allow changes by patients and clinicians to occur in order to see measurable differences in ED use. This finding also corroborates the perception of stakeholders that most Maryland hospitals have been slow to implement community partnerships that could help shift ED use to community physicians.
- However, the payment per outpatient ED visit declined in Maryland relative to the comparison group, indicating either that ED visits were less resource intensive during the implementation period or that hospitals were adjusting their rates to avoid exceeding their global budget.
- In addition, overall outpatient ED PBPM and other hospital outpatient PBPM expenditures also grew more slowly in Maryland relative to the comparison group, suggesting that hospitals may be responding to the All-Payer Model in part by reducing provision of outpatient services. This is supported by hospital leaders' reports that routine and lower-intensity services were being shifted to nonregulated, nonhospital settings.

Figures 21 through ***23*** show, for Maryland and the comparison group, the unadjusted rate of outpatient ED visits per 1,000 Medicare beneficiaries, outpatient ED expenditures, and other hospital outpatient expenditures by quarter.

- The rate of outpatient ED visits for Medicare beneficiaries was similar in Maryland and the comparison group throughout the baseline period (***Figure 21***). The ED visit rate showed some seasonal fluctuations, but it generally trended slightly upward for both Maryland and the comparison group throughout the baseline period. The upward trend continued for both groups through the implementation period; however, the ED visit rate increased slightly faster for Maryland beneficiaries.

- Average outpatient ED PBPM and other hospital outpatient department PBPM expenditures were consistently higher in Maryland than in the comparison group (***Figures 22*** and ***23***). Throughout the baseline and implementation period, outpatient ED and other hospital outpatient department expenditures increased.

Figure 21
Emergency department visits that did not lead to a hospitalization per 1,000 Medicare beneficiaries for first quarter 2011 through fourth quarter 2015 in Maryland and the comparison group

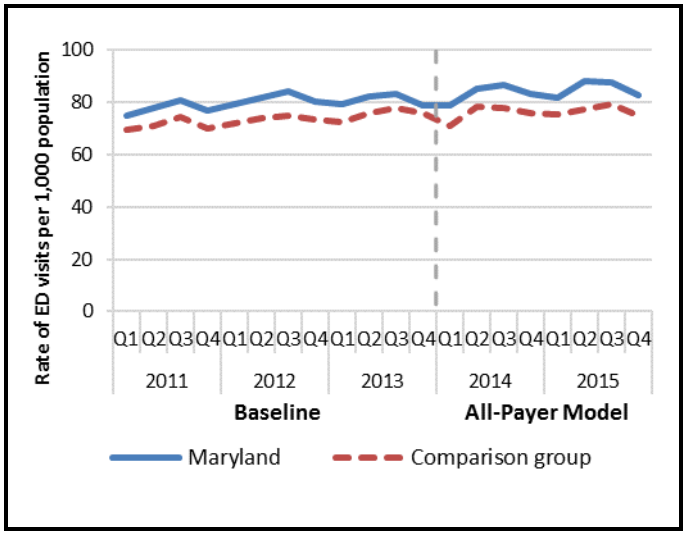


Figure 22
Average outpatient emergency department PBPM expenditures for first quarter 2011 through fourth quarter 2015 for Medicare beneficiaries in Maryland and the comparison group

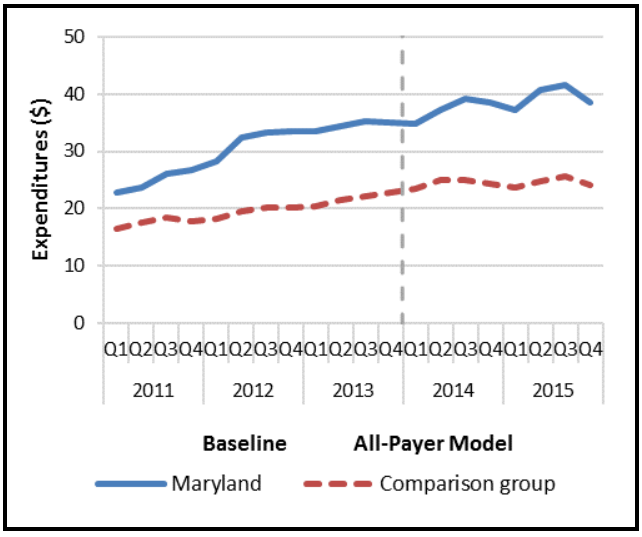
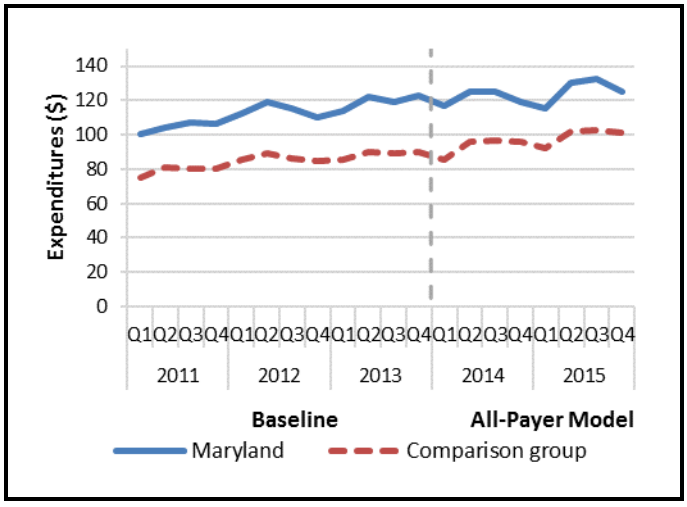


Figure 23
Average hospital outpatient department PBPM expenditures for first quarter 2011 through fourth quarter 2015 for Medicare beneficiaries in Maryland and the comparison group



NOTE: ED = emergency department, PBPM = Per beneficiary per month.

Table 4 shows the results of the D-in-D regression analyses for the quarterly rate of outpatient ED visits and observations stays per 1,000 Medicare beneficiaries, outpatient ED expenditures, other hospital outpatient expenditures, and payment per outpatient ED visit for Maryland relative to the comparison group. The plots in ***Figures 24, 25,*** and ***26*** include 90 percent and 95 percent CIs around the estimated quarterly effects for the change in the outpatient ED visit rate, outpatient ED expenditures, and other hospital outpatient expenditures, respectively.

- There was a larger increase from the baseline period in the quarterly outpatient ED visit rate in Maryland than in the comparison group in the first 2 years of the All-Payer Model implementation, although the magnitude of the relative difference was small. Overall, outpatient ED visits increased by 2 visits per 1,000 Medicare beneficiaries more in Maryland than in the comparison group after All-Payer Model implementation ($p<0.001$). The difference was larger in Year One than in Year Two. The increase in the outpatient ED visit rate was larger in Maryland than in the comparison group for each of the first eight quarters of the All-Payer model period (***Figure 24***). The quarterly estimates did not show a trend to increases or decreases in the relative change over time. The difference in the change for Maryland relative to the comparison group was statistically significant for all but the fifth and the seventh quarter.

- There was no significant difference in the change in the rate of observation stays in the first two years overall. However, the rate of observation stays increased more in Maryland than in the comparison group in Year 1 and the rate increased less in Maryland relative to the comparison group in Year 2.

- The change in total hospital expenditures noted above was due to slower growth in outpatient ED and other hospital outpatient department PBPM expenditures. Outpatient ED and other hospital outpatient department PBPM expenditures increased less in Maryland than in the comparison group in the 2 years of All-Payer Model implementation overall ($4.20 and $7.57 PBPM smaller increase, respectively, $p<0.0001$) and in Year One and Year Two individually. The size of the relative reduction was larger in Year Two for both measures. The increase in both measures was statistically significantly smaller in Maryland relative to the comparison group in all quarters of the first 2 years of the All-Payer Model period, with the exception of the first quarter for other hospital outpatient department PBPM expenditures (***Figures 25*** and ***26***). However, there is not a pattern of increasing reductions in Maryland relative to the comparison group over time.

- The average payment per outpatient ED visit decreased from the baseline period in Maryland, but it increased in the comparison group in each year of the All-Payer Model implementation period. Overall, the payment per ED visit decreased by $134 in Maryland relative to the comparison group ($p<0.001$).

Table 4
Difference in the pre-post change in outpatient hospital utilization for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	Implementation period adjusted mean, Maryland	Implementation period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
ED visits that did not lead to a hospitalization per 1,000 population							
Year One	66.7	61.4	70.2	62.6	2.5 (2.0, 2.9)	3.7	0.000
Year Two	66.7	61.4	71.3	64.3	1.6 (1.1, 2.2)	2.4	0.000
Overall	66.7	61.4	70.7	63.5	2.1 (1.7, 2.4)	3.1	0.000
Observation stays per 1,000 population							
Year One	7.9	11.0	9.3	12.5	0.47 (0.25, 0.68)	5.9	0.000
Year Two	7.9	11.0	8.9	12.9	−0.76 (−1.04, −0.47)	−9.5	0.000
Overall	7.9	11.0	9.1	12.7	−0.14 (−0.32, 0.04)	−1.8	0.190
Outpatient ED PBPM ($)							
Year One	25.40	19.93	26.94	25.03	−3.56 (−3.90, −3.22)	−14.0	0.000
Year Two	25.40	19.93	25.85	25.20	−4.83 (−5.22, −4.43)	−19.0	0.000
Overall	25.40	19.93	26.40	25.11	−4.20 (−4.45, −3.94)	−16.5	0.000

(continued)

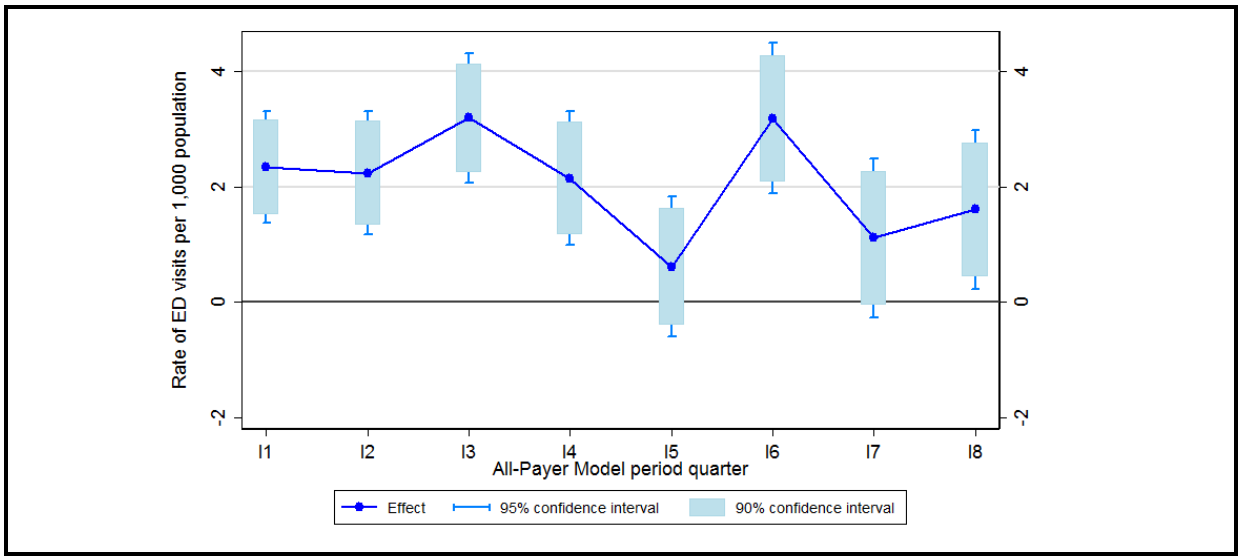
Table 4 (continued)
Difference in the pre-post change in outpatient hospital utilization for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	Implementation period adjusted mean, Maryland	Implementation period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Other hospital outpatient department PBPM ($)							
Year One	108.36	84.69	112.75	94.22	−5.15 (−6.24, −4.05)	−4.8	0.000
Year Two	108.36	84.69	112.08	98.39	−9.98 (−11.42, −8.54)	−9.2	0.000
Overall	108.36	84.69	112.41	96.31	−7.57 (−8.47, −6.66)	−7.0	0.000
Payment per outpatient ED visit ($)							
Year One	686.91	576.58	680.20	690.53	−121.00 (−128.50, −113.51)	−17.6	0.000
Year Two	686.91	576.58	642.04	679.03	−147.34 (−155.88, −138.79)	−21.5	0.000
Overall	686.91	576.58	661.12	684.78	−134.31 (−140.00, −128.62)	−19.6	0.000

NOTE: ED = emergency department. A logistic regression model was used to obtain estimates of the differences in probability of an acute inpatient admission and in the probability of an ED visit that did not lead to a hospitalization. The probability of any ED visit estimates is multiplied by 1,000 to obtain an approximate rate per 1,000 beneficiaries. A generalized linear model with an identity link and normal distribution was used to obtain estimates of the difference in length of stay. The same baseline period is used for the difference-in-differences (D-in-D) estimate for all implementation periods, so the adjusted mean is the same for each year and for the implementation period overall. For continuous outcomes estimated using linear models, the regression-adjusted D-in-D may not match exactly with the D-in-D calculated from the adjusted means because of rounding. For binary outcomes estimated using nonlinear models, the regression-adjusted D-in-D is calculated as the average treatment effect *on the treated*, whereas the D-in-D derived from the adjusted means represents the average treatment effect. As a result, the regression-adjusted D-in-D and the D-in-D calculated from the adjusted means will differ. A *negative* value for the regression-adjusted D-in-D corresponds to a *greater decrease* or a *smaller increase* in an outcome after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in an outcome in Maryland than in the comparison group. The relative difference is the D-in-D estimate as a percentage of Maryland's baseline period adjusted mean. The total weighted N for the ED visit rate models is 31,627,441. The total weighted N for all PBPM models is 31,187,726.

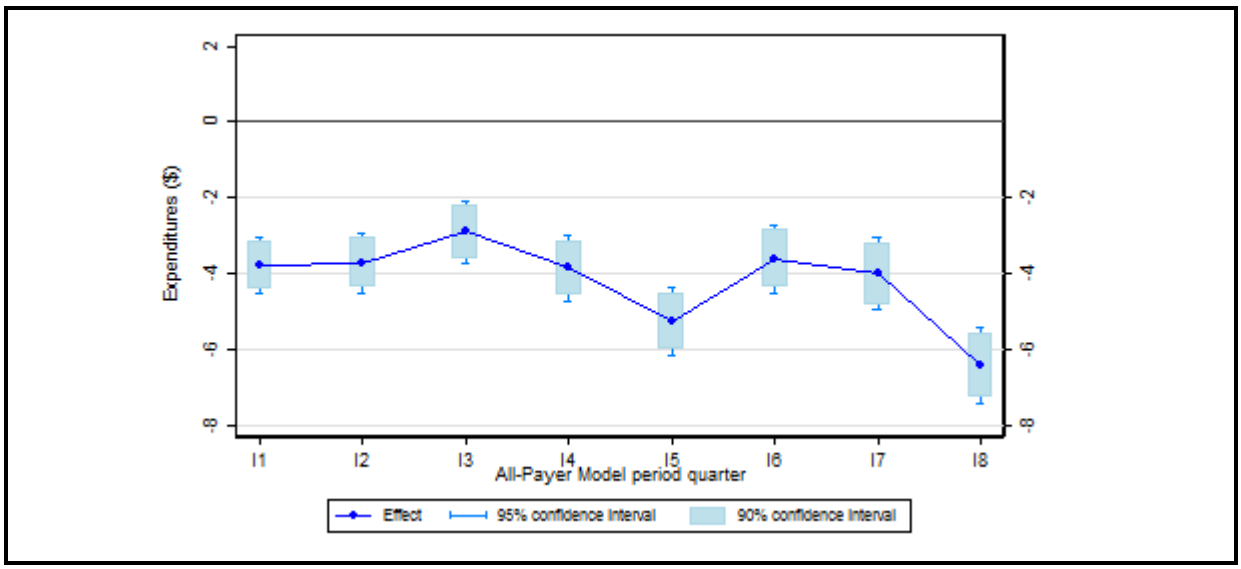
SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Figure 24
Difference in the pre-post change in ED visits that did not lead to a hospitalization (excluding observation stays) per 1,000 Medicare beneficiaries in Maryland and the comparison group, first eight quarters of Maryland All-Payer Model implementation



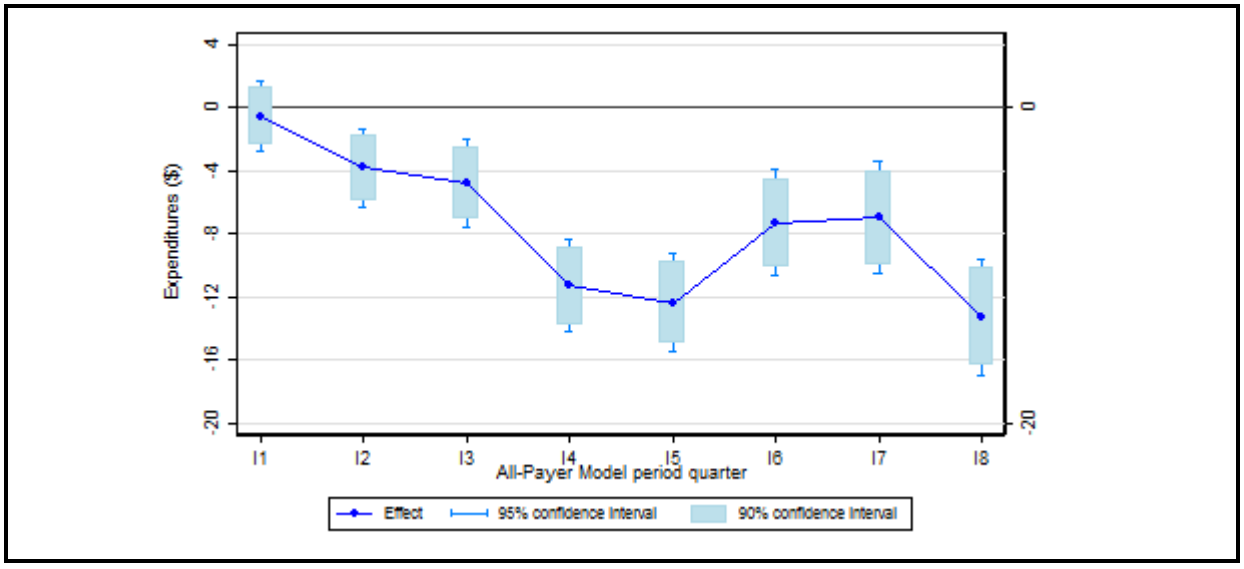
NOTE: ED = emergency department. Bars indicate 90 percent CIs, and lines that extend beyond the bars indicate 95 percent CIs. CIs that do not cross the origin on the x-axis indicate statistically significant effect estimates; CIs that cross the origin denote statistically insignificant effects.

Figure 25
Difference in the pre-post change in outpatient ED PBPM expenditures for Medicare beneficiaries in Maryland and the comparison group, first eight quarters of Maryland All-Payer Model implementation



NOTE: ED = emergency department; PBPM = per beneficiary per month. Bars indicate 90 percent CIs, and lines that extend beyond the bars indicate 95 percent CIs. CIs that do not cross the origin on the x-axis indicate statistically significant effect estimates; CIs that cross the origin denote statistically insignificant effects.

Figure 26
Difference in the pre-post change in other hospital outpatient department PBPM expenditures for Medicare beneficiaries in Maryland and the comparison group, first eight quarters of Maryland All-Payer Model implementation



NOTE: PBPM = per beneficiary per month. Bars indicate 90 percent CIs, and lines that extend beyond the bars indicate 95 percent CIs. CIs that do not cross the origin on the x-axis indicate statistically significant effect estimates; CIs that cross the origin denote statistically insignificant effects.

4.2.4 How Did Trends in Nonhospital Expenditures Change in Maryland Medicare Beneficiaries after the Implementation of the All-Payer Model Relative to the Comparison Group?

- After 2 years of implementation, we found that spending for physician services in both regulated and nonregulated settings and other services, such as outpatient, home health, and skilled nursing facility expenditures, all declined in Maryland relative to the comparison group.
- The relative decline in regulated and non-regulated physician and other services indicates that Maryland is not reducing hospital spending by shifting costs to other parts of the Maryland health care system outside of the global budgets.

Table 5 presents the results of the D-in-D regression analyses for the nonhospital expenditure measures.

- There was a statistically significant decrease in professional PBPM expenditures in Maryland relative to the comparison group. During the first 2 years of the All-Payer Model overall, professional PBPM expenditures declined slightly from the baseline period and decreased significantly relative to the comparison group ($2.68 greater decrease, $p<0.001$). In the regulated setting, physician payments declined in Maryland over time during the first 2 years overall and relative to the comparison group, where an increase was observed ($1.26 PBPM relative reduction, $p<0.001$); in the unregulated setting, physician payment increased for both Maryland and the comparison group, but it increased by a smaller amount in Maryland ($1.42 PBPM smaller increase, $p<0.01$). Although there were statistically significant reductions in Maryland relative to the comparison group in both Year One and Year Two for professional expenditures in total and in regulated settings, there was a significant difference only in Year One for services in unregulated settings.

- Other expenditures decreased from the baseline period in Maryland and the comparison group during the first 2 years of implementation overall, but the decrease was statistically significantly larger in Maryland ($2.56 greater decrease, $p<0.001$) and in Year One and Year Two individually. The decrease in Maryland relative to the comparison group was larger in Year One than in Year Two.

Table 5
Difference in the pre-post change in nonhospital expenditures for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	Implementation period adjusted mean, Maryland	Implementation period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Professional PBPM ($)							
Year One	239.59	244.57	238.12	247.01	−3.91 (−4.92, −2.90)	−1.6	0.000
Year Two	239.59	244.57	239.97	246.40	−1.45 (−2.72, −0.17)	−0.6	0.062
Overall	239.59	244.57	239.05	246.71	−2.68 (−3.49, −1.87)	−1.1	0.000
Professional PBPM—regulated settings ($)							
Year One	61.54	74.21	59.80	73.22	−0.75 (−1.23, −0.26)	−1.2	0.011
Year Two	61.54	74.21	57.14	71.57	−1.77 (−2.36, −1.18)	−2.9	0.000
Overall	61.54	74.21	58.47	72.39	−1.26 (−1.64, −0.88)	−2.0	0.000
Professional PBPM—unregulated settings ($)							
Year One	178.06	170.36	178.33	173.79	−3.16 (−3.99, −2.34)	−1.8	0.000
Year Two	178.06	170.36	182.84	174.84	0.32 (−0.73, 1.38)	0.2	0.627
Overall	178.06	170.36	180.58	174.32	−1.42 (−2.09, −0.75)	−0.8	0.001

(continued)

Table 5 (continued)
Difference in the pre-post change in nonhospital expenditures for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	Implementation period adjusted mean, Maryland	Implementation period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Other PBPM ($)[†]							
Year One	184.03	222.38	174.05	215.53	−3.13 (−4.57, −1.70)	−1.7	0.000
Year Two	184.03	222.38	171.60	211.92	−1.98 (−3.81, −0.16)	−1.1	0.074
Overall	184.03	222.38	172.83	213.72	−2.56 (−3.72, −1.40)	−1.4	0.000

NOTE: PBPM = per beneficiary per month. A generalized linear model with an identity link and normal distribution was used to obtain estimates of the difference in expenditures. The same baseline period is used for the difference-in-differences (D-in-D) estimate for all implementation periods, so the adjusted mean is the same for each year and for the implementation period overall. For continuous outcomes estimated using linear models, the regression-adjusted D-in-D may not match exactly with the D-in-D calculated from the adjusted means because of rounding. A *negative* value for the regression-adjusted D-in-D corresponds to a *greater decrease* or a *smaller increase* in an outcome after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in an outcome in Maryland than in the comparison group. The relative difference is the D-in-D estimate as a percentage of Maryland's baseline period adjusted mean. The total weighted N for all PBPM models is 31,187,726.

[†] Other PBPM includes payments for noninpatient and other services, including those made for outpatient, home health, hospice, and skilled nursing facility services, along with durable medical equipment payments.

SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

4.2.5 How Did Trends in Beneficiary Cost-Sharing Liability Change in Maryland after the Implementation of the All-Payer Model Relative to the Comparison Group?

- Because beneficiary cost sharing is closely linked with Medicare expenditures, out-of-pocket costs in total and for outpatient ED and other hospital outpatient department services likewise declined for Maryland beneficiaries relative to those in the comparison group during the implementation period.
- There was also a small decrease in beneficiary cost sharing for inpatient facility services relative to the comparison group, despite the absence of a difference in Medicare expenditures for these services. The decline in beneficiary cost sharing for inpatient services, which is a deductible rather than a copayment for the first 60 days of an inpatient stay, reflects the reduction in the admission rate.

Medicare beneficiary cost-sharing liability is closely associated with Medicare expenditures. As a result, any reductions (or increases) in Medicare expenditures as a result of the All-Payer Model also affect beneficiaries' out-of-pocket costs. Although these effects are driven by the effects on Medicare expenditures, to obtain a direct measure we estimated All-Payer Model effects on beneficiary cost-sharing liability for total, inpatient facility, outpatient ED, hospital outpatient, and professional services. ***Table 6*** presents the results of the D-in-D regression analyses for the beneficiary cost-sharing measures.

- In the first 2 years of All-Payer Model implementation overall, total beneficiary cost sharing decreased slightly from the baseline period in Maryland, while it increased in the comparison group. There was a statistically significant decrease in total beneficiary cost sharing in Maryland relative to the comparison group in the first 2 years of All-Payer Model implementation ($3.53 PBPM decrease, $p<0.001$) and in Year One and Year Two individually.

- There was a statistically significantly greater reduction in beneficiary cost sharing for inpatient facility services in Maryland than in the comparison group over the 2-year implementation period overall ($0.95 PBPM greater reduction, $p<0.001$) and in each of the first two implementation years.

- Beneficiary cost sharing for outpatient ED visits increased in Maryland and in the comparison group in the first 2 years after the implementation of the All-Payer Model overall, but it increased more slowly in Maryland, resulting in a $1.01 PBPM decrease in Maryland relative to the comparison group ($p<0.001$). The growth was statistically significantly slower in Maryland than in the comparison group in both Year One and Year Two.

Table 6
Difference in the pre-post change in beneficiary cost sharing for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	Implementation period adjusted mean, Maryland	Implementation period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Total PBPM ($)							
Year One	154.09	151.48	154.17	155.12	−3.57 (−4.23, −2.90)	−2.3	0.000
Year Two	154.09	151.48	152.61	153.48	−3.49 (−4.33, −2.66)	−2.3	0.000
Overall	154.09	151.48	153.39	154.30	−3.53 (−4.07, −2.99)	−2.3	0.000
Inpatient facility PBPM ($)							
Year One	24.25	26.82	22.94	26.12	−0.61 (−0.87, −0.35)	−2.5	0.000
Year Two	24.25	26.82	22.24	26.11	−1.30 (−1.62, −0.98)	−5.4	0.000
Overall	24.25	26.82	22.59	26.11	−0.95 (−1.16, −0.75)	−3.9	0.000
Outpatient ED PBPM ($)							
Year One	6.29	5.33	6.85	6.80	−0.91 (−0.99, −0.84)	−14.5	0.000
Year Two	6.29	5.33	6.67	6.81	−1.11 (−1.20, −1.02)	−17.6	0.000
Overall	6.29	5.33	6.76	6.81	−1.01 (−1.07, −0.95)	−16.0	0.000

(continued)

Table 6 (continued)
Difference in the pre-post change in beneficiary cost sharing for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	Implementation period adjusted mean, Maryland	Implementation period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Other hospital outpatient department PBPM ($)							
Year One	26.29	21.67	26.77	23.58	−1.43 (−1.70, −1.16)	−5.4	0.000
Year Two	26.29	21.67	26.26	23.31	−1.66 (−2.01, −1.31)	−6.3	0.000
Overall	26.29	21.67	26.52	23.44	−1.55 (−1.77, −1.32)	−5.9	0.000
Professional PBPM ($)							
Year One	66.25	67.09	66.81	67.96	−0.31 (−0.56, −0.05)	−0.5	0.045
Year Two	66.25	67.09	66.74	67.24	0.34 (0.01, 0.66)	0.5	0.086
Overall	66.25	67.09	66.78	67.60	0.013 (−0.19, 0.22)	0.02	0.924

NOTE: ED = emergency department; PBPM = per beneficiary per month. A generalized linear model with an identity link and normal distribution was used to obtain estimates of beneficiary cost sharing. The same baseline period is used for the difference-in-differences (D-in-D) estimate for all implementation periods, so the adjusted mean is the same for each year and for the implementation period overall. For continuous outcomes estimated using linear models, the regression-adjusted D-in-D may not match exactly with the D-in-D calculated from the adjusted means because of rounding. A *negative* value for the regression-adjusted D-in-D corresponds to a *greater decrease* or a *smaller increase* in an outcome after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in an outcome in Maryland than in the comparison group. The relative difference is the D-in-D estimate as a percentage of Maryland's baseline period adjusted mean. The total weighted N for all models is 31,187,726.

SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

- Beneficiary cost sharing for other hospital outpatient department services increased less in Maryland than in the comparison group in the first 2 years of All-Payer Model implementation overall, decreasing by $1.55 PBPM in Maryland relative to the comparison group ($p<0.001$). Beneficiary cost sharing declined statistically significantly in Maryland relative to the comparison group in both years.

- There was no statistically significant difference in the change in beneficiary cost sharing for professional services in Maryland relative to the comparison group in the first 2 years of implementation overall. Although there were statistically significant differences in Year One and Year Two, the direction of the difference differed. In Year One there was significantly slower growth in Maryland, whereas in Year Two there was significantly faster growth.

4.3 Discussion

In response to the All-Payer Model, utilization and expenditures for hospital services, especially inpatient admissions and ED use, should decrease. Our analyses of the first 2 years of All-Payer Model implementation among Medicare beneficiaries found reductions in utilization, expenditures, or both relative to the comparison group in all categories of hospital services. As expected, inpatient admissions and overall hospital expenditures declined more for Maryland Medicare beneficiaries than for the comparison group during the first 2 years of the All-Payer Model. The relative decline in hospital expenditures was largely driven by slower increases in outpatient ED and other hospital outpatient PBPM expenditures for Maryland relative to the comparison group; the change in overall inpatient facility PBPM expenditures did not differ between Maryland and the comparison group. In addition, we found that total expenditures declined more for Maryland relative to the comparison group, indicating that the model is reducing hospital costs without shifting costs to other parts of the Maryland health care system outside of the global budgets. After 2 years of implementation, we found that spending for physician services in both regulated and nonregulated settings and other services all declined in Maryland relative to the comparison group.

The inpatient admission rate decreased more in Maryland than in the comparison group over the first 2 years of All-Payer Model implementation. This could be related to Maryland hospitals' shifting routine and lower-intensity services to nonhospital settings, as reported by hospital leaders. The greater decrease in Medicare admissions in Maryland could also be due in part to hospital programs to moderate utilization by improving care management. In contrast, payments per admission for Medicare beneficiaries increased more in Maryland than in the comparison group. In combination with the reduction in the admission rate, this may suggest that Medicare patients who are admitted in Maryland are sicker and require more resource-intensive care or it could be due to rate adjustments that hospitals are permitted to make within prescribed limits to regain some of the lost revenue from decreased utilization in order to meet their global budgets. Consistent with more resource intensive admissions, we found a greater increase the DRG weight of Medicare admissions in Maryland than in the comparison group (see ***Section 6***).

The likelihood of a Medicare beneficiary's having an ED visit that did not lead to a hospitalization increased more in Maryland relative to the comparison group after All-Payer Model implementation. There was no significant difference in the change in the rate of

observation stays in the first two years overall. The increase in the ED visit rate could be consistent with the declining admission rates if it reflects hospitals' success in reducing admissions of people seen in the ED. Site visit findings suggested it would be unlikely to see reductions in ED use. Although during site visits hospitals reported at least some investment in reducing ED use, the consensus was that more time was needed to allow changes by patients and clinicians to occur in order to see measurable differences in ED use. The absence of reductions in ED use relative to the comparison group also corroborates the perception of stakeholders that most Maryland hospitals have been slow to implement community partnerships that could help shift ED use to community physicians.

Although the likelihood of having an outpatient ED visit increased more for Medicare beneficiaries in Maryland than in the comparison group, ED PBPM expenditures and payments per ED visit decreased relative to the comparison group, indicating either that ED visits were less resource intensive during the implementation period or that hospitals were adjusting their rates to avoid exceeding their global budget. Likewise, other hospital outpatient department expenditures increased less in Maryland than in the comparison group after implementation of the All-Payer Model. The relative decline in outpatient ED and other hospital outpatient department expenditures for Medicare beneficiaries suggests that hospitals may be responding to the All-Payer Model in part by reducing provision of outpatient services. This is supported by hospital leaders' reports that routine and lower-intensity services were being shifted to nonregulated, nonhospital settings.

Because beneficiary cost sharing is closely linked with Medicare expenditures, out-of-pocket costs in total and for outpatient ED and other hospital outpatient department services likewise declined for Maryland beneficiaries relative to those in the comparison group during the implementation period. There was also a small decrease in beneficiary cost sharing for inpatient facility services relative to the comparison group, despite the absence of a difference in Medicare expenditures for these services. The decline in beneficiary cost sharing for inpatient services is because the cost sharing for Part A inpatient services is a deductible rather than a copayment for the first 60 days of an inpatient stay. The decrease in the admission rate should translate into fewer people having to pay the deductible. Even though we found that Medicare inpatient facility payments did not decline because the cost per admission increased, an increase in cost per admission would not increase the deductible paid by the beneficiary. As such, there should be a reduction in cost-sharing because of the reduction in the admission rate.

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SECTION 5
WHAT WAS THE IMPACT OF THE MARYLAND ALL-PAYER MODEL ON QUALITY OF CARE?

Key Takeaways for Quality of Care

- During the first 2 years of All-Payer Model implementation, unplanned readmissions, admissions for ACSCs, and visits to the emergency department within 30 days of discharge declined more for Maryland Medicare beneficiaries relative to the comparison group. Reducing readmissions has been a target nationwide for several years, but the relatively larger decline in Maryland suggests that the focus on reducing readmissions in the All-Payer Model is yielding the desired changes needed to move Maryland's readmission rate toward the national average. Hospitals are beginning to develop strategies to reduce avoidable utilization, but they varied in their progress.
- Although the rate of follow-up visits after hospital discharge increased over time, it did not change significantly for the Medicare population in Maryland relative to the comparison group. Effecting change in outcomes that are dependent on the behavior of providers outside the hospital is challenging. We heard little evidence during site visits that hospitals were developing the partnerships with community providers that may be needed to increase follow-up visits or care coordination more generally.

5.1 Research Questions

The Maryland All-Payer Model has a three-part aim of promoting better care, better health, and lower cost for all Maryland patients. Global budgets may provide an incentive for hospitals to engage in population health management, which, if successful, can help the state to achieve these aims. Population health management can involve (1) a focus on subpopulations of patients (e.g., those with a specific chronic disease or at risk for certain conditions); (2) coordination of care, with primary care providers as leaders of the health care team; and (3) patient engagement and community integration. Other incentives introduced to reduce hospital costs may either improve or reduce hospital quality and population health.

An ongoing concern about cost-containment initiatives such as Maryland's All-Payer Model is that they may create incentives to limit care, resulting in poorer quality of care and worse patient outcomes. The All-Payer Model incorporates features to offset such incentives. Unlike in IPPS, hospitals are paid on the basis of individual units of service provided. Furthermore, the QBR program, one of the factors that determines hospitals' payment adjustment, creates incentives for hospitals to improve performance on the measures included in the QBR program, such as patient experience, patient safety indicators and complications, and mortality. Similarly, the adjustment to hospital budgets for PAU provides incentives to improve quality of care and reduce certain types of inappropriate utilization, including readmissions.

The All-Payer Model includes a number of goals related to improving population health, which is consistent with the goal of reducing hospital expenditures. It becomes even more important with the eventual transition to a total-cost-of-care model. Hospitals alone have limited

ability to affect aspects of population health such as obesity and smoking that are underlying drivers of morbidity and mortality. The All-Payer Model encourages hospitals to develop community partnerships (e.g., with tobacco cessation centers) to address these issues. However, particularly for hospitals operating under GBR, which serve patient populations that overlap with those of other hospitals, incentives to invest in activities to improve population health may be limited, as the benefits may not accrue to the hospital. Nonetheless, concurrent health system reform activities and the prospect of a total-cost-of-care model in the future may encourage hospital efforts to improve population health.

In this section, we address the following research questions related to quality of care:

- How did trends in avoidable or reducible utilization change in Maryland relative to the comparison group after implementation of the All-Payer Model?
- How did trends in care coordination activities change in Maryland relative to the comparison group after implementation of the All-Payer Model?

5.2 Results

5.2.1 How Did Trends in Avoidable and Reducible Utilization Change in Maryland Medicare Beneficiaries after the Implementation of the All-Payer Model Relative to the Comparison Group?

- Unplanned readmissions declined by 4.7 more readmissions per 1,000 discharges for Maryland than in the comparison group in the first 2 years of the All-Payer Model.
- Hospital admissions for ACSCs declined by 0.5 more admissions per 1,000 population for Maryland than in the comparison group.
- The percentage of discharges with an ED visit within 30 days of discharge declined by 0.41 percentage points in Maryland relative to the comparison group in the first 2 years of the All-Payer Model, although the percentage increased over time in both areas.
- Discussions during site visits suggested that hospitals are beginning to develop strategies to reduce avoidable utilization, including hiring care managers and discharge planners, creating clinics to see patients post-discharge, and developing data analytic capabilities to identify high-risk patients. However, these were fairly recent initiatives, and hospitals varied widely in the extent to which they were implementing them.

Figures 27 and ***28*** show, by quarter, the rate of unplanned readmissions within 30 days of discharge per 1,000 Medicare beneficiary inpatient discharges and the rate of admissions for ACSCs per 1,000 Medicare beneficiaries for Maryland and the comparison group.

- For Medicare beneficiaries, the unplanned readmission rate was consistently lower in Maryland than in the comparison group over the baseline and All-Payer Model periods (***Figure 27***). Between the start of the baseline period and the end of the All-Payer Model period overall, readmissions declined for both groups (Maryland by 3.13 percentage points and the comparison group by 2.44 percentage points).

- For Medicare beneficiaries, the rate of admissions for ACSCs was slightly lower in Maryland compared to the comparison group over the baseline and All-Payer Model periods, with noticeable seasonality in the admission rate for both groups (***Figure 28***). Between the start of the baseline period and the end of the All-Payer Model period, the rates for both groups decreased (Maryland by 0.56 percentage points and the comparison group by 0.59 percentage points). Although ACSC admissions declined for both groups during both the baseline and All-Payer Model periods, the reduction during the baseline period was larger.

Figure 27
Rate of Medicare beneficiary discharges with an unplanned readmission within 30 days per 1,000 discharges for first quarter 2011 through fourth quarter 2015 in Maryland and the comparison group

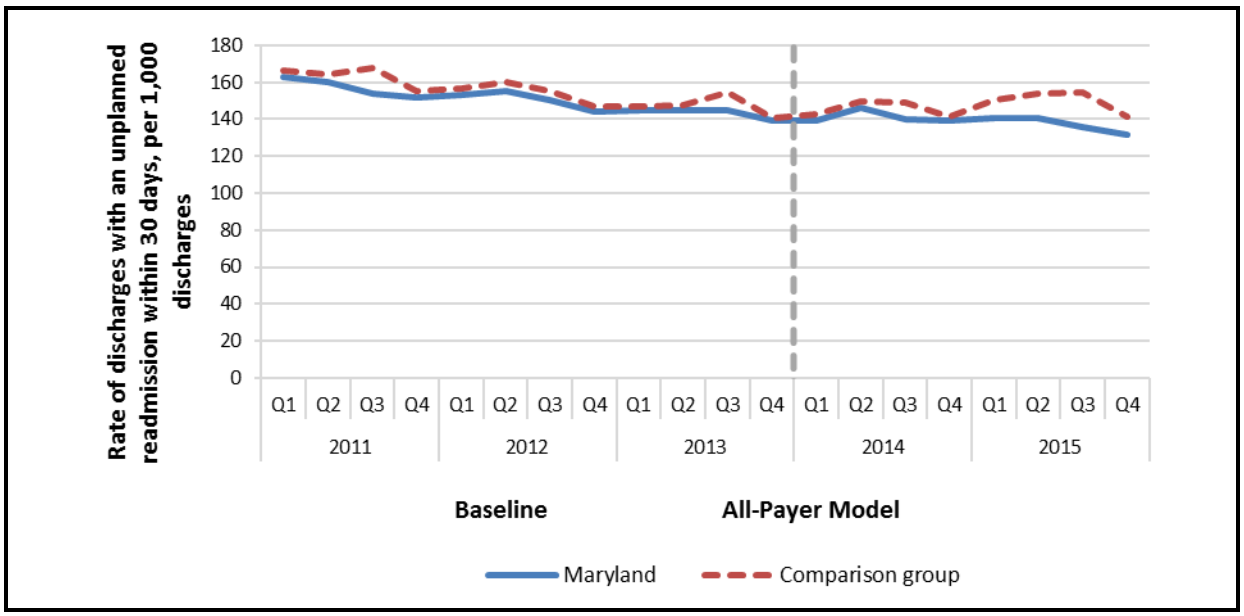


Figure 28
Rate of admissions for ACSCs per 1,000 Medicare beneficiaries for first quarter 2011 through fourth quarter 2015 in Maryland and the comparison group

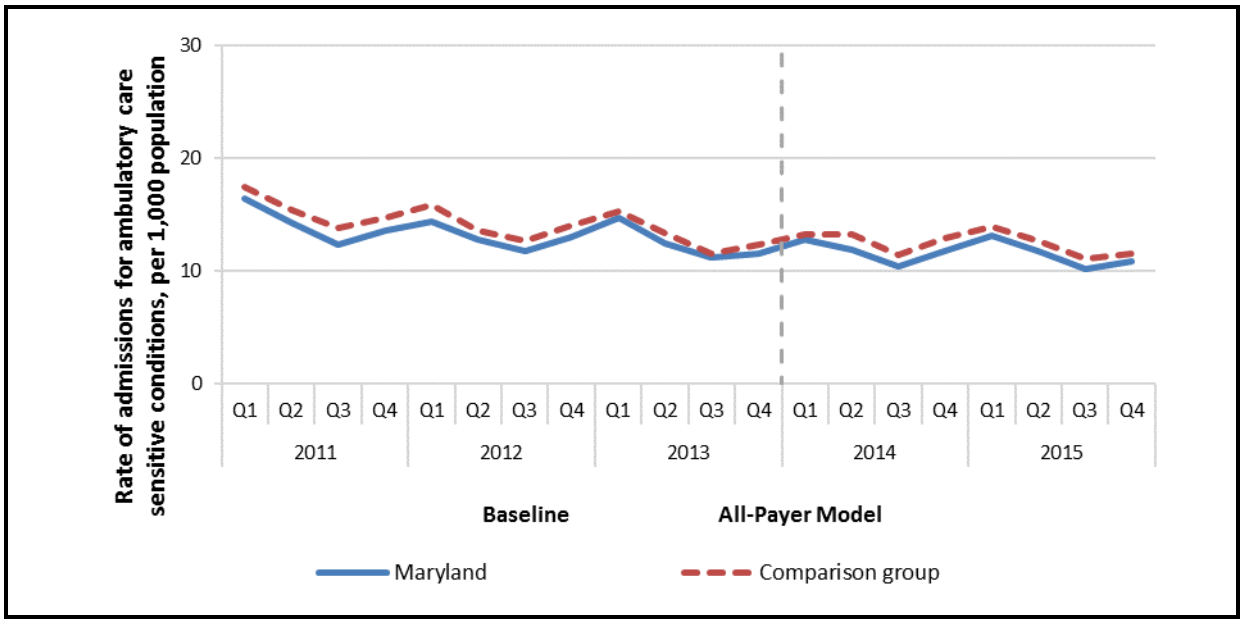


Table 7 presents the results of the D-in-D regression analysis for the rates of unplanned readmissions and ACSC admissions, and the percentage of hospital discharges with an ED visit within 30 days, including the D-in-D estimate for each year since the implementation of the All-Payer Model and an overall estimate for the first 2 years combined. The plots in ***Figures 29*** and ***30*** include 90 percent and 95 percent CIs around the estimated quarterly effects for the change in the rate of unplanned readmissions and the change in the rate of ACSC admissions, respectively.

- The rate of unplanned readmissions within 30 days of discharge decreased more in Maryland than in the comparison group. During the first 2 years of the All-Payer Model overall, the readmission rate fell by an additional 4.7 readmissions per 1,000 discharges in Maryland hospitals relative to comparison hospitals ($p<0.01$). This was driven by a statistically significant reduction in the readmission rate in Maryland relative to the comparison group in Year Two; there was no significant difference in the change in Year One. The change in the rate of 30-day unplanned readmissions fluctuated slightly, but the reduction was generally larger in Maryland than in the comparison group over the first eight quarters of the All-Payer Model period (***Figure 29***). The magnitude of the difference increased from the fourth to seventh quarter of implementation, and the difference was statistically significant in the sixth and seventh quarters of the All-Payer Model period.

- The ACSC admission rate decreased more in Maryland than in the comparison group during the first 2 years of the All-Payer Model. Overall, the quarterly ACSC admission rate fell by an additional 0.5 admissions per 1,000 Medicare beneficiaries

in Maryland relative to the comparison group during the All-Payer Model period ($p<0.001$). The reduction in the ACSC admission rate was statistically significantly larger in Maryland than in the comparison group in both Year One and Year Two. With the exception of the first quarter, the reduction in the ACSC admission rate was larger in Maryland than in the comparison group during the first eight quarters of the All-Payer Model period (***Figure 30***). The difference in the reduction in the ACSC admission rate was statistically significant in all quarters of the All-Payer Model period except quarters 1 and 5; however, the quarterly estimates did not show a trend to larger or smaller differences in the change over time

- In the first 2 years of All-Payer Model implementation overall, the percentage of Medicare beneficiary hospital discharges that had an ED visit within 30 days increased in both Maryland and the comparison group, but it increased by less in Maryland. The increase in the percentage of discharges with an ED visit within 30 days was 0.41 percentage points less in Maryland than in the comparison group during the All-Payer Model period ($p<0.05$). The difference between Maryland and the comparison group in the change in the percentage of hospital discharges with an ED visit within 30 days increased over time; the reduction in Maryland relative to the comparison group was statistically significant in the second year of the All-Payer Model implementation, but not the first year.

Table 7
Difference in the pre-post change in rates of avoidable or reducible utilization for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	All-payer model period adjusted mean, Maryland	All-payer model period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Unplanned readmissions within 30 days of discharge per 1,000 discharges							
Year One	152.8	154.1	142.4	144.4	−0.6 (−4.2, 3.0)	−0.4	0.789
Year Two	152.8	154.1	134.2	144.3	−8.9 (−13.0, −4.8)	−5.8	0.000
Overall	152.8	154.1	138.3	144.3	−4.7 (−7.5, −2.0)	−3.1	0.004
Hospital admissions for ACSCs per 1,000 population							
Year One	6.1	6.7	5.1	5.9	−0.4 (−0.6, −0.2)	−6.6	0.000
Year Two	6.1	6.7	4.8	5.6	−0.6 (−0.8, −0.4)	−9.9	0.000
Overall	6.1	6.7	5.0	5.7	−0.5 (−0.7, −0.4)	−8.2	0.000

(continued)

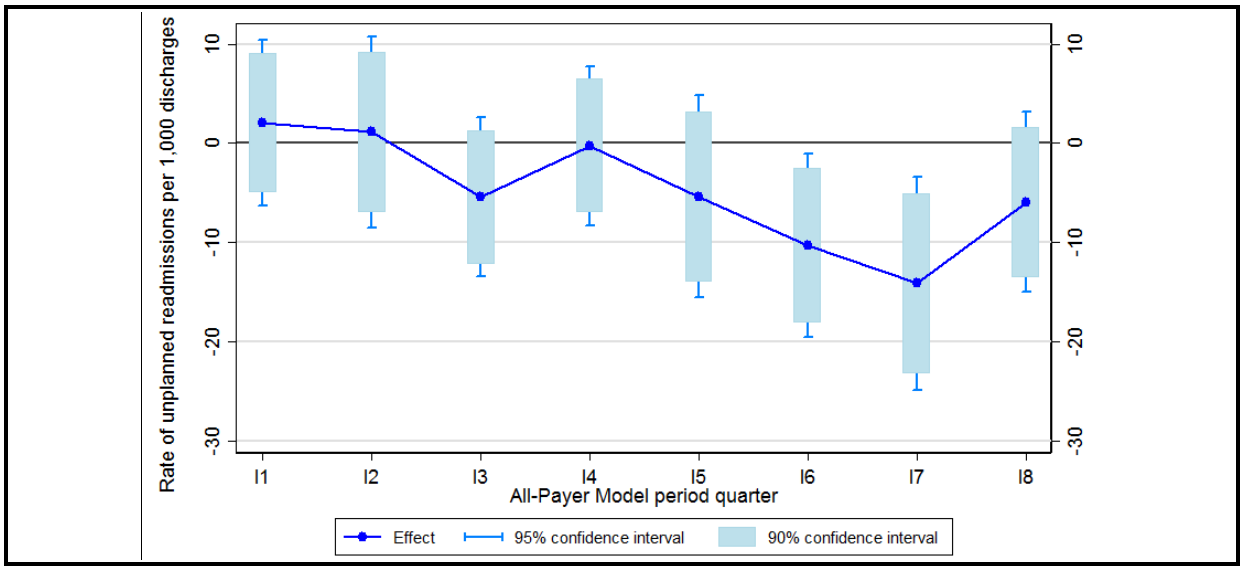
Table 7 (continued)
Difference in the pre-post change in rates of avoidable or reducible utilization for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	All-payer model period adjusted mean, Maryland	All-payer model period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Percentage of discharges with an ED visit within 30 days of discharge							
Year One	12.9	12.2	13.4	12.9	−0.25 (−6.4, 1.5)	−1.9	0.304
Year Two	12.9	12.2	13.5	13.2	−0.57 (−10.4, −1.0)	−4.4	0.045
Overall	12.9	12.2	13.5	13.1	−0.41 (−0.71, −0.10)	−3.2	0.028

NOTE: ACSC = ambulatory care sensitive condition; ED = emergency department. A logistic regression model was used to obtain estimates. The estimate of the probability of any admission for an ACSC is multiplied by 1,000 to obtain an approximate rate per 1,000 beneficiaries. The same baseline period is used for the difference-in-differences (D-in-D) estimate for all implementation periods, so the adjusted mean is the same for each year and for the implementation period overall. The regression-adjusted D-in-D is calculated as the average treatment effect *on the treated*, whereas the D-in-D derived from the adjusted means represents the average treatment effect. As a result, the regression-adjusted D-in-D and the D-in-D calculated from the adjusted means will differ. A *negative* value for the regression-adjusted D-in-D corresponds to a *greater decrease* or a *smaller increase* in an outcome after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in an outcome in Maryland than in the comparison group. The relative difference is the D-in-D estimate as a percentage of Maryland's baseline period adjusted mean. The total weighted N for probability of an unplanned readmission is 1,558,328. The total weighted N for probability of an ACSC admission is 31,627,441. The total weighted N for probability of an ED visit within 30 days of discharge is 1,398,998.

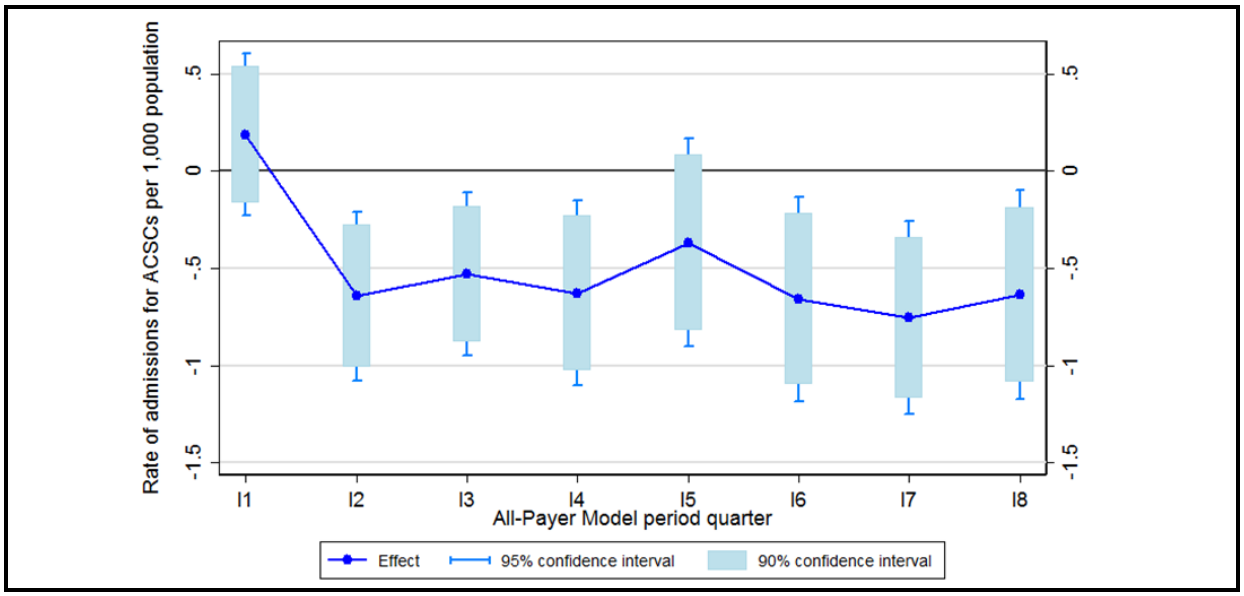
SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Figure 29
Difference in the pre-post change in unplanned readmissions within 30 days of discharge per 1,000 discharges for Medicare beneficiaries in Maryland and the comparison group, first eight quarters of Maryland All-Payer Model implementation



NOTE: Bars indicate 90 percent CIs, and lines that extend beyond the bars indicate 95 percent CIs. CIs that do not cross the origin on the x-axis indicate statistically significant effect estimates; CIs that cross the origin denote statistically insignificant effects.

Figure 30
Difference in the pre-post change in hospital admissions for ACSCs per 1,000 Medicare beneficiaries in Maryland and the comparison group, first eight quarters of Maryland All-Payer Model implementation



NOTE: Bars indicate 90 percent CIs, and lines that extend beyond the bars indicate 95 percent CIs. CIs that do not cross the origin on the x-axis indicate statistically significant effect estimates; CIs that cross the origin denote statistically insignificant effects.

5.2.2 How Did Trends in Care Coordination Change in Maryland Medicare Beneficiaries after the Implementation of the All-Payer Model Relative to the Comparison Group?

- The percentage of discharges with a follow-up visit within 14 days increased for both Maryland and the comparison group in the first 2 years of the All-Payer Model, but the difference in the increase was not statistically significant. Hospitals had made little progress in developing partnerships with community providers, although in the second round of site visits some were beginning to discuss the need to strengthen and redefine relationships with outpatient and post-acute care providers.

We present the results of the D-in-D regression analyses for the percentage of hospital discharges with a follow-up visit within 14 days after discharge in ***Table 8***. We report the D-in-D estimate for each year since the implementation of the All-Payer Model, along with an overall estimate for the first 2 years combined.

- There were no statistically significant differences between Maryland and the comparison group in the change in the percentage of hospital discharges that had a follow-up visit within 14 days in Year One or Year Two or in the first 2 years overall.

5.3 Discussion

Experience during the first 2 years of the All-Payer Model indicates that Maryland hospitals have been successful in reducing avoidable utilization among Medicare beneficiaries. HSCRC's annual report to Center for Medicare & Medicaid Intervention (CMMI) showed downward trends in ACSC admissions and all-cause readmissions in calendar years (CYs) 2014 and 2015, and Maryland was on a path to meet the requirement of its agreement with CMS to reduce the hospital readmission rate to the national average within 5 years (Health Services Cost Review Commission, 2016). Our analyses similarly showed downward trends in ACSC admissions and all-cause readmissions for both Maryland and the comparison group, and the rate of decrease after implementation of the All-Payer Model was larger in Maryland. Given that reducing readmissions has been a target nationwide for several years, the reduction observed for both Maryland and the comparison group is not unexpected. However, the relatively larger decline in Maryland suggests that the focus on reducing readmissions in the All-Payer Model is yielding the desired changes needed to move Maryland's readmission rate toward the national average. In addition, our analyses showed significant reductions relative to the comparison group in the rate of ED visits after hospital discharge, although the rate increased over time in both Maryland and the comparison group.

Table 8
Difference in the pre-post change in rate of follow-up visits within 14 days of discharge for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	All-payer model period adjusted mean, Maryland	All-payer model period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Percentage of discharges with a follow-up visit within 14 days of discharge							
Year One	76.6	76.0	77.0	76.8	−0.31 (−0.87, 0.25)	−0.4	0.362
Year Two	76.6	76.0	77.6	76.8	0.21 (−0.52, 0.93)	0.3	0.649
Overall	76.6	76.0	77.3	76.8	−0.06 (−0.51, 0.40)	−0.1	0.849

NOTE: A logistic regression model was used to obtain estimates of the difference in probability of a follow-up visit within 14 days of discharge. The same baseline period is used for the difference-in-differences (D-in-D) estimate for all implementation periods, so the adjusted mean is the same for each year and for the implementation period overall. The regression-adjusted D-in-D is calculated as the average treatment effect *on the treated*, whereas the D-in-D derived from the adjusted means represents the average treatment effect. As a result, the regression-adjusted D-in-D and the D-in-D calculated from the adjusted means will differ. A *negative* value for the regression-adjusted D-in-D corresponds to a *greater decrease* or a *smaller increase* in an outcome after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in an outcome in Maryland than in the comparison group. The relative difference is the D-in-D estimate as a percentage of Maryland's baseline period adjusted mean. The total weighted N is 1,554,156.

SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Nonetheless, the absence of significant reductions for some outcomes for the Medicare population in Year One suggests that hospitals may need time to reduce avoidable utilization. Discussions during site visits indicated that hospitals are beginning to develop strategies to reduce avoidable utilization, including hiring care managers and discharge planners, creating clinics to see patients post-discharge, and developing data analytic capabilities to identify high-risk patients. However, these were fairly recent initiatives, and hospitals varied widely in the extent to which they were implementing them. The HSCRC has developed policies to support and incentivize hospital efforts to reduce avoidable utilization. HSCRC increased rewards and introduced penalties related to reductions in readmissions. Furthermore, two hospitals have been awarded grants to hire and train workers for positions related to care coordination, population health, health information technology, and consumer engagement. It will be important to continue to monitor the ongoing development and evolution of hospital strategies and HSCRC policies that may have an impact on reducing avoidable utilization to see whether encouraging findings for the Medicare population are sustained and extended to the commercially insured and Medicaid populations.

Our findings for coordination of care with community providers were less encouraging. We did not find significant changes in the rate of follow-up visits after hospital discharge for the Medicare population. Effecting change in outcomes that are dependent on the behavior of providers outside the hospital is challenging, and we heard little evidence during site visits that hospitals were developing the partnerships with community providers that may be needed to increase follow-up visits or care coordination more generally. They provided few examples of hospitals developing partnerships with community physicians other than purchasing physician practices. In the second year of All-Payer Model implementation, hospitals were beginning to discuss the need to strengthen and redefine relationships with outpatient and post-acute care providers and some hospitals described new collaborations with other hospitals and with post-acute care providers.

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SECTION 6
WHAT WAS THE IMPACT OF THE MARYLAND ALL-PAYER MODEL ON HOSPITAL SERVICE MIX?

Key Takeaways for Service Mix

- The diagnosis-related group (DRG) weight for Medicare beneficiaries increased more in Maryland than in the comparison group after 2 years of All-Payer Model implementation. This could be due to the decline in inpatient admissions reported in ***Section 4***, if hospitals are shifting lower-intensity cases to other settings. However, results for the percentage of admissions classified as major or extreme severity of illness and the percentage of admissions with an intensive care unit (ICU) stay were not consistent with increased admission severity. These findings may indicate that hospitals are not systematically changing behavior related to hospital case mix in response to the All-Payer Model.
- After controlling for changes in case mix, the payment per discharge for Medicare beneficiaries increased more in Maryland than in the comparison group. This increase could be due to changes in intensity of services utilized within a DRG or to more rapid growth in hospital payment rates in Maryland than in IPPS.
- The percentage of hospital revenue from inpatient admissions increased relative to the comparison group, while the percentage of revenue from ED visits decreased. These revenue trends may reflect combined efforts to reduce ED utilization and expenditures while also limiting admissions to a more acutely ill population.

6.1 Research Questions

Under the All-Payer Model, hospital budgets are adjusted for changes in the population demographics of the hospital market area and market shifts, but there are no explicit adjustments for the case mix of the patient population. In some cases, the All-Payer Model creates conflicting incentives for hospital behavior so that the impacts on hospital case mix may be difficult to predict. Hospitals bill for services provided, which reduces incentives for patient skimming and dumping. Nonetheless, rate center categories necessarily encompass patients whose costliness varies. To the extent that this variation is predictable, hospitals have an incentive to avoid more costly patients within a rate center category. For example, to the extent that less acute patients who are less expensive to care for are shifted to ICUs, services billed to the ICU rate center will be more "profitable." However, restrictions on overall revenues limit incentives to increase billing for high-cost services.

Overall hospital patient mix may become more severe over time. Patient severity may increase if initiatives to reduce admissions of patients who could be treated outside of the hospital are successful. Increases in case-mix severity could increase the likelihood that an admission involves an ICU stay.

Initiatives to reduce PAU may decrease the share of hospital revenues from inpatient and ED services and increase the share from hospital outpatient clinic services. Within the inpatient setting, the share of medical admissions may fall relative to surgical admissions because of avoidance of unnecessary hospitalizations, which are more likely to be medical admissions.

Finally, to the extent that they are not accounted for in budget updates, the All-Payer Model budget constraints might adversely impact hospital adoption of new cost-increasing medical technologies.

To test our hypotheses on how hospitals responded to incentives in the All-Payer Model by altering their service mix, we addressed the following research questions:

- How did trends in hospital case-mix severity change in Maryland after the implementation of the All-Payer Model relative to the comparison group?
- How did trends in payments, utilization of specific hospital services, and share of revenue from care delivery settings change in Maryland after implementation of the All-Payer Model relative to the comparison group?
- How did trends in the adoption of new medical technology by Maryland hospitals change after the implementation of the All-Payer Model relative to the comparison group?

6.2 Results

6.2.1 How Did Trends in Hospital Case-Mix Severity Change in Maryland after the Implementation of the All-Payer Model Relative to the Comparison Group?

- The DRG weight increased more in Maryland than in the comparison group during the first 2 years of the All-Payer Model implementation overall.
- The percentage of inpatient admissions classified as major or extreme severity of illness decreased by 0.8 more percentage points in Maryland than in the comparison group over the first 2 years of implementation.
- The change in the percentage of admissions that included an ICU stay was not statistically significantly different in Maryland hospitals relative to comparison hospitals.
- These mixed findings may indicate that hospitals are not systematically changing behavior related to hospital case mix in response to the All-Payer Model. If the decline in inpatient admissions reported in ***Section 4*** is due to hospitals shifting lower-intensity cases to other settings, the relative increase in DRG weight could be due to lower acuity cases not being admitted to the hospital.

Table 9 displays findings for three outcomes that were used to measure changes in hospital case-mix severity after the implementation of the All-Payer Model: DRG weight per admission, percentage of admissions classified as major or extreme severity of illness, and percentage of admissions with an ICU stay.

- Admission severity, as measured by DRG weight, increased more in Maryland than in the comparison group during the first 2 years of the All-Payer Model implementation overall ($p<0.01$). This finding of a relative increase in Maryland was driven by a larger increase in DRG weights in Maryland relative to the comparison group during Year Two of implementation; there was no statistically significant difference in the change in weights during Year One.

- The percentage of inpatient admissions classified as major or extreme severity of illness decreased from the baseline to the All-Payer Model implementation period in both Maryland and the comparison group, but it decreased by a greater amount in Maryland. The reduction in the percentage of admissions classified as major/extreme severity in the All-Payer Model Period was 0.8 percentage points larger in Maryland hospitals than in comparison hospitals ($p<0.10$). The reduction was statistically significantly larger in the second year after the implementation of the All-Payer Model, but not in the first year.

- The change in the percentage of admissions that included an ICU stay was not statistically significantly different in Maryland hospitals relative to comparison hospitals in Year One or Year Two or over the first 2 years of the implementation of the All-Payer Model overall.

Table 9
Difference in the pre-post change in severity of admissions for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	All-payer model period adjusted mean, Maryland	All-payer model period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
DRG weight per admission							
Year One	1.572	1.544	1.626	1.599	−0.0016 (−0.011, 0.0076)	−0.1	0.790
Year Two	1.572	1.544	1.671	1.617	0.026 (0.016, 0.037)	1.7	0.000
Overall	1.572	1.544	1.648	1.608	0.012 (0.0052, 0.019)	0.8	0.005
Percentage of acute admissions with a major/extreme 3M APR-DRG severity							
Year One	20.4	16.9	17.9	15.1	−0.4 (−1.2, 0.4)	−1.9	0.431
Year Two	20.4	16.9	18.5	16.4	−1.3 (−2.4, −0.1)	−6.2	0.076
Overall	20.4	16.9	18.2	15.7	−0.8 (−1.5, −0.1)	−4.0	0.055

(continued)

Table 9 (continued)
Difference in the pre-post change in severity of admissions for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	All-payer model period adjusted mean, Maryland	All-payer model period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Percentage of acute admissions with an ICU stay							
Year One	24.8	44.0	24.5	43.2	0.3 (−0.8, 1.4)	1.3	0.642
Year Two	24.8	44.0	23.2	41.7	0.2 (−2.1, 2.4)	0.6	0.917
Overall	24.8	44.0	23.9	42.5	0.2 (−1.0, 1.5)	1.0	0.763

NOTE: APR-DRG = all-patient refined diagnosis-related group; ICU = intensive care unit. A generalized linear model with an identity link and normal distribution was used to obtain estimates of the difference in admission case severity. A logistic regression model was used to obtain estimates of the difference in percentage of major/extreme severity of illness for inpatient admissions and the percentage of acute admission with an ICU stay. The same baseline period is used for the difference-in-differences (D-in-D) estimate for all implementation periods, so the adjusted mean is the same for each year and for the implementation period overall. For continuous outcomes estimated using linear models, the regression-adjusted D-in-D may not match exactly with the D-in-D calculated from the adjusted means because of rounding. For binary outcomes estimated using non-linear models, the regression-adjusted D-in-D is calculated as the average treatment effect *on the treated*, whereas the D-in-D derived from the adjusted means represents the average treatment effect. As a result, the regression-adjusted D-in-D and the D-in-D calculated from the adjusted means will differ. A *negative* value for the regression-adjusted D-in-D corresponds to a *greater decrease* or a *smaller increase* in an outcome after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in an outcome in Maryland than in the comparison group. The relative difference is the D-in-D estimate as a percentage of Maryland's baseline period adjusted mean. The total weighted N for all regression models is 2,090,497.

SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

6.2.2 How Did Trends in Payments, Utilization of Specific Hospital Services, and Share of Revenue from Care Delivery Settings Change in Maryland after Implementation of the All-Payer Model Relative to the Comparison Group?

- The case-mix-adjusted payment per inpatient discharge increased by $412 more in Maryland than in the comparison group in the first 2 years of the All-Payer Model implementation overall, indicating that the payment for the same mix of admissions was growing at a faster rate in Maryland. This could be the result of faster growth in hospital payment rates or increasing intensity of services within a diagnosis category in Maryland.
- The percentage of inpatient revenues increased by 3.3 percentage points, while the percentage of revenue from ED visits decreased by 1.2 percentage points in Maryland hospitals relative to comparison group hospitals over the first 2 years of implementation. These revenue trends may reflect combined efforts to reduce ED utilization and expenditures while also limiting admissions to a more acutely ill population.
- Surgical admissions accounted for an increasing share of hospital admissions in both Maryland and comparison group hospitals, but the increase in surgical admissions compared to medical admissions was larger in Maryland over the first 2 years of the All-Payer Model. The trend to an increasing share of surgical admission is expected if admissions in Maryland were reduced by avoiding of unnecessary hospitalizations, which are more likely to be medical admissions. However, the difference in the change was small.

We examined the following outcomes related to changes in the use of specific hospital services: case-mix-adjusted payment per discharge, share of total revenues from inpatient admissions, share of total revenues from ED visits, and surgical-to-medical volume ratio. The first outcome focuses on changes in costs, presumably via intensity of services provided, within a DRG. The second and third outcomes examine changes in hospital care delivery setting that are associated with costs. Finally, the fourth outcome focuses on surgical compared with medical admissions as an indicator of the extent to which hospitals are reducing avoidable hospitalizations. Results from regression models for these outcomes are shown in ***Table 10***.

- The case-mix-adjusted payment per inpatient discharge increased by $412 more in Maryland than in the comparison group in the first 2 years of the All-Payer Model implementation overall ($p<0.001$), indicating that the payment for the same mix of admissions was growing at a faster rate in Maryland. The increase was statistically significantly larger in Maryland in both years, and the magnitude of the difference increased from Year One to Year Two.

- The percentage of total revenues that were from inpatient admissions decreased in Maryland and the comparison group from the baseline to the All-Payer Model period, but the decrease was smaller in Maryland. As a result, the percentage of inpatient

revenues increased by 3.3 percentage points ($p<0.001$) in Maryland hospitals relative to comparison group hospitals in aggregate over the first 2 years of the All-Payer Model implementation. The relative increase was statistically significantly different in both years, and the magnitude of the difference increased from Year One to Year Two.

- In contrast, the percentage of total revenues from ED visits increased more slowly in Maryland relative to the comparison group, resulting in a relative decrease of 1.2 percentage points ($p<0.001$) in aggregate over the first 2 years of implementation. The increase was statistically significantly slower in both years, and the magnitude of the difference was larger in Year Two than Year One.

- The ratio of surgical to medical admissions increased statistically significantly ($p<0.10$) in Maryland relative to the comparison group in aggregate over the first 2 years of the All-Payer Model overall and during the second year of implementation, but the difference in the change was small.

Table 10
Difference in the pre-post change in case-mix-adjusted payment per discharge, hospital revenue sources, and type of admissions for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	All-payer model period adjusted mean, Maryland	All-payer model period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Case-mix-adjusted payment per discharge ($)							
Year One	8,785.74	5,936.92	9,188.60	6,100.44	239.91 (204.73, 275.09)	2.7	0.000
Year Two	8,785.74	5,936.92	9,475.28	6,037.07	589.30 (548.10, 630.50)	6.7	0.000
Overall	8,785.74	5,936.92	9,331.94	6,068.75	412.42 (385.39, 439.46)	4.7	0.000
Percentage of hospital revenue from inpatient admissions							
Year One	74.9	78.8	74.3	75.7	2.5 (1.9, 3.0)	3.3	0.000
Year Two	74.9	78.8	74.8	74.6	4.2 (3.4, 5.0)	5.6	0.000
Overall	74.9	78.8	74.6	75.1	3.3 (2.9, 3.8)	4.5	0.000
Percentage of hospital revenue from emergency department visits							
Year One	6.5	5.4	7.0	7.1	−1.1 (−1.4, −0.8)	−17.2	0.000
Year Two	6.5	5.4	6.7	7.0	−1.3 (−1.8, −0.8)	−20.0	0.000
Overall	6.5	5.4	6.9	7.0	−1.2 (−1.5, −0.9)	−18.6	0.000

(continued)

Table 10 (continued)
Difference in the pre-post change in case-mix-adjusted payment per discharge, hospital revenue sources, and type of admissions for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	All-payer model period adjusted mean, Maryland	All-payer model period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Surgical to medical admission ratio							
Year One	28.4	28.6	28.7	28.7	0.2 (−0.5, 0.9)	0.7	0.669
Year Two	28.4	28.6	30.5	29.5	1.1 (2.4, 2.3)	4.0	0.092
Overall	28.4	28.6	29.6	29.1	0.7 (0.01, 1.3)	2.3	0.095

NOTE: A generalized linear model with an identity link and normal distribution was used to obtain estimates of the differences for each outcome. For continuous outcomes estimated using linear models, the regression-adjusted difference-in-differences (D-in-D) may differ from the D-in-D calculated from the adjusted means because of rounding. A *negative* value for the regression-adjusted D-in-D corresponds to a *greater decrease* or a *smaller increase* in an outcome after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in an outcome in Maryland than in the comparison group. The relative difference is the D-in-D estimate as a percentage of Maryland's baseline period adjusted mean. The total weighted N for the difference in case-mix-adjusted payments per discharge is 2,090,497. The total weighted N for the inpatient revenue and surgical-to-medical ratio regressions is 1,860. The total weighted N for the emergency department revenue regression is 1,840.

SOURCE Chronic Conditions Data Warehouse Medicare fee-for-service claims.

6.2.3 How Did Trends in the Adoption of New Medical Technology by Maryland Hospitals Change after the Implementation of the All-Payer Model Relative to the Comparison Group?

- There were conflicting findings on trends in use of the two medical technologies examined. The percentage of robotic prostatectomies in Maryland decreased relative to the comparison group over the first 2 years after the All-Payer Model was implemented. In contrast, the percentage of heart valve replacements that used endovascular surgery increased in Maryland relative to the comparison group.
- Slower growth in use of robotic-assisted prostatectomies could represent a constraint on high-cost resources. Yet, the greater increase in use of endovascular heart valve replacements seems to argue that hospitals do not necessarily face constraints on investing in high-cost resources.

We examined changes in the adoption of new medical technologies after the implementation of the All-Payer Model, estimating the likelihood that advanced technologies were used in two surgical procedures: prostatectomies and heart valve replacements. These surgical procedures are common in the Medicare population. They also are available in a more conventional technique and an advanced technique that uses emerging technology that is reimbursable but not yet considered standard of care. We present only overall results for the first 2 years of the All-Payer Model period for these outcomes because of the small number of observations. ***Table 11*** displays the results from these analyses.

- The percentage of prostatectomies that used robotic prostatectomy decreased in Maryland hospitals and increased in comparison group hospitals from the baseline period through the first 2 years of the All-Payer Model implementation. There was a statistically significant decrease in the percentage of robotic prostatectomies in Maryland relative to the comparison group after the All-Payer Model was implemented (9.6 percentage points, $p<0.10$).

- The percentage of heart valve replacements that used endovascular surgery increased in both Maryland and comparison group hospitals, but it increased by more in Maryland (7.3 percentage points, $p<0.05$) over the first 2 years of the All-Payer Model implementation.

6.3 Discussion

The analyses in this section examine changes in hospital case mix, use of specific hospital services and settings, and use of new technologies. Despite tight rate and volume controls integrated into Maryland's All-Payer Model, global budgets may create incentives for hospitals to change their case mix, type of services provided, and use of new technology to preserve financial status.

Table 11
Difference in the pre-post change in use of advanced technological procedures for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	All-payer model period adjusted mean, Maryland	All-payer model period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Percentage of prostatectomies using robotic prostatectomy							
Overall	51.8	54.8	48.1	61.4	−9.6 (−1.8, −1.3)	−18.5	0.058
Percentage of heart valve replacements using endovascular surgery							
Overall	7.9	4.2	35.1	15.5	7.3 (1.8, 12.9)	92.3	0.030

NOTE: Logistic regression models were used to obtain estimates of the percentages of robotic prostatectomy and endovascular surgery. For binary outcomes estimated using nonlinear models, the regression-adjusted difference-in-differences (D-in-D) is calculated as the average treatment effect *on the treated*, whereas the D-in-D derived from the adjusted means represents the average treatment effect. As a result, the regression-adjusted D-in-D and the D-in-D calculated from the adjusted means will differ. A *negative* value for the regression-adjusted D-in-D corresponds to a *greater decrease* or a *smaller increase* in an outcome after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in an outcome in Maryland than in the comparison group. The relative difference is the D-in-D estimate as a percentage of Maryland's baseline period adjusted mean. The total weighted N for the percentage of robotic prostatectomy is 3,006. The total weighted N for the percentage of endovascular surgery is 8,732. We present only overall results for the first 2 years of the All-Payer Model period for these outcomes because of the small number of observations.

SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Our findings provide mixed evidence on the change in admission severity after the All-Payer Model implementation. After 2 years of implementation, we found that the DRG weight for Medicare beneficiaries increased more in Maryland than in the comparison group. At the same time, we found that the percentage of admissions classified as having major or extreme severity decreased more for Medicare beneficiaries in Maryland hospitals than in comparison group hospitals (i.e., there was relative decrease) and there was no difference in the change in the percentage of admissions with an ICU stay. The All-Payer Model creates conflicting incentives for hospital behavior so the impacts on hospital case mix may be difficult to predict. These findings may indicate that hospitals are not systematically changing behavior related to hospital case mix in response to the All-Payer Model. As reported in Section 4, however, the decline in inpatient admissions could be due to hospitals shifting lower intensity cases to other settings. If so, the relative increase in DRG weights could be due to lower acuity cases being shifted to outpatient settings.

We found modest increases in the case-mix-adjusted payment per discharge for Medicare beneficiaries among Maryland hospitals relative to comparison hospitals. Because this measure controls for admission severity as a driver of increases in cost per discharge, increases in the case-mix-adjusted payment per discharge could be due to changes in intensity of services utilized within a DRG or to increases in payment rates among Maryland hospitals exceeding the rate of increase in IPPS payments in comparison hospitals. Comparison of hospital payment rates in Maryland with IPPS payments in comparison hospitals showed a widening differential in FY 2015 (see ***Section 8***). Although increased LOS in the first year after the implementation of the All-Payer Model could contribute to the increase in the case-mix-adjusted payment per discharge in Year One, there was no difference in LOS in Year Two or the first 2 years overall (see ***Section 4***).

Although inpatient revenues declined over time, the decrease was smaller in Maryland than in the comparison group so there was an increase in the percentage of total revenue from inpatient admissions relative to the comparison group. This is accompanied by a decrease in the percentage of total revenue from ED visits relative to the comparison group due to slower growth in Maryland. These revenue trends may reflect combined efforts to reduce ED utilization and expenditures while also limiting admissions to a more acutely ill population. Analyses of changes in utilization and expenditures for Medicare beneficiaries in Maryland and the comparison group showed a larger decrease in the inpatient admission rate accompanied by a greater increase in the payment per admission, but there was a larger increase in the ED visit rate and a relative decrease in the payment per visit (see ***Section 4***). The increase in the percentage of revenue from inpatient admissions in Maryland hospitals relative to comparison hospitals suggests that the increase in payment per admission more than offset the decrease in the admission rate, whereas the converse was true of ED visits.

Finally, findings on use of advanced technology in surgical procedures were heterogeneous. The slower growth in use of robotic-assisted prostatectomies could represent a constraint on high-cost resources. Yet, the greater increase in use of endovascular heart valve replacements seems to argue that hospitals do not necessarily face constraints on investing in high-cost resources.

SECTION 7
WERE THERE SPILLOVER EFFECTS FROM THE MARYLAND ALL-PAYER MODEL TO OTHER PARTS OF THE HEALTH CARE SYSTEM?

Key Takeaways for Spillover Effects

- Maryland hospitals were not more likely to transfer higher severity patients to other acute care or post-acute care providers following implementation of the All-Payer Model. Although there was a slight increase in transfers of Medicare patients to post-acute care settings in the second year of the All-Payer Model, this change was not concentrated among more severe cases whose care is expected to be more costly for the hospital.
- There was some evidence that services provided in hospital outpatient settings shifted to nonregulated settings outside of hospitals after the implementation of the All-Payer Model. Although primary care visits in Maryland increased in all sites of care, relative to the comparison group primary care visits in Maryland shifted away from hospital outpatient departments to non-hospital settings, including physician offices and health centers. There was a trend among Medicare beneficiaries in Maryland in increasing use of urgent care centers, which might be substitutes for EDs, but this upward trend preceded the All-Payer Model and slowed after implementation.
- It does not appear that Medicare beneficiaries had to seek care elsewhere because of restricted access to Maryland hospitals. Border crossing patterns—as evidenced by admissions of out-of-state Medicare beneficiaries to Maryland hospitals and admissions of Maryland Medicare beneficiaries to out-of-state hospitals—did not change after implementation of the All-Payer Model.
- There was no evidence that the All-Payer Model has led to unbundling of inpatient services for Medicare patients by shifting costs to preadmission or postdischarge periods.

7.1 Research Questions

The incentives in Maryland's All-Payer Model to reduce hospital costs are intended to reduce unnecessary hospital use and encourage delivery of services in appropriate lower-cost settings. However, incentives to reduce expenditures for hospital services might lead to underprovision of care, avoidance of costly cases, and shifting patients either to other hospitals or nonregulated (i.e., nonhospital) providers. Hospitals may have some ability to affect utilization of their services by shifting services to outside the time frame of the inpatient stay, either through admission behavior or subsequent discharge behavior. For example, hospitals might encourage testing to be completed before hospital admission. Hospitals might be more able to avoid complex, costly cases when admissions do not occur through the ED. Hospitals also might have a greater incentive to transfer costly, hard-to-manage cases to other short-term acute-care (STAC) hospitals or to PAC settings. Transferring patients to PAC settings is desirable if it results in patients' receiving treatment at more appropriate levels of care and reduces unnecessarily long hospital stays, but it is undesirable if it results in poorer patient outcomes and increases readmissions because patients are discharged too soon. As a consequence of the potential for undesirable changes in discharge behavior, the HSCRC's

budget-setting methodology contains adjustments for hospitals whose case-mix severity index fell during the prior year, adjustments for transfers of complex cases to academic medical centers, and penalties and rewards to encourage reductions in readmissions. These policies might limit incentives for hospitals to change their discharge behavior. Global budgets might also restrict the accessibility of outpatient hospital services, causing patients to seek care in nonhospital settings. Finally, implementation of the All-Payer Model could affect border crossing by Maryland residents and nonresidents. For some hospitals, revenues from care provided to out-of-state residents do not count against the budget constraint. Consequently, these hospitals have incentives to increase revenues from care provided to out-of-state residents. At the same time, if there are constraints on use of Maryland hospitals, Maryland residents might increase their use of out-of-state hospitals.

In this section, we address the following questions related to spillover effects of the All-Payer Model:

- Were Maryland hospitals more likely to avoid costly inpatient cases after the implementation of the All-Payer Model?
- Were services provided in hospital outpatient settings shifted to nonregulated settings outside of hospitals after the implementation of the All-Payer Model?
- Were there changes in the extent of border crossing by both Maryland residents and nonresidents in obtaining inpatient care after the implementation of the All-Payer Model?
- Were costs associated with inpatient episodes of care shifted to the preadmission and postdischarge periods after the implementation of the All-Payer Model?

7.2 Results

7.2.1 Were Maryland Hospitals More Likely to Avoid Costly Inpatient Cases after the Implementation of the All-Payer Model?

- It does not appear that Maryland hospitals' opportunities to avoid admitting complex, costly cases changed after implementation of the All-Payer Model. In the first 2 years of the All-Payer Model, the percentage of Medicare admissions occurring through the ED increased for both Maryland and comparison hospitals, but the difference in the increase was not statistically significant.
- There were no differences between Maryland and comparison hospitals in the change in the percentage of Medicare admissions that resulted in transfers to other STAC hospitals or in the percentage of transfers to other STAC hospitals that were classified as major or extreme severity.
- The percentage of Medicare admissions that resulted in a PAC transfer increased slightly from the baseline for both Maryland and comparison group hospitals, and the increase was significantly larger in Maryland. However, the percentage of admissions with a PAC transfer was low in Maryland both before and after the implementation of the All-Payer Model. The change in the percentage of PAC transfers classified as major or extreme severity did not differ between Maryland and the comparison group.

Table 12 shows the differences in the pre-post change in outcomes related to avoidance of admissions that are likely to be costly for Maryland admissions relative to the comparison group.

- In the first 2 years of the All-Payer Model, the percentage of admissions occurring through the ED increased from the baseline for both Maryland and comparison group hospitals, but there was no statistically significant difference in the change from the baseline in Year Two or the first 2 years of All-Payer Model implementation overall. The increase in the percentage of admissions through the ED was statistically significantly larger in Maryland in Year One ($p<0.10$), but the magnitude of the difference was less than 1 percent.

- There were no statistically significant differences in the change in the percentage of admissions that resulted in a STAC transfer or in the percentage of STAC transfers classified as major or extreme severity in Year One or Year Two or in the first 2 years overall.

Table 12
Difference in the pre-post change in outcomes related to avoidance of costly admissions for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline Period Adjusted Mean, Maryland	Baseline Period Adjusted Mean, Comparison group	All-Payer Model Period Adjusted Mean, Maryland	All-Payer Model Period Adjusted Mean, Comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Percentage of admissions through the ED							
Year One	75.4	75.2	78.0	77.1	0.8 (0.01, 1.5)	1.0	0.096
Year Two	75.4	75.2	78.4	78.1	0.2 (−0.8, 1.1)	0.2	0.776
Overall	75.4	75.2	78.2	77.6	0.5 (−0.1, 1.1)	0.6	0.205
Percentage of admissions resulting in STAC transfer							
Year One	1.03	0.44	1.01	0.43	−0.02 (−0.01, 0.10)	-1.6	0.824
Year Two	1.03	0.44	0.86	0.39	−0.08 (−0.20, 0.03)	-8.2	0.232
Overall	1.03	0.44	0.93	0.41	−0.05 (−0.13, 0.03)	-4.8	0.314
Percentage of STAC transfers classified as major or extreme severity							
Year One	75.4	63.5	76.3	64.0	0.7 (−4.0, 5.4)	0.9	0.816
Year Two	75.4	63.5	78.9	66.3	1.4 (−4.0, 6.7)	1.8	0.692
Overall	75.4	63.5	77.6	65.1	1.0 (−2.5, 4.6)	1.3	0.653

(continued)

Table 12 (continued)
Difference in the pre-post change in outcomes related to avoidance of costly admissions for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Outcome	Baseline Period Adjusted Mean, Maryland	Baseline Period Adjusted Mean, Comparison group	All-Payer Model Period Adjusted Mean, Maryland	All-Payer Model Period Adjusted Mean, Comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Percentage of admissions resulting in PAC transfer							
Year One	2.0	1.6	2.3	1.7	0.10 (−0.02, 0.22)	5.0	0.173
Year Two	2.0	1.6	2.5	1.7	0.23 (0.07, 0.39)	11.4	0.016
Overall	2.0	1.6	2.4	1.7	0.16 (0.07, 0.26)	8.1	0.006
Percentage of PAC transfers classified as major or extreme severity							
Year One	74.9	65.1	74.1	64.8	−0.7 (−3.5, 2.1)	−0.9	0.694
Year Two	74.9	65.1	73.9	62.9	1.0 (−2.3, 4.2)	1.3	0.635
Overall	74.9	65.1	74.0	63.9	0.1 (−2.0, 2.3)	0.2	0.930

NOTE: ED = emergency department; PAC = post-acute care; STAC = short term, acute care. A logistic regression model was used to obtain estimates for all outcomes. The same baseline period is used for the difference-in-differences (D-in-D) estimate for all implementation periods, so the adjusted mean is the same for each year and for the implementation period overall. For binary outcomes estimated using nonlinear models, the regression-adjusted D-in-D is calculated as the average treatment effect *on the treated*, whereas the D-in-D derived from the adjusted means represent the average treatment effect. As a result, the regression-adjusted D-in-D and the D-in-D calculated from the adjusted means will differ. A *negative* value for the regression-adjusted D-in-D corresponds to a *greater decrease* or a *smaller increase* in an outcome after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in an outcome in Maryland than in the comparison group. The relative difference is the D-in-D estimate as a percentage of Maryland's baseline period adjusted mean. The total weighted N for admission through the ED, admission resulting in a STAC transfer, and admission resulting in a PAC transfer is 2,264,046. The total weighted N for STAC transfer classified as major or extreme severity is 16,251. The total weighted N for PAC transfer classified as major or extreme severity is 39,373.

SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

- The percentage of admissions that resulted in a PAC transfer increased slightly from the baseline for both Maryland and comparison group hospitals, and the increase was significantly larger in Maryland during the first 2 years overall ($p<0.01$). However, the percentage of admissions with a PAC transfer was low in Maryland both before and after the implementation of the All-Payer Model (2.0% and 2.4%, respectively). The increase also was significantly larger in Year Two, but there was no significant difference in the change in Year One. The change in the percentage of PAC transfers classified as major or extreme severity did not differ between Maryland and the comparison group in Year One or Year Two or in the first 2 years overall.

7.2.2 Were Services Provided in Hospital Outpatient Settings Shifted to Nonregulated Settings Outside of Hospitals after the Implementation of the All-Payer Model?

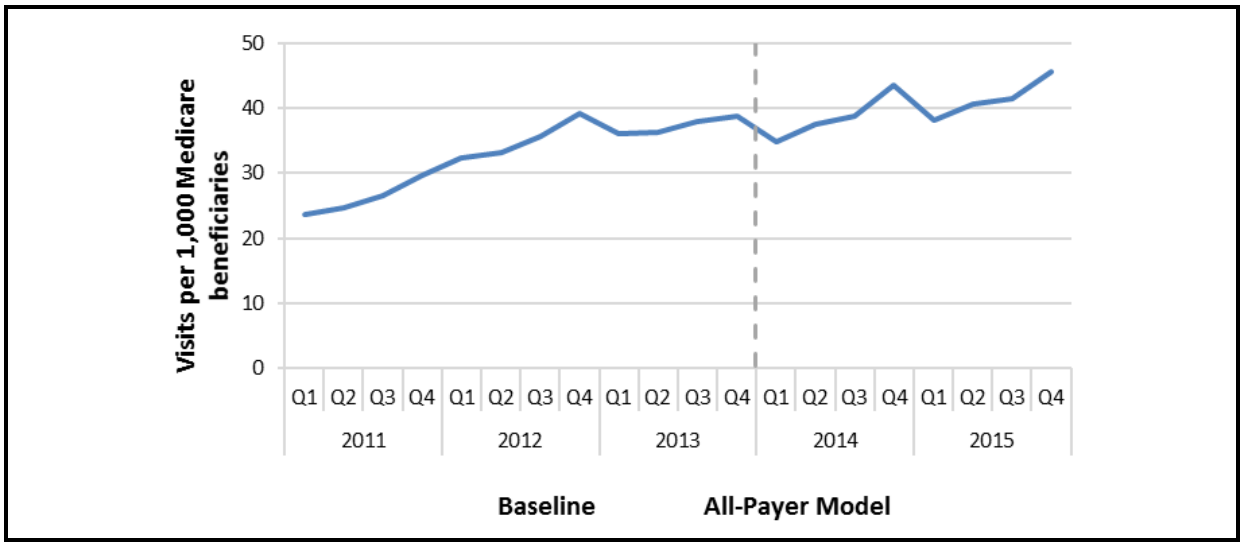
- There has been a trend toward increasing use of urgent care center services for Maryland's Medicare beneficiaries, but it does not appear to be related to implementation of the All-Payer Model. Although the urgent care center visit rate in Maryland almost doubled between the first quarter of 2011 and the last quarter of 2015, the rate increased more gradually in the All-Payer Model period than in the baseline period. We could not compare trends in Maryland with the comparison group because urgent care center visits could not be identified for the comparison group.

- Relative to the comparison group, the site of primary care visits for Medicare beneficiaries in Maryland shifted away from hospital outpatient departments to nonhospital settings. The percentage of Medicare beneficiaries with primary care visits at hospital outpatient departments increased more slowly among Maryland residents than among comparison group residents during the first 2 years of the All-Payer Model implementation. At the same time, the percentage of Medicare beneficiaries with primary care visits at physician offices and the percentage with visits at federal qualified health centers (FQHCs) and rural health clinics (RHCs) increased in Maryland relative to the comparison group.

Figure 31 shows the number of monthly visits at Maryland urgent care centers per 1,000 Maryland Medicare beneficiaries.[19]

- The urgent care visit rate rose steadily from 23.6 in the first quarter of 2011 to 38.8 in the fourth quarter of 2012. Monthly visits increased more gradually in the All-Payer Model period than in the baseline period, reaching 45.6 per 1,000 Medicare beneficiaries in the fourth quarter of 2015. A test of a structural break in the time trend showed a statistically significant change in the rate of increase in the number of monthly visits between the baseline and All-Payer Model periods ($p<0.05$).[20]

Figure 31
Monthly visits at Maryland urgent care centers per 1,000 Maryland Medicare beneficiaries for first quarter 2011 through fourth quarter 2015



[19] Urgent care visits per 1,000 Medicare beneficiaries were limited to Maryland residents and were analyzed only by descriptive methods because we could not identify these visits for the comparison group. The place of service code on Medicare physician claims is not reliably coded for the urgent care place of service because payment does not differ from services rendered in physician offices. Taxpayer Identification Numbers supplied by the HSCRC allowed us to identify visits in Maryland urgent care centers. Because payment is not affected, many providers at urgent care centers appear to be coding "office" place of service instead of "urgent care center."

[20] See the ***Appendix F*** for detail on the tests for structural breaks between the baseline and All-Payer Model periods.

Table 13 shows the differences in the pre-post change in the percentage of Medicare beneficiaries with primary care visits by place of service for Maryland residents relative to the comparison group.

- The percentage of Medicare beneficiaries with primary care visits at hospital outpatient departments increased more slowly among Maryland residents than among comparison group residents during the first 2 years of the All-Payer Model implementation. Although the difference in the change was statistically significant, the magnitude of the relative difference was small (0.15 percentage points smaller increase in Maryland than in the comparison group, $p<0.001$). The increase was statistically significantly smaller in Maryland in both years, and the magnitude of the difference increased from Year One to Year Two.

- The percentage of Medicare beneficiaries with primary care visits at physician offices (including visits to urgent care centers and Method II critical access hospitals[21]) increased slightly among Maryland residents and decreased slightly among comparison group residents between the baseline and the All-Payer Model years. The percentage having a primary care visit at a physician office increased by 0.97 percentage points in Maryland relative to the comparison group during the first 2 years of the All-Payer Model overall ($p<0.001$). The increase was statistically significantly larger in Maryland in both years, and the magnitude of the difference increased from Year One to Year Two.

- The percentage of Medicare beneficiaries with primary care visits at FQHCs and RHCs increased slightly among Maryland residents and was unchanged among comparison group residents between the baseline and the All-Payer Model periods, although the percentage was low (about 1%) in both groups in all time periods. The percentage of Medicare beneficiaries having a primary care visit at an FQHC or RHC increased by 0.12 percentage points in Maryland relative to the comparison group during the first 2 years of the All-Payer Model overall ($p<0.001$). The difference in the change from the baseline period was statistically significant in both years, and it increased from Year One to Year Two.

- The percentage of Medicare beneficiaries with a primary care visit at any of the sites of care increased in Maryland from the baseline period to the All-Payer Model period, but it decreased slightly in the comparison group. The percentage having a primary care visit at any site of care increased in Maryland relative to the comparison by 1.4 percentage points during the 2 years of All-Payer Model implementation overall ($p<0.001$). The increase in the percentage with a primary care visit in Maryland relative to the comparison group was statistically significant in both years, and the difference was larger in Year Two than Year One.

[21] Because of the aforementioned issues in identifying urgent care center visits, visits with an urgent care place of service as well as those from a Method II critical access hospital are combined with physician office visits.

Table 13
Difference in the pre-post change in the percentage of Medicare beneficiaries with primary care visits by place of service for Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Place of service	Baseline Period Adjusted Mean, Maryland	Baseline Period Adjusted Mean, Comparison group	All-Payer Model Period Adjusted Mean, Maryland	All-Payer Model Period Adjusted Mean, Comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Hospital outpatient departments							
Year One	5.1	8.0	5.8	9.1	−0.05 (−0.08, −0.01)	−1.0	0.024
Year Two	5.1	8.0	5.8	9.3	−0.26 (−0.31, −0.21)	−5.1	0.000
Overall	5.1	8.0	5.8	9.2	−0.15 (−0.18, −0.12)	−3.0	0.000
Physician offices[†]							
Year One	68.1	65.8	68.2	64.9	0.82 (0.76, 0.89)	1.2	0.000
Year Two	68.1	65.8	68.9	64.6	1.12 (1.03, 1.20)	1.6	0.000
Overall	68.1	65.8	68.6	64.8	0.97 (0.92, 1.02)	1.4	0.000
FQHCs and RHCs							
Year One	1.0	1.0	1.1	1.0	0.08 (0.06, 0.10)	7.6	0.000
Year Two	1.0	1.0	1.2	1.1	0.17 (0.15, 0.19)	16.3	0.000
Overall	1.0	1.0	1.1	1.0	0.12 (0.11, 0.14)	11.9	0.000

(continued)

Table 13 (continued)
Difference in the pre-post change in the percentage of Medicare beneficiaries with primary care visits by place of service for Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Place of service	Baseline Period Adjusted Mean, Maryland	Baseline Period Adjusted Mean, Comparison group	All-Payer Model Period Adjusted Mean, Maryland	All-Payer Model Period Adjusted Mean, Comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
All sites of care combined							
Year One	71.4	70.7	72.1	70.3	0.97 (0.90, 1.03)	1.4	0.000
Year Two	71.4	70.7	72.7	70.1	1.79 (1.70, 1.87)	2.5	0.000
Overall	71.4	70.7	72.4	70.2	1.38 (1.32, 1.43)	1.9	0.000

NOTE: FQHC = federally qualified health center; RHC = rural health clinic. A logistic regression model was used to obtain estimates of the difference in the percentage of beneficiaries with a primary care visit by place of service. The same baseline period is used for the difference-in-differences (D-in-D) estimate for all implementation periods, so the adjusted mean is the same for each year and for the implementation period overall. For binary outcomes estimated using nonlinear models, the regression-adjusted D-in-D is calculated as the average treatment effect *on the treated*, whereas the D-in-D derived from the adjusted means represents the average treatment effect. As a result, the regression-adjusted D-in-D and the D-in-D calculated from the adjusted means will differ. A *negative* value for the regression-adjusted D-in-D corresponds to a *greater decrease* or a *smaller increase* in an outcome after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in an outcome in Maryland than in the comparison group. The relative difference is the D-in-D estimate as a percentage of Maryland's baseline period adjusted mean. The total weighted N for all models is 31,627,441.

† Physician offices includes visits to urgent care centers.

SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

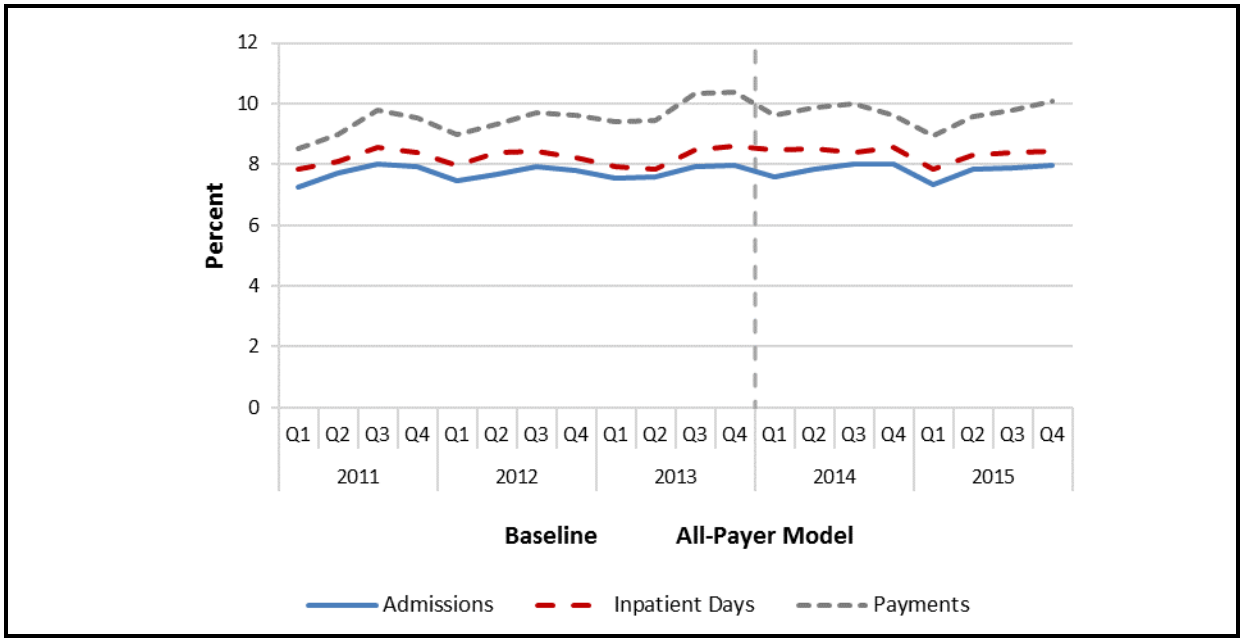
7.2.3 Were There Changes in the Extent of Border Crossing by Both Maryland Residents and Nonresidents in Obtaining Inpatient Care after the Implementation of the All-Payer Model?

- The nonresident share of Medicare admissions to Maryland hospitals remained constant at about 7 percent to 8 percent throughout the baseline and All-Payer Model periods.
- The implementation of the All-Payer Model did not affect the upward trend in the share of admissions for Maryland's Medicare beneficiaries at hospitals outside of Maryland that began during the baseline period.

Figure 32 shows the share of nonresident Medicare admissions, inpatient days, and Medicare inpatient payments at Maryland hospitals.

- The nonresident share of admissions was about 7 percent to 8 percent throughout the baseline and All-Payer Model periods, with no evidence of any trends during these time periods. The nonresident share of inpatient days also showed little evidence of trends. There was no evidence of a structural break in the time trend between the baseline and All-Payer Model periods for either measure.

Figure 32
Share of nonresident Medicare admissions, inpatient days, and inpatient payments at Maryland hospitals for first quarter 2011 through fourth quarter 2015



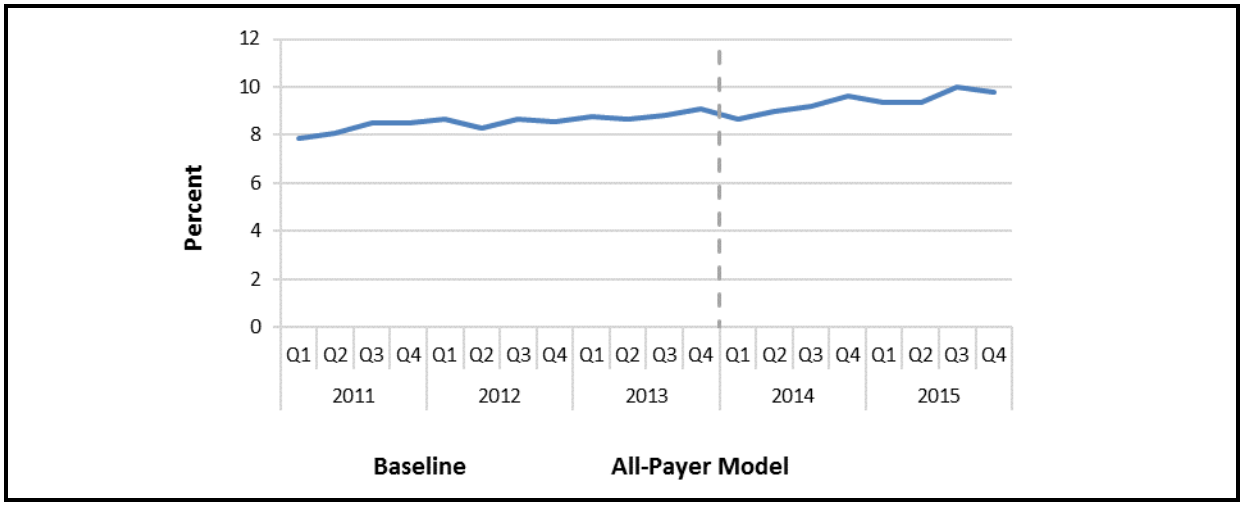
- The nonresident share of Medicare inpatient payments increased throughout the baseline period. The structural break analysis indicated that the share of inpatient payments did not increase as fast in the All-Payer Model period as in the baseline period ($p<0.10$).

We also explored the share of Medicare admissions, inpatient days, and inpatient payments for nonresidents by whether the beneficiary resided in a border state and whether revenues for services provided to nonresidents were included in the hospital's global budget. We did not find a change in the trend the share of Medicare admissions or inpatient days after implementation of the All-Payer Model for any of these groups. The trend in the share of nonresident inpatient payments was slower in the All-Payer Model period than in the baseline period, and this result did not differ by whether the nonresident lived in a bordering state or whether the hospital's budget included nonresident revenues.

Figure 33 shows the share of admissions for Maryland residents at out-of-state hospitals.

- There was an upward trend in the share of admissions for Maryland's Medicare beneficiaries at hospitals outside of Maryland that began during the baseline period and continued after implementation of the All-Payer Model. The test for a structural break between the two periods did not show a change in the trend.

Figure 33
Share of Maryland Medicare beneficiaries' admissions at hospitals outside of Maryland for first quarter 2011 through fourth quarter 2015



7.2.4 Were Costs Associated with Inpatient Episodes of Care Shifted to the Preadmission and Postdischarge Periods after the Implementation of the All-Payer Model?

- During the first 2 years of All-Payer Model implementation overall, regression-adjusted total episode payments increased in Maryland by $231 relative to the comparison group. This is due to increased payments during the hospital admission. Payments during the preadmission and postdischarge windows decreased by $167 in Maryland relative to the comparison group.
- The reduction in payments during the preadmission and postdischarge windows, which seems to be driven primarily by reductions in payments for hospital services after discharge from the index hospitalization, suggests that HSCRC policies designed to discourage inappropriate transfers and to reduce readmissions have had the intended effect.

Table 14 shows the components of inpatient episode payments for the 14-day preadmission, index hospitalization, and 30-day postdischarge windows. Average payments are displayed for the 12-quarter baseline period (January 2011–December 2013) and the 8-quarter All-Payer Model implementation period (January 2014–December 2015).

- Total episode payments were about 14 percent higher in Maryland hospitals than in comparison group hospitals during the baseline period. They were about 12 percent higher in Maryland hospitals than in comparison group hospitals during the All-Payer Model period. Total episode payments increased over time for both groups, but they increased more slowly in Maryland, resulting in a $174 lower total episode payment in Maryland than in the comparison group.

- Payments during the preadmission and postdischarge windows were about 1 percent higher in Maryland hospitals than in comparison hospitals during the baseline period. Payments during the All-Payer Model period were about 4 percent lower for Maryland hospitals than for the comparison hospitals. Preadmission and postdischarge window payments increased over time for comparison group episodes, whereas they fell for Maryland episodes. The change from the baseline period to the All-Payer Model period was $474 less for Maryland hospitals than for comparison group hospitals.

Table 14
Components of Medicare payments for inpatient episodes of care by time period, Maryland and comparison group, first 2 years of Maryland All-Payer Model implementation overall

Window/ payment component	Weighted mean payments				All-Payer Model minus baseline period		Difference-in-differences
	Baseline period		All-Payer Model period				
	Maryland	Comparison group	Maryland	Comparison group	Maryland	Comparison group	
14-day preadmission window							
Physician	335	365	368	383	34	18	15
Outpatient	297	201	332	234	35	33	2
Durable medical equipment	30	31	25	26	−6	−5	−1
Total	662	597	725	644	63	46	17
Index hospitalization window							
Index STAC hospital	12,106	9,376	12,893	9,895	787	519	268
Physician	1,317	1,488	1,375	1,515	59	27	32
Total	13,422	10,864	14,268	11,410	846	546	300
30-day postdischarge window							
Inpatient	3,645	3,542	2,964	3,332	−681	−210	−471
STAC	3,298	2,356	2,702	2,055	−596	−300	−296
Other inpatient	347	1,186	262	1,277	−85	90	−175
Skilled nursing facility	2,610	2,580	2,777	2,810	167	230	−63
Durable medical equipment	79	81	64	69	−15	−12	−3
Outpatient	740	504	815	575	76	71	5
Physician	814	967	808	957	−6	−11	5
Home health agency	601	750	629	742	28	−8	36
Total	8,489	8,425	8,057	8,485	−431	60	−491

(continued)

Table 14 (continued)
Components of Medicare payments for inpatient episodes of care by time period, Maryland and comparison group, first 2 years of Maryland All-Payer Model implementation overall

Window/ payment component	Weighted mean payments				All-Payer Model minus baseline period		Difference-in-differences
	Baseline period		All-Payer Model period				
	Maryland	Comparison group	Maryland	Comparison group	Maryland	Comparison group	
Total episode, all payment components	22,573	19,886	23,051	20,538	478	652	−174
Total preadmission and postdischarge windows, all payment components	9,151	9,022	8,782	9,129	−368	106	−474
Number of observations	468,320	402,612	296,525	245,118	N/A	N/A	N/A

NOTES: N/A = not applicable; STAC = short-term, acute-care.

SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

- The differential growth during the postdischarge window was driven by expenditures on inpatient services for admissions that were subsequent to the discharge from the index hospitalization, as well as expenditures for SNF services. Payments for services at STAC hospitals declined more for Maryland than for comparison group patients. Payments for services at other types of inpatient hospitals (e.g., long-term care hospitals, rehabilitation hospitals, and psychiatric hospitals) declined for Maryland patients but increased for comparison group patients. Payments for services at SNFs increased for Maryland and comparison group patients, but they increased less for Maryland.

Table 15 displays the results of the D-in-D regression analyses for total episode payments and total payments during the 14-day preadmission and 30-day postdischarge windows only. Estimates, derived from the D-in-D regression model, contrast the change in payments from the baseline to the implementation period for Maryland Medicare beneficiaries with the change for Medicare beneficiaries in the comparison group.

- During the first 2 years of All-Payer Model implementation overall, regression-adjusted total episode payments increased in Maryland and decreased slightly in the comparison group. Overall total episode payments in Maryland increased relative to the comparison group, and the difference was statistically significant ($231, $p<0.10$). This contrasts with the unadjusted descriptive analyses, which showed that payments decreased in Maryland relative to the comparison group. The change in total episode payments in Maryland was not statistically significantly different from the comparison group during the first year of the All-Payer Model implementation period. The change in total episode payments in the second year of the All-Payer Model was larger (and statistically significant) for Maryland hospitals relative to comparison hospitals.

- Payments during the preadmission and postdischarge windows decreased in Maryland and increased in the comparison group relative to the baseline period during the first 2 years of the All-Payer model implementation period. Payments decreased significantly in Maryland relative to the comparison group during the first 2 years overall ($167, $p<0.05$). Payments during the preadmission and postdischarge windows in Maryland decreased significantly relative to the comparison group during the first year of the All-Payer Model implementation period, but differences in the second year were not statistically significant.

Table 15

Difference in the pre-post change in Medicare payments for inpatient episodes of care for Medicare beneficiaries in Maryland and the comparison group, first 2 years of Maryland All-Payer Model implementation

Window	Baseline period adjusted mean, Maryland	Baseline period adjusted mean, comparison group	Implementation period adjusted mean, Maryland	Implementation period adjusted mean, comparison group	Regression-adjusted difference-in-differences (90% confidence interval)	Relative difference (%)	p-value
Total episode, all payment windows and payment components							
Year One	22,924.67	19,269.22	23,262.38	19,604.20	4.91 (−249.12, 258.94)	0.0	0.977
Year Two	22,924.67	19,269.22	23,010.58	18,891.47	461.68 (149.20, 774.16)	2.0	0.015
Overall	22,924.67	19,269.22	23,136.48	19,247.83	230.99 (30.04, 431.94)	1.0	0.058
Total preadmission and postdischarge window payments, all payment components							
Year One	9,067.50	8,695.50	9,179.30	9,019.85	−213.20 (−338.36, −88.04)	−2.4	0.005
Year Two	9,067.50	8,695.50	8,732.05	8,478.02	−119.95 (−308.53, 68.64)	−1.3	0.300
Overall	9,067.50	8,695.50	8,955.68	8,748.93	−167.04 (−279.77, −54.31)	−1.8	0.015

NOTE: A generalized linear model with an identity link and normal distribution was used to obtain estimates of the differences in Medicare payments for inpatient episodes of care. The same baseline period is used for the difference-in-differences (D-in-D) estimate for all implementation periods, so the adjusted mean is the same for each year and for the implementation period overall. For continuous outcomes estimated using linear models, the regression-adjusted D-in-D may not match exactly with the D-in-D calculated from the adjusted means due to rounding. A *negative* value for the regression-adjusted D-in-D corresponds to a *greater decrease* or a *smaller increase* in an outcome after implementation of the All-Payer Model in Maryland relative to the comparison group. A *positive* value corresponds to a *greater increase* or a *smaller decrease* in an outcome in Maryland than in the comparison group. The relative difference is the D-in-D estimate as a percentage of Maryland's baseline period adjusted mean. The total weighted N is 1,423,220.

SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

7.3 Discussion

Hospital revenue constraints under the All-Payer Model have the potential to produce unintended spillover effects on other parts of the health care delivery system if they create incentives for hospitals to avoid costly cases or to shift patients either to other hospitals or nonregulated (i.e., nonhospital or out-of-state hospital) providers. Throughout the first 2 years since the implementation of the All-Payer Model, we found only limited evidence of these types of spillover effects on health care services furnished to Medicare beneficiaries.

Hospitals might be more able to avoid complex, costly cases when admissions do not occur through the ED. We found inconclusive evidence as to whether Maryland hospitals' opportunities to avoid such cases changed after All-Payer Model implementation. The share of Medicare admissions that occurred through the ED increased in absolute terms but did not change relative to the comparison group. There was also no evidence that Maryland hospitals avoided costly Medicare cases by transferring patients to other hospitals. There was a slight increase in transfers of Medicare patients to PAC settings in Year Two, but not Year One; however, this change was not concentrated among more severe cases that are expected to be more costly.

Likewise, there was no evidence that the All-Payer Model has led to unbundling of inpatient services for Medicare patients by shifting costs to preadmission or postdischarge periods. The reduction in payments during the preadmission and postdischarge windows, which seems to be driven primarily by reductions in payments for hospital services after discharge from the index hospitalization, suggests that HSCRC policies designed to discourage inappropriate transfers and to reduce readmissions have had the intended effect. However, in Year Two and the first 2 years overall, total episode payments for Medicare admissions to Maryland hospitals increased relative to those to comparison hospitals. This seems to be driven by increased payments for the index hospital admission in Maryland relative to comparison hospitals, which is consistent with the relative increase in the average payment per admission for Medicare beneficiaries reported in ***Section 4***. The D-in-D regressions in these analyses controlled for case mix. Therefore, it appears that faster growth in hospital payment rates, rather than increasing case-mix severity, explains increased payments for the index admission. Analyses reported in ***Section 8*** confirm that hospital payment rates have grown more rapidly in Maryland than in the IPPS. Faster growth in payment rates could be due to more generous rate updates under Maryland's rate-setting system or upward adjustments in charges by hospitals to compensate for reductions in hospital volume.

We found mixed evidence of outpatient care being shifted to nonhospital settings. Although there has been a trend among Medicare beneficiaries in Maryland to greater use of urgent care centers, which might be substitutes for EDs, this upward trend preceded the All-Payer Model and it slowed after implementation. Furthermore, as reported in ***Section 4***, the likelihood of having an ED visit did not decrease relative to the comparison group for the Medicare population after All-Payer Model implementation. The likelihood of having a hospital outpatient department primary care visit increased in Maryland from the baseline to the All-Payer Model period for the Medicare populations. However, the change was smaller than that in the comparison group for Medicare beneficiaries. The relative reduction for the Medicare

population provides some evidence of primary care visits' being shifted to nonhospital settings, and the magnitude of the effect increased from Year One to Year Two.

Border crossing—as evidenced by admissions of out-of-state Medicare beneficiaries to Maryland hospitals and admissions of Maryland Medicare beneficiaries to out-of-state hospitals—did not change after implementation of the All-Payer Model. Although there has been a small upward trend in admissions of Maryland Medicare beneficiaries to out-of-state hospitals, this trend preceded the implementation of the All-Payer Model and, therefore, does not appear to reflect restricted access to Maryland hospitals as a result of global budget constraints. Global budgets for most Maryland hospitals include revenues from out-of-state patients, and so hospitals have no incentive to encourage or discourage nonresident admissions. A small number of hospitals whose global budgets exclude nonresident revenues might have an incentive to increase nonresident admissions; during a site visit, one of these hospitals reported using this strategy as a way to increase revenue. However, our analyses showed no difference in the trend in nonresident admissions by whether a hospital's budget includes nonresident revenues. These analyses were restricted to Medicare beneficiaries, and it is possible that changes might have occurred among privately insured patients or patients from other countries. We will analyze this possibility in future reports using hospital discharge data.

Although the findings from the analyses to date indicate that spillover effects are not a concern, they reflect experience relatively early in the implementation of the All-Payer Model. Hospital behaviors may change over time, particularly if financial constraints increase. The limited evidence of spillover effects—increases in PAC transfers and reductions in primary care visits to hospital outpatient departments—were found for the Medicare population. Future analyses will include data for Medicaid and commercially insured populations.

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SECTION 8
HOW DO INPATIENT PAYMENT RATES UNDER ALL-PAYER RATE SETTING IN MARYLAND DIFFER FROM OTHER PAYMENT SYSTEMS?

Key Takeaways for Inpatient Payment Differentials

- Depending on the year and the basis for comparison, Medicare payment rates for inpatient admissions were 32 to 39 percent higher under Maryland's all-payer rate-setting system than under the IPPS. Because of these higher rates, Medicare payments for inpatient admissions in Maryland averaged $831 to $871 million higher per year than they would have been under the IPPS.
- Depending on the year, commercial insurer payment rates for inpatient admissions were 11 to 15 percent lower in Maryland than in a matched comparison group. Based on these estimated payment differentials, commercial insurer payments for inpatient admissions averaged $433 million less per year in Maryland under all-payer rate setting than in other states.
- These findings are consistent with the expectation that all-payer rate setting will eliminate cross-subsidization among payers. However, they suggest that higher Medicare payments are not fully offset by lower commercial payments and combined payments for Medicare and commercial insurance are higher in Maryland than in areas that do not have all-payer rate setting. This finding does not take into account payments for Medicaid admissions, which are expected to be higher under all-payer rate setting.

8.1 Research Questions

Because Maryland's all-payer rate setting system eliminates cross-subsidization among payers—other than modest discounts for Medicare and Medicaid—some have hypothesized that Medicare payment rates will be higher and commercial insurer payment rates will be lower than they would be in states where hospitals operate under the IPPS. The analyses described in this section examine this hypothesis by comparing Medicare and commercial inpatient payment rates under Maryland's all-payer rate setting system with those that would be expected under the IPPS. These analyses address the following research questions:

- What is the magnitude and direction of the difference in inpatient payment rates for Medicare in Maryland compared with the IPPS?

- What is the magnitude and direction of the difference in inpatient payment rates for commercial payers in Maryland compared with what they would be if hospitals in the state did not have all-payer rate setting?

The analyses compared the weighted average payment per inpatient admission in Maryland and a comparison group for the same mix of admissions. Using the same mix of admissions controls for utilization differences between Maryland and the comparison group so the comparison only reflects payment rate differences. We used two comparisons for the Medicare payments in Maryland: (1) Medicare payments for admissions to a group of matched

comparison hospitals that operated under the IPPS; and (2) Medicare claims for admissions to Maryland hospitals that were repriced to approximate what would have been paid by Medicare if Maryland had operated under the IPPS. The analyses of commercial insurer payments used admissions in comparison hospital market areas in the MarketScan database. The analytic methods are described in ***Appendix A***.

8.2 Results

8.2.1 How do Payment Rates for Medicare Inpatient Admissions in Maryland Compare with Payments under the IPPS?

- Between 2011 and 2015, Medicare payment rates for inpatient admissions were 32 to 39 percent higher in Maryland than in a matched comparison group. The estimated total additional payment during the 5-year period was approximately $4.4 billion, or an average of $871 million per year.
- Results using re-priced Maryland claims to estimate the payment differential were similar. Between federal FYs 2013 and 2015, Medicare payments for inpatient admissions were 32 to 36 percent higher in Maryland than they would have been under the IPPS. The estimated average additional payment was $831 million per year, a total of $2.5 billion during the 3-year period.

Comparison group analyses. ***Table 16*** shows the difference in payment levels by year between Maryland and comparison group hospital admissions. We evaluated the growth in payments over time, as well as the difference in payments, for both groups. The weighted average payment differential ranged from 32 to 39 percent higher in Maryland than in the comparison group for the same mix of DRGs. There is no discernible trend in the payment differential either before or after implementation of the Maryland All-Payer Model in 2014. The average payment for Maryland hospitals grew by 12 percent, from $12,509 in 2011 to $13,960 in 2015. In the comparison group, average payment per admission for the same distribution of DRGs as Maryland grew by 7 percent, from $9,326 in 2011 to $10,008 in 2015. The rate of growth in payments was higher for the comparison group between 2011 and 2012, but higher in Maryland in all other periods. ***Figure 34*** is a graphical representation of the average payments over time, which shows a widening gap, particularly in 2015. Taking into account the average payment differential per admission in each year and the total number of Medicare admissions per year, we calculated that Medicare paid an additional $799 million to $972 million per year for admissions in Maryland than it would have if they had been paid under the IPPS. The estimated total additional payment during the 5-year time period was approximately $4.4 billion, or an average of $871 million per year.

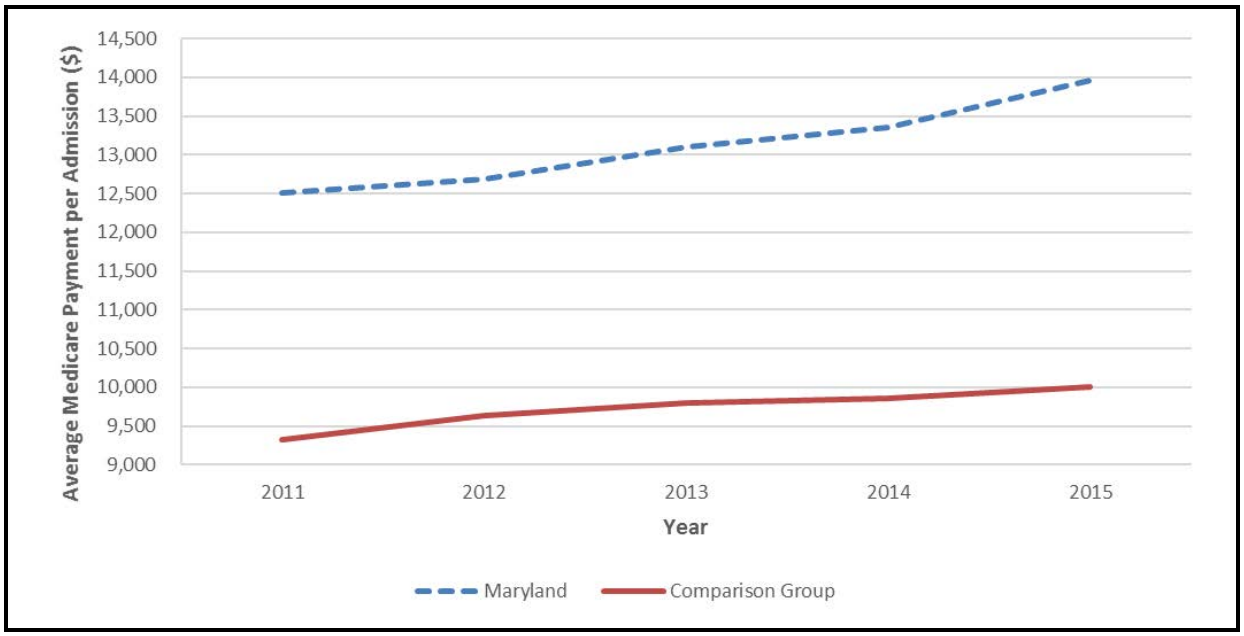
Table 16
Weighted average Medicare payment per admission and payment differential for Maryland and comparison group hospitals, 2011–2015

Payments	2011	2012	2013	2014	2015
Maryland payments ($)	12,509	12,684	13,100	13,349	13,960
Comparison group payments ($)	9,326	9,627	9,794	9,850	10,008
Difference in payment (%)	34	32	34	36	39
Maryland payment annual growth rate (%)	—	1.4	3.3	1.9	4.6
Comparison group payment annual growth rate (%)	—	3.2	1.7	0.6	1.6
Payment differential per discharge ($)	3,184	3,057	3,307	3,499	3,951
Total Medicare discharges	268,721	261,493	256,901	250,622	246,098
Total payment differential ($ in millions)	856	799	850	877	972

NOTE: All calculations are presented in calendar years.

SOURCES: Chronic Conditions Data Warehouse Medicare fee-for-service claims; HSCRC hospital discharge data.

Figure 34
Weighted average Medicare payment per admission by year for Maryland and comparison group hospitals, 2011–2015



SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims.

Repriced claims analyses. We examined the difference in payment levels by year between actual payments and hypothetical IPPS payments derived from repriced claims for Maryland hospital admissions (***Table 17***). The actual Maryland payments ranged from 32 to 36 percent higher than they would have been under the IPPS. The average growth in payments between federal FY 2013 and federal FY 2014 was 2.6 percent for Maryland's actual payments and would have been 2.0 percent if they were paid under the IPPS. This difference in payment growth was larger from federal FY 2014 to federal FY 2015, increasing to 2.9 percent for Maryland's actual payments and decreasing to 1.2 percent for IPPS payments. ***Figure 35*** is a graphical representation of the average payments over time, which shows a widening gap in 2015. Taking into account the average payment differential per admission in each year and the total number of Medicare admissions per year, we calculated that Medicare paid an additional $804 million to $869 million per year for federal FYs 2013–2015. Although the number of Medicare discharges declined over time, the total payment difference increased as a result of the increasing payment differential per discharge. The estimated total additional payment during the 3-year time period was approximately $2.5 billion, or an average of $831 million per year.

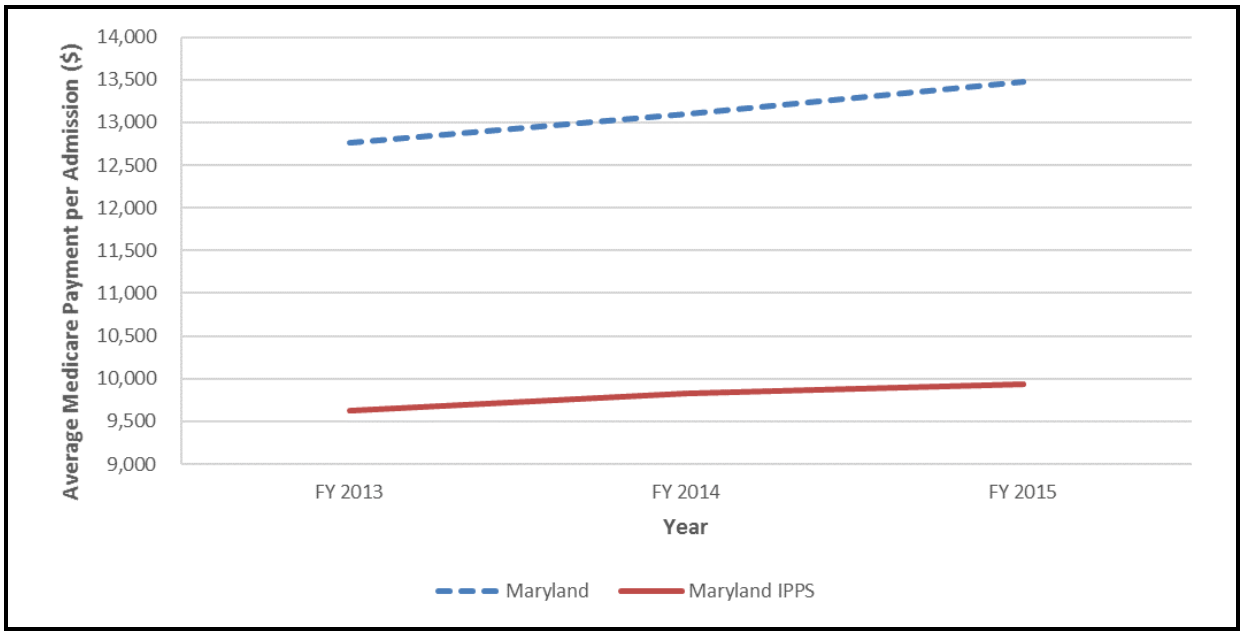
Table 17
Average Medicare payment per admission and payment differential for actual Maryland hospital claims and claims repriced to IPPS payments, 2013–2015

Payments	FY 2013	FY 2014	FY 2015
Maryland actual payments ($)	12,760	13,094	13,473
Maryland IPPS payments ($)	9,632	9,825	9,941
Difference in payment (%)	32	33	36
Maryland actual payment annual growth rate (%)	—	2.6	2.9
Maryland IPPS payment annual growth rate (%)	—	2.0	1.2
Payment differential per discharge ($)	3,128	3,269	3,533
Total Medicare discharges	256,901	250,622	246,098
Total payment differential ($ in millions)	804	819	869

NOTE: Total Medicare discharges are calculated on a calendar year basis. The payment differential is calculated on a federal fiscal year basis.

SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims; repriced Medicare claims data from Lewin Group; HSCRC hospital discharge data.

Figure 35
Average Medicare payment per admission for actual Maryland hospital payments and claims repriced to IPPS payments, 2013–2015



8.2.2 How do Payment Rates for Commercial Inpatient Admissions in Maryland Compare with Payments in Areas That Do Not Have All-Payer Rate Setting?

- Between 2011 and 2014, commercial insurer payment rates for inpatient admissions were 11 to 15 percent lower in Maryland than in a matched comparison group, as expected under all-payer rate setting. Applying these estimated payment differentials from a limited set of commercial insurers in Maryland to all commercially insured admissions in the state, the estimated total commercial insurer payments were approximately $1.7 billion lower in Maryland, or an average of $433 million per year.

Table 18 shows the difference in payment levels by year between Maryland residents and residents of the comparison group market areas using commercial insurer claims data from the MarketScan database. The weighted average payment differential ranged from 11 to 15 percent lower in Maryland than in the comparison group for the same mix of DRGs. The average Maryland payment grew by 9 percent, from $13,010 in 2011 to $14,133 in 2015. For the same distribution of DRGs as in Maryland, the average payment per admission in the comparison group grew from $14,563 in 2011 to $16,533 in 2015, almost 14 percent. The rate of growth in payments was higher for the comparison group in two of the three years. ***Figure 36*** is a graphical representation of the average payments over time, which shows a widening gap over time. Applying the average payment differential from this sample of commercial discharges to the total number of commercial discharges in Maryland, we estimated that annual commercial insurance payments to Maryland hospitals ranged from $369 million to $501 million lower than they would have been if hospitals were paid rates by commercial insurers similar to those in states without all-payer rate setting. Similar to the finding for Medicare using the comparison group, although the number of discharges declined over time, with the exception of 2013 the total payment difference increased as a result of the increasing payment differential per discharge. In aggregate, estimated payments were $1.7 billion lower in Maryland for 2011–2014, or an average of $433 million per year.

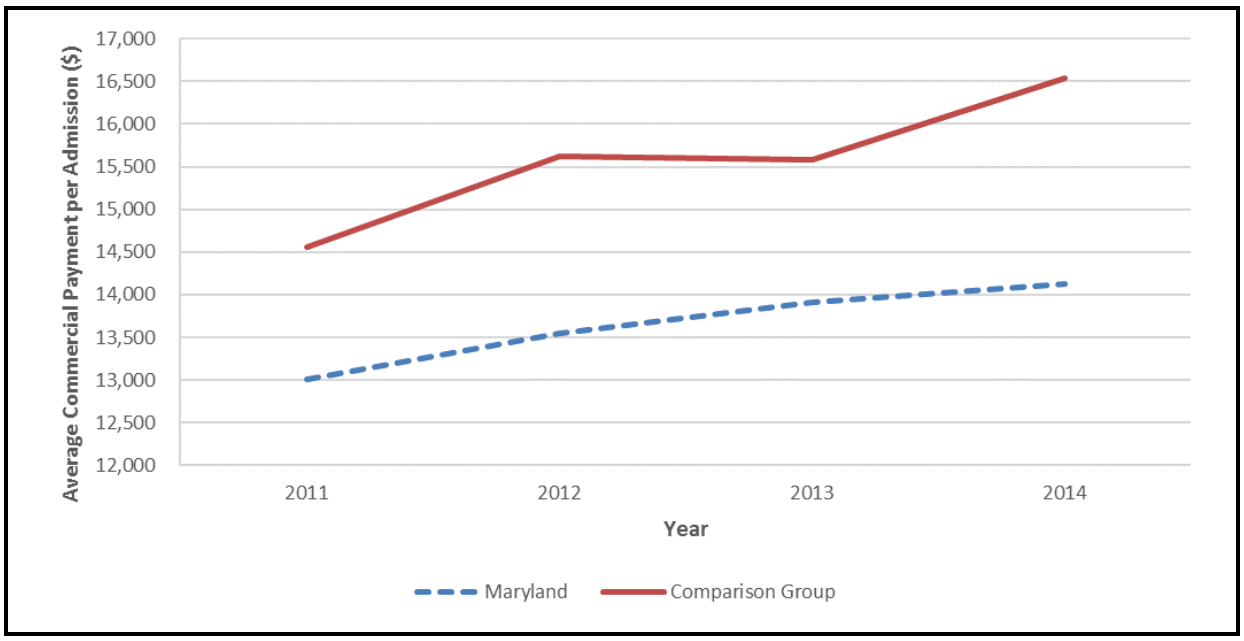
Table 18
Weighted average commercial insurance payment per admission and payment differential for Maryland and comparison group residents, 2011–2014

	2011	2012	2013	2014
Maryland payments ($)	13,010	13,549	13,910	14,133
Comparison group payments ($)	14,563	15,618	15,586	16,533
Difference in payment (%)	−11	−13	−11	−15
Maryland payment annual growth rate (%)	—	4.1	2.7	1.6
Comparison group payment annual growth rate (%)	—	7.2	−0.2	6.1
Payment differential per discharge ($)	−1,552	−2,069	−1,677	−2,400
Total commercial discharges	243,772	234,072	220,210	208,563
Total payment differential ($ in millions)	−378	−484	−369	−501

NOTE: All calculations are on a calendar year basis.

SOURCE: MarketScan commercial claims database; HSCRC hospital discharge data.

Figure 36
Weighted average commercial insurance payment per admission for Maryland and comparison group residents, 2011–2014



We conducted sensitivity analyses restricted to claims for large, self-insured employers in the MarketScan database because of concerns that results could be biased by changes over time in the commercial insurers in the comparison areas that contributed to the MarketScan database. The results of the sensitivity analyses were similar those using the full MarketScan database, but showed a somewhat larger payment differential—depending on the year, 13 to 19 percent lower in Maryland than in the comparison group for the same mix of DRGs (see Appendix Table G-1).[22]

8.2.3 What Is the Net Effect of Medicare and Commercial Payment Differentials on Aggregate Payments to Maryland Hospitals?

- As expected under all-payer rate setting, higher Medicare payment rates for Maryland hospitals compared to what they would have received under the IPPS are offset by lower commercial payment rates in Maryland compared to areas that do not have all-payer rate setting, although higher Medicare payments are only partially offset. After taking into account higher Medicare payments and estimates of lower commercial payments from a limited sample of commercial insurers, net payments to Maryland hospitals ranged from $315 million to $481 million higher per year than they would have been if the state did not have all-payer rate setting. These analyses do not account for Medicaid payment differentials.

To estimate the overall impact of all-payer rate setting on Maryland hospitals, we compared the net payment differential at the state level for Medicare and commercial payers to see if the higher Medicare payments were partially or fully offset by lower commercial payments. At the current time, we do not have data to estimate the differential in Medicaid payments, but these will be incorporated in future reports. Overall, the net difference in payments to Maryland hospitals for Medicare and commercial admissions calculated using Medicare payment rates for comparison group hospitals was higher in all years, ranging from $376 million higher in 2014 to $481 million higher in 2013 (***Table 19***). The net difference in payments to Maryland hospitals calculated using repriced IPPS claims was $435 million higher in 2013 and $318 million higher in 2014. Analyses restricted to self-insured employer commercial claims also showed higher net payments to Maryland hospitals, but the differences were smaller (Appendix Table G-2).

[22] Although the estimated payment differential using self-insured employer claims was larger, the difference from the estimate based on all commercial insurance claims in the MarketScan database (about 4 percent) was the same in 2012 as in 2013 and 2014 when a number of commercial insurers in some of the comparison group market areas stopped contributing to the MarketScan database. This suggests that findings based on all commercial insurance claims most likely are not biased by the change in the commercial insurers contributing to the MarketScan database.

Table 19
Net difference in Medicare and commercial insurance payments for Maryland and comparison group using alternative estimation methodologies

	2011	2012	2013	2014	2015
Medicare payment difference vs. comparison group ($ in millions)	856	799	850	877	972
Medicare payment difference vs. repriced claims ($ in millions)	NA	NA	804	819	869
Commercial payment difference vs. comparison group ($ in millions)	−378	−484	−369	−501	NA
Net payment difference to hospitals vs. comparison group for Medicare ($ in millions)	478	315	481	376	NA
Net payment difference to hospitals vs. repriced claims for Medicare ($ in millions)	NA	NA	435	318	NA

NOTE: IPPS calculations are on a federal fiscal year basis. All other calculations are on a calendar year basis. NA = not available.

SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims; repriced Medicare claims data from Lewin Group; HSCRC hospital discharge data.

8.3 Discussion

Maryland's all-payer rate-setting system eliminates the commercial payer subsidy of Medicare that is present in other states by establishing uniform payment rates for all payers, other than a modest discount for Medicare and Medicaid. These analyses confirm the expectation that Medicare payment rates are higher and commercial payer rates are lower under all-payer rate setting relative to those in their respective comparison groups.

Using two separate methods to estimate the Medicare payment differential in Maryland compared with payments under the IPPS, it appears that higher Medicare payments are partially, but not fully, offset by lower commercial payments under all-payer rate-setting. It will be important to incorporate comparisons of Medicaid rates in future analyses to provider an all-payer perspective. Hospitals likely receive higher payments from Medicaid under all-payer rate setting than they would otherwise and, depending on the year, Medicaid represents about one-fifth to one-quarter of hospital admissions. We also are not able to assess whether lower commercial payment rates are passed on to consumers in the form of lower premiums. This is an important area for future research, though one that is outside the scope of this evaluation.

Although these analyses showed substantial payment differences between Maryland and the comparison group other factors could explain some of the differences. First, Maryland hospitals do not have the same incentives to completely code diagnoses for beneficiaries because, unlike hospitals operating under the IPPS, their payment does not differ on the basis of patient diagnoses. Therefore, we expect that secondary diagnoses may be undercoded in claims

for Maryland hospitals, thus leading to less complex DRG categorizations. Specifically, we expect DRGs with complicating or comorbid conditions and major complicating or comorbid conditions to be less prevalent in the Maryland claims. If this is the case, the payment differential may reflect not only payment rate differences but also higher costs because of the greater complexity of cases within a DRG in Maryland than in the comparison group. As a result, our estimate of the magnitude of the Medicare payment differential may be overstated and the magnitude of the commercial payment differential may be understated.

Second, payment differences between Maryland and the comparison areas may be the result of factors related to location and facility type, including cost differences based on wages and other input prices, and indirect medical education (IME), DSH, UCC, and other adjustments. Payments for comparison hospitals can be standardized to remove IME, DSH, UCC, and wage adjustments, but we were not able to obtain information needed to standardize payments for Maryland hospitals. Therefore, our analyses used payments that were not standardized. Although our comparison hospital selection implicitly controlled for many of these factors, differences between Maryland and the comparison group in the distribution of admissions within a DRG by hospital type may still contribute to payment differences. For example, if relatively more cases occurred at community hospitals in Maryland while relatively more occurred in teaching hospitals in the comparison group, the comparison group payments may have been biased upward. The repriced claims analyses calculated the IPPS payment counterfactual from the same set of claims as the actual payment, which ensures that location and facility type differences are held constant. The differential in Medicare payment amounts under the repriced claims method is very similar to the differential using the matched comparison group, which suggests that the comparison group analyses are likely not biased by differences in hospital location and facility type. Like the comparison group analyses, the repriced claims analyses are subject to upward biases due to potential underreporting of diagnoses.

Finally, hospitals may raise their charged rates in response to reductions in hospital volume to meet the upper limits of their global budgets. If hospitals are increasing their charges in response to global budgets, we would expect a larger net payment differential after the All-Payer Model was implemented in 2014. There is some evidence for this, but the changes are not large.

The analysis of commercial insurance payment differentials has several limitations. First, unlike the Medicare data, which included all Medicare admissions, MarketScan data used to estimate the commercial payment differential are generalized to all commercial admissions using a subset of 8 percent of commercial admissions in Maryland. These admissions include predominately large self-insured employers and are not representative of all commercial claims data. Although a comparable statistic is not available for the comparison group, the MarketScan data presumably represent a similarly small percentage of the commercial insurance population in these areas. Second, we were not able to directly identify hospitals in MarketScan data, so the analysis used hospital discharges for residents of Maryland and residents of the comparison group hospital market areas to identify commercial insurance payments. As a result, this analysis included hospitalizations that were not in a Maryland or comparison group hospital. Analyses of Medicare data showed that only about half of comparison group resident admissions were to the comparison group hospital in the market area where they resided. Although a similar percentage

of Maryland residents were admitted to a hospital in the market area where they resided, about 90 percent of hospital admissions for Maryland residents were to a Maryland hospital. As a result, the Maryland claims used in the commercial analyses were nearly all for admissions to Maryland hospitals, but a high percentage of the comparison group claims were for admissions to hospitals that were not comparison group hospitals and, therefore, were not matched to Maryland hospitals. This could bias the estimate of the payment differential if, for example, beneficiaries travel outside of their market area for more specialized treatment that is more likely to be available from teaching or other hospitals with higher prices. To assess the impact on the commercial payment analyses of including admissions to hospitals that were not part of the comparison group, we applied the commercial payment methodology to Medicare data and compared the comparison group payment estimate from this method to the estimate based on comparison group hospitals only. Medicare payments for the comparison group were 7 to 9 percent higher following the methodology used in the MarketScan analyses. If commercial insurance payment rate estimates were biased upwards similarly in our analyses of MarketScan data, the magnitude of the commercial payment differential in Maryland would be overstated.

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SECTION 9
DISCUSSION

The All-Payer Model is expected to limit growth in hospital costs for Medicare and the Maryland population overall, while reducing avoidable utilization and improving population health. The second year of our evaluation continued to show evidence of success for the All-Payer Model in some areas; for several outcomes, findings strengthened from Year One to Year Two. However, there were ongoing challenges in achieving some goals.

We found Maryland hospitals reduced both total expenditures and total hospital expenditures for Medicare beneficiaries without shifting costs to other parts of the Maryland health care system outside of global budgets or to out-of-state providers. The successes are particularly notable because site visit discussions indicated that hospitals varied widely in the extent to which they had developed strategies to reduce utilization and, to the extent they had implemented such strategies, the initiatives were fairly new.

Medicare population analyses suggest that hospitals may be responding to the All-Payer Model in part by reducing provision of outpatient services. Although hospital expenditures for Medicare beneficiaries in Maryland fell relative to the comparison group following implementation of the All-Payer Model, there was no difference in the growth in inpatient facility expenditures. Rather, the reduction was driven by decreases in ED and other hospital outpatient department expenditures.

Outpatient ED expenditures decreased relative to those for the comparison group because of a significant reduction in the payment per ED visit; however, there was an absolute increase in the ED visit rate for Medicare beneficiaries in Maryland and an increase relative to the comparison group. The increase in the ED visit rate could reflect hospitals' success in reducing admissions of people seen in the ED. During site visits, hospitals reported at least some investment in reducing ED use, but the consensus was that more time was needed for changes by patients and clinicians to occur that would alter care-seeking patterns. This increase in the ED visit rate also corroborates stakeholder perceptions that most Maryland hospitals have been slow to implement community partnerships that could help shift ED use to community physicians.

Despite a reduction in admissions, the change in inpatient facility expenditures for Medicare beneficiaries did not differ for Maryland and the comparison group because the payment per admission grew more rapidly in Maryland. The payment per admission could increase if fewer cases that might have been treatable in outpatient settings were admitted and the avoided admissions are less severe cases. This is consistent with reports by hospital leaders that Maryland hospitals are shifting routine and lower-intensity cases to nonhospital settings. Although we did find a greater increase in admission severity, as measured by DRG weight, in Maryland than in the comparison group during the first 2 years of the All-Payer Model, after controlling for changes in case mix the payment per admission still increased more in Maryland than in the comparison group. Faster growth in the case-mix adjusted payment per admission suggests that hospital payment rates grew more rapidly in Maryland than in the IPPS, which was confirmed by analyses that showed a modest widening of the differential between inpatient payment rates in Maryland and the IPPS following implementation of the All-Payer Model. This could result from differences between the rate updates in Maryland's all-payer rate-setting

system and in the IPPS, as well as rate adjustments made by hospitals to regain some of the lost revenue from decreased utilization.

We found progress in decreasing avoidable or reducible utilization after implementation of the All-Payer Model for Medicare beneficiaries in Maryland relative to the comparison group, including reductions in unplanned readmissions, ACSC admissions, and the percentage of Medicare patients who had an ED visit within 30 days after hospital discharge. Although reducing readmissions has been a hospital target nationwide for several years, the relatively larger decline in Maryland suggests that the focus on this in the All-Payer Model is yielding positive results. The most common strategy adopted by hospitals in response to the All-Payer Model, including those that had made minimal efforts to adapt to the new system, was to increase investment in initiatives to improve care continuity and management, discharge planning, and treatment adherence. In addition, changes to global budget update policies strengthened incentives to reduce readmissions. While the reductions in ED visits and unplanned readmissions after hospital discharge might suggest improvement in care transitions from the hospital to community providers, there was little change in the percentage of hospital discharges that had a follow-up visit within 14 days of discharge and no difference in the change relative to the comparison group. Although hospitals described care continuity as a focus, they provided few examples of hospitals developing partnerships with community physicians other than purchasing physician practices.

Perhaps because of HSCRC policies intended to discourage inappropriate transfers and reduce readmissions, we also did not find that the All-Payer Model encouraged unbundling of inpatient services for Medicare patients by shifting costs to preadmission or postdischarge periods or increased transfers of costly patients to other STAC hospitals or PAC settings. There was some evidence that primary care visits for Medicare beneficiaries were shifted to nonhospital settings, but expenditures for professional services decreased in both regulated and unregulated settings relative to the comparison group and, as noted earlier, total PBPM Medicare expenditures have fallen relative to the comparison group during the All-Payer Model period.

In some instances, the findings from our evaluation differ from those based on performance against the terms of the agreement with CMS. For example, the comparison with the national average in the All-Payer Model agreement showed faster growth in per capita total cost of care for Medicare beneficiaries in Maryland in the second year of the All-Payer Model. The D-in-D analyses conducted for this evaluation showed reductions in total expenditures in Maryland relative to the comparison group in each of the first 2 years and the first 2 years overall. To the extent our evaluation and the All-Payer Model agreement use comparable outcomes, the results of evaluation analyses through Year Two suggest stronger performance by the All-Payer Model. The difference is likely because the D-in-D methodology used in this evaluation has a different basis for comparison than the model agreement terms. D-in-D estimates are regression adjusted and based on comparison with a set of hospitals and populations in market areas selected because they are comparable to those in Maryland. The model agreement terms are based on comparison with either hospitals nationwide or externally established benchmarks (e.g., the previous 10-year growth in gross state product [GSP]). In addition, the outcomes used to measure compliance with the terms of the All-Payer Model agreement may differ somewhat from the evaluation outcomes.

Maryland's all-payer hospital payment rates are explicitly intended to eliminate cross-subsidization among payers. As a result, Medicare payment rates in Maryland are expected to be higher than they are in other states, whereas commercial payment rates are expected to be lower. These expectations were confirmed in our analyses. Both before and after implementation of the All-Payer Model, we found substantially higher Medicare payment rates under Maryland's all-payer rate-setting system than under the IPPS, and the magnitude was similar regardless of whether the estimate was based on IPPS payments in comparison hospitals or simulated IPPS payments for Maryland hospitals. As noted earlier, this could result from differences between the rate updates in Maryland's all-payer rate-setting system and in the IPPS, as well as rate adjustments made by hospitals to regain some of the lost revenue from decreased utilization. We also found substantially lower payment rates for commercial patients in Maryland than for those in the comparison group. These findings for Medicare and commercial payment rates, although not unexpected given the goal of eliminating payer cross-subsidies, may be biased by less complete diagnosis coding on hospital claims in Maryland, which results in assigning higher-complexity cases to lower-resource-intensity DRGs in Maryland hospitals than in other hospitals. As a result, less complete diagnosis coding may overstate the extent to which Medicare payments are higher in Maryland and understate the payment differential for commercial patients.

Limited hospital revenue growth under global budgets does not appear to have had an adverse effect on hospital operating margins, which grew in the early years after implementation of the All-Payer Model. Increasing operating margins suggest that cost containment initiatives described by hospital leaders—including staffing changes, price negotiations with suppliers, and consolidations of service lines within hospital systems—may have yielded efficiencies. However, it is also possible that rate updates exceeded underlying trends in operating expenses, despite concerns voiced by some hospital stakeholders that rate updates had been less than expected.

Maryland hospitals must operate within a narrow 0.5 percent corridor around their global budgets or face substantial penalties. To date, most hospitals have successfully managed their revenues to remain within the budget corridor even with declining growth in budgets, but in FY 2016 the majority of hospitals with revenues outside the 0.5 percent corridor overran the approved revenues in their global budget, whereas the opposite was the case in FY 2015. We continued to find that some types of hospitals had greater challenges remaining within the budget corridor—namely, GBR hospitals, small hospitals, hospitals affiliated with hospital systems, and hospitals with high DSH percentages. GBR hospitals have had less time to adapt to global budgets than TPR hospitals, which have been operating under global budgets since FY 2011 or earlier, and interviews with hospital stakeholders suggest that GBR hospitals' strategies for operating under global budgets are less developed. Smaller hospitals and hospitals with high DSH percentages may have fewer resources to invest in strategies to adapt to global budgets. Smaller hospitals also may experience greater variability in their patient volumes, which makes it more difficult to remain within the narrow 0.5 percent budget corridor.

Hospitals continued to make rate adjustments during the course of the year, and during site visits, hospital finance leaders described rate modifications as a critical tool for operating within global budgets. In FY 2016 about one-third of hospitals received permission to vary their

rates by more than 5 percent from the hospital-specific rates established by the HSCRC. Unlike in FY 2015, most hospitals requested permission early in FY 2016 rather than waiting until the end of the year. Although the numbers were smaller than in FY 2015, in FY 2016 many hospitals varied their rates by more than 10 percent despite the fact that almost none of them had been granted permission to do so. However, the average rates charged over the course of the year for most of these hospitals differed from the rate order amount by smaller amounts, suggesting that hospitals made offsetting rate increases and decreases over the course of the year in response to short-run volume fluctuations to ensure that they remained in compliance with their annual budgets.

To some extent, hospital savings are virtually guaranteed by the design of the All-Payer Model, which directly restricts hospital revenues, as long as hospitals operate within their allowed budgets. The large percentage of hospitals that continue to request permission to vary their rates in order to meet their budgets raises questions about the extent to which expenditure reductions reflect meaningful changes in utilization. However, there were reductions in certain types of hospital utilization after implementation of the All-Payer Model for the Medicare population.

The HSCRC continues to fine-tune its policies to encourage hospital efforts to reduce avoidable utilization and to improve the All-Payer Model's performance in areas where it was not as strong as desired. For example, the HSCRC increased the reward for meeting the annual readmission reduction target and introduced penalties for failing to do so. A tension between competing needs for midcourse refinements and policy stability emerged during site visit discussions with hospital stakeholders. In addition, stakeholders in some hospitals expressed concern that the All-Payer Model restricted their financial capacity to invest in infrastructure and initiatives that would support more efficient care delivery. It will be important to see whether hospital strategies to reduce avoidable utilization mature and whether hospitals that have yet to make fundamental changes begin to do so.

During site visits we heard little evidence that hospitals were developing strategies to align hospital and physician incentives or reduce patient demand for hospital services by improving population health and altering care-seeking patterns. The absence of improvement in follow-up visit rates and the failure to reduce ED use may reflect the lack of progress in these areas. Effecting change in outcomes that require actions outside a hospital's direct control is more challenging than doing so for outcomes that can be influenced by internal hospital initiatives such as triaging ED patients, meeting quality-of-care goals, or increasing operating efficiency.

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APPENDIX A:
ANALYTIC METHODS

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A.1 Primary Data Collection and Analysis

The RTI evaluation team conducted two types of qualitative data collection—telephone interviews with key informants and in-person hospital site visits comprising individual interviews and focus groups. Key informants selected for telephone interviews included payers; state officials; and representatives of physician, hospital, and PAC organizations. Ten hospitals were selected for in-person site visits. The selection was based on several factors to achieve as representative a sample of Maryland hospitals as possible: (1) urban or rural location, (2) hospital size, (3) global budget model (GBR or TPR), and (4) system affiliation. Hospitals that participated in the first round of interviews in 2015 were excluded from consideration. Key informant interviews were conducted as participants' schedules allowed, with each interview typically lasting for 1 hour. Each of the 10 site visits took place on a single day, with three or four RTI staff members either conducting the interviews and focus groups or taking summary-level notes. After each site visit, members of the site visit team summarized their interview and focus group findings in a debriefing document that served as the basis for the analysis presented in ***Section 2*** of this report.

Table A-1 shows the number of interviews and site visits conducted from March through August 2016. RTI interviewed nine key informants comprising a variety of state regulators, payers, and professional advocacy organizations for health care providers. During the site visits at 10 Maryland hospitals, RTI staff interviewed 54 senior hospital leaders, including chief executive, financial, medical, and nursing officers as well as upper-level managers responsible for case management, population health, or quality of care.

Table A-1
Interviews and site visits conducted in 2016

Category	N
Key informant interviews	9
Hospital site visits	10
Individual Hospital leaders interviewed during site visits	54

Interviews with hospital administrators were complemented by two focus group discussions at each site for a total of 20 focus groups. Physician focus groups consisted of physicians who (1) had been working in their respective hospitals for a minimum of 5 years; (2) primarily provide patient care, rather than teach or conduct research; and (3) had a patient volume in the top 50 percent of physicians in their hospital. Focus groups for nurses and care management personnel focused primarily on staff with direct patient interaction and included bedside nurses, nurse managers, discharge planners, and other care management staff. Each hospital was responsible for identifying and recruiting the appropriate health care providers for these focus group discussions.

Table A-2 shows the number of physicians and nurses or care managers that participated in focus group discussions in 2016. The RTI site visit team conducted 10 focus group discussions with a total of 71 physicians and 10 focus group discussions with a total of 92 hospital nursing and care management staff. Although we attempted to recruit 10–12 participants for each focus group, the number of actual focus group participants varied by site, based largely on the availability and willingness of clinical staff to participate; the size of our focus groups did not vary by hospital size. By their nature, focus groups are not statistically representative of any individual hospital or its clinical staff and are designed to offer supplemental descriptive data. Our goal in these focus group discussions was to identify both common and unique perspectives based on experience of a convenience sample of hospitals' clinical staff members.

Table A-2
Focus group participant composition in 2016

Hospital	Physicians (N)	Nurses (N)
A	6	20
B	11	12
C	8	4
D	6	7
E	8	11
F	5	5
G	9	6
H	10	10
I	3	7
J	5	10
Total	**71**	**92**

A.2 Secondary Data Analysis

To estimate the impact of the Maryland All-Payer Model on a broad variety of outcomes, we conducted quantitative analyses using several secondary data sources. We present results of both descriptive trends and D-in-D analyses for outcomes across six of the evaluation domains: (1) hospital financial performance; (2) service mix; (3) service utilization and expenditures; (4) quality of care; (5) spillover effects; and (6) comparison with IPPS. This appendix details the methods we used for each of these domains.

Hospital financial performance—The analyses of hospital financial performance in Section 3 include information from 46 of the 47 Maryland acute care hospitals. Holy Cross Germantown, which opened in October of 2014, was excluded because its global budget had not

been established during the time period covered by most of the analyses in this report.[23] All analyses include regulated and unregulated services, as well as services to patients who are not residents of Maryland.

The analyses subdivided facilities into five major hospital characteristic categories (***Table A-3***). Hospital characteristics were defined using the 2014 Medicare Impact file and the Maryland Health Care Commission's (MHCC) *Annual Report on Selected Maryland Acute Care and Special Hospital Services* for FY 2015. To maintain consistent comparisons over time, we do not redefine hospital characteristics using updated information. Data for the University of Maryland at Dorchester were combined with those for the University of Maryland Shore Medical Center at Easton in the Medicare Impact file, which was used to define teaching status and DSH percentage. Therefore, teaching status and DSH percentage for these hospitals were based on their combined information in the Impact file.

Adherence to global budgets was determined using global budget and total revenue data obtained from the HSCRC for FY 2014, FY 2015, and FY 2016. A list of hospitals receiving penalties for failing to adhere to their budgets in FY 2015 and FY 2016 and the amounts of penalties was provided by the HSCRC.

Table A-3
Number of Maryland hospitals by selected characteristics

Hospital characteristic	Number of hospitals [1] (percentage of all hospitals)
All Maryland hospitals	**46 (100%)**
Current regulatory system	
Global Budget Revenue	36 (78%)
Total Patient Revenue	10 (22%)
Number of inpatient beds	
<150	14 (30%)
150–349	23 (50%)
350+	9 (20%)
Teaching status [2]	
IBR ≤ 5%	33 (72%)
IBR > 5%	13 (29%)
DSH percentage [2]	
<20	18 (39%)
20–30	16 (35%)
>30	12 (26%)

(continued)

[23] Holy Cross Germantown will begin operating under a modified global budget in FY 2016.

Table A-3 (continued)
Number of Maryland hospitals by selected characteristics

Hospital characteristic	Number of hospitals [1] (percentage of all hospitals)
System affiliation	
Affiliated	29 (63%)
Not affiliated	17 (37%)

[1] The analyses include information from 46 of the 47 Maryland acute care hospitals. Holy Cross Germantown Hospital opened in FY 2015, but it is excluded from these analyses because it did not operate under a global budget during the time period covered.

[2] Intern-to-bed ratio (IBR) and disproportionate share hospital (DSH) percentage were based on data from the 2014 Medicare Impact file. Data for University of Maryland Medical Center at Dorchester are reported under University of Maryland Shore Medical Center at Easton in the Impact file. Therefore, teaching status and DSH percentage for these hospitals were based on their combined information in the Impact file.

Hospital charged rates for the selected services are calculated from the HSCRC Revenue and Volumes Report, which contains inpatient and outpatient revenue and volume data by rate center for each Maryland hospital. The report also includes hospital beds by rate center. Final Revenue and Volumes Reports were used for FYs 2011–2015; an interim report was used for FY 2016 because the final report was not available in time for this report. Hospital statements of revenues and expenditures, obtained from the HSCRC, include information on regulated and unregulated revenues, operating expenses, UCC (including bad debt, charity care, and uncompensated care), and operating margins (percentage excess or deficit of operating revenues net of deductions and operating expenses relative to operating revenues net of deductions). Individual hospital rates by rate center set by the HSCRC were taken from hospital rate orders for each fiscal year. Information on approval to vary rates beyond the 5 percent corridor was obtained from quarterly reports submitted by the HSCRC to CMS. Depending on data availability, the time periods included in the analyses vary. All financial analyses included FYs 2012–2015. Analyses of hospital adherence to rate corridors included FYs 2014–2016 (first two quarters of FY 2014 only). Analyses of hospital beds and patient volume included FYs 2011–2016.

IPPS comparison analyses—The analyses compared the weighted average payment per inpatient admission in Maryland and a comparison group for the same mix of admissions. We used two comparisons for the Medicare payments in Maryland: (1) Medicare payments for admissions to a group of matched comparison hospitals that operated under the IPPS; and (2) Medicare claims for admissions to Maryland hospitals that were repriced to approximate what would have been paid by Medicare if Maryland had operated under the IPPS. The analyses of commercial insurer payments used admissions in comparison hospital market areas in the MarketScan database.

Medicare analyses. We compared Medicare payments for inpatient admissions in Maryland with the IPPS in two ways. The first method compared the weighted average Medicare payments for inpatient admissions to Maryland hospitals with the weighted average Medicare payments for admissions to a group of comparison hospitals that operated under the IPPS. We used all admissions to Maryland hospitals and to the comparison group hospitals. We excluded any DRG that was not present in both Maryland and the comparison group in each year. Analyses included Medicare claims data for inpatient discharges from CY 2011 through CY 2015. Medicare payments to the comparison hospitals served as a proxy for what Maryland hospitals would have been paid under the IPPS. To ensure a fair comparison, we added the per diem payments (bad debt, organ acquisition, capital pass through and direct graduate medical education) to the comparison group's IPPS payment amounts because reimbursement for these costs are incorporated in Maryland's all-payer rates. We calculated Medicare inpatient payments for each inpatient stay for all admissions to eligible Maryland or comparison group hospitals. Calculating the average for comparison hospitals involved several steps. We applied a matching weight that accounts for the number of comparison hospitals matched to each Maryland hospital and the fact that some comparison hospitals were matched to more than one Maryland hospital. In addition, we applied a volume weight so the proportion of comparison group admissions represented by an individual comparison hospital was the same as the proportion of Maryland admissions that its matched Maryland hospitals represented. Comparison hospitals' contribution to the overall comparison averages were calculated using the hospital matching weights and the admission volume weights, as described above. We then calculated the average payment for each DRG by year for admissions to both Maryland and comparison group hospitals. Next, we calculated the DRG weighted average payment per admission by year in both Maryland and the comparison group. To apply the same weight to DRGs in Maryland and the comparison group, we calculated the relative weight for each DRG/year combination in Maryland by dividing the count of admissions in each DRG by the sum of all admissions in that year. This annual DRG weight was then applied to each DRG/year combination in the comparison group to calculate the average payment per admission based on a distribution of DRGs equivalent to that found in Maryland. In addition to calculating the difference in the average payment per admission, we multiplied this number by the total number of Medicare discharges in Maryland, obtained from HSCRC hospital discharge data, to calculate the total payment differential.

The second method for comparing inpatient Medicare rates in Maryland with the IPPS used repriced inpatient claims for Maryland[24] to approximate what would have been paid by Medicare if Maryland had operated under the IPPS. These analyses included Medicare claims data for Maryland inpatient discharges in federal FYs 2013, 2014, and 2015. This analysis provides an alternative comparison of the payment differential that controls for any differences between Maryland and comparison group hospitals in factors related to location and facility type that might influence the comparison described above. We calculated the average payment per admission using repriced claims and compared it to the actual average payment under

[24] Repriced claims for Maryland hospitals were prepared by the Lewin Group under a contract with CMS.

Maryland's all-payer rate-setting system.[25] As we did for the comparisons using comparison hospital data, we multiplied the payment difference per admission by the total number of Medicare discharges, obtained from HSCRC hospital discharge data, to calculate the total payment differential.

Commercial analyses. The second question was addressed using commercial claims from the MarketScan database. The analyses included hospital discharges in CY 2011 through CY 2014. MarketScan data include approximately 8 percent of all commercial admissions in Maryland,[26] and large employers are overrepresented. The commercial payer analyses followed the methodology used in the first type of Medicare analyses described above—that is, we compared the weighted average payments for inpatient admissions of commercially insured patients in Maryland with those for commercially insured patients in the comparison group, using weights defined based on the share of commercial insurance admissions by DRG in Maryland hospitals. Because of limitations in MarketScan data, we were not able to identify admissions to specific hospitals. Instead, we used all admissions for Maryland and comparison group residents.[27] In a manner similar to that of the Medicare analyses, we multiplied the difference in the weighted average payment per admission by the total number of commercial discharges, obtained from HSCRC hospital discharge data, to calculate the total payment differential.

MarketScan data include both claims for admissions covered by commercial insurers and admissions covered by self-insured employers. A number of commercial insurers in some of the comparison group market areas stopped contributing to the MarketScan database beginning in 2013. This could bias comparison group payment trends if these insurers' payment rates differed systemically from the remaining payers. Participation of self-insured employers, however, was generally stable over the study period. To test the sensitivity of our results to this change in the participating payers, we conducted the same analyses restricted to admissions paid by self-insured employers.

Descriptive analyses of utilization, expenditure, and quality-of-care outcomes—For the descriptive analyses of key utilization, expenditure, and quality-of-care trends, we present graphs of quarterly averages for Maryland and the comparison group for the baseline period (2011–2013) and the first 2 years of the All-Payer Model period (2014 and 2015) for Medicare beneficiaries. The quarterly averages were weighted by the product of two factors: (1) the fraction of the quarter during which the beneficiary was eligible for the analyses (the eligibility

[25] A simple average, rather than a weighted average, was used in the comparisons using repriced claims. The repriced claims data and the claims data with actual payment amounts included the same discharges, so the annual DRG weights are identical in the two datasets.

[26] We do not have comparable information for the comparison group but they presumably represent a similarly small share of all commercial admissions.

[27] Because of the difference in the sample population, matching weights and volume weights were calculated at the hospital market area level, rather than the hospital level.

fraction) and (2) the beneficiary's propensity score. The quarterly weighted number of observations for the key outcomes we present graphs for are shown in ***Table A-4***.

Because some individuals were not enrolled in health insurance throughout an entire period, we calculated eligibility fractions for each individual. The eligibility fraction is defined as the total number of months the person was enrolled in a given period divided by total number of months in the period. For example, an individual enrolled in Medicare for 2 months of a quarter has an eligibility fraction of 0.66 for that 3-month period. The eligibility fraction was used to inflate outcomes, such as expenditure and utilization data, if an individual was not enrolled for an entire period for any reason, including death.[28] Inflating these outcomes provides comparability to those for individuals who are enrolled for the full quarter. The eligibility fractions are also used to calculate weighted average outcomes. The eligibility fractions downweight observations for beneficiaries who are not eligible for the full period because there is greater uncertainty about the information, so the observations exert less influence on the analyses.

Table A-4
Weighted number of observations for core outcomes

Group and time period	Medicare spending outcomes	Medicare utilization outcomes	Medicare 30-day unplanned readmissions
2011			
Q1	648,509	656,720	36,982
Q2	651,544	659,602	35,415
Q3	660,639	669,319	33,824
Q4	667,399	676,547	34,474
2012			
Q1	666,461	675,846	34,461
Q2	672,865	681,655	33,667
Q3	683,615	692,649	32,366
Q4	690,712	699,574	33,280
2013			
Q1	691,370	701,073	34,201
Q2	697,793	706,674	33,231
Q3	708,173	717,158	31,645
Q4	714,579	723,248	32,123

(continued)

[28] We chose to not prorate people who died in a time period differently because we did not expect there to be a difference in the death rate between Maryland and comparison areas. The impact of inflating outcomes for decedents is more modest for outcomes measured over quarterly rather than annual periods.

Table A-4 (continued)
Weighted number of observations for core outcomes

Group and time period	Medicare spending outcomes	Medicare utilization outcomes	Medicare 30-day unplanned readmissions
2014			
Q1	713,989	723,327	32,104
Q2	718,950	727,511	32,163
Q3	730,771	739,909	31,034
Q4	737,522	746,572	32,613
2015			
Q1	738,462	748,227	33,254
Q2	742,126	751,183	31,761
Q3	752,789	761,941	31,191
Q4	758,633	767,934	32,662
2011			
Q1	831,350	841,392	49,160
Q2	836,047	846,025	48,956
Q3	847,322	857,879	47,920
Q4	856,285	867,337	48,159
2012			
Q1	849,366	860,740	47,347
Q2	856,847	867,702	47,162
Q3	869,628	880,775	45,810
Q4	877,068	887,854	46,673
2013			
Q1	870,847	882,326	46,699
Q2	877,655	888,460	45,600
Q3	889,476	900,721	43,917
Q4	897,152	908,204	43,399
2014			
Q1	867,156	893,554	41,687
Q2	861,382	876,538	43,368
Q3	851,506	869,624	42,080
Q4	854,645	869,065	43,222
2015			
Q1	821,633	837,837	40,993
Q2	830,562	843,202	42,168
Q3	844,703	856,683	40,222
Q4	850,193	864,854	41,335

Baseline analyses for difference-in-difference models. The following section describes the baseline analysis we conducted to inform the D-in-D model. A quarterly fixed-effects model considered for the evaluation is shown in ***Equation A.1***:

$$y = \alpha_0 + \alpha_1 I + \sum \beta_n Q_{n,b} + \delta_0 Post + \sum \varphi_t Q_{t,p} \bullet I + \delta X + \mu \quad , \qquad \text{(A.1)}$$

where

y = a performance measure (e.g., total PBPM cost per quarter) for the *i*-th beneficiary in the *j*-th group (Maryland or comparison), in period t (i,j,t subscripts suppressed).

I = a 0,1 indicator (0 = comparison group, 1 = Maryland).

Post = a 0,1 indicator (0 = base period, 1 = post [All-Payer Model] period).

X = a vector of patient and hospital characteristics.

$Q_{n,b}$, $Q_{t,d}$ = 0,1 indicator of the *n*-th or *t*-th calendar quarter in the base (*b*) or post (*p*) period (*n* starts counting at first baseline period, whereas *t* starts with first All-Payer Model quarter).

μ = error term.

The model in ***Equation A.1*** assumes that, except for an intercept difference α_0, the outcomes for beneficiaries in Maryland and beneficiaries in the comparison groups followed a similar growth trend during the baseline period. We investigated whether the baseline period before the start of All-Payer Model satisfied the baseline trend assumptions of the D-in-D model in ***Equation A.1***—that is, whether the outcome trends for beneficiaries in Maryland and in the comparison group were similar during this period. Because we have 12 baseline quarters, it is possible to assess whether baseline outcome trends were, in fact, similar across groups.

One option for testing the assumption that Maryland and the comparison group had similar baseline trends is to estimate the model in ***Equation A.1*** for the baseline period only and expand the model by including a set of interactions between I_j (the Maryland indicator) and the indicators for the baseline quarters on the right-hand side of the model. Statistically significant interaction coefficients would indicate whether the outcome difference between Maryland and the comparison group increased or decreased in particular baseline quarters. However, it is difficult to make a judgment about a trend on the basis of a large number of interaction coefficients because it is not clear how to interpret the many sequences of significant and insignificant coefficients that could arise.[29]

[29] For example, suppose that the interactions coefficients for quarters 2, 5, and 8 are statistically significant. From such a pattern, it would be difficult to conclude whether outcome trends during the baseline period were similar or not.

As an alternative, simpler approach to testing the similarity of baseline trends, we used a model with a linear trend during the baseline period. We tested whether this trend differed for Maryland beneficiaries relative to comparison group beneficiaries. Specifically, the model for the outcomes may be written as follows.

$$y = \alpha_0 + \alpha_1 I + \theta \bullet t + \lambda I \bullet t + \delta X + \mu. \quad \text{(A.2)}$$

In ***Equation A.2***, *y, I,* X, and μ are defined as in ***Equation A.1***. The variable *t* is linear time ranging from 1 to 12. The linear time trend in the comparison group is θ•*t*, whereas for Maryland beneficiaries (*I*=1) it is $(\theta + \lambda)*t$. Hence, λ measures the difference in linear trends and the *t*-statistic for this coefficient can be used to test the null hypothesis of equal trends (λ =0). In other words, rejecting the null hypothesis would suggest that the assumption of equal trends underlying our outcome models is not met.

The parameters of ***Equation A.2*** were estimated using weighted least-squares regression models for 12 key outcomes. The weights are a function of the eligibility fraction and propensity scores. For each outcome, we report estimates and standard errors of the difference between the baseline trend in Maryland and the comparison groups (λ).

Tables A-5 and ***A-6*** show estimates of the baseline trend differences for the following outcomes:

- Total Medicare expenditures.
- Medicare expenditures for short-stay, acute-care hospitalizations.
- Medicare expenditures for outpatient ED visits.
- Medicare expenditures for other hospital outpatient department care.
- Medicare payments per acute inpatient stay.
- Medicare payments per outpatient ED visit.
- Probability of any acute inpatient stay.
- Probability of any outpatient ED visit.
- Probability of any ACSC admission.
- Probability of readmission within 30 days after an inpatient discharge.
- Probability of a follow-up visit within 14 days after an inpatient discharge.
- LOS for an acute admission.

Table A-5
Differences in average quarterly PBPM Medicare expenditures and expenditures per admission and per ED visit during the baseline period, Maryland Medicare FFS beneficiaries and comparison group beneficiaries

Parameter estimate	Total ($)	Acute care ($)	ED ($)	OP ($)	Payment per acute admission ($)	Payment per ED visit ($)
Maryland–CG trend difference	−0.50	−2.10***	0.64***	1.12***	−20.86**	19.46***
	(0.82)	(0.59)	(0.032)	(0.14)	(10.21)	(9.67)

NOTES: CG = comparison group; ED = outpatient emergency department; FFS = fee for service; OP = other hospital outpatient department; PBPM = per beneficiary per month. Baseline is the period January 2011–December 2013. The trend (slope) is the quarter-to-quarter change in PBPM Medicare expenditures or probability of use. Standard errors are given in parentheses. *p<0.10; **p<0.05; ***p<0.01.

Table A-6
Differences in probability of use and length of stay during the baseline period, Maryland Medicare FFS beneficiaries and comparison group beneficiaries

Parameter estimate	Any inpatient	Any ED visit	Any ACSC admission	Any 30-day readmission	Any 14-day follow-up after discharge	Length of stay
Maryland–CG trend difference	0.000037	−0.00032***	−0.000024*	−0.00010	0.00010	0.012**
	(0.000029)	(0.000033)	(0.000014)	(0.00030)	(0.00020)	(0.0050)

NOTES: ACSC = ambulatory care sensitive conditions; CG = comparison group; ED = outpatient emergency department; FFS = fee for service. Baseline is the period January 2011–December 2013. The trend (slope) is the quarter-to-quarter change in probability of use or length of stay. Standard errors are given in parentheses. *p<0.10; **p<0.05; ***p<0.01.

Relative to the comparison group, there was no statistically significant difference in the baseline trend for total Medicare expenditures. This overall result masks differences in the subcategories, however; acute inpatient expenditures declined faster in Maryland than in the comparison group (−$2.10 PBPM per quarter), whereas outpatient ED and other hospital outpatient department expenditures increased slightly faster in Maryland than in the comparison group ($1.12 and $0.64 PBPM per quarter, respectively). The payment per acute admission decreased at a faster rate in Maryland than in the comparison group over the baseline period (−$20.86 per admission per quarter), but the payment per outpatient ED visit increased faster in Maryland than in the comparison group over the same period ($19.46 per ED visit per quarter).

Relative to the comparison group, there was no statistically significant difference in the change in the probability of having an acute inpatient stay in Maryland, whereas the probability of having an outpatient ED visit increased slightly more slowly (0.032 percentage point slower gain in the probability of an ED visit per quarter, Table A-6). In addition, over the baseline period, ACSC admissions had a marginally significant (p<0.10) faster decline in Maryland relative to the comparison group, no statistically significant difference was seen in the trend in probability of a 30-day readmission or 14-day follow-up visit after an acute inpatient discharge, and the length of an acute inpatient stay increased 0.012 days faster per quarter in Maryland.

Difference-in-difference regression model—The D-in-D model is shown in ***Equation A.3***. The model includes the quarterly interaction terms from ***Equation A.1*** along with the linear time trend in ***Equation A.2.*** As in ***Equation A.1***, Y_{ijt} is the outcome for individual i in state (Maryland or comparison group) j in quarter t; I_{ij} (=0,1) is an indicator equal to 1 if the individual is in Maryland and 0 if the individual is in its comparison group; and t is a linear time trend ranging from 1 to 20, where t=1 in the first calendar quarter (first quarter 2011) and 20 in the last calendar quarter (fourth quarter 2015). The term that interacts the Maryland indicator and time (I_{ij}*Time) measures differences in trends between Maryland and the comparison group over the entire period. Q_t is a series of quarter dummies for the post quarters (t=13 to 17). The interaction of the Maryland indicator and Q_t (I_{ij}* Q_t) measures the difference in the pre-post change between Maryland and its comparison states. With this model specification, the post quarter*Maryland interactions measure any deviation from the trend line in the post period.

$$Y_{ijt} = \alpha_0 + \beta_1 I_{ij} + \alpha_1 t + \beta_2 I_{ij} * t + \alpha_2 Q_t + \gamma I_{ij} * Q_t + \lambda X_{ijt} + \varepsilon_{ijt} \quad \text{(A.3)}$$

Table A-7 illustrates the interpretation of the D-in-D estimate from this model. The coefficient β_1 in ***Equation A.3*** is the difference in the measure between individuals in Maryland and the comparison group at the start of the baseline period, holding constant other variables in the equation. For individuals in the comparison group, the baseline time trend is captured by $\alpha_1 * t$, whereas for individuals in Maryland, it is $(\alpha_1 + \beta_2) * t$. The α_2 coefficient captures any deviations from the time trend line during each post quarter. The coefficient of the interaction term between Q_t and Maryland (I) measures any deviations from the trend line in the post period that are different for Maryland relative to the comparison group. Thus, in the post period, the comparison group mean is captured by $\alpha_0 + \alpha_1 * t + \alpha_2$, whereas the Maryland mean is captured by $(\alpha_0 + \beta_1) + (\alpha_1 + \beta_2) * t + (\alpha_2 + \gamma))$. In other words, the between-group difference changes from $\beta_1 + \beta_2 * t$ during the baseline years to $\beta_1 + \beta_2 * t + \gamma$ during the post period. The D-in-D parameter, γ, shows whether the between-group difference increased ($\gamma > 0$) or decreased ($\gamma < 0$) after the All-Payer Model was implemented. If the All-Payer Model was successful in reducing expenditures or utilization in Maryland relative to the comparison group, then $\gamma < 0$. Using the quarterly fixed effects model, we calculated yearly and overall estimates by taking linear combinations of the quarterly estimates.

Table A-7
Difference-in-differences estimate

Group	Pre period	Post period	Pre-post difference
Maryland	$(\alpha_0 + \beta_1) + (\alpha_1 + \beta_2) * t$	$(\alpha_0 + \beta_1) + (\alpha_1 + \beta_2) * t + (\alpha_2 + \gamma)$	$\alpha_2 + \gamma$
Comparison	$\alpha_0 + \alpha_1 * t$	$\alpha_0 + \alpha_1 * t + \alpha_2$	α_2
Between group	$\beta_1 + \beta_2 * t$	$\beta_1 + \beta_2 * t + \gamma$	γ

All of the population-based regression models were estimated with the beneficiary quarter as the unit of analysis. All admission- or visit-level outcomes used the admission or visit

as the unit of analysis, with observations assigned to a quarter on the basis of date of service. For the utilization outcomes, we converted quarterly utilization counts into binary outcomes (1 = any use) and used weighted logistic regression models. Count models are not appropriate because of the low occurrence of multiple hospitalizations and ED visits for individual beneficiaries in any quarter; however, we multiplied the marginal effect from the logistic regression models by 1,000 to obtain approximate rates of utilization per 1,000 beneficiaries. Multiplying the marginal effect by 1,000 does not produce an exact rate of utilization per 1,000 beneficiaries as it assumes no person has more than one visit or admission per quarter. However, we concluded that this is a reason approximation because at least 98% of the Medicare population had zero or one ED visit or admission per quarter. For expenditure outcomes, we used weighted generalized linear models with a normal distribution and identity link.

Control Variables. Control variables depend on whether the outcome is a person-level, ED visit-level, admission-level, or hospital-level outcome. Control variables for models with the Medicare population include person-level variables (age, gender, race, dual status, original reason for Medicare entitlement based on disability, presence of end-stage renal disease, HCC risk score, number of chronic conditions) and county-level variables (urban/rural, percentage uninsured, percentage with high school and college educations, percentage in poverty, and supply of hospitals and other providers). In addition, admission-level models for service mix and spillover effects control for the hospital's resident-to-bed ratio, number of short-term acute beds, area wage index, and DSH percentage, as well as a measure of case mix (DRG weight for the admission for the spillover effects models and case mix severity index for the service mix models). The service mix models also control for the percentage of the county population that is enrolled in Medicare. Hospital-level models for service mix control for resident-to-bed ratio, number of short-term acute beds, and DSH percentage.

Weighting and Clustering. All of the regression models were estimated using weighted least squares. Person-level models were weighted by the propensity score times the eligibility fraction times the HSA weight; admission- and ED visit level analyses were weighted by the propensity score times the HSA weight. The HSA weight accounts for any hospitals or market areas that appear more than once in the comparison group. In addition, all of the person-level models and admission-level models in ***Section 5*** took into account nested clustering at the beneficiary and ZIP code levels to account for multiple observations per person and per ZIP code. Hospital-level models and admission-level models in ***Sections 4, 6,*** and ***7*** took into account clustering at the hospital level.

Methodological changes from the First Annual Report—We changed the methods and sample selection criteria we used for some outcomes from those in the First Annual Report. The unit of observation, including sample, regression model, and propensity score weights used for the First and Second Annual Reports, are detailed in ***Table A-8***. Holy Cross Germantown did not operate under a global budget during the period covered by the claims analyses and, therefore, is excluded from analyses where the unit of observation is the hospital and from admission-level analyses that are limited to Maryland hospitals. Utilization at Holy Cross Germantown is included in beneficiary-level expenditure and utilization measures, as well as average expenditures per admission and ED visit, which are related to beneficiary-level utilization measures.

Table A-8
Comparison of methodology in the First and Second Annual Reports

Outcome	Unit of observation	AR1 sample	AR2 sample	AR1 P-score	AR2 P-score	AR1 model	AR2 model
Expenditures (total, inpatient, ED, outpatient, professional, other)	Beneficiary	All MD and CG residents	Same as AR1	Beneficiary level	Same as AR1	GLM with normal distribution and identity link	Same as AR1
Probability of an admission/ED visit	Beneficiary	All MD and CG residents	Same as AR1	Beneficiary level	Same as AR1	LPM	Logistic regression model
Average expenditure per admission/ED visit	Admission/ED visit	Includes all admissions/ED visits for MD and CG residents regardless of where they occur	Same as AR1	Beneficiary level	Admission/ visit level	GLM with normal distribution and identity link	Same as AR1
Admission-level quality-of-care measures (30 day readmission, ED visit within 30 days, 14-day follow-up)	Admission	Includes index admissions to MD/CG hospitals by MD/CG residents†	Same as AR1	Beneficiary level	Admission level	LPM	Logistic regression model
Admission-level service mix and spillover measures (DRG weight per admission, case-mix adjusted charge per discharge, probability that an admission is classified as major/extreme, probability of an intensive care unit stay, probability that an admission occurs through the ED, probability that an admission results in a transfer to another short-term acute-care or post-acute care hospital)	Admission	Admissions to MD/CG hospitals by MD/CG residents	All admissions to MD/CG hospitals regardless of whether the patients were MD/CG residents	Beneficiary level	Admission level	GLM with normal distribution and identity link for continuous outcomes; LPM for binary outcomes	Same as AR1 for continuous outcomes; logistic regression for binary outcomes

(continued)

Table A-8 (continued)
Comparison of methodology in the First and Second Annual Reports

Outcome	Unit of observation	AR1 sample	AR2 sample	AR1 P-score	AR2 P-score	AR1 model	AR2 model
Hospital-level service mix measures (proportion of hospital revenue from inpatient admissions/ ED visits, surgical to medical admission ratio)	Hospital	All admission/ visits to MD/CG hospitals regardless of resident status	Same as AR1	None	Same as AR1	GLM with normal distribution and identity link	Same as AR1

† In AR1, we used a beneficiary-level flag that identified individuals who were Maryland or comparison group residents and had an admission at a Maryland or comparison group hospital in a given quarter; in AR2, we used an admission-level flag that identified admissions to Maryland or comparison group hospitals by Maryland or comparison group residents. Because very few people have more than 1 admission per quarter, the two flags are quite similar. AR1/AR2 = First [Second] Annual Report; CG = comparison group; DRG = diagnosis-related group; ED. emergency department; GLM = generalized linear model; LPM = linear probability model; MD = Maryland.

The unit of observation remains the same for both reports; however, we made changes in how we selected and weighted the sample for admission-level outcomes. Specifically, for service mix and spillover admission-level measures, we removed the requirement that admissions had to be for Maryland or comparison group residents to be included in the sample. Instead, we selected all admissions to Maryland and comparison group hospitals regardless of whether they were for residents or nonresidents. We made the change because these outcomes are measuring hospital behavior, which should apply to all patients. For admission-level quality-of-care measures, however, we retained the resident restriction because hospitals can reasonably be expected to affect the population health of residents only. Because we changed from selecting beneficiaries who were residents and had admissions to Maryland or comparison hospitals to selecting admissions from Maryland and comparison group hospitals, we also changed the propensity scores to be admission level rather than beneficiary level. For all admission-level outcomes in the First Annual Report, we used a beneficiary-level propensity score weight that was repeated for beneficiaries with multiple admissions in a year. In the Second Annual Report, we use an admission-level propensity score that is specific to the admission. The changes we made for each of the admission level outcomes are detailed below:

- **Admission level quality measures (30 day readmission, ED visit within 30 days, 14-day follow-up)—**The unit of observation is a hospital admission. For both the First Annual Report and Second Annual Report, the denominator should include index admissions to Maryland or comparison group hospitals by Maryland or comparison group residents. The numerator includes all admissions/ED visits within 30 days of the index admission regardless of whether they were to Maryland or comparison group hospitals. In the First Annual Report, we used person-level propensity scores that were repeated for individuals with more than one admission. In the Second Annual Report, we used admission level propensity scores. There was a slight difference in our methods for selecting admissions to hospitals by residents: In

the First Annual Report, we used a person level flag that identified individuals who were Maryland/comparison group residents and had an admission at a Maryland or comparison group hospital in a given quarter; in the Second Annual Report, we used an admission level flag that identified admissions to Maryland or comparison group hospitals by Maryland/comparison group residents. Because very few people have more than 1 admission per quarter, however, the two flags are in fact quite similar. We also did sensitivity analyses with lifting the resident restriction and found the results were similar with and without the restriction.

- **Admission level service mix and spillover measures (DRG weight per admission, case-mix adjusted charge per discharge, probability that an admission is classified as major/extreme, probability of an ICU stay, probability that an admission occurs through the ED, probability that an admission results in a transfer to another STAC hospital or PAC hospital)—**The unit of observation is a hospital admission. For the First Annual Report, the sample includes admissions to Maryland/comparison group hospitals by Maryland/comparison group residents. For the Second Annual Report, the sample includes all admissions to Maryland/comparison group hospitals regardless of whether the patients were MD/CG residents. In the First Annual Report, we used person-level propensity scores that were repeated for individuals with more than one admission. In the Second Annual Report, we used admission level propensity scores.

- **Hospital level service mix measures (proportion of hospital revenue from inpatient admissions/ED visits, surgical to medical admission ratio)—**The unit of observation is the hospital. For the First Annual Report and the Second Annual Report, the sample includes all admission/visits to Maryland/comparison group hospitals regardless of resident status. There is no propensity score for this analysis since the analysis is at the hospital level.

In addition, for binary outcomes, we changed from using a linear probability model (LPM) to a logistic regression model. ***Tables A-9*** and ***A-10*** summarize the results for four key binary outcomes (probability of an inpatient admission, ED visit, 30-day unplanned readmission, and ACSC admission) using a logit model and LPM. This analysis used data from the First Annual Report so that the change from LPM to logit model is the only methodological difference. Overall, there were no major changes in the magnitude of the effects between the LPM and logit model. The effects in all models are relatively small in both models. There are a few estimates in the models for all-cause admissions and ACSC admissions that were insignificant using the LPM but are significant using the logit model. However, the signs of the estimates are unchanged (with the exception of one of the quarterly estimates for ACSC admissions that was zero using the LPM and is negative in the logit model). The sign of one of the quarterly estimates for probability of readmission differs between the LPM and logit model, but in both cases it is not statistically significant.

Table A-9
Results for binary outcomes using logistic and linear probability regression models

	Logistic regression	Linear probability regression
	Estimated treatment effect (95% confidence interval)	
Probability of an acute inpatient admission		
Q1	0.0011** (0.00023, 0.0020)	0.0004 (–0.0011, 0.0019)
Q2	–0.00091* (–0.0018, 0.000011)	–0.00060 (–0.0022, 0.0009)
Q3	–0.0011** (–0.0020, –0.00012)	–0.0019** (–0.0036, –0.00030)
Q4	–0.0017*** (–0.0027, –0.0007)	–0.0023*** (–0.0041, –0.0006)
Q5	–0.0012** (–0.0022, –0.0001)	–0.0016 (–0.0034, 0.0003)
Overall	–0.0004 (–0.0011, 0.0002)	–0.0010 (–0.0022, 0.0002)
Probability of an emergency department visit that did not lead to a hospitalization		
Q1	0.0020*** (0.0010, 0.0030)	0.0021** (0.0004, 0.0038)
Q2	0.0023*** (0.0013, 0.0034)	0.0021** (0.0003, 0.0039)
Q3	0.0029*** (0.0017, 0.0040)	0.0035*** (0.0016, 0.0054)
Q4	0.0021*** (0.0009, 0.0033)	0.0024** (0.0004, 0.0044)
Q5	0.0005 (–0.0008, 0.0017)	0.0017 (–0.0004, 0.0039)
Overall	0.0022*** (0.0014, 0.0030)	0.0024*** (0.001, 0.0037)

(continued)

Table A-9 (continued)
Results for binary outcomes using logistic and linear probability regression models

	Logistic regression	Linear probability regression
	Estimated treatment effect (95% confidence interval)	
Probability of unplanned readmission within 30 days of discharge		
Q1	0.002 (–0.006, 0.011)	0.001 (–0.008, 0.011)
Q2	0.0009 (–0.008, 0.010)	–0.002 (–0.013, 0.009)
Q3	–0.006 (–0.015, 0.004)	–0.007 (–0.018, 0.004)
Q4	–0.0007 (–0.010, 0.009)	–0.002 (–0.012, 0.009)
Q5	–0.006 (–0.016, 0.004)	–0.006 (–0.010, 0.005)
Overall	−0.001 (−0.011, 0.009)	−0.002 (−0.010, 0.005)
Probability of admission for ambulatory care sensitive condition		
Q1	0.0001 (−0.0003, 0.0005)	0.0003 (−0.0004, 0.0010)
Q2	−0.0006*** (−0.0011, −0.0002)	−0.0002 (−0.0010, 0.0005)
Q3	−0.0006*** (−0.0009872, −0.0001475)	−0.0007* (−0.0015, 0.0000)
Q4	−0.0008*** (−0.0012, −0.0002)	−0.0003 (−0.0011, 0.0005)
Q5	−0.0005* (−0.0010, 0.00003)	0.0000 (−0.0009, 0.0009)
Overall	−0.0004** (−0.0007, −0.00006)	−0.0002 (−0.0007, 0.0004)

NOTE: *p<0.10, **p<0.05, ***p<0.01

Table A-10
Summary of differences between logistic regression and linear probability model estimates

Outcomes	Direction of estimated effects	Statistical significance of estimated effects
Probability of an acute inpatient admission	No changes	The treatment effects in Q1, Q2, and Q5 are statistically significant in the logit model but not in the LPM. The direction of these effects did not change between the logit model and the LPM.
Probability of an ED visit that did not lead to a hospitalization	No changes	No changes
Probability of unplanned readmission within 30 days of discharge	The treatment effect is positive in Q2 in the logit model but negative in the LPM. The treatment effect in Q2 is not statistically significant in either the logit model or the LPM.	No changes
Probability of admission for ambulatory care sensitive conditions	The treatment effect is negative in the logit model in Q5 but zero in the LPM	The treatment effects for Q2, Q4, Q5, and the 5 quarters overall are statistically significant in the logit model but not in the LPM. The direction of the treatment effects for Q2, Q4, and the 5 quarters overall does not change between the LPM and logit models. The treatment effect is negative in the logit model in Q5 but zero in the LPM.

NOTE: LPM = linear probability model; Q1 = January–March 2014, Q2 = April–June 2014, Q3 = July–September 2014, Q4 = October–December 2014, Q5 = January–March 2015.

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APPENDIX B:
COMPARISON HOSPITAL COVARIATE BALANCE AND PROPENSITY SCORE METHODOLOGY

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B.1 Comparison Group Selection

Overview—National trends in payment methodologies and provision of health care also affect the environment in which the Maryland model operates. For example, the Maryland health care delivery system is not immune to the national trends toward higher deductibles, the increased presence of value-based contracts, changes in the distribution of health care payer (commercial, Medicare, or Medicaid) enrollment, and reductions in the number of uninsured persons. Given the co-occurring changes in the health care environment, isolating the effects of any one health reform is difficult. As such, the evaluation uses comparison groups wherever possible to isolate effects of the Maryland All-Payer Model from those of other changes in the health care environment. Given that so much change is occurring across the nation, this comparison does not measure what would have happened in the absence of the implementation of the Maryland All Payer Model. Rather, it answers the question, "Are hospital global budgets more effective at changing cost and utilization than other potential models that are being implemented nationwide?"

The comparison group is used as a counterfactual to the Maryland All-Payer Model. Therefore, included hospitals and hospital market areas from which the comparison population is drawn should closely resemble Maryland hospitals and the populations residing in their market areas. RTI used a two-stage method for selecting the comparison group, beginning with selection of individual hospitals. From these individual hospitals, we then constructed hospital market areas and selected the population residing in these areas. This two-stage selection process allowed us to create comparison groups for both hospital admission-level and population-level outcomes.

There are multiple challenges to selecting a comparison group for the All-Payer Model evaluation. First, Maryland has had a unique approach to paying hospitals, including Medicare reimbursement, since the 1970s. Even before the adoption of the All-Payer Model, Maryland hospitals operated in a very different environment from and faced different financial and regulatory pressures than hospitals elsewhere in the country. Given Maryland's unique history, it is not possible to construct a comparison group that represents the counterfactual of what would have happened in Maryland in the absence of the All-Payer Model, and it is difficult even to identify a comparison group that reflects the counterfactual of what would have happened if other potential models that are being implemented nationwide were implemented in Maryland instead of the All-Payer Model.

Second, the comparison group for the evaluation must be drawn from outside Maryland because the All-Payer Model is implemented statewide. Selection of a comparison group, particularly one from out of state, is always challenging because it must account for many factors that can influence the outcomes of interest, including population and health care market characteristics, as well as Medicaid program and other state health policies. It is unlikely that a single state provides the ideal comparison. Selecting the comparison population from multiple states and hospital market areas can reduce the potential for biasing results in a particular way because of a poor choice of comparison area.

Third, the evaluation of the Maryland All-Payer Model focuses on a wide variety of research questions and specific areas of interest. Multiple comparison groups are necessary to

adequately address these questions. The evaluation includes analyses at several different levels. Some analyses, conducted at the population level (e.g., per capita health care expenditures, hospital admission rates in a population), include all residents within a hospital market area. Other analyses are conducted at the admission level (e.g., hospital LOS, hospital readmission rate). A small number of analyses are conducted at the hospital level (e.g., hospital proportion of revenue from inpatient expenditures, hospital surgical-to-medical admission ratio).

As described in the following sections, we matched Maryland hospitals with comparison hospitals using hospital and market characteristics during the baseline period and also balanced individual and market area characteristics at the person level, admission level, or ED visit level (depending on the outcome) using propensity score weighting. Nonetheless, the health care environment is dynamic, and comparison hospitals and their market areas may be affected by health system reform initiatives and other changes during the All-Payer Model implementation period. Although these changes can be viewed as the counterfactual against which Maryland is being compared, some might affect the comparability of these groups. For example, Illinois, where a large number of comparison hospitals are located, participates in a demonstration in which dually eligible beneficiaries in selected counties are enrolled in capitated managed care for both Medicare and Medicaid services, although they can elect to opt out and remain in FFS Medicare. As a result, the proportion of dually eligible enrollees in the comparison group drawn from Illinois declined somewhat in the first quarter of 2015. Dual eligible status is one of the characteristics used in propensity score weighting, which allows us to adjust for changes in the proportion of dually eligible beneficiaries over time. However, the dually eligible beneficiaries in Illinois who opt out of the demonstration and remain in FFS Medicare may be systematically different from the overall dually eligible population in unobservable ways, and this difference could potentially bias the comparison. The impact of the decline in the comparison group dually eligible population on the results in this report is expected to be minimal because dually eligible beneficiaries are a relatively small portion of the overall Medicare population. Furthermore, Illinois is only one state from which the comparison group is drawn, although it does compose a disproportionately large share. If this reduction in the proportion of dually eligible beneficiaries continues or other important external changes occur during the All-Payer Model implementation period, we will explore including covariates in outcome regression models to control for their impacts.

In the following sections, we describe the procedures for selecting the comparison hospitals and constructing market areas. The comparison group balance diagnostics at both stages of comparison group selection are presented in the first annual report.

Hospital selection—Hospitals in all states except Maryland in the IPPS Impact file were considered as potential comparison hospitals. We used variables from the IPPS Impact file, the Area Health Resource File (AHRF) from the Health Resources and Services Administration (HRSA), the American Hospital Association (AHA) survey, and the state/county report for all Medicare beneficiaries to select comparison group hospitals.

We considered variables in four broad domains: (1) hospital characteristics, (2) baseline market area demographics, (3) baseline Medicare costs, and (4) baseline Medicare utilization. The set of potential covariates was refined by examining pairwise correlations among all potential variables to identify and remove highly correlated (i.e., redundant) variables. With only

47 Maryland hospitals, the number of covariates that could be included in a conventional propensity score model using logistic regression was somewhat limited. The covariates and domains, which include hospital and market area characteristics, are as follows:

- Hospital characteristics (hospital-level variables):
  - Bed size.
  - Resident physicians per bed.
  - Proportion of hospital discharges that are Medicare beneficiaries.
  - Disproportionate share hospital (DSH) percentage.
  - Percent capacity (average daily census/total beds).
  - Transfer-adjusted case mix.
  - Hospital bed-to-total county bed ratio.
- Demographic characteristics (county-level variables):
  - Median household income (2013).
  - Average Hierarchical Condition Category (HCC) score (2013).
- Medicare costs and managed care penetration (county-level variables):
  - Standardized risk-adjusted Medicare total costs per beneficiary (2013).
  - Medicare Advantage penetration (2013).
- Medicare utilization (county-level variables):
  - Percent change in inpatient stays per 1,000 beneficiaries (2008–2013).

Genetic matching—We used a genetic matching approach (GenMatch) to optimize balance between Maryland and comparison hospitals on observed characteristics while maximizing the diversity of comparison group hospitals selected (Diamond and Sekhon, 2012). We used the GenMatch package because of the large number of available user-specified options, the ability to perform exact matching on specified variables, and the prior experience of RTI's consultant with this package.

We selected up to two comparison hospitals for each Maryland hospital. Each comparison hospital could match with more than one, but a maximum of three, Maryland hospitals. A standardized difference of less than 0.1 is the conventional threshold for covariate balance with large sample sizes; however, larger standardized differences (e.g., 0.25) are

considered acceptable for covariate balance with smaller samples, such as those in our hospital selection.

Within GenMatch we explored many of the user-specified functions, including population size, match ratio, alternative specifications of the balance matrix, addition of a propensity score as an additional x-covariate (both included in the balance matrix and not included in the balance matrix), wait generations, exact match, matching with and without replacement, caliper size, and omitting less important variables from the balance matrix.

A 1:1 ratio performed better than 2:1 or 3:1 match ratios. Matching with replacement was superior to matching without replacement in all match ratios examined. Addition of a propensity score to both the x-covariates and the balance matrix improved covariate balance as well. We found a balance matrix with all first-order interaction terms and squared terms for continuous variables to be superior to any theory-based model specifications. Exact matching on the type of hospital (sole, nonteaching, and teaching) improved balance on resident-to-bed ratio and hospital bed-to-county bed covariates. It also provided a means to match on a crucial theory-based distinction. Although postmatching balance was generally substantially improved from prematching balance, we were concerned about the extent of comparison group hospital replacement occurring with the optimal user specifications.

Using a 1:1 match ratio with replacement, we identified only 28 comparison group hospitals for the group of Maryland hospitals. One comparison group hospital was used five separate times as a match, and several additional comparison group hospitals matched to three or four different intervention hospitals. We were concerned about the degree of replacement occurring to achieve balance and about the potential implications of substantially upweighting these comparison group hospitals in outcome analysis.

We were not able to manipulate the degree of replacement within the GenMatch program other than to specify with or without replacement. This limitation led to two divergent extremes: suboptimal covariate balance in 1:1 matching without replacement and optimal covariate balance with excessive duplication of comparison group hospitals in 1:1 matching with replacement. We manually created two hybrid scenarios. In the first scenario we opted for a 3:1 match ratio with replacement and then manually eliminated matches involving duplicate comparison group hospitals until no comparison group hospital was used more than three times. In the second scenario, we followed a similar procedure but used a 2:1 match ratio with replacement. The strengths and weaknesses of each scenario are shown in ***Table B-1***.

Table B-1
Summary of positive and negative aspects of alternative matching scenarios

Option	Mean Standardized Difference	Positives	Negatives
1:1 match with replacement	12.3	Best balance	Resulted in duplicates (up to 5); only 1 match per Maryland hospital
1:1 match without replacement	17.5	No duplicate hospitals	Worse balance than option 1; still only 1 match per Maryland hospital
3:1 match with replacement/limit duplicates	18.7	Fewer duplicates than option 1; more than 1 match for some hospitals	Worse balance than option 1
2:1 match with replacement/limit duplicates	13.1	Fewer duplicates than option 1; better balance than option 2; more than 1 match for some hospitals	Worse balance than option 1

After reviewing the results for these four scenarios, we proceeded with the final scenario, 2:1 matching with replacement followed by a manual deduplication to ensure that no comparison hospital was used more than three times in the comparison group. The covariate balance for the matched hospitals and Maryland hospitals is shown in the First Annual Report.

The final list of comparison hospitals is shown in ***Table B-2***.

Table B-2
Final list of comparison hospitals

State	Name
IL	Presence Saint Joseph Medical Center
IL	Sherman Hospital
IL	St Mary's Hospital
IL	MacNeal Hospital
IL	Morris Hospital & Healthcare Centers
IL	Swedish Covenant Hospital
IL	Hinsdale Hospital
IL	Franciscan St James Health
IL	Presence Saints Mary and Elizabeth Medical Center

(continued)

Table B-2 (continued)
Final list of comparison hospitals

State	Name
IL	Riverside Medical Center
IL	Advocate Condell Medical Center
IL	Norwegian-American Hospital
IL	Advocate Christ Hospital & Medical Center
IL	Harrisburg Medical Center
IL	Edward Hospital
IL	Westlake Community Hospital
IL	Central DuPage Hospital
IL	Alexian Brothers Medical Center
IL	Kishwaukee Community Hospital
KS	Great Bend Regional Hospital
LA	Byrd Regional Hospital
MA	Marlborough Hospital
MA	Lowell General Hospital
MA	Massachusetts General Hospital
MA	South Shore Hospital
MA	Brigham and Women's Hospital
MA	Good Samaritan Medical Center
NC	Lenoir Memorial Hospital
NC	Carolina East Medical Center
NJ	Univ Medical Center of Princeton at Plainsboro
NJ	Cape Regional Medical Center Inc
NJ	Trinitas Regional Medical Center
NJ	Newton Memorial Hospital
NJ	Riverview Medical Center
NJ	Robert Wood Johnson University Hospital
NJ	Jersey City Medical Center
NJ	JFK Medical Ctr—Anthony M. Yelencsics Community
NY	Orange Regional Medical Center
NY	St Luke's Cornwall Hospital
OK	Memorial Hospital & Physician Group
OK	Southwestern Medical Center
PA	Pocono Medical Center
TX	Guadalupe Regional Medical Center
VA	Inova Loudoun Hospital
VA	Reston Hospital Center

(continued)

Table B-2 (continued)
Final list of comparison hospitals

State	Name
VA	Sentara Northern Virginia Medical Center
VA	Chesapeake General Hospital
WV	Davis Memorial Hospital

Hospital Market Area Construction

Market area selection—The Maryland All-Payer Model includes a commitment to focus on population health, and Maryland hospitals, to some extent, are expected to have a positive impact on population health. For the purposes of this evaluation, the hospital market area is defined to be an area where the population could reasonably be expected to be affected by the hospital. We expect that hospitals will have the greatest influence on population health in the geographic areas located nearest them because they are likely to provide a larger proportion of hospital services to those populations.

To create the hospital market areas for our selected comparison hospitals, we examined several alternative methodologies. One set of alternatives takes into account geographic distance to construct hospital market areas. A criterion for geographic distance can be defined in terms of ZIP codes within a specified distance from the ZIP code in which the hospital is located. A second alternative is based on hospital volume. Under this method, ZIP codes are rank ordered based on the number of admissions to the hospital. ZIP codes that exceed a specified minimum share of a hospital's admissions or that in combination account for a specified share of admissions are selected. Geographic distance and volume can also be used in combination (e.g., ZIP codes within a specified distance that meet a minimum volume threshold). A third alternative methodology is to use an existing hospital market area definition, such as the *Dartmouth Atlas of Health Care* HSAs. The HSAs are locally defined markets for receipt of hospital care. Each HSA is a collection of ZIP codes from which the plurality of residents receive most of their hospital care from hospitals in that area. The ZIP codes within an HSA are also required to be geographically contiguous. The HSAs were created based on Medicare data from the early 1990s. The HSAs have been kept static since that time to preserve historical continuity; they have not been updated to reflect hospital closures and openings or changes in where populations seek hospital care.[30] RTI also considered replicating the methodology used to define hospital primary service area in the GBR/TPR agreements with Maryland hospitals. However, the HSCRC allowed hospitals to use their own criteria to define primary service area, so this definition could not be replicated for comparison hospitals.

We examined five different methods for defining HSAs. The first three methods rely solely on geographic distance, assigning all ZIP codes that fall within 5, 10, or 15 miles of the hospital ZIP code. The fourth variant uses both geographic distance (15 miles) and a minimum

[30] http://www.dartmouthatlas.org/downloads/methods/geogappdx.pdf

threshold (2%) of the hospital admissions coming from the assigned ZIP code. Finally, we considered using the HSAs as defined by the *Dartmouth Atlas of Health Care*. We examined the performance of the alternative definitions for the comparison group hospitals. In addition, we examined performance for Maryland hospitals to assess whether the definitions performed similarly for Maryland and comparison group hospitals.

As described earlier, geographic distance and market share are important factors to consider in assigning market areas to hospitals. We created several ZIP-code-level definitions of hospital market areas based on geographic proximity to the hospital ZIP code (measured using SAS: ZIPCITYDISTANCE) and the proportion of the hospital's total admissions received from the ZIP code. We considered several distance cutoffs—15, 10, and 5 miles—for constructing hospital market areas. Henceforth, we refer to the 15-mile cutoff as Option 1 and use the other definitions as a reference. We created a fourth option that considered only ZIP codes that both were within 15 miles of the hospital and accounted for at least 2 percent of the hospital's total Medicare admissions. Henceforth, we refer to the Dartmouth HSAs as Option 2.

We assessed the alternative market area definitions on two dimensions: (1) the percentage of the hospital's total Medicare admissions that originate from the assigned market area, and (2) the percentage of market area admissions that are to the hospital. These measures are inversely related. Expanding the first measure will reduce the second measure because it includes a larger market area (defined by ZIP codes). The larger market will capture more of the hospital's admissions, but a smaller share of the overall market will use the hospital. Therefore, a decision about market area definition must weigh trade-offs between these criteria. It should also be noted that the share of market area admissions going to the selected hospital will be lower in markets with multiple competing hospitals. ***Table B-3*** provides a brief summary and comparison of the results of analyses of the alternative market definitions for all included Maryland hospitals and the 48 comparison hospitals. We present a weighted average of percentages using the number of in-state Medicare admissions as the weight to appropriately account for larger hospitals.

Overall, Option 1 captured a greater percentage of the hospital's total admissions than Option 2. Option 1 covered 85 percent of the total hospital admissions for both Maryland hospitals and comparison hospitals. We found that for academic medical centers, Option 1 captured a larger percentage of admissions than Option 2, both in Maryland and particularly for the comparison hospitals. Option 2 captures 71 percent and 67 percent of hospital admissions in Maryland and the comparison hospitals, respectively. Under Option 1, however, the selected hospital covers a smaller proportion of the admissions in the market area, 25 percent (MD) and 24 percent (comparison group). The selected hospital covers a larger proportion of the market area admissions under Option 2—43 percent (MD) and 49 percent (comparison group). Overall, Option 2 assigns a more tightly defined market area (fewer ZIP codes) and therefore, the hospital captures more of the overall market area admissions. However, the result of the more restricted market area is that fewer of the overall hospital admissions are included. The Dartmouth definition performs similarly to or better than the other three market area definitions (10-mile, 5-mile, and 15/2 rule) on both dimensions, so we did not consider these further.

Table B-3
Comparison of alternative definitions of hospital market areas

Option	Percent of hospital admissions coming from assigned market area	Percent of assigned market area admissions going to hospital
15-mile rule (Option 1)		
MD	85	25
CG	85	24
Dartmouth (Option 2)		
MD	71	43
CG	67	49
10-mile rule		
MD	74	32
CG	65	31
5-mile rule		
MD	48	43
CG	48	43
15/2 rule		
MD	68	40
CG	65	42

NOTES: MD = Maryland hospitals; CG = comparison group hospitals.

Table B-4 provides a count of the number of Maryland and comparison hospitals that have more than 50 percent of their total hospital admissions in the assigned market area by Option 1 and Option 2. A count of the number of hospitals in which the hospital admissions account for more than 50 percent of the assigned market area by Option 1 and Option 2 is also shown.

Maryland and comparison group hospitals performed similarly under both Option 1 and Option 2. We also compared Option 1 and Option 2 with respect to the coverage of the ZIP codes within Maryland to ensure that the entire state would be included with the assigned methodology. We found that both methods leave less than 1 percent of the population unassigned. Therefore, we do not find an advantage to using Option 1 or Option 2 on this basis.

Table B-4
Count of hospitals based on performance on market area measures

Option	Count of hospitals with more than 50% of hospital admissions coming from assigned market area	Count of hospitals where more than 50% of assigned market area admissions going to hospital
Option 1		
MD (45 hospitals)	44	8
CG (48 hospitals)	47	10
Option 2 (Dartmouth)		
MD (45 hospitals)	38	20
CG (48 hospitals)	38	27

NOTES: MD = Maryland hospitals; CG = comparison group hospitals.

Option 1 is attractive because market areas can be defined based on current (2013) admission patterns of the selected comparison hospitals. In addition, a large number of the hospital admissions in the state will be assigned to a HSA (85%). Finally, this method covers a higher percentage of hospital admissions for the academic medical centers in both Maryland and the comparison group. The downside of Option 1 is that the wider market area definition leads to a market area that is less affected by the given hospital, as measured by the percentage of market area admissions to the hospital.

Option 2 is an existing, recognized methodology that is likely to be acceptable among involved stakeholders. In addition, market area definitions in Option 2 are better aligned the geographic areas where patients are more likely to use the selected hospital. There are two downsides to this option. First, the market areas were created in 1993 and have not been updated since that time, except to include new ZIP codes. However, the analyses used to compare Option 1 and Option 2 are based on 2013 admission data and the Dartmouth market areas still performed well. Second, Option 2 assigns fewer of the hospital's total admissions to the hospital from the assigned market area than Option 1.

Both Option 1 and Option 2 have advantages and disadvantages. The critical question to answer was whether we wanted the measure to maximize (1) the share of the selected hospital's admissions captured or (2) the share of market area admissions that are captured by the selected hospital. When calculating differences in total spending between the Maryland and comparison group hospitals, we would capture more of the hospitalized patients who actually use the hospital with Option 1. However, the hospital would have less overall control of the market area, because it includes ZIP codes where the hospital may account for a very small proportion of admissions. With Option 2, we would capture fewer of the hospital's actual patients, but we have a better focus on the geographic areas where patients are more likely to use the hospital and where the hospital conceivably has more control.

It was also important to consider the primary purpose of the market areas for analysis. Our aggregated hospital-level analysis captures all hospital admissions regardless of how the

market areas are defined. We use market areas for population-level outcomes such as inpatient admission rates and spending per capita. The population-level analysis is focused on outcomes among beneficiaries residing in a defined area. These outcomes are not entirely dependent on hospital utilization, yet are expected to be influenced by a hospital serving the area. Given the focus on population-level outcomes of the analyses that use market areas, we gave greater weight to the share of market area admission accounted for by the selected hospital. For this reason, combined with the fact that it is an accepted method that has been used in previous studies, we implemented Option 2 to define market areas for comparison hospitals.

B.3 Propensity Score Methodology

Overview—After selecting comparison hospitals and hospital market areas, we constructed person-level, admission-level, and ED visit-level propensity score weights. Generally, person-level weights were used in expenditure and utilization analyses. They were also used in the analyses of one quality of care outcome (the probability of an admission for an ambulatory care sensitive condition [ACSC]) and a set of spillover outcomes (probability of a primary care visit by place of service). ED visit-level weights were used in one expenditure analysis. Admission-level weights were used in service mix, spillover, and most quality of care analyses, but ACSC admissions used person-level weights. The propensity score weights were used in outcome regression models to facilitate balance between Maryland and the comparison group on individual and market area characteristics. Person-level propensity weights were derived from logistic regressions for the probability of being a Maryland resident among Maryland and comparison group residents. The ED-visit level propensity weight was constructed from a logistic regression for the probability that an ED visit was made by a Maryland resident among all ED visits for Maryland and comparison group residents. Admission-level propensity score weights were derived from logistic regressions for the probability of a hospital being a Maryland hospital or the probability of an individual with a hospital admission being a Maryland resident. To accommodate different outcomes, we developed three types of admission-level propensity scores, which are described in ***Table B-5***.

Table B-5
Types of admission-level propensity scores used in outcome models

Description	Population	Outcomes used
Probability of admission to a Maryland hospital	All inpatient admissions to Maryland or comparison group hospitals regardless of patient's residence	Service mix, spillover
Probability of admission to a Maryland hospital among Maryland and comparison group residents	All inpatient admissions to Maryland or comparison group hospitals among Maryland or comparison group residents only	Quality of care (unplanned readmission within 30 days of hospital discharge, follow-up visit within 14 days of discharge, emergency department visit within 30 days of discharge)
Probability of admitted person being a Maryland resident	All inpatient admissions to any hospital by Maryland or comparison group residents	Expenditures and utilization (length of stay, payment per admission)

To achieve balance on these characteristics, we included various combinations and functional forms of the following covariates in the logistic regression models:

- Age.
- Race (White = 1).
- Dually eligible status.
- Gender.
- Originally entitled to Medicare because of disability status.
- End-stage renal disease status.
- HCC score.
- County population density.
- County unemployment rate.
- County percentage of persons 25+ years of age with a high school diploma.
- County percentage of persons 25+ years of age with four or more years of college.

- County uninsured rate among individuals under age 65.
- County short-term general acute care beds per 1,000 residents.
- County primary care physicians (PCPs) per 1,000 residents.
- County urban area indicator.
- County health professional shortage area (HPSA) for primary care indicator.

The propensity score is the predicted probability of the dependent variable's being equal to 1 (i.e., being a Maryland resident) for each observation in the logistic regression. For each population, we created propensity score weights by assigning a weight of 1 to Maryland residents (or admissions or ED visits) and a weight of propensity score/(1-propensity score) for individuals (or admissions or ED visits) in the comparison group. We then calculated absolute standardized differences between Maryland and both the unweighted and weighted comparison groups to determine the residual level of covariate imbalance. The full covariate balance details are shown below and in the First Annual Report. This process of estimating a logistic regression, creating a propensity score weight, and reviewing postweighting covariate balance was performed for each year of available data to create year-specific propensity score weights.

For all tables included in this appendix, we report both unweighted and propensity score/HSA-weighted covariate means and absolute mean standardized differences. The standardized difference is calculated as shown in ***Equation B.1*** for continuous variables or ***Equation B.2*** for dichotomous variables.

Continuous:

$$d = \frac{\left(\bar{x}_{treatment} - \bar{x}_{control}\right)}{\sqrt{\frac{s^2_{treatment} + s^2_{control}}{2}}}, \tag{B.1}$$

where $\bar{x}_{treatment}$ and $\bar{x}_{control}$ denote the sample mean of the covariate in treated and untreated subjects, respectively, and $s^2_{treatment}$ and $s^2_{control}$ denote the sample variance of the covariate in treated and untreated subjects, respectively.

Dichotomous:

$$d = \frac{\left(\hat{p}_{treatment} - \hat{p}_{control}\right)}{\sqrt{\frac{\hat{p}_{treatment}\left(1-\hat{p}_{treatment}\right) + \hat{p}_{control}\left(1-\hat{p}_{control}\right)}{2}}}, \tag{B.2}$$

where $\hat{p}_{treatment}$ and $\hat{p}_{control}$ denote the prevalence or mean of the dichotomous variable in treated and untreated subjects, respectively.

B.4 Model 1: Maryland Residents and Residents of Comparison Group Market Area

We estimated a logistic regression where the dependent variable was the probability of being a Maryland resident or not for each admission to a Maryland or comparison group hospital. We included residents of Maryland and comparison hospital market areas in the sample for analyses. The following covariates were included in the model: Age, race (white = 1), dual eligible status, gender, originally disabled status, end-stage renal disease (ESRD) status, HCC score, county population density, county unemployment rate, county percentage of persons 25+ years of age with a high school diploma 2009–2013, county percentage of persons 25+ years of age with 4 or more years of college 2009–2013, uninsured rate among individuals less than 65 years of age, short-term general acute-care beds per 1,000 residents, PCPs per 1,000 residents, urban area indicator, and whether the county was an HPSA for primary care. ***Table B-6*** contains covariate balance diagnostics for the year 2015; the covariate balance diagnostics for 2011-2014 are shown in the First Annual Report.

Table B-6
Maryland population-level propensity score balance 2015

Variable	Maryland mean, unweighted	Comparison mean, unweighted	Standardized difference	Maryland mean, weighted	Comparison mean, weighted	Standardized difference
Age	71.58	71.18	0.03	71.58	71.39	0.02
White	0.67	0.63	0.06	0.67	0.73	0.11
Number of months dually eligible	0.16	0.24	0.17	0.16	0.18	0.06
Male	0.44	0.44	0.00	0.44	0.44	0.00
Disabled	0.20	0.25	0.10	0.20	0.22	0.04
End-stage renal disease	0.01	0.01	0.01	0.01	0.01	0.01
Hierarchical condition category score	1.10	1.19	0.07	1.10	1.14	0.03
Metro	0.96	0.96	0.01	0.96	0.92	0.16
Population density 2013	1,867.39	4,246.16	0.87	1,867.39	2,480.34	0.27
Unemployment rate 2013	6.78	8.74	1.37	6.78	8.54	1.17
Poverty rate 2013	10.64	14.78	0.82	10.64	12.90	0.44
Percent <65 years uninsured	11.66	14.63	0.72	11.66	13.52	0.46
Acute hospital beds per 1,000 residents	2.21	2.64	0.25	2.21	2.22	0.00
Primary care providers per 1,000 residents	0.87	0.92	0.13	0.87	0.81	0.19
Health professional shortage area primary care	0.74	0.90	0.33	0.74	0.85	0.21

B.5 Model 2: Probability of Admission to a Maryland Hospital for Each Admission to a Maryland or Comparison Group Hospital

We estimated a logistic regression of an admission being to a Maryland hospital for each admission among all admissions to a Maryland or comparison group hospital during the year. We included the following covariates in the model: Age, race (white = 1), dual eligible status, gender, originally disabled status, ESRD status, HCC score, county population density, county unemployment rate, county percentage of persons 25+ years of age with a high school diploma 2009–2013, county percentage of persons 25+ years of age with 4 or more years of college 2009–2013, uninsured rate among individuals less than 65 years of age, short-term general acute-care beds per 1,000 residents, PCPs per 1,000 residents, urban area indicator, and whether the county was an HPSA for primary care. We present covariate balance for all years because we did not estimate propensity models for this group for the First Annual Report analyses. ***Tables B-7*** through ***B-11*** contain covariate balance diagnostics for years 2011–2015, respectively.

Table B-7
Maryland admission-level propensity score balance 2011

Variable	Maryland mean, unweighted	Comparison mean, unweighted	Standardized difference	Maryland mean, weighted	Comparison mean, weighted	Standardized difference
Age	73.24	73.69	0.03	73.24	72.96	0.02
White	0.70	0.76	0.12	0.70	0.68	0.03
Number of months dually eligible	0.27	0.35	0.15	0.27	0.29	0.03
Male	0.43	0.44	0.01	0.43	0.43	0.01
Disabled	0.30	0.32	0.02	0.30	0.31	0.02
End-stage renal disease	0.07	0.06	0.02	0.07	0.07	0.01
Hierarchical condition category score	2.42	2.46	0.02	2.42	2.44	0.01
Metro	0.95	0.91	0.12	0.95	0.92	0.10
Population density 2013	2,174.53	3,119.21	0.31	2,173.57	2,182.90	0.00
Unemployment rate 2013	7.07	8.67	1.07	7.06	8.39	0.86
Poverty rate 2013	11.92	13.51	0.29	11.92	12.59	0.12
Percent <65 years uninsured	11.82	13.55	0.42	11.81	13.10	0.31
Acute hospital beds per 1,000 residents	0.73	0.85	0.24	0.73	0.82	0.16
Primary care providers per 1,000 residents	2.60	2.41	0.10	2.60	2.17	0.22
Health professional shortage area primary care	0.85	0.84	0.01	0.85	0.81	0.12

Table B-8
Maryland admission-level propensity score balance 2012

Variable	Maryland mean, unweighted	Comparison mean, unweighted	Standardized difference	Maryland mean, weighted	Comparison mean, weighted	Standardized difference
Age	73.09	73.71	0.04	73.09	72.84	0.02
White	0.69	0.76	0.13	0.69	0.67	0.04
Number of months dually eligible	0.27	0.36	0.16	0.27	0.29	0.03
Male	0.43	0.43	0.01	0.43	0.43	0.01
Disabled	0.31	0.32	0.02	0.31	0.32	0.02
End-stage renal disease	0.07	0.07	0.01	0.07	0.07	0.01
Hierarchical condition category score	2.58	2.64	0.02	2.58	2.60	0.01
Metro	0.95	0.92	0.11	0.95	0.92	0.09
Population density 2013	2,174.09	3,114.07	0.31	2,172.56	2,174.06	0.00
Unemployment rate 2013	7.05	8.67	1.08	7.05	8.40	0.88
Poverty rate 2013	11.86	13.46	0.29	11.85	12.51	0.12
Percent <65 years uninsured	11.81	13.51	0.41	11.81	13.04	0.30
Acute hospital beds per 1,000 residents	0.73	0.85	0.24	0.73	0.82	0.16
Primary care providers per 1,000 residents	2.58	2.40	0.09	2.58	2.16	0.22
Health professional shortage area primary care	0.85	0.84	0.02	0.85	0.81	0.13

Table B-9
Maryland admission-level propensity score balance 2013

Variable	Maryland mean, unweighted	Comparison mean, unweighted	Standardized difference	Maryland mean, weighted	Comparison mean, weighted	Standardized difference
Age	73.01	73.55	0.04	73.01	72.74	0.02
White	0.69	0.76	0.13	0.69	0.67	0.03
Number of months dually eligible	0.27	0.36	0.15	0.27	0.29	0.03
Male	0.43	0.44	0.01	0.43	0.43	0.00
Disabled	0.31	0.32	0.02	0.31	0.32	0.02
End-stage renal disease	0.07	0.06	0.01	0.07	0.07	0.01
Hierarchical condition category score	2.43	2.53	0.04	2.43	2.45	0.01
Metro	0.95	0.92	0.10	0.95	0.92	0.09
Population density 2013	2,139.57	3,136.45	0.33	2,138.45	2,150.31	0.00
Unemployment rate 2013	7.05	8.63	1.06	7.05	8.35	0.84
Poverty rate 2013	11.84	13.41	0.29	11.83	12.42	0.11
Percent <65 years uninsured	11.81	13.44	0.39	11.81	12.95	0.27
Acute hospital beds per 1,000 residents	0.73	0.85	0.23	0.73	0.81	0.15
Primary care providers per 1,000 residents	2.57	2.40	0.09	2.56	2.14	0.22
Health professional shortage area primary care	0.85	0.85	0.01	0.85	0.81	0.11

Table B-10
Maryland admission-level propensity score balance 2014

Variable	Maryland mean, unweighted	Comparison mean, unweighted	Standardized difference	Maryland mean, weighted	Comparison mean, weighted	Standardized difference
Age	72.78	73.89	0.08	72.78	72.61	0.01
White	0.68	0.77	0.15	0.68	0.67	0.02
Number of months dually eligible	0.28	0.35	0.13	0.28	0.29	0.03
Male	0.44	0.44	0.01	0.44	0.43	0.01
Disabled	0.32	0.32	0.01	0.32	0.33	0.02
End-stage renal disease	0.07	0.06	0.02	0.07	0.07	0.00
Hierarchical condition category score	2.37	2.48	0.05	2.37	2.38	0.00
Metro	0.95	0.93	0.08	0.95	0.93	0.09
Population density 2013	2,127.05	3,107.26	0.32	2,125.94	2,124.53	0.00
Unemployment rate 2013	7.04	8.57	1.01	7.04	8.27	0.79
Poverty rate 2013	11.81	13.18	0.25	11.80	12.26	0.09
Percent <65 years uninsured	11.80	13.24	0.34	11.80	12.76	0.23
Acute hospital beds per 1,000 residents	0.73	0.85	0.22	0.73	0.81	0.16
Primary care providers per 1,000 residents	2.55	2.36	0.10	2.55	2.12	0.23
Health professional shortage area primary care	0.85	0.85	0.01	0.85	0.81	0.11

Table B-11
Maryland admission-level propensity score balance 2015

Variable	Maryland mean, unweighted	Comparison mean, unweighted	Standardized difference	Maryland mean, weighted	Comparison mean, weighted	Standardized difference
Age	72.99	74.32	0.10	72.99	72.83	0.01
White	0.68	0.77	0.17	0.68	0.67	0.03
Number of months dually eligible	0.27	0.27	0.00	0.27	0.29	0.02
Male	0.44	0.45	0.01	0.44	0.44	0.00
Disabled	0.32	0.31	0.00	0.32	0.33	0.02
End-stage renal disease	0.07	0.06	0.01	0.07	0.07	0.00
Hierarchical condition category score	2.46	2.55	0.04	2.46	2.45	0.00
Metro	0.95	0.92	0.08	0.95	0.92	0.09
Population density 2013	2,110.08	3,042.33	0.30	2,109.18	2,075.31	0.01
Unemployment rate 2013	7.04	8.48	0.94	7.04	8.21	0.75
Poverty rate 2013	11.79	13.01	0.22	11.78	12.21	0.08
Percent <65 years uninsured	11.77	12.91	0.27	11.77	12.54	0.18
Acute hospital beds per 1,000 residents	0.73	0.85	0.23	0.73	0.82	0.17
Primary care providers per 1,000 residents	2.53	2.34	0.10	2.53	2.11	0.23
Health professional shortage area primary care	0.84	0.85	0.02	0.84	0.81	0.09

B.6 Model 3: Probability of Admission to a Maryland Hospital Among Maryland Residents and Residents of Comparison Group Market Area

We estimated a logistic regression for each admission to a Maryland or comparison group hospital among Maryland or comparison group market area residents during the year where the dependent variable was the probability of the admission being to a Maryland hospital or not for each admission. We included the following covariates in the model: Age, race (white = 1), dual eligible status, gender, originally disabled status, ESRD status, HCC score, county population density, county unemployment rate, county percentage of persons 25+ years of age with a high school diploma 2009–2013, county percentage of persons 25+ years of age with 4 or more years of college 2009–2013, uninsured rate among individuals less than 65 years of age, short-term general acute-care beds per 1,000 residents, PCPs per 1,000 residents, urban area indicator, and whether the county was an HPSA for primary care. We present covariate balance for all years because we did not estimate propensity models for this group for the First Annual Report analyses. ***Tables B-12*** through ***B-16*** contain covariate balance diagnostics for years 2011–2015, respectively.

Table B-12
Maryland admission-level propensity score balance 2011

Variable	Maryland mean, unweighted	Comparison mean, unweighted	Standardized difference	Maryland mean, weighted	Comparison mean, weighted	Standardized difference
Age	73.31	73.69	0.03	73.31	72.24	0.08
White	0.69	0.76	0.12	0.69	0.63	0.10
Number of months dually eligible	0.27	0.35	0.15	0.27	0.32	0.08
Male	0.43	0.44	0.02	0.43	0.43	0.01
Disabled	0.30	0.32	0.02	0.30	0.34	0.06
End-stage renal disease	0.07	0.06	0.03	0.07	0.08	0.02
Hierarchical condition category score	2.44	2.46	0.01	2.44	2.52	0.03
Metro	0.96	0.91	0.15	0.96	0.89	0.22
Population density 2013	2,149.43	3,121.51	0.33	2,149.43	2,462.39	0.12
Unemployment rate 2013	7.06	8.67	1.07	7.06	8.70	1.08
Poverty rate 2013	11.65	13.52	0.34	11.65	13.24	0.29
Percent <65 years uninsured	11.56	13.56	0.50	11.56	13.69	0.55
Acute hospital beds per 1,000 residents	0.72	0.85	0.26	0.72	0.84	0.24
Primary care providers per 1,000 residents	0.86	0.84	0.05	0.86	0.79	0.22
Health professional shortage area primary care	2.61	2.41	0.11	2.61	2.29	0.17

Table B-13
Maryland admission-level propensity score balance 2012

Variable	Maryland mean, unweighted	Comparison mean, unweighted	Standardized difference	Maryland mean, weighted	Comparison mean, weighted	Standardized difference
Age	73.17	73.71	0.04	73.17	72.19	0.07
White	0.68	0.76	0.14	0.68	0.62	0.11
Number of months dually eligible	0.27	0.36	0.15	0.27	0.32	0.08
Male	0.43	0.43	0.01	0.43	0.43	0.00
Disabled	0.31	0.32	0.01	0.31	0.34	0.06
End-stage renal disease	0.07	0.07	0.01	0.07	0.08	0.02
Hierarchical condition category score	2.59	2.64	0.01	2.59	2.69	0.03
Metro	0.96	0.92	0.15	0.96	0.90	0.21
Population density 2013	2,144.92	3,116.56	0.34	2,144.92	2,452.86	0.12
Unemployment rate 2013	7.05	8.67	1.09	7.05	8.71	1.11
Poverty rate 2013	11.58	13.47	0.34	11.58	13.15	0.29
Percent <65 years uninsured	11.56	13.52	0.49	11.56	13.64	0.54
Acute hospital beds per 1,000 residents	0.72	0.85	0.26	0.72	0.84	0.24
Primary care providers per 1,000 residents	0.86	0.84	0.06	0.86	0.79	0.23
Health professional shortage area primary care	2.59	2.40	0.10	2.59	2.27	0.17

Table B-14
Maryland admission-level propensity score balance 2013

Variable	Maryland mean, unweighted	Comparison mean, unweighted	Standardized difference	Maryland mean, weighted	Comparison mean, weighted	Standardized difference
Age	73.11	73.55	0.03	73.11	72.01	0.08
White	0.68	0.76	0.14	0.68	0.62	0.11
Number of months dually eligible	0.28	0.36	0.14	0.28	0.33	0.10
Male	0.43	0.44	0.02	0.43	0.44	0.01
Disabled	0.31	0.32	0.02	0.31	0.35	0.06
End-stage renal disease	0.07	0.06	0.02	0.07	0.07	0.01
Hierarchical condition category score	2.45	2.53	0.03	2.45	2.51	0.02
Metro	0.96	0.92	0.14	0.96	0.90	0.21
Population density 2013	2,123.47	3,138.07	0.35	2,123.47	2,450.29	0.13
Unemployment rate 2013	7.05	8.64	1.06	7.05	8.67	1.07
Poverty rate 2013	11.56	13.41	0.34	11.56	13.10	0.28
Percent <65 years uninsured	11.56	13.44	0.47	11.56	13.59	0.52
Acute hospital beds per 1,000 residents	0.72	0.85	0.25	0.72	0.84	0.23
Primary care providers per 1,000 residents	0.86	0.85	0.03	0.86	0.79	0.21
Health professional shortage area primary care	2.58	2.40	0.09	2.58	2.26	0.16

Table B-15
Maryland admission-level propensity score balance 2014

Variable	Maryland mean, unweighted	Comparison mean, unweighted	Standardized difference	Maryland mean, weighted	Comparison mean, weighted	Standardized difference
Age	72.89	73.89	0.07	72.89	72.00	0.06
White	0.68	0.77	0.16	0.68	0.62	0.09
Number of months dually eligible	0.28	0.35	0.12	0.28	0.33	0.08
Male	0.44	0.44	0.02	0.44	0.44	0.01
Disabled	0.32	0.32	0.01	0.32	0.35	0.06
End-stage renal disease	0.07	0.06	0.02	0.07	0.07	0.01
Hierarchical condition category score	2.38	2.48	0.04	2.38	2.43	0.02
Metro	0.96	0.93	0.11	0.96	0.91	0.18
Population density 2013	2,102.10	3,109.23	0.35	2,102.10	2,411.21	0.12
Unemployment rate 2013	7.04	8.57	1.01	7.04	8.59	1.02
Poverty rate 2013	11.52	13.18	0.30	11.52	12.85	0.24
Percent <65 years uninsured	11.56	13.24	0.41	11.56	13.38	0.46
Acute hospital beds per 1,000 residents	0.72	0.85	0.25	0.72	0.84	0.23
Primary care providers per 1,000 residents	0.86	0.85	0.03	0.86	0.80	0.21
Health professional shortage area primary care	2.56	2.36	0.10	2.56	2.23	0.17

Table B-16
Maryland admission-level propensity score balance 2015

Variable	Maryland mean, unweighted	Comparison mean, unweighted	Standardized difference	Maryland mean, weighted	Comparison mean, weighted	Standardized difference
Age	73.10	74.32	0.09	73.10	72.26	0.06
White	0.67	0.77	0.18	0.67	0.62	0.09
Number of months dually eligible	0.28	0.27	0.01	0.28	0.32	0.07
Male	0.44	0.45	0.01	0.44	0.44	0.01
Disabled	0.32	0.31	0.00	0.32	0.35	0.06
End-stage renal disease	0.07	0.06	0.01	0.07	0.07	0.01
Hierarchical condition category score	2.47	2.55	0.03	2.47	2.51	0.02
Metro	0.96	0.92	0.12	0.96	0.90	0.20
Population density 2013	2,081.67	3,045.12	0.33	2,081.67	2,345.15	0.10
Unemployment rate 2013	7.04	8.48	0.94	7.04	8.52	0.96
Poverty rate 2013	11.51	13.01	0.27	11.51	12.80	0.24
Percent <65 years uninsured	11.53	12.91	0.33	11.53	13.16	0.41
Acute hospital beds per 1,000 residents	0.72	0.85	0.25	0.72	0.84	0.23
Primary care providers per 1,000 residents	0.86	0.85	0.02	0.86	0.79	0.19
Health professional shortage area primary care	2.54	2.35	0.10	2.54	2.22	0.17

B.7 Model 4: Probability of Admission to a Maryland or Comparison Group Hospital Being a Maryland Resident

We estimated a logistic regression for each admission to a Maryland or comparison group hospital during the year where the dependent variable was the probability of the admission being a Maryland resident. We included the following covariates in the model: Age, race (white = 1), dual eligible status, gender, originally disabled status, ESRD status, HCC score, county population density, county unemployment rate, county percentage of persons 25+ years of age with a high school diploma 2009–2013, county percentage of persons 25+ years of age with 4 or more years of college 2009–2013, uninsured rate among individuals less than 65 years of age, short-term general acute-care beds per 1,000 residents, PCPs per 1,000 residents, urban area indicator, and whether the county was an HPSA for primary care. ***Table B-17*** contains covariate balance diagnostics for the year 2015; the covariate balance diagnostics for 2011–2014 are shown in the First Annual Report.

Table B-17
Maryland admission-level propensity score balance 2015

Variable	Maryland mean, unweighted	Comparison mean, unweighted	Standardized difference	Maryland mean, weighted	Comparison mean, weighted	Standardized difference
Age	73.03	73.28	0.02	73.03	72.33	0.05
White	0.67	0.66	0.01	0.67	0.72	0.10
Number of months dually eligible	0.27	0.31	0.07	0.27	0.31	0.07
Male	0.44	0.45	0.02	0.44	0.44	0.00
Disabled	0.31	0.34	0.04	0.31	0.34	0.05
End-stage renal disease	0.07	0.08	0.02	0.07	0.08	0.03
Hierarchical condition category score	2.47	2.63	0.06	2.47	2.56	0.03
Metro	0.96	0.95	0.03	0.96	0.91	0.15
Population density 2013	2,007.69	4,093.98	0.73	2,007.69	2,674.66	0.27
Unemployment rate 2013	6.98	8.79	1.26	6.98	8.60	1.07
Poverty rate 2013	11.30	14.72	0.65	11.30	13.16	0.35
Percent <65 years uninsured	11.63	14.51	0.70	11.63	13.51	0.46
Acute hospital beds per 1,000 residents	0.73	0.91	0.36	0.73	0.87	0.27
Primary care providers per 1,000 residents	0.85	0.90	0.15	0.85	0.83	0.05
Health professional shortage area primary care	2.44	2.62	0.10	2.44	2.29	0.08

B.8 Model 5: Probability of ED Visit to a Maryland or Comparison Group Hospital Being a Maryland resident

We estimated a logistic regression for each ED visit to a Maryland or comparison group hospital during the year where the dependent variable was the probability of the individual being a Maryland resident. We included the following covariates in the model: Age, race (white = 1), dual eligible status, gender, originally disabled status, ESRD status, HCC score, county population density, county unemployment rate, county percentage of persons 25+ years of age with a high school diploma 2009–2013, county percentage of persons 25+ years of age with 4 or more years of college 2009–2013, uninsured rate among individuals less than 65 years of age, short-term general acute-care beds per 1,000 residents, PCPs per 1,000 residents, urban area indicator, and whether the county was an HPSA for primary care. ***Table B-18*** contains covariate balance diagnostics for the year 2015; the covariate balance diagnostics for 2011-2014 are shown in the First Annual Report.

Table B-18
Maryland ED visit-level propensity score balance 2015

Variable	Maryland mean, unweighted	Comparison mean, unweighted	Standardized difference	Maryland mean, weighted	Comparison mean, weighted	Standardized difference
Age	68.33	68.62	0.02	68.33	67.95	0.02
White	0.60	0.61	0.02	0.60	0.67	0.11
Number of months dually eligible	0.36	0.40	0.07	0.36	0.39	0.06
Male	0.41	0.42	0.02	0.41	0.41	0.00
Disabled	0.41	0.44	0.04	0.41	0.43	0.03
End-stage renal disease	0.04	0.05	0.03	0.04	0.04	0.02
Hierarchical condition category score	1.89	2.00	0.05	1.89	1.95	0.03
Metro	0.95	0.94	0.03	0.95	0.90	0.16
Population density 2013	2,106.49	4,255.38	0.70	2,106.49	2,820.24	0.27
Unemployment rate 2013	7.11	8.69	1.06	7.11	8.58	0.95
Poverty rate 2013	11.78	15.02	0.60	11.78	13.73	0.35
Percent <65 years uninsured	11.75	14.35	0.61	11.75	13.84	0.50
Acute hospital beds per 1,000 residents	0.77	0.90	0.28	0.77	0.86	0.19
Primary care providers per 1,000 residents	2.59	2.72	0.07	2.59	2.39	0.10
Health professional shortage area primary care	0.83	0.92	0.27	0.83	0.83	0.02

APPENDIX C:
DATA SOURCES USED FOR SECONDARY ANALYSIS

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Table C-1 summarizes information about the data sources used in the quantitative analyses. For each type of data, we identify the organization providing the data, the units of analysis for which the data are used, the time period of the data included in this report, and the content or variables of interest in the data source. More detail on each data source follows.

Table C-1
Data sources and years used for analysis

Data source	Data provider	Unit of analysis			Data period used	Contents/variables of interest
		Facility	Patient	State		
Medicare Part A and Part B fee-for-service claims and enrollment in the Chronic Conditions Warehouse data enclave	CMS	X	X	X	January 2011–December 2015	Patient-level inpatient and outpatient claims and enrollment data
Repriced Medicare Part A fee-for-service claims for Maryland	Lewin Group			X	October 1, 2013–September 30, 2015	Patient-level inpatient claims
Maryland Revenue and Volumes Report	Maryland Health Services Cost Review Commission	X			January 1, 2014–July 31, 2016	Hospital revenue and volume data
Inpatient Prospective Payment System Impact file	CMS	X			2013	Hospital characteristics
American Hospital Association (AHA) annual survey	AHA	X			2013	Organizational structure, facility and service lines, physician arrangements, staffing, corporate and purchasing affiliations, teaching status, and a geographic indicator
Annual Report on Selected Maryland Acute Care and Special Hospital Services	Maryland Health Care Commission	X			FY 2015	Hospital system affiliation
Area Health Resource File (AHRF)	Health Resources and Services Administration			X	AHRF is produced annually, but the data availability for individual data elements varies. We used the latest data available from the baseline period (2012–2013).	County-level demographic and health care supply variables
Geographic Variation Public Use File	CMS			X	2013	Aggregated demographic, spending, utilization, and quality indicators at the state and county levels

CMS = Centers for Medicare & Medicaid Services.

Medicare data—We used Medicare claims data provided by CMS in the CCW to derive expenditure, utilization, quality of care, service mix, and spillover outcomes for Medicare beneficiaries in Maryland and the comparison group. Medicare data were also used to compare

inpatient payment rates under the All-Payer Model with IPPS payment rates. The Medicare data in the CCW include (1) denominator information, which indicates the number of beneficiaries alive and residing in Maryland or the comparison hospital market areas during the period; (2) enrollment information, which indicates the number of days that beneficiaries were enrolled in Medicare during the period; (3) the claims experience for each beneficiary, including inpatient, hospital outpatient, physician, SNF, home health agency, hospice, and durable medical equipment claims; and (4) a health care characteristics file, which contains the HCC risk score[31] for beneficiaries. We used both Part A and Part B claims to create claims-based outcome measures and the health care characteristics file to obtain the beneficiaries' risk scores for risk adjustment in outcome regression models. For this report, we used Medicare data from the first quarter of 2011 through the fourth quarter of 2015. Because Medicare Advantage (i.e., managed care) enrollees may not have complete utilization and expenditure data, we excluded beneficiaries with any months of enrollment in Medicare managed care. We further restricted the Medicare sample to beneficiaries who were alive at the beginning of the year, had at least 1 month of both Part A and Part B enrollment, and had no months of only Part A or only Part B enrollment.

Repriced Medicare Part A fee-for-service claims prepared by the Lewin Group were also used for the comparison with IPPS payment rates. The Lewin Group applied pricing algorithms to Medicare final action claims to reprice all Medicare fee-for-service claims submitted by a Maryland hospital as though such bills were paid in accordance with Medicare prospective payment systems. For this report, we used repriced Medicare data from the first quarter of 2011 through the fourth quarter of 2015.

HSCRC financial data—We used the HSCRC[32] Revenue and Volumes Report to assess changes in rates charged, patient volume, and number of beds by rate center, as well as changes in total Medicare revenue and Maryland resident revenue. The Revenue and Volumes Report includes monthly revenue and volume data by rate center for each acute care hospital in Maryland.[33] These data are submitted monthly by hospitals within 30 days of the end of a month and, among other purposes, are used to monitor whether hospitals are charging rates in compliance with their rate corridors. Revenue and Volumes Report data are available on a monthly basis. These data were used in the analyses of hospital rate adherence. Information on hospital rate orders and permissions for hospitals to vary from their rate orders by more than 5 percent, obtained from quarterly reports submitted by the HSCRC to CMS, were also used in the

[31] The HCC grouping is based on the average of all beneficiaries' health risk scores, which is calculated using CMS's HCC risk adjustment model. The HCC risk adjustment model uses beneficiary demographic information (e.g., gender, age, Medicaid status, disability status) and diagnosis codes reported in Medicare claims data from the previous year to predict payments for the current year. This risk score often is used as a proxy for a beneficiary's health status (severity of illness).

[32] The HSCRC is responsible for monitoring hospital financial affairs in Maryland. The MHCC is responsible for establishing strategies to limit health care costs and expand access to Marylanders. Both departments fall under the Regulatory Programs Division, which is one of five large subgroups under the Secretary of the Department of Health and Mental Hygiene (DHMH).

[33] Additional information on hospital financial databases maintained by the HSCRC is available at http://www.hscrc.maryland.gov/Pages/hsp_Data2.aspx .

rate adherence analyses. Information on hospital global budgets and penalties were provided by the HSCRC. Finally, we used annual audited hospital statements of revenues and expenditures, obtained from the HSCRC, for analyses of hospital total revenues, operating expenses, and operating margins.

American Hospital Association Annual Survey Data—We used the 2013 AHA annual survey data to select hospitals included in the comparison group. The AHA survey data include information on U.S. hospitals from the AHA's Annual Survey of Hospitals, AHA membership data, and U.S. Census Bureau identifiers. We used data on hospital ownership status from the AHA in the selection of comparison hospitals.

IPPS Impact File—The IPPS Impact file was used as an additional source of information for selecting the comparison group and for categorizing hospitals in the revenue, cost, and volume analyses. The IPPS Impact file contains data elements by provider that CMS uses in calculating the final IPPS rates and estimating payment impacts of policy changes to the IPPS. The data elements in this file are abstracted from the Medicare Provider Analysis and Review, Provider of Services, and Medicare cost report files. We used the Impact file to obtain data on hospital characteristics, including DSH percentages, number of beds, number of residents, transfer-adjusted case mix, and Medicare days as a percentage of total inpatient days.

Area Health Resource File—The AHRF comprises data collected by the HRSA from more than 50 sources containing more than 6,000 variables related to health care access at the county level. We used information on health professions supply, hospital bed supply, and population characteristics and economic data to select the comparison group and to use as covariates in the analysis.

Medicare State/County Report—The Geographic Variation Public Use File created by CMS contains aggregated demographic, spending, utilization, and quality indicators at the state and county levels. The file was developed to enable researchers and policymakers to evaluate geographic variation in the utilization and quality of health care services for the Medicare FFS population. These data were used in selecting the comparison group.

Annual Report on Selected Maryland Acute Care and Special Hospital Services—This report, produced each fiscal year by the MHCC, provides information on hospital system affiliation; licensed bed capacity for selected services by hospital; and hospital capacity to provide surgical, emergency, obstetrics and delivery, and psychiatric care. These data were used to categorize hospitals in the hospital financial performance analyses.

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APPENDIX D:
MEASURE SPECIFICATIONS

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We present estimates from claims and other secondary data for six domains of performance: (1) hospital revenue and rate adherence, (2) service mix, (3) service utilization and expenditures, (4) quality of care, (5) spillover effects, and (6) comparison of payment rates in Maryland hospitals with payment rates for hospitals operating under the IPPS. In this Second Annual Report, we present claims-based measures for the Medicare population and the commercially insured population in the MarketScan database. Results for Medicaid populations will be provided in future annual reports. Specifications for measures in all of these domains except hospital global budget adherence and the IPPS rate comparison are provided below. All measures in all domains were created for the Medicare population, and a subset of measures for selected domains was created for the commercially insured.

D.1 Hospital Revenue, Cost, and Volume Measures

To evaluate the change in hospital revenue, cost, and volume for Maryland hospitals, we assessed the following measures.

- **Percent variation of hospital charges from approved rates for clinic services, outpatient emergency department services, and inpatient medical/surgical acute services:** We used the HSCRC's Revenue and Volumes Report data to calculate total revenue and volume for three selected service lines (clinic services, outpatient ED services, and inpatient medical/surgical acute services) for each hospital. We summed monthly revenue and volume at the hospital level to create quarterly revenue and volume for each hospital in Maryland. We divided quarterly revenue by quarterly volume for each service line to calculate the average charge for each service. This average charge was compared to the approved rate for each hospital.

- **Net operating revenues:** Each hospital's annual net operating revenue comes from its audited financial statements.

- **Total operating expenses:** Each hospital's annual total operating expenses comes from hospital audited financial statements.

- **Operating margin:** Each hospital's annual operating margin comes from hospital audited financial statements.

D.2 Service Mix

To evaluate the impact of the All-Payer Model on service mix, we report the following measures for Medicare beneficiaries. For all measures, inpatient admissions were identified as defined below in the "probability of any inpatient use" description under the "Utilization" section. The inclusion criteria for hospital admissions for the Medicare population are noted in the measure description.

- **DRG weight per admission:** This represents the diagnosis-related group relative weight of admissions to Maryland and comparison group hospitals.

- **Probability that an admission is classified as major or extreme using the APR-DRG Grouper:** The denominator included all admissions to Maryland or comparison group hospitals. The numerator included any admission classified as major/extreme by the grouper.

- **Probability that an admission includes an ICU stay:** The denominator was all acute admissions to Maryland or comparison group hospitals as defined in the all-cause hospitalizations description below. The numerator identified admissions for which REV_CTR = 200, 201, 202, 203, 204, 206, 207, 208, 209, 210, 211, 212, 213, 214, or 219.

- **Case-mix-adjusted payment per discharge:** This represents the sum of net facility payments to a Maryland or comparison group hospital for covered services provided during an inpatient admission, divided by the DRG relative weight for the institution of the admission.

- **Probability of robotic prostatectomy among prostatectomies:** This represents the probability of having had a robotic prostatectomy among individuals who had a prostatectomy at a Maryland or comparison group hospital. The denominator consisted of all male inpatient admissions that included a prostatectomy (ICD_PRCDR_CD1 through ICD_PRCDR_CD25 variables = 60.3, 60.4, 60.5, 60.62, 60.69 for ICD-9; 0VT00ZZ, 0VT07ZZ, 0VT04ZZ, 0VT08ZZ, 0VT34ZZ, 0VT30ZZ, 0V500ZZ, 0V503ZZ, 0V504ZZ for ICD-10). The numerator included any denominator admissions that included a robotic-assisted prostatectomy (ICD_PRCDR_CD1 through ICD_PRCDR_CD25 variables = 17.41, 17.42, 17.43, 17.44, 17.49 for ICD-9; 8E0W0CZ, 8E0W3CZ, 8E0W4CZ, 8E0W7CZ, 8E0W8CZ, 0VT04ZZ, 0VT08ZZ for ICD-10).

- **Probability of endovascular surgery among heart valve replacements:** This represents the probability of having had endovascular surgery among individuals who had heart valve replacements at Maryland or comparison group hospital. The denominator consisted of all inpatient admissions that included heart valve replacements (ICD_PRCDR_CD1 through ICD_PRCDR_CD25 variables = 35.05, 35.06, 35.07, 35.08, 35.09, 35.20, 35.21, 35.22, 35.23, 35.24, 35.25, 35.26, 35.27, 35.28 for ICD-9; see ***Table D-1*** for relevant ICD-10 codes). The numerator included any denominator admissions that included endovascular surgery (ICD_PRCDR_CD1 through ICD_PRCDR_CD25 variables = 35.05, 35.07, 35.09 for ICD-9; 02RF37Z, 02RF38Z, 02RF3JZ, 02RF3KZ, 02RH37Z, 02RH38Z, 02RH3JZ, 02RH3KZ, 02RG37H, 02RG37Z, 02RG38H, 02RG38Z, 02RG3JH, 02RG3JZ, 02RG3KH, 02RG3KZ for ICD-10).

Table D-1
Procedure codes for identifying heart valve replacements

ICD-9	ICD-10
35.05	02RF37Z, 02RF38Z, 02RF3JZ, or 02RF3KZ
35.06	02RF37H, 02RF38H, 02RF3JH, or 02RF3KH
35.07	02RH37Z, 02RH38Z, 02RH3JZ, or 02RH3KZ
35.08	02RH37H, 02RH38H, 02RH3JH, or 02RH3KH
35.09	02RF37Z, 02RF38Z, 02RF3JZ, 02RF3KZ, 02RG37H, 02RG37Z, 02RG38H, 02RG38Z, 02RG3JH, 02RG3JZ, 02RG3KH, 02RG3KZ, 02RH37Z, 02RH38Z, 02RH3JZ, or 02RH3KZ
35.20	02RF07Z, 02RF08Z, 02RF0JZ, 02RF0KZ, 02RF47Z, 02RF48Z, 02RF4JZ, 02RF4KZ, 02RG07Z, 02RG08Z, 02RG0JZ, 02RG0KZ, 02RG47Z, 02RG48Z, 02RG4JZ, 02RG4KZ, 02RH07Z, 02RH08Z, 02RH0JZ, 02RH0KZ, 02RH47Z, 02RH48Z, 02RH4JZ, 02RH4KZ, 02RJ07Z, 02RJ08Z, 02RJ0JZ, 02RJ0KZ, 02RJ47Z, 02RJ48Z, 02RJ4JZ, or 02RJ4KZ
35.21	02RF07Z, 02RF08Z, 02RF0KZ, 02RF47Z, 02RF48Z, or 02RF4KZ
35.22	02RF0JZ or 02RF4JZ
35.23	02RG07Z, 02RG08Z, 02RG0KZ, 02RG37Z, 02RG38Z, 02RG3KZ, 02RG47Z, 02RG48Z, or 02RG4KZ
35.24	02RG0JZ, 02RG3JZ, or 02RG4JZ
35.25	02RH07Z, 02RH08Z, 02RH0KZ, 02RH47Z, 02RH48Z, or 02RH4KZ
35.26	02RH0JZ or 02RH4JZ
35.27	02RJ07Z, 02RJ08Z, 02RJ0KZ, 02RJ47Z, 02RJ48Z, or 02RJ4KZ
35.28	02RJ0JZ or 02RJ4JZ

- **Probability of endovascular intracranial surgery among intracranial vascular surgeries:** This represents the probability of having had endovascular intracranial surgery among individuals who had intracranial vascular surgeries. The denominator consists of all inpatient admissions that included intracranial vascular surgeries (DRG = 020, 021, or 022) at a Maryland or comparison group hospital. The numerator includes any denominator admissions that included endovascular intracranial surgery (ICD_PRCDR_CD1 through ICD_PRCDR_CD25 variables = 39.72, 39.74, 39.75, 39.76 for ICD-9; see ***Table D-2*** for ICD-10 codes).

Table D-2
Procedure codes for identifying endovascular intracranial surgery

ICD-9	ICD-10
39.72	03LG3DZ, 03LG4DZ, 03LH3DZ, 03LH4DZ, 03LJ3DZ, 03LJ4DZ, 03LK3DZ, 03LK4DZ, 03LL3DZ, 03LL4DZ, 03LM3DZ, 03LM4DZ, 03LN3DZ, 03LN4DZ, 03LP3DZ, 03LP4DZ, 03LQ3DZ, 03LQ4DZ, 03LR3DZ, 03LR4DZ, 03LS3DZ, 03LS4DZ, 03LT3DZ, 03LT4DZ, 03VG3DZ, 03VG4DZ, 03VH3DZ, 03VH4DZ, 03VJ3DZ, 03VJ4DZ, 03VK3DZ, 03VK4DZ, 03VL3DZ, 03VL4DZ, 03VM3DZ, 03VM4DZ, 03VN3DZ, 03VN4DZ, 03VP3DZ, 03VP4DZ, 03VQ3DZ, 03VQ4DZ, 03VR3DZ, 03VR4DZ, 03VS3DZ, 03VS4DZ, 03VT3DZ, 03VT4DZ, 03VU3DZ, 03VU4DZ, 03VV3DZ, 03VV4DZ
39.74	03CG3ZZ, 03CG4ZZ, 03CH3ZZ ,03CH4ZZ, 03CJ3ZZ, 03CJ4ZZ, 03CK3ZZ, 03CK4ZZ, 03CL3ZZ, 03CL4ZZ, 03CM3ZZ, 03CM4ZZ, 03CN3ZZ, 03CN4ZZ, 03CP3ZZ, 03CP4ZZ, 03CQ3ZZ, 03CQ4ZZ, 03CR3ZZ, 03CR4ZZ, 03CS3ZZ, 03CS4ZZ, 03CT3ZZ, 03CT4ZZ, 03CU3ZZ, 03CU4ZZ, 03CV3ZZ, 03CV4ZZ,
39.75	03LG3DZ, 03LG4DZ, 03LH3DZ, 03LH4DZ, 03LJ3DZ, 03LJ4DZ, 03LK3DZ, 03LK4DZ, 03LL3DZ, 03LL4DZ, 03LM3DZ, 03LM4DZ, 03LN3DZ, 03LN4DZ, 03LP3DZ, 03LP4DZ, 03LQ3DZ, 03LQ4DZ, 03VG3DZ, 03VG4DZ, 03VH3DZ, 03VH4DZ, 03VJ3DZ, 03VJ4DZ, 03VK3DZ, 03VK4DZ, 03VL3DZ, 03VL4DZ, 03VM3DZ, 03VM4DZ, 03VN3DZ, 03VN4DZ, 03VP3DZ, 03VP4DZ, 03VQ3DZ, 03VQ4DZ, 03VR3DZ, 03VR4DZ, 03VS3DZ, 03VS4DZ, 03VT3DZ, 03VT4DZ, 03VU3DZ, 03VU4DZ, 03VV3DZ, 03VV4DZ
39.76	03LG3BZ, 03LG4BZ, 03LH3BZ, 03LH4BZ, 03LJ3BZ, 03LJ4BZ, 03LK3BZ, 03LK4BZ, 03LL3BZ, 03LL4BZ, 03LM3BZ, 03LM4BZ, 03LN3BZ, 03LN4BZ, 03LP3BZ, 03LP4BZ, 03LQ3BZ, 03LQ4BZ, 03VG3BZ, 03VG4BZ, 03VH3BZ, 03VH4BZ, 03VJ3BZ, 03VJ4BZ, 03VK3BZ, 03VK4BZ, 03VL3BZ, 03VL4BZ, 03VM3BZ, 03VM4BZ, 03VN3BZ, 03VN4BZ, 03VP3BZ, 03VP4BZ, 03VQ3BZ, 03VQ4BZ

- **Proportion of hospital revenue from inpatient admissions:** This represents the proportion of an individual Maryland or comparison group hospital's revenue that was derived from inpatient admissions. The denominator was the hospital revenue derived from inpatient, outpatient ED, and other hospital outpatient payments. The proportion of inpatient payments for a hospital was calculated as the sum of all inpatient payments for which the hospital was listed as the provider, divided by the total (inpatient + outpatient ED + other hospital outpatient) payments for which the hospital was listed as the provider.

- **Proportion of hospital revenue from ED visits:** This represents the proportion of an individual Maryland or comparison group hospital's revenue that was derived from outpatient ED. The denominator was the hospital revenue derived from inpatient, outpatient ED, and other hospital outpatient payments. The proportion of outpatient ED payments for a hospital was calculated as the sum of all outpatient ED payments for which the hospital was listed as the provider, divided by the total (inpatient + outpatient ED + other hospital outpatient) payments for which the hospital was listed as the provider.

- **Proportion of hospital revenue from other outpatient hospital visits:** This represents the proportion of a Maryland or comparison group hospital's revenue that was derived from other outpatient hospital visits. The denominator was the hospital revenue derived from inpatient, outpatient ED, and other hospital outpatient payments. The proportion of other outpatient hospital payments for a hospital was calculated as the sum of all other outpatient hospital payments for which the hospital was listed as the provider, divided by the total (inpatient + outpatient ED + other hospital outpatient) payments for which the hospital was listed as the provider.

- **Surgical-to-medical admission ratio:** This represents the ratio of surgical to medical hospital admissions. Admissions to Maryland or comparison group hospitals were included. Surgical and medical admissions were identified on the basis of the type of DRG associated with the admission. The ratio is the number of surgical admissions over the number of medical admissions.

D.3 Service Utilization and Expenditures

D.3.1 Utilization

Utilization measures are reported as percentages. For each measure, the numerator was an indicator of having had at least one event (inpatient admission or ED visit that did not lead to a hospitalization). Events were included in a period's total if the discharge or service date on the claim was during the period. The denominator was the number of eligible beneficiaries in the state enrolled during the period. All utilization measures are reported for FFS Medicare beneficiaries who were residents of either Maryland or comparison group ZIP codes.

- **Probability of having any inpatient use:** This is an indicator of whether the beneficiary had at least one admission to an acute-care hospital reported in the inpatient file for the quarter, divided by the number of beneficiaries in the same quarter. For Medicare, we identified all hospital admissions in which the last four digits of the provider values were 0001–0879 (acute inpatient) or 1300–1399 (critical access hospitals [CAHs]). Some records in the inpatient claims files may appear to be multiple admissions but are in fact transfers between facilities; these records were counted as a single admission. To combine transfers into one acute admission, we identified claims that had no more than 1 elapsed day between discharge date of the index claim and admission date of the subsequent claim. We combined the claims into one record by taking the earliest admission date and latest discharge date and summing all payment amounts.

- **Probability of having any ED visits excluding ED observations stays that did not lead to a hospitalization (outpatient ED) use:** This is an indicator of whether the beneficiary had at least one visit to the ED, excluding observations stays, that did not result in an inpatient hospital admission, divided by the number of beneficiaries in the same period. ED visits excluding observation stays are identified in the outpatient services file as visits with a revenue center line item equal to 045X, and 0981 (ED care). If the procedure code on every line item of the ED claim equaled 70000–89999, or was equal to G0106, G0120, G0122, G0130, G0202, G0204, G0206, G0219, G0235, G0252, G0255, G0288, G0389, S8035, S8037, S8040, S8042, S8080, S8085, S8092, or S9024, that claim was excluded (thus excluding claims for which only radiology or pathology/laboratory services were provided). Multiple ED visits excluding ED observation stays on a single day were counted as a single visit.

- **Probability of having any observation stay ED visit that did not lead to a hospitalization (outpatient ED) use:** This is an indicator of whether the beneficiary had at least one observation visit to the ED that did not result in an inpatient hospital admission, divided by the number of beneficiaries in the same period. For all data sources, observation stay ED visits are identified in the outpatient services file as visits with a revenue center line item equal to 0760 (and CPT code = G0378 and number of times the service was performed ≥ 8) or 0762 (treatment or observation room). Multiple observation stay ED visits on a single day were counted as a single visit.

- **Length of stay:** This represents the number of days elapsed during an acute inpatient admission (as defined above). LOS = (discharge date − admission date) + 1. Admissions were assigned to a period based on discharge date.

D.3.2 Expenditures

Weighted average expenditures were calculated on a per-beneficiary-per-month (PBPM) basis. For each individual, PBPM payments were estimated as one-third of his or her quarterly payments. Expenditures are then multiplied by the eligibility fraction to account for partial-quarter enrollment. Expenditures were defined as payments made by Medicare; beneficiary cost-sharing was reported separately. The beneficiary cost-sharing liability measures comprise coinsurance and deductible payments. Averages include all individuals enrolled during the period, so that the figures also reflect the presence of individuals with zero medical costs. The payments were not risk adjusted[34] or price standardized across geographic areas. Negative payments on claims were set to zero. Depending on the type of claim, claims were included in a period's total if discharge or thru date on the claim was during the period. We report the following measures for Medicare beneficiaries who are residents of either Maryland or comparison group ZIP codes.

[34] Although the expenditures were not formally risk adjusted, the comparison groups were weighted by the propensity score (see ***Appendix C***), which includes some risk adjustment measures.

- **Total:** This represents overall net payment amounts from all inpatient and outpatient (facility and professional) claims (i.e., Part A and Part B for Medicare); it excludes member cost-sharing and pharmacy component expenditures (i.e., Part D for Medicare).

- **Inpatient facility:** This represents the sum of net facility payments to a hospital for covered services provided during all inpatient admissions. Inpatient admissions were assigned to a period on the basis of the discharge date. Inpatient admissions were defined as above.

- **Outpatient ED:** This is the overall payment amount for ED visits that did not lead to a hospitalization, including observation stays. Outpatient ED visits were defined as above in the "Utilization" section.

- **Other hospital outpatient department:** This includes the overall payment amount for hospital outpatient department services, excluding ED payments.

- **Professional:** This is the overall net payment amount from all inpatient and outpatient professional claims.

- **Professional—Regulated:** This is the overall net payment amount from all inpatient and outpatient professional claims for services rendered in facilities that are subject to Maryland's rate-setting regulations. Professional claims were restricted to place of service equal to 21 (inpatient hospital), 22 (outpatient hospital), or 23 (ER hospital).

- **Professional—Unregulated:** This is the overall net payment amount from all inpatient and outpatient professional claims for services rendered in facilities that are not subject to Maryland's rate-setting regulations. Professional claims were restricted to place of service not equal to 21 (inpatient hospital), 22 (outpatient hospital), or 23 (ER hospital).

- **Other:** This represents the sum of net payments for all other services, including those made for outpatient, home health, hospice, and SNF services, along with durable medical equipment payments.

- **Hospital:** This represents the sum of net payments for inpatient facility, outpatient ED, and other hospital outpatient department services.

In addition to expenditure categories, we report the payment per inpatient admission and per ED visit as defined below:

- **Expenditures per hospital admission:** This represents the sum of net facility payments to a hospital for covered services provided during an inpatient admission. Inpatient admissions were defined as above and were assigned to a period on the basis of the discharge date.

- **Expenditures per outpatient ED visit:** This represents the sum of net facility payments to a hospital for covered services provided during a visit to the ED that did not result in an inpatient hospitalization. ED visits were defined as above and were assigned to a period on the basis of the thru date.

We present the following expenditure categories for beneficiary cost sharing. For all measures, the sum of coinsurance and deductible payments was calculated:

- **Total:** This represents the sum of beneficiary cost-sharing payments from institutional (inpatient, outpatient, short-term nursing facility) and noninstitutional (physician, durable medical equipment) claims. Home health and hospice services are not subject to cost sharing and were excluded.

- **Inpatient:** This represents the sum of beneficiary cost-sharing payments from inpatient claims as defined above.

- **Outpatient ED:** This represents the sum of beneficiary cost-sharing payments for covered services provided during a visit to the ED that did not result in an inpatient hospitalization as defined above.

- **Other hospital outpatient department:** This represents the sum of beneficiary cost-sharing payments for covered services provided during a visit to the hospital outpatient department, excluding ED visits.

- **Professional:** This represents the beneficiary cost-sharing payments from physician claims.

- **Other:** This represents the beneficiary cost-sharing payments for all other services, including those made for outpatient, home health, hospice, and SNF services, along with durable medical equipment payments.

- **Hospital:** This represents the beneficiary cost-sharing payments for inpatient facility, outpatient ED, and other hospital outpatient department services.

D.4 Quality of Care

To evaluate the impact on quality of care, we report the following quality measures for FFS Medicare beneficiaries who were residents of either Maryland or comparison group ZIP codes. The measure descriptions include the definition of the numerator and denominator used for Medicare data.

- **Probability of having a follow-up visit within 14 days of hospital discharge:** The denominator includes hospitalizations to Maryland hospitals by Maryland residents and to comparison group hospitals by residents of the comparison group ZIP codes. Discharges were included if they were billed by short-term acute-care (STAC) facilities (under the IPPS)—for Maryland, by hospitals that would have operated

under IPPS in the absence of the state's exemption from IPPS. IPPS hospitals can be identified through the hospital ID known as the CMS Certification Number (CCN). IPPS hospitals have CCNs whose last four bytes are in the range 0001 to 0879. In the case of Maryland hospitals, those whose CCNs would have classified them as IPPS are considered STAC hospitals. All of the Maryland hospitals in the All-Payer Model and all of the comparison group hospitals meet the IPPS facility criterion.

A given discharge was excluded if there was a subsequent admission within 14 days. Postdischarge visits were included if one of the following *Current Procedural Terminology* (CPT) codes was listed on the outpatient claim within 14 days of the discharge:

99201, 99202, 99203, 99204, 99205, 99211, 99212, 99213, 99214, 99215, 99241, 99242, 99243, 99244, 99245, 99304, 99305, 99306, 99307, 99308, 99309, 99310, 99315, 99316, 99318, 99324, 99325, 99326, 99327, 99328, 99334, 99335, 99336, 99337, 99339, 99340, 99341, 99342, 99343, 99344, 99345, 99347, 99348, 99349, 99350, 99411, 99442, 99443, 99374, 99375, 99376, 99377, 99378, 99379, 99380, 99495, 99496, or Revenue center codes 521 or 522 (to capture federally qualified health center [FQHC] visits)

- **Probability of having an ED visit within 30 days of hospital discharge:** The denominator includes hospitalizations to Maryland hospitals by Maryland residents and comparison group hospitals by residents of the comparison group ZIP codes. Discharges were eligible for the denominator if they were billed by IPPS STAC facilities. A given discharge was excluded if there was a subsequent admission within 30 days. ED visits were identified in hospital outpatient claims as described above in the description for "Probability of having any ED visits that did not lead to a hospitalization." The subsequent ED visit can occur at any hospital, i.e., ED visits were included whether or not they occur at a Maryland or comparison group hospital.

- **Probability of having a readmission within 30 days of hospital discharge:** This is the total number of unplanned hospital readmissions within 30 days of discharge, divided by the total number of index admissions in the period. The denominator includes hospitalizations to Maryland hospitals by Maryland residents and comparison group hospitals by residents of the comparison group ZIP codes. The numerator includes readmissions to any hospital, whether or not it is a Maryland or comparison group hospital. An index hospital discharge is identified as an inpatient stay with a discharge date within the given measurement period (12 months) minus 30 days from the end of the period. An index admission was kept if the beneficiary was enrolled in Medicare FFS at admission, was age 65 or older at admission, and the admission was not to a PPS-exempt cancer hospital. We excluded admissions if the beneficiary died during the hospitalization, was transferred to another STAC hospital, did not have 30 days of postdischarge enrollment, was discharged against medical advice, was admitted for a primary psychiatric diagnosis, was admitted for rehabilitation, or was admitted for medical treatment of cancer. Planned admissions were not counted as readmissions. These include bone marrow, kidney, or other organ

transplants; maintenance chemotherapy or rehabilitation; and a list of potentially planned procedures if they are not acute or complications of care.

- **Probability of having an admission for an ACSC (Agency for Healthcare Research and Quality, 2013):** The denominator includes the Medicare population ages 18 and older who are residents of Maryland or the comparison group ZIP codes. The numerator is discharges, for patients ages 18 and older, that met the inclusion and exclusion rules for the numerator in any of the following prevention quality indicators (PQIs) (Agency for Healthcare Research and Quality, 2013, May).

  The ***Overall Composite (PQI #90)*** includes 12 of the 14 individual PQIs:

  - PQI #01 Diabetes Short-Term Complications Admission Rate.
  - PQI #11 Bacterial Pneumonia Admission Rate.
  - PQI #03 Diabetes Long-Term Complications Admission Rate.
  - PQI #12 Urinary Tract Infection Admission Rate.
  - PQI #05 Chronic Obstructive Pulmonary Disease or Asthma in Older Adults Admission Rate.
  - PQI #13 Angina without Procedure Admission Rate.
  - PQI #07 Hypertension Admission Rate.
  - PQI #14 Uncontrolled Diabetes Admission Rate.
  - PQI #08 Heart Failure Admission Rate.
  - PQI #15 Asthma in Younger Adults Admission Rate.
  - PQI #10 Dehydration Admission Rate.
  - PQI #16 Rate of Lower-Extremity Amputation among Patients with Diabetes.

D.5 Spillover Effects

To evaluate spillover effects of the All-Payer Model, we report the following measures for Medicare beneficiaries.

- **Avoidance of complex inpatient cases:** Medicare inpatient claims from IPPS STAC hospitals were used as units of observation in the analyses. Medicare inpatient claims for Maryland or comparison group hospitals were included..

  Several outcome variables for the STAC inpatient claims were created for these analyses, as follows.

Admission through the ED: An admission through the ED was defined as having a revenue center code on the claim equal to 0450–0459 or 0981.

- **IPPS transfer:** Each claim for a STAC admission was examined to ascertain whether it was followed by a claim at another STAC hospital. IPPS transfer rules (even for Maryland STAC hospitals) were applied to determine whether the following claim qualified as an IPPS transfer. The admission date on the following STAC claim had to be either on the same date as the discharge date on the initial STAC claim or only 1 day after. In addition, the initial STAC must have been a short stay. A short stay is defined as a LOS for the admission that is equal to or less than the geometric mean LOS for all cases for the DRG, minus 1 (Medicare Payment Advisory Commission, 2015).

- **IPPS transfer classified as major or extreme severity:** Case severity was determined using 3M's APR-DRG Grouper.

- **PAC transfer:** Each claim for a STAC admission was examined to ascertain whether it was followed by a claim at a PAC provider. The following are considered PAC providers: long-term care hospital, rehabilitation hospital or unit, psychiatric hospital or unit, skilled nursing facility or unit, and home health agency. PAC transfer rules (even Maryland STAC hospitals) were applied to determine whether the following claim qualified as a PAC transfer. The admission date on the PAC claim must have been within 3 days of the discharge date on the initial STAC claim. In addition, the initial STAC must have been a short stay. A short stay is defined as a LOS for the admission that is equal to or less than the geometric mean LOS for all cases for the DRG, minus 1. A final requirement is that the DRG had to have been classified as a "PAC DRG" (Medicare Payment Advisory Commission, 2015).

- **PAC transfer classified as major or extreme severity:** Case severity was determined using 3M's APR-DRG Grouper.

- **Inpatient Episode Payments:**

  - Episodes were constructed on the basis of an index hospitalization. Hospitalizations to Maryland or comparison group hospitals were included. For a hospitalization (admission) to qualify as an index hospitalization it must have met the following criteria:

    - The hospital must a STAC hospital. For hospitalizations at comparison group hospitals, payments must be covered by Medicare's IPPS. For hospitalizations at Maryland hospitals, only those that would have been covered by the IPPS in the absence of Maryland's All-Payer Model were used.

    - The discharge date of the hospitalization must be within the analytic time period. The discharge date was also used to classify the hospitalization into a specific analytic quarter.

- Episode windows were from 14 days before admission date to 30, 60, or 90 days after discharge date.

- Episode payments included all Medicare payments (excluding beneficiary cost sharing) for home health, skilled nursing facility, outpatient, inpatient, durable medical equipment, or professional claim. Payments were broken out by preadmission (14 days before admit date), index admission (admission through discharge date), and postdischarge (30, 60, or 90 days after discharge date) time periods.

- **Urgent care visits:** Claims in the CCW carrier file that had Taxpayer Identification Numbers (TINs) belonging to Maryland urgent care centers were used. The TINs were made available by the HSCRC. The claims were subset to those that were allowed for payment and to those for services provided to Maryland's Medicare FFS beneficiaries. All visits that met these requirements were used to count the number of urgent care visits.

- **Sites of care visits:** Claims from the CCW carrier file were used to count primary care visits at physician practices, urgent care centers, and hospital outpatient departments (claim type = 71 or 72). Claims from the CCW "outpatient" file were used to count primary care visits at FQHCs (bill type = 77), rural health clinics (RHCs; bill type = 71), and Method II critical access (CAH2) hospitals (bill type = 85 plus revenue center code = 096x, 097x, or 098x). The claims were subset to those that were allowed for payment and to those for services provided to Medicare FFS beneficiaries residing in Maryland and the comparison group ZIP codes.

  The analytic places (sites) of care categories were (1) physician practices, urgent care centers, and CAH2s; (2) hospital outpatient departments; and (3) FQHCs and RHCs. CAH2 place of care was not included in MarketScan analyses. For the visit to have been counted as a primary care visit, the codes had to have been any one of the following: CPT codes 99201–99205 or 99211–99215; *Healthcare Common Procedure Coding System* (HCPCS) Level II codes G0402, G0438, or G0439; or revenue center code 0521.

  - The place of service codes used for the first category were 11 (physician office), 17 (walk-in clinic), 20 (urgent care), or 49 (independent clinic).

    - In addition to the bill type and revenue center code requirements listed above for CAHs, the procedure code had to have been one of the codes in the preceding bullet.

  - The place of service code used for the second category was 22 (hospital outpatient department).

  - For the third category, we identify FQHCs where bill type = 77 and rural health clinics where bill type = 71.

- Border Crossing: Medicare inpatient claims from STAC hospitals (IPPS and CAHs) were used. The state code component of the hospital ID (PRVDR_NUM) was used to classify a STAC claim as a Maryland hospital (hosp_state_cd = 21) or from another state. For some subanalyses, hospitals outside Maryland were classified as being located in either border states or all other states. The border states were Delaware (hosp_state_cd = 08), the District of Columbia (09), Pennsylvania (39), Virginia (49), and West Virginia (51).

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APPENDIX E:
HOSPITAL FINANCIAL PERFORMANCE BY HOSPITAL CHARACTERISTIC

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Table E-1
Number of hospitals by percent variation of revenues from budget, all Maryland hospitals and by hospital characteristic, FY 2014, FY 2015, and FY 2016

Hospital characteristic	FY 2014								FY 2015							
	Underage (-)				Overage (+)				Underage (-)				Overage (+)			
	> −2.0%	−1.01 to −2.0%	−0.51 to −1.0%	≤ −0.5%	≤ 0.5%	0.51% to 1.0%	1.01% to 2.0%	> 2.0%	> −2.0%	−1.01 to −2.0%	−0.51 to −1.0%	≤ −0.5%	≤ 0.5%	0.51% to 1.0%	1.01% to 2.0%	> 2.0%
All Maryland hospitals*	**1**	**1**	**1**	**16**	**20**	**5**	**1**	**1**	**2**	**1**	**4**	**17**	**19**	**1**	**0**	**2**
Current regulatory system																
GBR	1	1	1	12	15	4	1	1	2	0	4	12	16	1	0	1
TPR	0	0	0	4	5	1	0	0	0	1	0	5	3	0	0	1
Number of inpatient beds																
<150	1	1	0	4	5	3	0	0	2	1	1	5	4	0	0	1
150–349	0	0	0	8	13	1	0	1	0	0	1	7	14	0	0	1
350+	0	0	1	4	2	1	1	0	0	0	2	5	1	1	0	0
Teaching status†																
IBR ≤ 5%	1	1	1	10	16	3	0	1	2	1	2	14	13	0	1	1
IBR > 5%	0	0	0	6	4	2	1	0	0	0	2	3	6	1	0	1
DSH percentage†																
<20	1	0	0	4	11	1	0	1	0	1	1	9	7	0	0	0
20–30	0	1	0	9	4	2	0	0	1	0	1	6	7	0	0	1
>30	0	0	1	3	5	2	1	0	1	0	2	2	5	1	0	1
System affiliation																
Affiliated	0	1	1	12	10	3	1	1	1	0	4	9	13	1	0	1
Not affiliated	1	0	0	4	10	2	0	0	1	1	0	8	6	0	0	1

(continued)

Table E-1 (continued)
Number of hospitals by percent variation of revenues from budget, all Maryland hospitals and by hospital characteristic, FY 2014, FY 2015, and FY 2016

	FY 2016							
	Underage (-)				Overage (+)			
Hospital characteristic	> −2.0%	−1.01 to −2.0%	−0.51 to −1.0%	≤ −0.5%	≤ 0.5%	0.51% to 1.0%	1.01% to 2.0%	> 2.0%
All Maryland hospitals*	**3**	**0**	**1**	**20**	**16**	**4**	**0**	**2**
Current regulatory system								
GBR	3	0	1	15	12	4	0	1
TPR	0	0	0	5	4	0	0	1
Number of inpatient beds								
<150	1	0	0	4	6	2	0	1
150–349	2	0	1	11	7	2	0	0
350+	0	0	0	5	3	0	0	1
Teaching status†								
IBR ≤ 5%	2	0	1	14	11	4	0	1
IBR > 5%	1	0	0	6	5	0	0	1
DSH percentage†								
<20	0	0	1	9	6	1	0	1
20–30	0	0	0	9	4	3	0	0
>30	3	0	0	2	6	0	0	1
System affiliation								
Affiliated	2	0	1	14	8	3	0	1
Not affiliated	1	0	0	6	8	1	0	1

NOTES: * Holy Cross Germantown Hospital opened in FY 2015, but it is excluded from these analyses because it did not operate under a global budget during the time period covered. † IBR and DSH percentages were based on data from the 2015 Medicare Impact File. Data for the University of Maryland Medical Center at Dorchester are reported under the University of Maryland Shore Medical Center at Easton in the Medicare Impact file. Therefore, teaching status and DSH percentage for these hospitals were based on their combined information in the Impact file. GBR = Global Budget Revenue; IBR = intern-to-bed ratio; TPR = Total Patient Revenue; DSH = disproportionate share hospital.

Table E-2
Number of Maryland hospitals with permission to vary rates and with charged rates for selected rate centers outside the 5 percent rate corridor by quarter, Q3 of FY 2014 through Q4 of FY 2016

Hospital service and rate variation	Q3 FY 2014	Q4 FY 2014	Q1 FY 2015	Q2 FY 2015	Q3 FY 2015	Q4 FY 2015	FY 2015 aggregate	Q1 FY 2016	Q2 FY 2016	Q3 FY 2016	Q4 FY 2016	FY 2016 aggregate
Number of hospitals with permission to vary rates more than 5%	N/A	N/A	2	3	9	21	N/A	16	16	14	14	N/A
Clinic services												
# of hospitals with 5–10% rate variation	11	13	8	11	13	11	7	12	11	19	12	13
# of hospitals with >10% rate variation	6	13	13	11	7	13	5	9	9	10	10	2
Outpatient emergency services												
# of hospitals with 5–10% rate variation	9	11	11	7	15	15	8	12	11	15	14	12
# of hospitals with >10% rate variation	7	12	6	12	6	13	2	9	8	9	8	2
Inpatient medical/surgical acute services												
# of hospitals with 5–10% rate variation	15	13	9	12	14	15	9	15	14	16	8	13
# of hospitals with >10% rate variation	13	18	16	10	8	16	3	7	9	13	12	3

NOTE: In fiscal years, Q1 = January–March, Q2 = April–June, Q3 = July–September, and Q4 = October–December. N/A = not applicable.

Table E-3
Percentage of Maryland hospitals with charged rates for inpatient medical/surgical acute services outside the 5 percent corridor by hospital characteristic and quarter, Q3 of FY 2014 through Q4 of FY 2016

Hospital characteristic	Variation from rate order	Q3 FY 2014	Q4 FY 2014	Q1 FY 2015	Q2 FY 2015	Q3 FY 2015	Q4 FY 2015	FY 2015 aggregate	Q1 FY 2016	Q2 FY 2016	Q3 FY 2016	Q4 FY 2016	FY 2016 aggregate
All Maryland hospitals*	**5–10%**	**33**	**28**	**20**	**26**	**30**	**33**	**20**	**33**	**30**	**35**	**17**	**28**
	>10%	**28**	**39**	**35**	**22**	**17**	**35**	**7**	**15**	**20**	**28**	**26**	**7**
Current regulatory system													
GBR	5–10%	28	22	19	22	31	36	17	36	25	36	19	31
	>10%	25	36	33	17	17	33	8	14	25	28	28	6
TPR	5–10%	50	50	20	40	30	20	30	20	50	30	10	20
	>10%	40	50	40	40	20	40	0	20	0	30	20	10
Number of inpatient beds													
<150	5–10%	14	29	29	29	29	29	29	21	21	36	21	21
	>10%	50	64	36	36	21	43	14	29	29	36	29	14
150–349	5–10%	48	26	22	22	30	35	17	35	39	35	9	43
	>10%	17	30	26	17	22	30	4	13	17	26	30	0
350+	5–10%	22	33	0	33	33	33	11	44	22	33	33	0
	>10%	22	22	56	11	0	33	0	0	11	22	11	11
Teaching status†													
IBR > 5%	5–10%	46	38	15	15	38	46	15	62	23	38	23	23
	>10%	23	23	54	23	8	31	8	8	15	31	31	8
IBR ≤ 5%	5–10%	27	24	21	30	27	27	22	21	33	33	15	30
	>10%	30	45	27	21	21	36	6	18	21	27	24	6

(continued)

Table E-3 (continued)
Percentage of Maryland hospitals with charged rates for inpatient medical/surgical acute services outside the 5 percent corridor by hospital characteristic and quarter, Q3 of FY 2014 through Q4 of FY 2016

Hospital characteristic	Variation from rate order	Q3 FY 2014	Q4 FY 2014	Q1 FY 2015	Q2 FY 2015	Q3 FY 2015	Q4 FY 2015	FY 2015 aggregate	Q1 FY 2016	Q2 FY 2016	Q3 FY 2016	Q4 FY 2016	FY 2016 aggregate
DSH percentage†													
<20	5–10%	28	6	17	22	33	28	33	33	22	28	11	28
	>10%	33	56	33	28	28	39	6	22	22	33	17	6
20–30	5–10%	50	50	25	38	38	38	6	13	44	50	25	25
	>10%	19	25	38	13	0	25	6	13	6	13	25	6
>30	5–10%	17	33	17	17	17	33	17	58	25	25	17	33
	>10%	33	33	33	25	25	42	8	8	33	42	42	8
System affiliation													
Affiliated	5–10%	31	24	17	38	28	41	21	38	28	34	21	28
	>10%	21	38	28	14	17	31	7	17	21	31	28	7
Not affiliated	5–10%	35	35	24	6	35	18	18	24	35	35	12	29
	>10%	41	41	47	35	18	41	6	12	18	24	24	6

NOTES: * Holy Cross Germantown Hospital opened in FY 2015 and is excluded from these analyses. † IBR and DSH percentages were based on data from the 2015 Medicare Impact File. Data for the University of Maryland Medical Center at Dorchester are reported under the University of Maryland Shore Medical Center at Easton in the Medicare Impact File. Therefore, teaching status and DSH percentage for these hospitals were based on their combined information in the Impact file. GBR = global budget revenue; IBR = intern-to-bed ratio; TPR = total patient revenue; DSH = disproportionate share hospital. In fiscal years, Q1 = January–March, Q2 = April–June, Q3 = July–September, and Q4 = October–December.

Table E-4
Total gross patient revenue, all Maryland hospitals and by hospital characteristic, FY 2012–FY 2015

Hospital characteristic	FY 2012 ($)	FY 2013 ($)	FY 2014 ($)	FY 2015 ($)
All Maryland hospitals*	**16,194,941,089**	**16,599,051,613**	**17,107,999,049**	**17,400,225,886**
Current regulatory system				
GBR	14,397,564,188	14,776,212,587	15,262,315,985	15,515,807,969
TPR	1,797,376,901	1,822,839,026	1,845,683,064	1,884,417,917
Number of inpatient beds				
<150	1,544,302,751	1,561,870,807	1,593,423,751	1,621,695,949
150–349	7,705,930,494	7,680,527,942	7,907,338,258	8,075,066,782
350+	6,944,707,844	7,356,652,864	7,607,237,040	7,703,463,156
Teaching status†				
IBR > 5%	8,315,087,545	8,742,909,659	9,029,129,486	9,130,005,541
IBR ≤ 5%	7,879,853,544	7,856,141,954	8,078,869,563	8,270,220,345
DSH percentage†				
<20	4,860,339,569	4,802,274,409	4,969,943,290	5,101,091,527
20–30	4,627,404,921	4,681,735,956	4,826,950,568	4,868,645,311
>30	6,707,196,599	7,115,041,248	7,311,105,191	7,430,489,048
System affiliation				
Affiliated	11,185,443,571	11,539,367,179	12,002,843,535	12,188,614,350
Not affiliated	5,009,497,518	5,059,684,434	5,105,155,514	5,211,611,536

NOTES: * Holy Cross Germantown Hospital opened in FY 2015 and is excluded from these analyses. † IBR and DSH percentages were based on data from the 2015 Medicare Impact File. Includes regulated and unregulated revenue. Data for the University of Maryland Medical Center at Dorchester are reported under the University of Maryland Shore Medical Center at Easton in the Medicare Impact File. Therefore, teaching status and DSH percentage for these hospitals were based on their combined information in the Impact file. GBR = global budget revenue; IBR = intern-to-bed ratio; TPR = total patient revenue; DSH = disproportionate share hospital.

Table E-5
Gross inpatient revenue, all Maryland hospitals and by hospital characteristic, FY 2012–FY 2015

Hospital characteristic	FY 2012 ($)	FY 2013 ($)	FY 2014 ($)	FY 2015 ($)
All Maryland hospitals*	**9,597,246,933**	**9,387,513,675**	**9,718,459,334**	**9,324,320,896**
Current regulatory system				
GBR	8,762,891,648	8,543,217,701	8,874,869,018	8,485,619,206
TPR	834,355,286	844,295,974	843,590,316	838,701,690
Number of inpatient beds				
<150	747,028,053	719,314,915	706,270,869	689,569,097
150–349	4,431,528,019	4,166,414,805	4,165,547,145	4,127,160,543
350+	4,418,690,862	4,501,783,955	4,846,641,320	4,507,591,256
Teaching status†				
IBR > 5%	5,189,635,842	5,171,160,990	5,484,242,137	5,057,149,667
IBR ≤ 5%	4,407,611,092	4,216,352,685	4,234,217,198	4,267,171,229
DSH percentage†				
<20	2,695,352,563	2,526,542,138	2,608,944,944	2,645,821,986
20–30	2,632,876,361	2,528,756,666	2,530,335,222	2,299,635,494
>30	4,269,018,009	4,332,214,871	4,579,179,168	4,378,863,415
System affiliation				
Affiliated	6,943,463,039	6,864,847,386	7,249,084,146	6,878,180,864
Not affiliated	2,653,783,895	2,522,666,289	2,469,375,189	2,446,140,031

NOTES: * Holy Cross Germantown Hospital opened in FY 2015 and is excluded from these analyses. † IBR and DSH percentages were based on data from the 2015 Medicare Impact File. Includes regulated and unregulated revenue. Data for the University of Maryland Medical Center at Dorchester are reported under the University of Maryland Shore Medical Center at Easton in the Medicare Impact File. Therefore, teaching status and DSH percentage for these hospitals were based on their combined information in the Impact file. GBR = global budget revenue; IBR = intern-to-bed ratio; TPR = total patient revenue; DSH = disproportionate share hospital.

Table E-6
Gross outpatient revenue, all Maryland hospitals and by hospital characteristic, FY 2012–FY 2015

Hospital characteristic	FY 2012 ($)	FY 2013 ($)	FY 2014 ($)	FY 2015 ($)
All Maryland hospitals*	**6,597,694,156**	**7,211,537,939**	**7,389,539,715**	**8,075,904,991**
Current regulatory system				
GBR	5,634,672,541	6,232,994,887	6,387,446,966	7,030,188,764
TPR	963,021,615	978,543,052	1,002,092,749	1,045,716,227
Number of inpatient beds				
<150	797,274,698	842,555,892	887,152,882	932,126,852
150–349	3,274,402,475	3,514,113,137	3,741,791,113	3,947,906,239
350+	2,526,016,982	2,854,868,909	2,760,595,720	3,195,871,900
Teaching status†				
IBR > 5%	3,125,451,703	3,571,748,669	3,544,887,350	4,072,855,875
IBR ≤ 5%	3,472,242,452	3,639,789,269	3,844,652,365	4,003,049,116
DSH percentage†				
<20	2,164,987,006	2,275,732,271	2,360,998,346	2,455,269,541
20–30	1,994,528,560	2,152,979,290	2,296,615,346	2,569,009,817
>30	2,438,178,590	2,782,826,377	2,731,926,023	3,051,625,633
System affiliation				
Affiliated	4,241,980,532	4,674,519,793	4,753,759,390	5,310,433,486
Not affiliated	2,355,713,624	2,537,018,146	2,635,780,326	2,765,471,505

NOTES: * Holy Cross Germantown Hospital opened in FY 2015 and is excluded from these analyses. † IBR and DSH percentages were based on data from the 2015 Medicare Impact File. Includes regulated and unregulated revenue. Data for the University of Maryland Medical Center at Dorchester are reported under the University of Maryland Shore Medical Center at Easton in the Medicare Impact File. Therefore, teaching status and DSH percentage for these hospitals were based on their combined information in the Impact file. GBR = global budget revenue; IBR = intern-to-bed ratio; TPR = total patient revenue; DSH = disproportionate share hospital.

Table E-7
Total operating expenses, all Maryland hospitals and by hospital characteristic, FY 2012–FY 2015

Hospital characteristic	FY 2012 ($)	FY 2013 ($)	FY 2014 ($)	FY 2015 ($)
All Maryland hospitals*	**13,036,797,022**	**13,501,704,149**	**13,640,481,096**	**14,149,621,430**
Current regulatory system				
GBR	11,660,948,838	12,132,868,824	12,268,708,241	12,740,708,810
TPR	1,375,848,184	1,368,835,324	1,371,772,856	1,408,912,520
Number of inpatient beds				
<150	1,202,482,852	1,229,792,195	1,239,674,178	1,265,317,196
150–349	5,995,831,010	6,032,348,168	6,095,329,748	6,283,495,875
350+	5,838,483,160	6,239,563,785	6,305,477,170	6,600,808,260
Teaching status†				
IBR > 5%	6,799,234,818	7,203,718,433	7,263,188,155	7,614,136,340
IBR ≤ 5%	6,237,562,204	6,297,985,716	6,377,292,941	6,535,485,090
DSH percentage†				
<20	3,910,431,090	3,928,241,999	3,977,539,567	4,092,012,106
20–30	3,425,339,488	3,469,388,891	3,515,762,056	3,642,361,970
>30	5,701,026,444	6,104,073,259	6,147,179,473	6,415,247,254
System affiliation				
Affiliated	9,051,917,316	9,483,799,615	9,623,670,449	10,019,931,026
Not affiliated	3,984,879,706	4,017,904,533	4,016,810,647	4,129,690,404

NOTES: * Holy Cross Germantown Hospital opened in FY 2015 and is excluded from these analyses. † IBR and DSH percentages were based on data from the 2015 Medicare Impact File. Includes regulated and unregulated expenses. Data for the University of Maryland Medical Center at Dorchester are reported under the University of Maryland Shore Medical Center at Easton in the Medicare Impact File. Therefore, teaching status and DSH percentage for these hospitals were based on their combined information in the Impact file. GBR = global budget revenue; IBR = intern-to-bed ratio; TPR = total patient revenue; DSH = disproportionate share hospital.

Table E-8
Operating margin percentages, all Maryland hospitals and by hospital characteristic, FY 2012–FY 2015

Hospital characteristic	FY 2012 (%)	FY 2013 (%)	FY 2014 (%)	FY 2015 (%)
All Maryland hospitals*	**2.5**	**1.2**	**2.8**	**3.7**
Current regulatory system				
GBR	2.5	0.7	2.5	3.4
TPR	2.5	5.0	5.8	6.5
Number of inpatient beds				
<150	0.0	−3.0	2.6	3.5
150–349	1.6	0.4	2.3	4.2
350+	3.4	1.7	2.9	3.0
Teaching status†				
IBR > 5%	2.3	1.0	2.5	2.4
IBR ≤ 5%	2.6	1.4	3.0	5.1
DSH percentage†				
<20	2.0	0.8	2.8	5.1
20–30	3.1	2.4	4.3	4.2
>30	2.4	0.8	1.9	2.5
System affiliation				
Affiliated	2.7	0.8	2.5	3.4
Not affiliated	1.9	1.8	3.1	4.4

NOTES: * Holy Cross Germantown Hospital opened in FY 2015 and is excluded from these analyses. † IBR and DSH percentages were based on data from the 2015 Medicare Impact File. Data for the University of Maryland Medical Center at Dorchester are reported under the University of Maryland Shore Medical Center at Easton in the Medicare Impact File. Therefore, teaching status and DSH percentage for these hospitals were based on their combined information in the Impact file. GBR = global budget revenue; IBR = intern-to-bed ratio; TPR = total patient revenue; DSH = disproportionate share hospital.

APPENDIX F:
STRUCTURAL BREAK TESTS

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For outcomes in the spillover analyses that did not have a comparison group, we examined time trends and tested whether there was a change in the time trend after implementation of the All-Payer Model. There is more than one approach to determining whether there was a change in the time trend. One approach is to specify a regression in which a binary (dummy) variable denoting quarters during the All-Payer Model (D) period is included with the regressors, as shown in ***Equation F.1***:

$$Y_i = \beta_1 + \beta_2 T_i + \alpha D_i + \gamma (D_i T_i) + \varepsilon_i, \quad \text{(F.1)}$$

where T is the time period indicator. D has the value of zero for each of the baseline quarters (T=1, …, 12) and one for each of the All-Payer Model quarters (T = 13, …, 20). The γ coefficient indicates whether there is a change in the trend associated with the All-Payer Model. One problem with this specification is that it assumes that the variance of the error term is the same for the two subperiods.

Instead, we used the Chow test, which does not assume that the variance of the error term is the same for the two subperiods, to determine whether there was a "structural break" in the time trend associated with the implementation of the All-Payer Model. The essence of the Chow test is to estimate separate equations for the baseline period (T=1, …, 12) and the All-Payer Model period (T=13, …, 20) and to then compare the two results to an equation estimated over the two time periods together (T=1, …, 20). ***Equation F.2*** was estimated for both of the subperiods and for the entire baseline plus All-Payer Model period:

$$Y_i = \beta_1 + \beta_2 T_i + \varepsilon_i \quad \text{(F.2)}$$

The null hypothesis is that there was no structural change between the two subperiods; the alternate hypothesis is that there was structural change between the baseline and All-Payer Model periods. The F statistic for the Chow test is shown in ***Equation F.3***:

$$F_{k,N+M-2k} = \frac{(ESS_R - ESS_{UR})/k}{ESS_{UR}/(N+M-2k)}, \quad \text{(F.3)}$$

where ESS_R is the residual sum-of-squares for the regression based on all 20 quarters, ESS_{UR} is the sum of the two residual sum-of-squares for the separate baseline and All-Payer Model period regressions, N is the number of quarters in the baseline period, M is the number of quarters in the All-Payer Model period, and k is the number of regressors (including the constant term). The null hypothesis is rejected if the F statistic is larger than the critical value of the F distribution with k and $N+M-2k$ degrees of freedom.

In addition to the basic functional form, two other specifications were tested to account for nonlinear movements in the dependent variable over time. The second specification included a squared time variable as well as the linear time variable. The third specification added a cubed time variable to the second variant. Consequently, for each measure, three regressions (and three Chow tests) were performed. There were not enough observations to permit inclusion of quarterly binary variables, to account for seasonality, in the regressions.

For each measure, the p-value for the regression with the highest adjusted R-square is shown in ***Table F-1***. A blank in both the second (T plus T-squared) and third (T, T-squared, plus T-cubed) columns indicates that the p-value is based on a simple linear trend. An "x" in the second column only indicates that the p-value is based on a regression with a T-squared control, and an "x" in both the second and third columns indicates that the p-value is based on a regression including both the T-squared and T-cubed controls.

The following four measures had a p-value of 0.10 or less:

- Monthly urgent care visit rate for Maryland's Medicare beneficiaries.
- Share of Maryland hospitals' total Medicare payments from nonresidents.
- Share of Maryland hospitals total Medicare payments from border-state residents.
- Share of the three Johns Hopkins hospitals' Medicare payments from nonresidents.

The tests for structural breaks were performed using the *sbknown* post-estimation procedure in Stata 14. We attempted to use another post-estimation procedure, *sbsingle*, to ascertain when, if at all, the All-Payer Model had impacts on time trends. However, there were not enough observations (quarters) to run *sbsingle*.

Table F-1
Results of tests for structural breaks in time series

Description of measure	Variables in addition to linear time		Structural break
	Time squared	Time cubed	p-value
Monthly urgent care utilization rate for Maryland's Medicare beneficiaries	x		0.010
Share (percent) of Maryland residents' admissions to non-Maryland hospitals			0.232
Share (percent) of Maryland residents' admissions to non-Maryland border-state hospitals			0.261
Share of Maryland hospitals' total admissions from nonresidents			0.948
Share of Maryland hospitals' total inpatient days from nonresidents			0.340
Share of Maryland hospitals' total Medicare payments from nonresidents			0.083
Share of Maryland hospitals' total admissions from border-state residents			0.215
Share of Maryland hospitals' total inpatient days from border-state residents			0.590
Share of Maryland hospitals' total Medicare payments from border-state residents			0.027
Total admissions, hospitals whose budgets exclude nonresidents	x	x	0.199
Johns Hopkins & U. Maryland hospitals' admissions from nonresidents	x	x	0.332
Share of Johns Hopkins & U. Maryland hospitals' admissions from nonresidents	x		0.733
Share of Johns Hopkins & U. Maryland hospitals' inpatient days from nonresidents			0.125
Share of Johns Hopkins & U. Maryland hospitals' Medicare payments from nonresidents	x		0.300
Johns Hopkins & U. Maryland hospitals' admissions from border-states residents	x	x	0.123
Share of Johns Hopkins & U. Maryland hospitals' admissions from border-state residents	x		0.646
Share of Johns Hopkins & U. Maryland hospitals' inpatient days from border-state residents	x		0.813
Share of Johns Hopkins & U. Maryland hospitals' Medicare payments from border-state residents	x		0.599
Johns Hopkins hospitals' total admissions	x	x	0.103
Johns Hopkins hospitals' admissions from nonresidents	x	x	0.525
Share of Johns Hopkins hospitals' admissions from nonresidents			0.732
Share of Johns Hopkins hospitals' inpatient days from nonresidents			0.463
Share of Johns Hopkins hospitals' Medicare payments from nonresidents	x	x	0.088
Johns Hopkins hospitals' admissions from border-states residents	x	x	0.203
Share of Johns Hopkins hospitals' admissions from border-state residents	x		0.775
Share of Johns Hopkins hospitals' inpatient days from border-state residents			0.792
Share of Johns Hopkins hospitals' Medicare payments from border-state residents			0.732

NOTES: Tests for structural changes between the baseline period and the All-Payer Model period. Chow tests were applied to each of the three sets of regression results for each measure. The reported p-values are for the regression with the highest adjusted R square.

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APPENDIX G:
PAYMENT DIFFERENTIAL ANALYSIS FOR SELF-INSURED EMPLOYERS

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Table G-1 shows the difference in payment levels by year between Maryland residents and residents of the comparison group market areas using the restricted sample of self-insured employer claims. The weighted average payment differential ranged from 13 to 19 percent lower in Maryland than in the comparison group for the same mix of DRGs. The average Maryland payment grew by 10 percent, from $12,665 in 2011 to $13,901 in 2015. For the same distribution of DRGs as in Maryland, the average payment per admission in the comparison group grew from $14,640 in 2011 to $17,241 in 2015, almost 18 percent. The rate of growth in payments was higher for the comparison group in 2 of the 3 years. ***Figure G-1*** is a graphical representation of the average payments, which shows a widening gap over time. Applying the payment differential from the subset of self-insured employer claims analyses to the total volume of commercial discharges in Maryland, we estimated that annual commercial insurance payments to Maryland hospitals ranged from $481 million to $696 million lower than they would have been if hospitals were paid rates by commercial insurers similar to those in states without all-payer rate setting. In aggregate, estimated payments were $2.3 billion lower in Maryland for 2011–2014, or an average of $577 million lower per year. As shown in ***Table G-2,*** the net difference in payments to Maryland hospitals for Medicare and commercial admissions is smaller in analyses that are restricted to self-insured employer claims than in those that use all commercial claims in the MarketScan database. The net payment difference calculated using Medicare payment rates for comparison group hospitals ranged from $181 million higher in 2012 to $375 million higher in 2011. The net difference in payments to Maryland hospitals calculated using repriced IPPS claims was $292 million higher in 2013 and $123 million higher in 2014.

Table G-1
Weighted average insurance payment per admission for self-insured employers and payment differential for Maryland and comparison group residents, 2011–2014

	2011	2012	2013	2014
Maryland payments ($)	12,665	12,898	13,544	13,901
Comparison group payments ($)	14,640	15,536	15,867	17,241
Difference in payment (%)	−13	−17	−15	−19
Maryland payment annual growth rate (%)	—	1.8	5.0	2.6
Comparison group payment annual growth rate (%)	—	6.1	2.1	8.7
Payment differential per discharge ($)	−1,975	−2,638	−2,323	−3,339
Total commercial discharges	243,772	234,072	220,210	208,563
Total payment differential ($ in millions)	−481	−618	−512	−696

NOTE: All calculations are on a calendar year basis.

SOURCE: MarketScan commercial claims database; HSCRC hospital discharge data.

Figure G-1
Weighted average insurance payment per admission for self-insured employers for Maryland and comparison group residents, 2011–2014

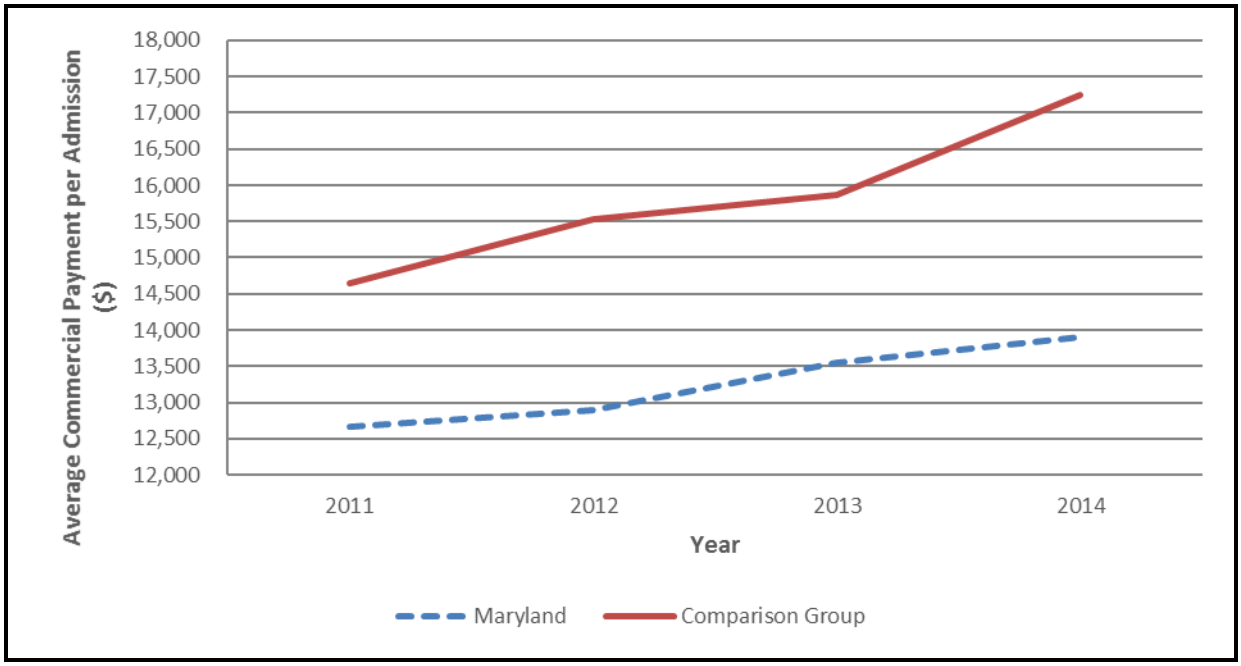

Table G-2
Net difference in Medicare and self-insured employer payments for Maryland and comparison group using alternative estimation methodologies

	2011	2012	2013	2014	2015
Medicare payment difference vs. comparison group ($ in millions)	856	799	850	877	972
Medicare payment difference vs. repriced claims ($ in millions)	NA	NA	804	819	869
Self-insured commercial payment difference vs. comparison group ($ in millions)	−481	−618	−512	−696	NA
Net payment difference to hospitals vs. comparison group for Medicare ($ in millions)	375	181	338	181	NA
Net payment difference to hospitals vs. repriced claims for Medicare ($ in millions)	NA	NA	292	123	NA

Note: IPPS calculations are on a federal fiscal year basis. All other calculations are on a calendar year basis. NA = not available.

SOURCE: Chronic Conditions Data Warehouse Medicare fee-for-service claims; repriced Medicare claims data from Lewin Group; HSCRC hospital discharge data.