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Restructuring the Incentives in the Medicare Hospital Acquired Condition Reduction Program to Achieve Better Patient Outcomes

3M Clinical and Economic Research

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Executive Summary

The Centers for Medicare & Medicaid Services implemented the Medicare Hospital-Acquired Condition Reduction Program (HACRP) in October 2014 with the intent to provide hospitals with a financial incentive to reduce inpatient complications. HACRP has failed to meet this objective because it is based on a relatively small number of complications, has inadequate risk adjustment and can result in disproportionate payment penalties. This study proposes a restructuring of HACRP using a redesigned complication payment incentive model referred to as the Hospital Complication Avoidance Rate Evaluation or H-CARE. Developed based on lessons learned from the highly successful Medicare Inpatient Prospective Payment System (IPPS) and the Maryland Hospital Acquired Conditions (HMAC) complication payment incentive program, H-CARE can provide comprehensive, clinically credible, and actionable incentives for improving hospital inpatient complication performance. Unlike HACRP, the design of the H-CARE payment policy includes both payment bonuses and payment penalties.

Medicare fee-for-service claims data from 2018 was used to evaluate hospital complication performance and simulate an H-CARE payment system. Using the subset of hospitals with the best complication performance, a best practice complication norm was developed. Using the best practice complication norm to determine hospital performance and a 1% cap on hospital penalties and bonuses, the H-CARE simulation resulted in Medicare payment reductions that are roughly twice the payment reductions from HACRP. Two-thirds of hospitals received a payment penalty and one-third of hospitals received a payment bonus. No payment bias toward hospitals treating a disproportionate volume of Medicare patients from geographic areas that have a lower socioeconomic status was observed. However, higher than expected complication performance was observed in large hospitals with high management complexity.

Introduction: Hospital-Acquired Condition Reduction Program

In 2014, the Centers for Medicare & Medicaid Services (CMS) implemented the Hospital-Acquired Condition Reduction Program (HACRP) as a component of Medicare's hospital Inpatient Prospective Payment System (IPPS). HACRP is intended to provide hospitals with the financial incentive to reduce inpatient complications. Under HACRP, hospital complication performance is based on five chart-abstracted measures of hospital associated infections,[1] and claims-based measures for pressure ulcers, iatrogenic pneumothorax, in-hospital falls and selected post-operative complications (commonly referred to as Patient Safety Indicator (PSI) 90).[2] CMS determines a composite score across these measures for each hospital. Neither the individual measures nor the composite score is risk adjusted for a hospital's patient case mix. However, some of the individual measures are adjusted for a hospital's practice pattern related to the use of ICU days and the length of time of catheter placements. CMS imposes a 1% reduction in Medicare IPPS payments on the worst-performing quartile of hospitals based on the HACRP composite score. The HACRP penalties vary across fiscal years but are generally in the $300-400 million range.[3]

The narrow range of complications included in HACRP has resulted in disproportionate penalties for minor differences in performance.

With little evidence that HACRP has resulted in improved patient outcomes in the nearly eight years since its inception,[4] health care researchers have raised significant concerns regarding the effectiveness of HACRP.[5] The lack of adequate risk adjustment has led to disproportionate penalties for hospitals caring for socioeconomically disadvantaged patients and some types of hospitals such as teaching hospitals.[6] The narrow range of complications included in HACRP has also resulted in disproportionate penalties for minor differences in performance.[7]

This study proposes restructuring HACRP to address its current limitations. To provide hospitals with effective financial incentives to reduce inpatient complications, the proposed restructuring will be based on payment system design principles that were the foundation for the success of IPPS.

Inpatient Prospective Payment System

In 1984, facing the imminent insolvency of the Medicare Hospital Trust Fund, CMS implemented the Inpatient Prospective Payment System (IPPS). IPPS created the incentive for hospital efficiency by paying a prospective price for each type of patient using the Diagnosis Related Group (DRG) patient classification system. Although the IPPS implementation was budget neutral, Medicare annual expenditures for hospital care in 1990 were $18 billion lower than originally projected at the time of IPPS implementation, representing a 20% decrease in annual hospital Medicare expenditures (the equivalent of $37 billion in today's dollars).[8] IPPS has kept the Medicare Hospital Trust Fund solvent for nearly 40 years, demonstrating that well-designed payment incentives can lead to substantive and sustainable behavior changes that improve efficiency and quality. The lessons learned from the success of IPPS can be applied to any incentive-based payment system.[9] Unfortunately, the design of HACRP fails to adhere to these key lessons.

Lessons Learned from IPPS

The IPPS financial incentive for efficiency, created by a DRG prospective price combined with the management approach inherent in a DRG unit of payment, revolutionized how hospitals were managed. CMS has observed that the success of any payment system reform that is predicated on providing incentives for performance improvement is "almost totally dependent on the effectiveness with which the incentives are communicated."[10] Thus, the language value of DRGs was key to the success of IPPS. DRGs created a language that linked the clinical and financial aspects of care, thereby enabling the effective communication of cost containment incentives across the entire hospital. The easily understood "product with a price" design, communicated in a clinically credible manner (the DRGs), was the foundation for the success of IPPS.

The Inpatient Prospective Payment System has kept the Medicare Hospital Trust Fund solvent for nearly 40 years, demonstrating that well-designed payment incentives can lead to substantive and sustainable behavior changes.

For HACRP to be consistent with the underlying design principles of IPPS, any redesign must meet four essential requirements:

- *Clinically credible and actionable:* The determination of complications performance should be limited to those beneficiaries whose clinical circumstances indicate there is reasonable likelihood that the complication could have been prevented (e.g., post-op wound infection). Failure to exclude beneficiaries with a complication over which a hospital has no influence or control (e.g., infection in an immunocompromised patient)

is not clinically credible, not actionable and undermines a hospital's ability to achieve the real behavior changes needed to improve performance.

- *Comprehensive:* Successful quality improvement efforts require behavior changes that typically require changes in organizational culture. Such cultural changes cannot occur in limited areas within a hospital but need to be organization wide.[11] This means that the full scope of inpatient complications, not just isolated examples, should be included in a redesigned HACRP.

- *Risk adjustment that provides a language of performance*: IPPS uses DRGs as the method of risk adjustment. The categorical structure of the DRGs allows performance benchmarks (the DRG price) to be set for each risk category (each DRG), thereby creating the language of performance expectations. It is essential to use real-world benchmarks for judging complication performance because even the best performing hospitals will have a residual rate of complications. Similarly, the risk adjustment for complications should be based on discrete clinically credible risk categories that allow hospital performance to be compared to national benchmarks in each risk category, thereby creating a clinically credible language of complication performance expectations.

- *Include both Penalties and Bonuses:* Under IPPS, hospitals can realize a profit or take a loss that is directly related to their relative performance. Penalty-only systems weaken the incentive for performance improvement. The magnitude of any penalties or bonuses should be proportional to the actual financial harm or benefit of a hospital's complication performance and not based on arbitrary payment adjustments that can be disproportionate to the relative impact of the hospital's complication performance.

These four requirements may seem obvious, but none of these requirements are met in the design of the current HACRP system.

Hospital Complication Avoidance Rate Evaluation (H-CARE)

An alternative to HACRP, referred to as the Hospital Complication Avoidance Rate Evaluation or H-CARE is proposed. To the extent possible, H-CARE is based on payment systems for complications that have been implemented and are actively being used today for hospital payment. Five state Medicaid programs have implemented payment incentive systems related to complication performance that are generally consistent with the IPPS payment design principles. These states use Potentially Preventable Complications (PPCs)[12,13] for a comprehensive identification of complications and All Patient Refined DRGs (APR DRGs)[14,15] for risk adjustment.

- *Potentially Preventable Complications:* PPCs are harmful events (accidental laceration during a procedure) or negative outcomes (hospital-acquired pneumonia) that may result from the process of care and treatment rather than from a natural progression of underlying disease. The PPCs are claims-based and are composed of 57 individual PPCs that encompass the full range of complications including the PSI 90 complications used in HACRP. For each PPC, the patients considered at risk for the PPC and the clinical circumstances under which the PPC can be considered potentially preventable are specified. Any patient who experiences one or more PPCs during their hospital stay is considered to have a PPC. The marginal cost of each PPC is known and can be used to determine the financial impact of PPC performance.[16]

- *All Patient Refined Diagnosis Related Groups:* APR DRGs are a categorical clinical model composed of base DRGs that are subdivided into four severity of illness levels based on the extent of physiologic decompensation or organ system loss of function. The underlying clinical principle of APR DRGs is that patients with high severity of illness are usually characterized by multiple serious illnesses. In the APR DRGs, the assessment of a patient's severity of illness is specific to the base APR-DRG assigned to the patient (the reason for admission). In other words, the determination of the severity of illness is disease specific. In APR DRGs, high severity of illness is primarily determined by the interaction of multiple diseases. Patients with multiple comorbid conditions involving multiple organ systems represent difficult-to-treat patients who tend to have poor outcomes. The APR DRG is computed at the time of admission and at the time of discharge. The admission APR DRG is used for risk adjusting PPCs.

Because PPCs and APR DRGs have been used in government payment systems, they have undergone the intense scrutiny associated with any regulatory implementation. PPC and APR DRG-based payment system reforms have had a substantial impact on inpatient complication rates. For example, in the Maryland HMAC all-payer complication payment reform initiative, hospitals in Maryland were able to achieve a 56.6% reduction in inpatient complications over the first five years of the PPC payment reform.[17] PPCs and APR DRGs have been widely evaluated and utilized in the health care literature. Appendix A contains a bibliography of articles and reports using the PPCs and APR DRGs.

Hospital Expected PPC Performance

The rate of occurrence of each type of complication (each PPC) will vary across each APR DRG. Each type of PPC differs in clinical significance and financial impact. For example, a complication of sepsis has a greater clinical and financial impact than a complication of a UTI. Poor PPC performance can be the result of an excess total number of PPCs or a more serious and costly mix of PPCs. Thus, both the frequency of occurrence across APR DRGs and the mix of PPCs must be accounted for in determining PPC performance. The marginal cost of each PPC is used as the basis for determining the PPC performance when there is a mix of PPCs.

In the Maryland Hospital Acquired Conditions (HMAC) all-payer complication payment reform initiative, hospitals in Maryland were able to achieve a 56.6% reduction in inpatient complications over the first five years of the PPC payment reform.

A national PPC norm for each APR DRG can be calculated by summing the actual PPC volume adjusted for the mix of PPCs across all Medicare admissions at-risk for the PPC being potentially preventable. The PPC expected value for any hospital is the number of at-risk beneficiaries in each APR DRG admitted to the hospital times the national PPC norm value for the APR DRG summed over all APR DRGs (indirect rate standardization). Because HACRP was intended to reduce Medicare payments to hospitals, a national best practice norm can also be computed using the subset of hospitals with the best PPC performance. Using a PPC best practice norm to compute PPC expected values ensures that penalty payments will exceed bonus payments. Comparison to a reference norm is critical because even the best performing delivery systems that provide optimal care will have an underlying rate of performance issues.

H-CARE Payment Model

Once the actual (A) and expected (E) PPC performance for a hospital has been determined, the product of the A minus E difference (A-E) times the APR DRG per case payment is a measure of the financial harm or benefit from the PPC performance of the hospital. Dividing the (A-E) financial PPC impact by total payments to the hospital provides a measure of the fraction of total payments to the hospital that are associated with PPC performance. A positive fraction indicates a higher-than-expected PPC financial impact, and a negative fraction indicates a lower-than-expected PPC financial impact. To determine a payment adjustment factor, the PPC financial impact fraction can be constrained to be within a predefined upper and lower bound such as -2% to +2%. Subtracting the PPC financial impact fraction from 1.0 gives a payment adjustment factor that can be applied to all IPPS payments to a hospital (e.g., a positive 2% PPC financial impact fraction results in a 98% payment adjustment factor being applied to all IPPS payments).

Comparison of HACRP and H-CARE

Table 1 contains a comparison of the key design components of HACRP and H-CARE. The essential lesson of IPPS is that improved performance requires real behavior change, so payment system incentives must be clinically credible and actionable. The design of H-CARE is consistent with this key lesson. IPPS is a straightforward and easily understood "product with a price" payment system that sets a target efficiency performance expectation based on the condition of a patient (DRG). Similarly, the H-CARE payment model sets a target performance expectation for each type of complication (PPC) based on the condition of a patient (APR DRG). Both IPPS and H-CARE create a clinically credible and understandable language of performance that facilitates real and sustainable behavior change.

Table 1: Essential design components of HACRP and H-CARE

Design Component	HACRP	H-CARE
Comprehensive	Narrow group of infections and post-op complications	Complete scope of complications
Risk adjustment	No patient condition-based risk adjustment. Limited adjustment for practice patterns related to ICU and catheter use.	Full patient condition-based risk adjustment including patient severity of illness
Performance norms	No complication and patient condition specific performance targets	Complication and patient condition specific performance targets
Financial incentives	Avoid being in the bottom quartile of performance	Meet or exceed complication and patient condition specific performance targets
Clinically credible and actionable	All complications assumed to be preventable	Based on patient condition excludes complications not considered potentially preventable
Payment bonuses	Penalty only	Penalties and bonuses
Proportional financial impaction	Disproportionate 1% penalty on all Medicare payments	Penalty and bonus proportional to financial impact of complication performance

Socioeconomic Status

HACRP penalties disproportionately impact hospitals caring for socioeconomic disadvantaged patients. The socioeconomic status (SES) component of The Social Vulnerability Index (SVI) from the Centers for Disease Control and Prevention (CDC)[18] ranks U.S. counties based on the SES of the population residing in the county. The average SES rank of the county of residence of admitted patients was computed for each hospital. Hospitals were then ranked based on the average SES rank of the counties where their patients resided. This hospital rank was used to evaluate the impact of SES on the distribution of penalties and bonuses under H-CARE.

HACRP penalties disproportionately impact hospitals caring for socioeconomic disadvantaged patients.

Data

The PPC payment simulation used data in the Medicare Standard Analytic Files (Limited Data Set (LDS)) for calendar year 2018. The LDS files contain 100% of Medicare fee-for-service (FFS) claims data for hospital inpatients. The LDS Master Beneficiary Summary File (MBSF) contains enrollment data on all Medicare beneficiaries enrolled in or entitled to Medicare within a given calendar year. The 3,091 hospitals paid under IPPS were included in the simulation. The hospital data contains a present on admission (POA) indicator for each diagnosis. The POA indicator is used to identify complications that occur during the hospital stay. A series of edits were applied to the POA field to determine if a hospital was reporting reliable POA data. The POA edits excluded 206 hospitals from the simulation. For a small number of counties, no SVI SES rank was available. 42 hospitals were excluded from the simulation because they had a substantial number of patients residing in counties with no SVI SES rank. After exclusions, 2,843 hospitals with 8,638,028 admissions were included in the simulation.

Simulating an H-CARE Payment System

A best practice norm based on the 1,409 best PPC performing hospitals that comprise 40% of Medicare IPPS admissions was used in the payment simulation. Table 2 contains the PPC payment simulation results for different upper and lower bounds applied to the hospital payment adjustment factor. The %(A-E)/E is also contained in Table 1. If (A-E) is positive (A>E), the %(A-E)/E is the percent by which the actual PPC performance is higher than expected (i.e., the percent improvement necessary to achieve PPC best practice). If (A-E) is negative (A>E), the %(A-E)/E is the percent by which the actual PPC performance is lower than expected (i.e., the percent by which PPC performance is better than best practice).

Table 2: H-CARE payment simulation results for different upper and lower bounds applied to the hospital payment adjustment factor

	Hospitals	%(A-E)/E	$ No Cap (000,000)	$ 3% Cap (000,000)	$ 2% Cap (000,000)	$ 1% Cap (000,000)
With Penalty	2,019	39.7	1,290.0	1,241.5	1,115.7	725.6
With Bonus	824	-17.8	101.8	100.7	98.0	81.5
All Hospitals Net	2,843	31.1	1,188.2	1,140.8	1,017.7	644.1

Using the best practice norm to determine hospital complication performance results in 2,019 hospitals (71%) with a penalty and 824 (29%) with a bonus. 1,260 of the hospitals with a penalty had the full 1% penalty imposed and 322 of the hospitals with a bonus received the full 1% bonus. Thus, H-CARE financial penalties and bonuses provides substantial incentives for complication performance improvement. On average, the hospitals with a penalty exceeded the best practice norm by 39.7% and the hospitals with a bonus were 17.8% below the best practice norm. Although the 39.7% improvement needed to achieve best practice performance requires significant behavior change and improved performance, Maryland hospitals were able to achieve a 56.6% reduction in inpatient complications over the first five years of the PPC payment reform.[18] Furthermore, the level of improvements achieved by IPPS were far greater. For example, before the implementation of IPPS, there was a six-fold variation in the average amount Medicare paid to individual hospitals for the treatment of an acute myocardial infarction.[19] IPPS essentially eliminated that six-fold level of variation.

Substantial and sustainable improvements in hospital inpatient complication performance can only be achieved through real behavior change. Because the H-CARE payment penalties and bonuses are comprehensive, clinically credible and actionable, they can provide an effective incentive for real behavior change.

With no cap on the payment adjustment factor, payment penalties were $1.29 billion and payment bonuses were $101.8 million for a net payment reduction of $1.19 billion. The addition of a 3% or 2% payment cap on the hospital payment adjustment factor reduced the net payment reduction only slightly. A 1% cap on the hospital payment adjustment factor did have a substantial impact, reducing the net payment reduction to $644.3 million. The 1% cap is consistent with the HACRP hospital penalty of 1%. The HACRP payment penalties in 2018 are estimated to be $294 million.[4] With a 1% cap on the hospital payment adjustment factor, H-CARE has a net payment reduction of $644.3, which is roughly double the HACRP payment penalty. The net payment reduction can be reduced further by lowering the percent cap below 1%. For example, a payment cap of 0.5% of the total Medicare payments to a hospital would reduce the net payment reduction to $346.5 million. Because HACRP limits a hospital's payment reduction to 1%, a 1% payment cap will be utilized in the H-CARE payment simulations discussed below.

H-CARE Payment Simulation by State

The H-CARE payment simulation with a 1% cap for the hospitals in each state is contained in Table 3. The overall %(A-E)/E across states varies from a high of 79.8% above best practice performance for the District of Columbia to a low of 23.5 above best practice for Maryland. While 29% of hospitals have bonus payments overall, the percent of hospitals with a bonus ranged from zero to 66.7%. Vermont, Utah and Maryland had the highest percent of hospitals with a bonus at 66.7, 62.1 and 59.5%, respectively. However, Maryland is the only state in which bonus payments exceeded penalty payments to hospitals. This is not surprising since Maryland has implemented aggressive payment incentives to lower inpatient complications.

Table 3: H-CARE payment simulation with a one percent cap by state

			With Penalty			With Bonus				
State	Hospitals	%(A-E)/E	Hospitals	%(A-E)/E	$(000)	Hospitals	%(A-E)/E	$(000)	% of Hospitals	Net $(000)
Alabama	61	39.7	41	46.3	14,201	20	-26.4	1,051	32.8	13,150
Alaska	7	44.6	6	48.8	1,460	1	-6.6	32	14.3	1,429
Arizona	54	24.9	40	33.8	13,308	14	-12.0	1,186	25.9	12,122
Arkansas	42	23.8	27	34.2	8,245	15	-20.0	1,246	35.7	6,999
California	261	25.9	178	36.5	53,596	83	-19.7	8,385	31.8	45,211
Colorado	44	23.4	28	35.0	7,044	16	-8.1	982	36.4	6,062
Connecticut	27	51.3	24	53.1	11,177	3	-40.2	198	11.1	10,979
Delaware	5	51.6	5	51.6	4,139	0	——	0	0.0	4,139
DC	7	79.8	6	83.9	3,786	1	-39.4	151	14.3	3,634
Florida	157	23.2	110	34.3	48,215	47	-17.6	9,677	29.9	38,538
Georgia	86	35.0	66	42.2	22,098	20	-12.7	1,530	23.3	20,568
Hawaii	12	27.4	8	39.5	1,799	4	-24.5	336	33.3	1,464
Idaho	14	12.4	9	22.2	1,813	5	-12.9	427	35.7	1,387
Illinois	120	38.8	91	47.9	36,152	29	-22.9	4,033	24.2	32,119
Indiana	77	34.3	58	41.3	18,112	19	-17.2	1,180	24.7	16,932
Iowa	32	36.4	24	45.1	7,329	8	-12.9	648	25.0	6,681
Kansas	39	15.8	20	31.7	6,315	19	-13.1	1,285	48.7	5,029
Kentucky	57	29.8	39	44.4	11,592	18	-9.0	1,496	31.6	10,096
Louisiana	68	26.2	48	34.2	10,167	20	-21.3	1,450	29.4	8,717
Maine	17	43.7	14	47.7	3,993	3	-21.5	169	17.6	3,824
Maryland	42	1.2	17	23.5	6,417	25	-20.6	7,195	59.5	-778
Massachusetts	52	48.1	45	52.7	23,430	7	-26.7	1,387	13.5	22,044
Michigan	87	36.8	67	39.9	28,600	20	-22.5	1,341	23.0	27,259
Minnesota	47	30.6	38	32.2	17,045	9	-24.1	373	19.1	16,672
Mississippi	41	33.6	27	44.4	8,352	14	-13.4	987	34.1	7,365
Missouri	65	27.1	41	37.4	14,133	24	-13.7	2,407	36.9	11,726
Montana	13	16.2	10	24.8	2,268	3	-18.7	454	23.1	1,814
Nebraska	23	27.3	11	45.9	4,843	12	-19.7	1,181	52.2	3,662
Nevada	18	29.7	12	36.7	5,346	6	-6.0	260	33.3	5,086
New Hampshire	13	51.3	12	53.9	4,664	1	-10.0	84	7.7	4,580
New Jersey	63	32.5	57	36.7	23,839	6	-28.0	1,285	9.5	22,554
New Mexico	26	33.4	20	41.9	2,971	6	-9.7	237	23.1	2,734
New York	134	44.3	114	47.7	48,711	20	-17.2	1,672	14.9	47,038
North Carolina	80	31.1	64	34.6	27,018	16	-15.3	1,294	20.0	25,724
North Dakota	6	38.8	6	38.8	3,535	0	——	0	0.0	3,535
Ohio	118	33.6	80	41.0	27,621	38	-17.5	2,735	32.2	24,886
Oklahoma	59	26.6	38	35.5	10,249	21	-17.2	1,397	35.6	8,852
Oregon	34	21.3	24	25.7	5,682	10	-11.1	408	29.4	5,274
Pennsylvania	136	27.9	93	34.6	31,846	43	-19.5	3,256	31.6	28,590
Rhode Island	9	69.9	8	73.7	2,597	1	-13.5	58	11.1	2,539
South Carolina	50	29.8	32	41.2	11,298	18	-14.6	1,708	36.0	9,591
South Dakota	14	24.3	9	32.8	2,654	5	-24.8	243	35.7	2,411
Tennessee	75	28.7	53	33.1	17,668	22	-27.6	1,595	29.3	16,073
Texas	202	27.1	131	37.4	46,977	71	-17.6	6,185	35.1	40,792
Utah	29	6.6	11	29.5	2,616	18	-22.3	1,772	62.1	844
Vermont	6	16.6	2	38.5	1,077	4	-18.9	393	66.7	684
Virginia	68	27.7	44	39.0	22,791	24	-21.8	3,565	35.3	19,226
Washington	48	38.0	42	40.6	16,682	6	-16.3	438	12.5	16,244
West Virginia	25	48.7	17	54.6	7,163	8	-13.8	375	32.0	6,788
Wisconsin	64	29.3	46	39.5	12,223	18	-17.8	1,636	28.1	10,587
Wyoming	9	19.3	6	33.6	737	3	-4.6	87	33.3	650

Impact of Patient Socioeconomic Status

Hospitals were ranked based on the average SES rank of the counties where their patients resided from highest to lowest (the bottom 25th percentile contains the 25% of hospitals with the greatest population of patients from counties with low SES). Table 4 contains the results for hospitals in the top and bottom SES quartile for H-CARE with a 1% payment cap. There is little difference in %(A-E)/E for the hospitals in the top and bottom SES quartiles, indicating there is not a significant H-CARE payment bias for hospitals admitting patients from high and low SES areas. The percent of hospitals with a penalty and bonus is roughly the same for hospitals admitting patients from high and low SES areas.

Table 4: H-CARE payment simulation with a one percent cap for the hospitals in the top and bottom SES quartile based on the residence of patient population

	Hospitals With Penalty			Hospitals With Bonus		
	Count	%(A-E)/E	$(000,000)	Count	%(A-E)/E	$(000,000)
Bottom Quartile	485	41.7	121.1	225	-18.2	18.2
Top Quartile	510	39.9	189.3	201	-16.9	20.9

Impact of Hospital Type

Table 4 is based on the location (residence) of the patient. Table 5 is based on the location of the hospital expressed as large urban, other urban and rural. The difference in %(A-E)/E across hospital locations is relatively small indicating there is not a significant H-CARE payment bias for hospitals in different locations. The percent of hospitals with a penalty and bonus is roughly the same across hospitals in different locations. Thus, H-CARE does not have payment bias based on the residence of a hospital's patient population or the location of the hospital.

Table 5: H-CARE payment simulation with a one percent cap across different hospital locations

Hospital Location	%(A-E)/E with Penalty	Hospitals with Penalty	$ Penalty (000,000)	%(A-E)/E with Bonus	Hospitals with Bonus	$ Bonus (000,000)
Large Urban	40.25	816	321.8	-17.61	291	33.4
Other Urban	37.38	550	210.1	-18.05	251	27.0
Rural	41.28	653	193.7	-17.77	282	21.0

Hospitals can also be characterized by bed size, teaching status and caseload of disproportionate share patients. Although some studies have found that very large hospitals appear to experience a diseconomy of scale in terms of their production efficiency,[20,21] it is not clear whether there is a diseconomy of scale for quality of care. One study did find that large hospitals performed poorer in terms of risk-adjusted readmissions for non-surgical patients.[22] A high management complexity hospital can be defined as a hospital in the top 10% of bed size and either in the top 20% of caseload of Medicaid disproportionate share patients (IPPS DSH) or top 10% of teaching programs (IPPS IME). Of the 2,843 hospitals included in the simulation, there are 161 hospitals that meet this management complexity criteria. Table 6 contains the H-CARE simulation results for the high management complexity hospitals. 95.3% of high management complexity hospitals have an H-CARE penalty.

Table 6: H-CARE payment simulation with a one percent cap by hospital type

Hospital	%(A-E)/E with Penalty	Hospitals with Penalty	$ Penalty (000,000)	%(A-E)/E with Bonus	Hospitals with Bonus	$ Bonus (000,000)
High Management Complexity	51.51	161	176.9	-6.46	8	1.5
Other	36.45	1,858	548.7	-18.29	816	79.9

The relatively poor complication performance of high management complexity hospitals can be due to an inadequacy in the method of risk adjustment, or the inherent management complexity of these hospitals. Disproportionate share reflects the caseload of Medicaid patients in a hospital and is not necessarily indicative of the Medicare population in the hospital. The SES measure in Table 4 directly reflects the Medicare population of hospitals. Because complication performance for Medicare patients across SES populations is relatively consistent, it suggests that the excess complications observed for Medicare patients in large high-volume Medicaid hospitals is not a risk adjustment issue but more likely associated with the management complexity of these hospitals.

The dual mission of large teaching hospitals makes them inherently more complex to manage. Under H-CARE, the evaluation of complication performance is limited to those patients whose clinical circumstances make the complication potentially preventable. Arguably, teaching hospitals should be the best performing hospitals in avoiding such potentially preventable complications. The APR DRG risk adjustment used in H-CARE is very focused on identifying high severity patients with multi-organ system involvement. These are difficult to treat patients who may disproportionately be treated in teaching hospitals. While limitations in the risk adjustment cannot be completely ruled out, the inherent management complexity of large teaching hospitals is certainly a likely contributing factor to their complication performance. Medicare pays a higher per case payment rate to teaching hospitals. Those additional funds are intended to provide these hospitals with the resources needed to manage the additional complexity of their patient populations associated with their role as referral centers for specialized care such as major trauma care.

Discussion

The underlying assumption for the design of H-CARE is that substantial and sustainable improvements in hospital inpatient complication performance can only be achieved through real behavior change. Because the H-CARE payment penalties and bonuses are comprehensive, clinically credible, and actionable, they can provide an effective incentive for real behavior change. The design of H-CARE is consistent with the lessons learned from the implementation of IPPS and the implementation of the all-payer Maryland complication payment incentive system.

As the data in Table 3 demonstrates, the State of Maryland has been able to achieve real and sustainable improvements in complication performance. Thus, H-CARE is not a theoretical proposal, but an incentive-based payment system that has been proven to work in the real world. In contrast, HACRP has been largely unsuccessful in providing effective incentives for improving hospital complication performance.

The penalty and bonus amounts in the H-CARE simulation are estimates. Outlier payments and other payment adjustments for quality such as hospital value-based purchasing were not included in the payment simulation. Nevertheless, the simulation results do provide a fairly accurate estimate of the penalties and bonuses that would occur under H-CARE.

Summary and Conclusions

HACRP has proven to be an ineffective system for incentivizing improvements in inpatient complication performance. Modeled after the highly successful IPPS and Maryland complication payment incentive system, H-CARE provides comprehensive, clinically credible, and actionable incentives for improving hospital inpatient complication performance. H-CARE includes both payment penalties and bonuses to hospitals. Using a best practice norm to determine hospital complication performance and a 1% cap on hospital penalties and bonuses, H-CARE would result in Medicare payment reductions that are roughly twice the payment reductions resulting from HACRP. Under H-CARE, two-thirds of hospitals would have a payment penalty and one third of hospitals would have a payment bonus. There is not a payment bias toward hospitals treating a disproportionate volume of Medicare patients from geographic areas that have a lower socioeconomic status. However, large high management complexity hospitals do have higher than expected complication performance.

References

[1] Centers for Medicare & Medicaid Services (CMS). (2021, December 1). Hospital-Acquired Condition Reduction Program. https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/HAC-Reduction-Program

[2] U.S. Agency for Health Care Research and Quality (AHRQ). (2016, August 31). PSI 90 Fact Sheet: Patient Safety and Adverse Events Composite (modified version PSI 90) for ICD-9 CM/PCS, v6.0 (FY2016). https://qualityindicators.ahrq.gov/News/PSI90_Factsheet_FAQ.pdf?msclkid=47aceeedaaae11ecad195a8ec887d36a

[3] Vsevolozhskaya O, Manz K, Zephyr P Waters T. Measurement matters: changing penalty calculations under the hospital acquired condition reduction program (HACRP) cost hospitals millions. BMC Health Services Research. 21(131). February 2021.

[4] Lawton E, Sheertz K, Ryan A. Improving the Hospital-Acquired Condition Reduction Program Through Rulemaking. JAMA Health Forum. 2020;1(5).

[5] Arntson E, Dimick JB, Nuliyalu U, Errickson J, Engler TA, Ryan AM. Changes in hospital-acquired conditions and mortality associated with the Hospital-Acquired Condition Reduction Program. Ann Surg. Published online October 16, 2019.

[6] Rajaram R, Chung JW, Kinnier CV, et al. Hospital characteristics associated with penalties in the Centers for Medicare & Medicaid Services Hospital-Acquired Condition Reduction Program. JAMA. 2015;314(4):375-383.

[7] Fuller RL, Goldfield NI, Averill RF, Hughes JS. Is the CMS Hospital-Acquired Condition Reduction Program a valid measure of hospital performance? Am J Med Qual. 2016;32(3):254-260.

[8] Russell, Manning. (1989). The Effects of Prospective Payment on Medicare Expenditures. The New England Journal of Medicine, 320(7).

[9] Averill, R., Hughes, J., Goldfield, N., “Paying for Outcomes, Not Performance: Lessons from the Medicare Inpatient Prospective Payment System”, The Joint Commission Journal on Quality and Patient Safety, Vol. 37, No 4, April 2011, pp 184-192.

[10] Federal Register. Vol. 66, No.87, Proposed Rules, May 4, 2001. p. 22668

[11] Walker B, Soule S. “Changing Company Culture Requires a Movement, Not a Mandate”, Harvard Business Review, June 20, 2017.

[12] Hughes JS, Averill RF, Goldfield NI, Gay JC, Muldoon J, McCullough E, Xiang J. Identifying potentially preventable complications using a present on admission indicator. Health Care Financ Rev. 2006;27(3):63-82.

[13] 3M Health Information Systems. 3M Patient Classification Methodologies: Potentially Preventable Complications. Web page: https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppcs/

[14] Averill RF, Goldfield NI, Muldoon J, Steinbeck BA, Grant TM. A closer look at All-Patient Refined DRGs. J AHIMA. 2002;73(1):46-49.

[15] 3M Health Information Systems. 3M Patient Classification Methodologies: All Patient Refined DRGs (APR DRGs). Web page: https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/apr-drgs/

[16] Fuller RL, McCullough EC, Bao MZ, Averill RF. Estimating the costs of potentially preventable hospital acquired complications. Health Care Financing Review, 30(4), 17–32.

[17] Health Services Cost Review Commission, Baltimore, MD. (2016, January 13). Final Recommendation for Modifying the Maryland Hospital-Acquired Conditions Program for FY 2018. https://hscrc.maryland.gov/documents/HSCRC_Initiatives/QualityImprovement/MHAC/RY2018/MHAC-Final-Rec-RY18.pdf

[18] CDC Agency for Toxic Substances and Disease Registry. CDC SVI 2018 Documentation. Centers for Disease Control & Prevention. January 31, 2020. https://www.atsdr.cdc.gov/placeandhealth/svi/documentation/SVI_documentation_2018.html.

[19] Schweiker RS. Hospital Prospective Payment for Medicare. Report to Congress. December 1982.

[20] Giancotti M, Guglielmo A, Mauro M. Efficiency and optimal size of hospitals: Results of a systematic search. PLoS One.12(3). March 2017. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5371367/

[21] Roh CY, Moon MJ, Jung C. Measuring Performance of US Nonprofit Hospitals Do Size and Location Matter? *Public Performance & Management Review*. 2010; 34(1):22–37.

[22] Fuller RL, Hughes JS, Goldfield NI, Averill RF. Will hospital peer grouping by patient socioeconomic status fix the Medicare hospital readmission reduction program or create new problems? Jt Comm J Qual Patient Saf. 2018;44:177-185

Appendix A: Bibliography of Publicly Available Articles and Reports

All articles and reports are publicly available and are listed in chronological order. The opinions and conclusions in these articles and reports are solely those of the authors.

Potentially Preventable Complications (PPCs)

Articles, Reports, and Book Chapters

Hughes JS, Averill RF, Goldfield NI, Gay JC, Muldoon J, McCullough E, Xiang J. Identifying potentially preventable complications using a present on admission indicator. Health Care Financ Rev. 2006;27(3):63-82.

Averill R, Vertrees J, McCullough E, Hughes J, Goldfield N. Redesigning the Medicare inpatient PPS to adjust payment for post admission complications. Health Care Financ Rev. 2006.

Averill R, Hughes J, Goldfield N, McCullough E. Hospital complications: linking payment reduction to preventability. Jt Comm J Qual Patient Saf. 2009;35(5):283-285.

Fuller RL, McCullough EC, Bao MZ, Averill RF. Estimating the costs of potentially preventable hospital acquired conditions. Health Care Financ Rev. 2009;30(4)17-32.

Fuller RL, Clinton S, Goldfield NI, Kelly WP. Building the affordable medical home. J Ambul Care Manage. 2010;33(1):71-80.

Fuller RL, McCullough EC, Averill RF. A new approach to reducing payments made to hospitals with high complication rates. Inquiry. 2011;48:68-83.

Lagoe RJ, Johnson PE, Murphy MP. Inpatient hospital complications and lengths of stay--a short report. BMC Research Notes. 2011;4(135).

Calikoglu S, Murray R, Feeney D. Hospital pay-for-performance programs in Maryland produced strong results, including reduced hospital-acquired conditions. Health Aff (Millwood). 2012;31(12):2649-2658

Goldfield N, Kelly W, Patel K. Potentially Preventable Events: an actionable set of measures for linking quality improvement and cost savings. Qual Manage Health Care. 2012;21(4):213-219.

Lagoe R, Bick J. Reducing hospital inpatient complications: A four-year experience. Advances in Bioscience and Biotechnology. 2013;4:118-125.

Millwee B, Goldfield N, Averill R, Hughes J. Payment system reform: one state's journey. J Ambul Care Manage. 2013;36(3):199-208.

Texas Health and Human Services Commission. Potentially Preventable Complications in the Texas Medicaid Population SFY 2012. Austin, TX: HHSC, 2013.

Michlewski E, Patterson W, Conroy MB. New York State All Payer Hospital Inpatient Potentially Preventable Complication (PPC) Rates: 2009-2012. Statistical Brief No. 1. Albany, NY: New York Department of Health, 2014.

University of Florida, Institute for Child Health Policy. Potentially Preventable Complications in Texas Medicaid and CHIP Programs FY 2013. Report to the Texas Health and Human Services Commission. Tallahassee, FL: ICHP, 2014

Patel A, Rajkumar R, Colmers JM, Kinzer D, Conway PH, Sharfstein JM. Maryland's global hospital budgets--preliminary results from an all-payer model. N Engl J Med. 2015;373:1899-1901.

Averill RF, Hughes JS, Fuller RL, Goldfield NI. Quality improvement initiatives need rigorous evaluation: the case of pressure ulcers. Am J Med Qual. 2017;32(5):552-555. doi:10.1177/1062860616666672.

Fuller RL, Goldfield NI, Averill RF, Hughes JS. Is the CMS Hospital-Acquired Condition Reduction Program a valid measure of hospital performance? Am J Med Qual. 2016;32(3):254-260.

Quinn K, Weimar D, Gray J, Davies B. Thinking about clinical outcomes in Medicaid. J Ambul Care Manage. 2016;39(2).

University of Florida, Institute for Child Health Policy. Texas Medicaid Managed Care and CHIP Summary of Activities and Trends in Healthcare Quality. Tallahassee, FL: ICHP, 2017.

Maryland Health Services Cost Review Commission. Final Recommendation for the Maryland Hospital-Acquired Conditions Program for Rate Year 2020. Baltimore, MD: HSCRC, 2018.

Millwee B, Quinn K, Goldfield N. Moving toward paying for outcomes in Medicaid. J Ambul Care Manage. 2018;41(2):88-94.

Texas Department of State Health Services. Potentially Preventable Complications in Texas CY 2016 Report. Austin, TX: DSHS, 2018.

University of Florida, Institute for Child Health Policy. Hospital Quality-Based Program: Potentially Preventable Complications. Technical notes for state FY 2018. Tallahassee, FL: ICHP, 2019

Maryland Health Services Cost Review Commission. Final Recommendation for the Maryland Hospital Acquired Conditions Program for Rate Year 2018. Baltimore: HSCRC, 2016.

New York Department of Health. Delivery System Reform Incentive Payment (DSRIP) Amendment Request. Albany, NY: NYDOH, Sept. 17, 2019.

Texas External Quality Review Organization. Quality, Timeliness, and Access to Health Care for Texas Medicaid and CHIP Recipients: Summary of Activities Calendar Year 2017. Austin, TX: Texas EQRO, n.d.

Websites

3M Health Information Systems: Overview of the 3M patient classification methodologies, with a link to a separate PPC sub-page. www.3m.com/his/methodologies

New York Department of Health*:* Consumer information website with charts and data sets showing PPC performance by hospital for multiple years. https://health.data.ny.gov/

Texas Department of State Health Services: Reports on statewide all-payer PPC incidence. https://www.dshs.texas.gov/thcic/hospitals/Potentially-Preventable-Complications-Reports/

Texas Health and Human Services Commission: Interactive webpage on PPC performance by hospital, by service delivery plan, and by managed care plan, with data for multiple years. www.thlcportal.com

All Patient Refined Diagnosis Related Groups (APR DRG)

Articles, Reports, and Book Chapters

Jones P. A case study in APR DRGs: the Greater Southeast Community Hospital Experience. Manage Care Q. 1994;2(3):48-56.

Averill RF, Muldoon JH, Vertrees JC, Goldfield NI, Mullin RL, Finneran EC, Zhang MC, Steinbeck B, Grant T. The evolution of case mix measurement using Diagnosis Related Groups. In: Goldfield N. Physician profiling and risk adjustment. 2nd ed. Gaithersburg, MD: Aspen; 1999. p. 391-454.

Franklin PD, Legault JP. Using data to evaluate hospital inpatient mortality. J Nurs Care Qual. 1999;14(1):55-66.

Muldoon J. Structure and performance of different DRG classification systems for neonatal medicine. Pediatrics. 1999;103(1 Suppl E):302-18.

Goldfield N, Averill R. On "Risk-adjusting acute myocardial infarction mortality: are APR DRGs the right tool?" Health Serv Res. 2000;34(7):1491-1495; discussion 1495-1498.

Romano PS, Chan BK. Risk-adjusting acute myocardial infarction mortality: are APR DRGs the right tool? Health Serv Res. 2000;34(7):1469-1489

Averill RF, Goldfield NI, Muldoon J, Steinbeck BA, Grant TM. A closer look at All-Patient Refined DRGs. J AHIMA. 2002;73(1):46-49.

Lorenzoni I, Cisbani I, Manzoli I, Fantini MP. The evaluation of neonatal case mix using Medicare DRG and APR DRG classification systems. Italian Journal of Pediatrics. 2002;28:225-229.

Fantini MP, Cisbani L, Manzoli L, Vertrees J, Lorenzoni I. On the use of administrative databases to support planning activities. The case of the evaluation of neonatal casemix in the Emilia-Romagna region using DRG and APR DRG classification systems. Eur J Public. 2003;13(2):138-145.

Shen Y. Applying the 3M All Patient Refined Diagnosis Related Groups Grouper to measure inpatient severity in the VA. Med Care. 2003;41(6 Suppl):II103-10

Zhan C, Miller MR. Excess length of stay, charges, and mortality attributable to medical injuries during hospitalization. JAMA. 2003;290(14):1868-1874.

Sedman AB, Bahl V, Bunting E, Bandy K, Jones S, Nasr SZ, Schulz K, Campbell DA. Clinical redesign using All Patient Refined Diagnosis Related Groups. Pediatrics. 2004;114;975-969.

Fontaine P, Licoppe C, D'Andrea R. International-Refined (IR-DRG) versus 3M All Patient Refined DRG (APR DRG) to describe and predict costs of patients in 42 Belgium hospitals. Proceedings, WHO Family of International Classifications, Tokyo Meeting. http://www3.who.int/icd/tokyomeeting/documentlist (June 2005), P2-9.

Medicare Payment Advisory Commission. Physician-Owned Specialty Hospitals. Report to Congress. Washington, DC: MedPAC, March 2005.

Davis MP, Walsh D, LeGrand SB, Lagman RI, Harrison SB, Rybicki L. The financial benefits of acute inpatient palliative medicine: an inter-institutional comparative analysis by All Patient Refined-Diagnosis Related Group and case mix index. J Support Oncol. 2005;3(4):313-316.

Pirson M, Martins D, Jackson T, Dramaix M, Leclercq P. Prospective casemix-based funding, analysis and financial impact of cost outliers in All-Patient Refined Diagnosis Related Groups in three Belgian general hospitals. Eur J Health Econ. 2006;7(1):55-65.

Pirson, M., Dramaix, M., Leclercq, P., Jackson, T.: Analysis of cost outliers within APR-DRGs in a Belgian general hospital: two complementary approaches. Health Policy. 2006;76(1):13–25.

Wynn BO, Scott M. Evaluation of Severity-adjusted DRG Systems: Addendum to the Interim Report. Santa Monica, CA: RAND, 2007.

Fay MD, Jackson DA, Vogel BB. Implementation of a severity-adjusted diagnosis-related groups payment system in a large health plan: implications for pay for performance. J Ambul Care Manage. 2007;30(3):211-217.

Hayes KJ, Pettengill J, Stensland J. Getting the price right: Medicare payment rates for cardiovascular services. Health Aff (Millwood). 2007;26(1):124-136.

Baram D, Daroowalla F, Garcia R, Zhang G, Chen JJ, Healy E, Riaz SA, Richman P. Use of the All Patient Refined-Diagnosis Related Group (APR-DRG) Risk of Mortality score as a severity adjustor in the medical ICU. Clin Med Circ Respirat Pulm Med. 2008;2:19–25.

Baram D, Daroowalla F, Garcia R, Zhang G, Chen JJ, Healy E, Riaz SA, Richman P. Use of the All Patient Refined-Diagnosis Related Group (APR-DRG) Risk of Mortality score as a severity adjustor in the medical ICU. Clin Med Insights Circ Respir Pulm Med. 2008;2:(1-25).

Quinn K. New directions in Medicaid payment methods for hospital care. Health Aff (Millwood). 2008;27(1):269-80.

Talsma A, Bahl V, Campbell D. Exploratory analyses of the “failure to rescue” measure: evaluation through medical record review. J Nurs Care Qual. 2008;2(3):202-210.

Averill R, McCullough E, Hughes J, Goldfield N, Vertrees J, Fuller R. Redesigning the Medicare inpatient PPS to reduce payments to hospitals with high readmission rates. Health Care Financ Rev. 2009;30(4):1-15.

Feudtner C, Levin JE, Srivastava R, Goodman DM, Slonim AD, Sharma V, Shah SS, Pati S, Fargason C Jr, Hall M. How well can hospital readmission be predicted in a cohort of hospitalized children? A retrospective, multicenter study. Pediatrics. 2009;123(1):286-293.

Kernisan LP, Lee SJ, Boscardin WJ, Landefeld CS, Dudley RA. Association between hospital-reported Leapfrog safe practices scores and inpatient mortality. JAMA. 2009;301(13):1341-1348.

Kozower BD, Ailawadi G, Jones DR, Pates RD, Lau CL, Kron IL, Stukenborg GJ. Predicted risk of mortality models: surgeons need to understand limitations of the University HealthSystems Consortium models. J Am Coll Surg. 2009;209(5):551-556

Lavernia CJ, Laoruengthana A, Contreras JS, Rossi MD. All-Patient Refined Diagnosis-Related Groups in primary arthroplasty. J Arthroplasty. 2009 Sep;24(6 Suppl):19-23.

Goldfield N. The evolution of diagnosis-related groups (DRGs): from its beginnings in case-mix and resource use theory, to its implementation for payment and now for its current utilization for quality within and outside the hospital. Qual Manage Health Care. 2010;19(1)3-16.

Kelly WP, Wendt SW, Vogel BB. Guiding principles for payment system reform. J Ambul Care Manage. 2010;33(1):29-34.

Shahian M, Wolf RE, Iezzoni LI, Kirle L, Normand ST. Variability in the measurement of hospital-wide mortality rates. New Engl J Med. 2010;363(26):2530-2539.

Puget Sound Health Alliance. 2011 Report: Use of Resources in High-Volume Hospitalizations. https://wahealthalliance.org/wp-content/uploads/2013/11/puget_sound_health_alliance_resource_use_report_2011.pdf

Mills R, Butler R, McCullough E, Bao M, Averill R. Impact of the transition to ICD-10 on Medicare inpatient hospital payments. Medicare Medicaid Res Rev. 2011;2(2);E1-E13.

Quinn K, Davies B. Variation in Payment for Hospital Care in Rhode Island. Report to the Office of Health Insurance Commissioner. Cranston, RI: Xerox State Healthcare; 2012.

Myers RP, Hubbard JN, Shaheen AAM, Dixon E, Kaplan GG. Hospital performance reports based on severity adjusted mortality rates in patients with cirrhosis depend on the method of risk adjustment. Ann Hepatol. 2012;11(4):526-535

Shine D. Risk-adjusted mortality: problems and possibilities. Comput Math Methods Med

Iezzoni, LI. Coded data from administrative sources. In Iezzoni LI, ed., Risk Adjustment for Measuring Healthcare Outcomes. 4th ed. Chicago: Health Administration Press, 2013

Vertrees J, Averill R, Eisenhandler J, Quain A, Switalski J, Gannon D. The Ability of Event-Based Episodes to Explain Variation in Charges and Medicare Payments for Various Post Acute Service Bundles. Report to MedPAC. Wallingford, CT: 3M Health Information Systems, 2013.

Vigen G, Coughlin S, Duncan I. Measurement and Performance Healthcare Quality and Efficiency: Resources for Healthcare Professionals. Third update. Society of Actuaries, 2013.

Xerox State Healthcare. Medi-Cal DRG Project Policy Design Document. Report to the California Department of Health Care Services. Atlanta: Xerox, 2013.

Berry JG, Toomey SL, Zaslavsky AM, Jha AK, Nakamura MM, Klein DJ, Feng JY, Shulman S, Chiang VW, Kaplan W, Hall M, Schuster MA. Pediatric readmission prevalence and variability across hospitals. JAMA. 2013;309(4):372-380.

Mull HJ, Chen Q, O'Brien WJ, Shwartz M, Borzecki AM, Hanchate A, Rosen AK. Comparing 2 methods of assessing 30-day readmissions: what is the impact on hospital profiling in the Veterans Health Administration? Med Care. 2013;51(7):589-96.

Pirson M, Schenker L, Martins D, Duong D, Chale JJ, Leclerq P. What can we learn from international comparisons of costs by DRG? Eur J Health Econ. 2013;14(1):67-73.

Vertrees J, Averill R, Eisenhandler, J, Quain, A, Switalski J. Bundling Post-Acute Care Services into MS-DRG Payments. Medicare Medicaid Res Rev. 2013;3(3):E1-E19

Averill R, Fuller R. Low-cost outliers as alternatives to the two-midnight rule. Healthc Financ Manage. 2014(December)

McCullough EC, Sullivan C, Banning P, Goldfield NI, Hughes JS. Challenges and benefits of adding laboratory data to a mortality risk adjustment method. Qual Manage Health Care. 2011;20(4):253-262.

Quinn K. After the revolution: DRGs at age 30. Ann Intern Med. 2014;160:426-429.

Quinn K, Davies B. Applicability of Hospital-Specific Relative Value (HSRV) DRG Weights. Memorandum to California Department of Health Care Services. West Sacramento, CA: Xerox State Healthcare, 2015.

Mellinger JL, Richardson CR, Mathur AK, Volk ML. Variation among United States hospitals in inpatient mortality for cirrhosis. Clin Gastroenterol Hepatol. 2015;13(3):577-584.

Mills R, Bulter R, Averill R, McCullough E, Fuller R, Bao, M. The impact of the transition to ICD-10 on Medicare inpatient hospital payments. J AHIMA. 2015(February).

Quinn K. The 8 basic payment methods in health care. Ann Intern Med. 2015;163(4):300-306.

Villwock JA, Goyal P. Early versus delayed treatment of primary epistaxis in the United States. Int Forum Allergy Rhinol. 2014;4:69–75.

Wissoker D, Garrett B. Designing a Unified Prospective Payment System for Postacute Care. Contractor report. Washington, DC: MedPAC, 2016

Averill RF, Fuller RL. Implementing a site-neutral PPS. Healthc Financ Manag. 2016(April).

Fuller RL, Averill RF, Muldoon JH, Hughes JS. Comparison of the properties of regression and categorical risk-adjustment models. J Ambul Care Manage. 2016;39(2):157-165.

Fuller RL, Averill RF, Muldoon JH, Hughes JS. Response to commentaries on “Comparison of the properties of regression and categorical risk-adjustment models.” J Ambul Care Manage. 39(2):175-177. doi:10.1097/JAC.0000000000000147.

Leyenaar JK, Ralston SL, Shieh M, Pekow PS, Mangione-Smith R, Lindenauer PK. Epidemioology of pediatric hospitalizations at general hospitals and freestanding children's hospitals in the United States. J Hosp Med. 2016;11(11):743-749.

Medicaid and CHIP Payment and Access Commission. Comparing Medicaid Hospital Payment Across States and to Medicare. Washington, DC: MACPAC, 2017.

California Department of Health Care Services. Review of SFYs 2013-14 and 2014-15 Utilization and Payment. Sacramento, CA: DHCS, 2017.

Navigant Inc. Arkansas DRG Conversion Plan. Report to the Arkansas Department of Human Services. Chicago: Navigant, 2017.

Alaska Department of Health and Social Services. AK DHSS Annual Medicaid Reform Report FY 2018. Anchorage, AK: DSS, 2018.

Fuller R. An Analysis of Real Price Effects Resulting from Charge Setting Practices in the US Hospital Sector. Highland, MD: Jayne Koskinas Ted Giovanis Foundation for Health and Policy, 2018.

Marks T, Gifford K, Perlin S, Byrd M, Beger T. Factors Affecting the Development of Medicaid Hospital Payment Policies--Findings from Structured Interviews in Five States. Report to MACPAC. Lansing, MI: HMA, 2018.

Medicaid and CHIP Payment and Access Commission. State Medicaid Payment Policies for Inpatient Hospital Services. Available at https://www.macpac.gov/publication/macpac-inpatient-hospital-payment-landscapes/

Fuller RL, Hughes JS, Goldfield NI, Atkinson G. Are we confident of across-hospital mortality comparisons? Am J Med Qual. 2018;33(6):662-664.

McCormick PJ, Lin HM, Deiner SG, Levin MA. Validation of the All Patient Refined Diagnosis Related Group (APR-DRG) risk of mortality and severity of illness modifiers as a measure of perioperative risk. J Med Syst. 2018;42(5):81.

Deschepper M. Using standard available hospital-wide data in the interpretation and prediction of outcome indicators. Doctoral dissertation, Ghent University. Faculty of Medicine and Health Sciences; 2019.

Averill RF, Fuller RL, Mills RE. Financial Impact of Geographic Variation in Hospital Quality Performance in Medicare. Murray, UT: 3M Health Information Systems, 2019.

Medicare Payment Advisory Commission. The effects of the Hospital Readmissions Reduction Program. Chapter 1 in Medicare and the Health Care Delivery System. Report to Congress. Washington, DC: MedPAC, June 2018.

U.S. Agency for Health Care Research and Quality. AHRQ Quality Indicators: Quality Indicator Empirical Methods. Rockville, MD: AHRQ, 2019.

Fuller RL, Hughes JS, Atkinson G, Aubry BS. Problematic risk adjustment in National Healthcare Safety Network Measures. Am J Med Qual. 2019:1-8.

Lawrence YR, Golan T, Urban D, Hammer L, Amit U, Catane R, Bar J, Goldstein J, Symon Z, Urban G. Effect of hospital volume on mortality rates amongst neutropenic cancer patients within the United States. J Clin Onc.2016;34:15_sup 6600\

Souza J, Santos JV, Canedo VB, Betanzos A, Alves D, Freitas A. Importance of coding co-morbidities for APR-DRG assignment: focus on cardiovascular and respiratory diseases. Health Inf Manag. 2019; doi: 10.1177/1833358319840575. [Epub ahead of print]

Averill RF. Fuller RL, Mills RE. Surgical Mortality as a Measure of Hospital Quality. Murray, UT: 3M Health Information Systems, 2020.

Fuller R, Hughes J. DNR orders known at the time of admission can improve hospital mortality ratings [abstract]. HSR. 2020;55(51):96

Websites

Washington Health Alliance. Inpatient Spending Trends in Washington State (February 2020). Webpage: https://www.wacommunitycheckup.org/highlights/inpatient-spending-trends-in-washington-state-february-2020/

Washington Health Alliance. Variation of Pricing for Inpatient Treatments in Washington State. 2019. webpage: https://www.wacommunitycheckup.org/highlights/variation-of-pricing-for-inpatient-treatments-in-washington-state/

Illinois DRG Pricing Calculator. https://www.illinois.gov/hfs/MedicalProviders/hospitals/hospitalratereform/Pages/default.aspx

Montana Medicaid Inpatient Pricing Calculator. https://medicaidprovider.mt.gov/01#186035117-fee-schedules---hospital---apr-drg

RI Medicaid APR-DRG Pricing Calculator. http://www.eohhs.ri.gov/ProvidersPartners/GeneralInformation/ProviderDirectories/Hospitals.aspx

3M Health Information Systems. 3M Patient Classification Methodologies. Webpage: www.3m.com/his/methodologies

Arizona Health Care Cost Containment System. AZ APR-DRG Pricing Calculator FY 2020. Available at: www.azahcccs.gov/PlansProviders/RatesAndBilling/FFS/APRDRGrates.html

Colorado Department of Health Care Policy and Financing. Inpatient Hospital Payment. [Webpage]. https://www.colorado.gov/pacific/hcpf/inpatient-hospital-payment

Connecticut Department of Social Services. Medicaid Hospital Reimbursement. Webpage: www.ctdssmap.com/CTPortal/Hospital%20Modernization/tabId/143/Default.aspx

District of Columbia Department of Health Care Finance. Rates and Reimbursements. Webpage: https://dhcf.dc.gov/page/rates-and-reimbursements

Indiana Department of Health. Hospital Discharge Data [webpage]. www.in.gov/isdh/20624.htm

Minnesota Department of Human Services. Payment Methodology for Inpatient Hospitals. Webpage: https://mn.gov/dhs/partners-and-providers/policies-procedures/minnesota-health-care-programs/provider/types/payment-methodology-for-inpatient-hospitals.jsp

Mississippi Division of Medicaid. Inpatient Hospital Payment Method for Mississippi Medicaid [webpage]. https://medicaid.ms.gov/providers/reimbursement/

Texas Medicaid and Healthcare Partnership. Acute Care Hospital Reimbursement [webpage]. http://www.tmhp.com/resources/rate-and-code-updates/acute-care-hospital-reimbursement

Washington HealthCareCompare [webpage]. https://www.wahealthcarecompare.com/

Wisconsin Department of Health Services. ForwardHealth Rates and Weights [webpahe]. https://www.forwardhealth.wi.gov/WIPortal/Tab/42/icscontent/Provider/Medicaid/hospital/drg/drg.htm.spage#

California Department of Health Care Services. https://www.dhcs.ca.gov/provgovpart/Pages/DRG.aspx

Florida Agency for Health Care Administration--consumer information. www.floridahealthfinder.gov

Illinois Department of Healthcare and Family Services. www.illinois.gov/hfs/MedicalProviders/MedicaidReimbursement/Pages/DRGHICalcuWorksheet.aspx

New York Department of Health--consumer information. https://health.data.ny.gov/

New York Department of Health--Medicaid. https://www.health.ny.gov/facilities/hospital/reimbursement/apr-drg/

Indiana Medicaid Diagnosis-Related Group Inpatient Reimbursement. https://www.in.gov/medicaid/providers/669.htm

Ohio Department of Medicaid Hospital Payment Policy. https://medicaid.ohio.gov/Provider/ProviderTypes/HospitalProviderInformation/HospitalPaymentPolicy

North Carolina Community Care Networks, Inc. Clinical Program Analysis. Report to the North Carolina Department of Health and Human Services. Raleigh, NC: NCCC, 2015

Berry JG, Hall M, Cohen E, O'Neill M, Feudtner C. Ways to identify children with medical complexity and the importance of why. J Pediatr. 2015;167(2):229-237. HSR. 20014;39(1):73-

DuBard CA, Jacobsen Vann JC, Jackson C. Conflicting readmission rate trends in a high-risk population: implications for performance measurement. Popul Health Manag. 2015;18:351–357

Jackson C, Shahsahehi M, Wedlake T, DuBard CA. Timeliness of outpatient follow-up: an evidence-based approach for planning after hospital discharge. Ann Fam Med. 2015:13(2):155-122.

Jones C, Finison K, McGraves-Lloyd, Tremblay T, Mohlman MK, Tanzman B, Hazard M, Maier, Samuelson J. Vermont's community-oriented all-payer medical home model reduces expenditures and utilization while delivering high-quality care. Popul Health Manag. 2015. DOI: 10.1089/pop.2015.0055.

Neff JM, Clifton H, Popalisky J, Zhou C. Stratification of children by medical complexity. Acad Pediatr. 2015;15(2):191-196.

Pfister DG, Rubin DM, Elkin EE, Neill US, Duck E, Radzyner M, Bach PB. Risk adjusting survival outcomes in hospitals that treat patients with cancer without information on cancer stage. JAMA Oncol. 2015;1(9):1303-1310.

Quinn K. The 8 basic payment methods in health care. Ann Intern Med. 2015;163(4):300-306.

Florida Agency For Healthcare Administration. Analyzing the Disease Burden of Florida Medicaid Enrollees Using Clinical Risk Groups. Tallahassee, FL: AHCA, Winter 2016.

Hileman G, Steele S. Accuracy of Claims-Based Risk Scoring Models. Schaumburg, IL: Society of Actuaries, 2016.

DuBard CA. Key Performance Indicators of Cost and Utilization for Medicaid Recipients Enrolled in Community Care of North Carolina. N C Med J. 2016;77(4):297-300.

Fuller RL, Goldfield N. Paying for on-patent pharmaceuticals: limit prices and the emerging role of a pay for outcomes approach. J Ambul Care Manage. 2016;39(2):143-149.

Fuller RL, Goldfield N. Response to commentaries on "Paying for on-patent pharmaceuticals: limit prices and the emerging role of a pay for outcomes approach". J Ambul Care Manage. 2016;39(2):155-156.

Fuller RL, Hughes JS, Goldfield NI. Adjusting population risk for functional health status. Popul Health Manage. 2016;19(2):136-144.

Gareau S, Lopez-De Fede A, Loudermilk BL, Cummings TH, Hardin JW, Picklesimer AH, Crouch E, Covington-Kolb S. Group prenatal care results in Medicaid savings with better outcomes: a propensity score analysis of CenteringPregnancy participation in South Carolina. Matern Child Health J. 2016;20(7):1384–1393.

Juhnke C,Bethge S, Mühlbacher AC. A review on methods of risk adjustment and their use in integrated healthcare systems. Int J Integr Care. 2016;16(4):1–18

Mohlman MK, Tanzman B,Finison K, Pinettte M, Jones C. Impact of medication-assisted treatmernt for opioid addiction on Medicaid expenditures and health services utilization rates in Vermont. J Subst Abuse Treat. 2016;67: 9–14

Finison K , Mohlman M, Jones C, Pinette M, Jorgenson D, Kinner A, Tremblay T, Gottlieb D. Risk-adjustment methods for all-payer comparative performance reporting in Vermont. BMC Health Serv Res. 2017;17.

Bednar WR, Axene JW, Liliedahl RL. An Analysis of End-of-Life Costs for Terminally Ill Medicare Fee-for-Service (FFS) Cancer Patients. Schaumburg, Society of Actuaries, 2018.

Fuller RL, Goldfield NI, Hughes JS, McCullough EC. Nursing home compare star rankings and the variation in potentially preventable emergency department visits and hospital admissions. Popul Health Manage. Epub ahead of print. July 30, 2018.

Averill RF, Fuller RL, Mills RE. Financial Impact of Geographic Variation in Hospital Quality Performance in Medicare. Murray, UT: 3M Health Information Systems, 2019.

Connecticut Department of Social Services. Connecticut State Innovation Model Operational Plan Award Year 4. Hartford, CT: DSS, 2019.

Vermont Agency of Human Services. Annual Report on The Vermont Blueprint for Health. Report to the Legislature. Burlington, VT; Agency of Human Services, 2020

Vermont Agency of Human Services. Community Health Profiles [webpage]. https://blueprintforhealth.vermont.gov/community-health-profiles. Accessed Aug. 17, 2020.

Andrews AL, Bettenhausen J, Hoefgen E, Richardson T,Macy ML; Zima BT, Colvin J; Hall M; Shah SS, Neff NM, Auger KA. Measures of ED Utilization in a National Cohort of Childen. Am J Manag Care. 2020;26(6):267-272.

3M Health Information Systems. 3M Patient Classification Methodologies. Webpage: www.3m.com/his/methodologies. Accessed Sept. 28, 2020

Vermont Agency of Human Services. Hub and Spoke Profiles [webpage]. Annual Report on The Vermont Blueprint for Health. Report to the Legislature. Burlington, VT; Agency of Human Services, 2020

Superior Health Plan. 3M Health Information. Available at https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP_20195046-3M-HIS-Resource-Guide-P-508-03202019.pdf

Superior Health Plan. 3M HIS Prospective Dashboard User Guide. Available at https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP_20173928-3M-HIS-Dashboard-Training-P-05312018.pdf.

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