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Inpatient Quality Outcome Performance and Population Resource Utilization

3M Clinical and Economic Research

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Introduction

The Medicare Payment Advisory Commission's (MedPAC) June 2020 Report to Congress focused on Medicare and the Healthcare delivery system.[1] MedPAC recommended a "value incentive program" be established that is based on a "small set of population-based measures to score clinical outcomes." While the MedPAC June 2020 report focused on the Medicare Advantage program, the core attributes of the payment policies advocated by MedPAC are clear:

- **Value:** an integration of quality outcome performance and financial performance
- **Outcomes:** Outcomes of care as opposed to care processes
- **Focused:** Manageable number of performance measures
- **Population:** Overall delivery system effectiveness

Value in health care is a positive outcome at a reasonable cost. An effective delivery system is necessary to achieve value for a population. This report will examine the impact of inpatient quality outcome performance on the overall functioning of the inpatient delivery system for the Medicare population in each state, and in so doing, provides an example of an approach that can meet the criteria of MedPAC's proposed value incentive program.

The 3M Clinical and Economic Research report entitled *The Financial Impact of Geographic Variation in Hospital Quality Performance in Medicare*[2] (referred to as the Geographic Variation Report) examined the geographic variation in eight quality outcome performance measures (QOPMs) within the Medicare program. This report will focus the four QOPMs that relate to hospital inpatient care or care in the emergency department that directly impact the volume of inpatient admissions and bed days. The four QOPMs used in this Report are:

- Inpatient Complications – Potentially Preventable Complications (PPCs)
- Readmissions within 30 days – Potentially Preventable Readmissions (PPRs)
- Post Discharge Emergency Department Visits within 30 days of hospital discharge – Potentially Preventable Return Emergency Department visits (PPREDs)
- Hospital Admissions from Emergency Department

The Geographic Variation Report contains a description and details of the QOPMs, the methods of risk adjustment, determination of national norms, methods for computing expected values and methods of estimating the financial impact of QOPM performance differences. Also, as described in the Geographic Variation Report, the QOPM measures differ from those used by Medicare for its complications, readmissions, and value-based-purchasing programs. The QOPMs are measures that describe quality outcome performance during an inpatient episode that encompasses ED care prior at admission, the inpatient stay and the post-acute discharge period.

Using Medicare fee-for-service data, this Report builds on the Geographic Variation Report to examine the relationship within a state between inpatient episode performance as measured using the four QOPMs and the functioning of the hospital inpatient delivery system as measured using the following five population utilization metrics:

- Inpatient stays per 1,000 Medicare beneficiaries
- Inpatient bed days per 1,000 Medicare beneficiaries

- Standardized Medicare inpatient per capita expenditures
- Standardized Medicare outpatient per capita expenditures
- Ratio of Medicare standardized outpatient per capita expenditures to Medicare standardized inpatient per capita expenditures

A well-functioning hospital delivery system should be able to deliver care without an excess number of avoidable complications, readmissions and ED visits. Outpatient utilization practice patterns can also have an impact on inpatient resource use and expenditures. The five population utilization metrics are highly interrelated and can provide an insight into the functioning of a hospital inpatient delivery system within a state.

It is reasonable to expect that poor inpatient quality outcome performance will likely increase population inpatient resource use and expenditures, however, that is not always true. The cost savings from aggressive cost containment efforts that limit access to hospital services and reduce hospital staffing levels could be substantial enough to offset the increased cost needed to correct the quality problems cause by inadequate care and staffing. Furthermore, the QOPMs are not a measure of the volume of negative quality outcomes but are a measure of the volume of *excess* negative quality outcomes either above or below expected performance (i.e., relative quality outcome performance). This report analyzes the relationship between quality outcome performance during the inpatient episode and the functioning of the hospital inpatient delivery system. In examining this relationship across geographic areas, the report asks a basic question: Does relative quality outcome performance during an inpatient episode as measured by the QOPMs provides useful information on the overall functioning of a hospital delivery system as measured by the five population metrics (i.e., whether relative inpatient episode quality outcome performance tends to be associated with overall population resource use within the hospital delivery system).

QOPMs

In health care, cost and quality of care are inextricably connected. Delivery system ineffectiveness can be an end manifestation of underlying quality problems. For example, poor hand sanitizing compliance causing avoidable infections is an underlying quality problem that leads to excess complications that have a direct impact on hospital inpatient expenditures. Conversely, lowering costs can lead to failures in quality, resulting in a greater volume of services and additional costs to correct the quality problem. Shorter hospital stays reduce inpatient costs, but a patient discharged from a hospital too quick or too sick, may lead to an avoidable readmission or ED visit, resulting in an overall increase in cost.

The QOPMs provide a means of quantifying relative quality outcome performance, allowing the impact of this performance on delivery system effectiveness to be examined. To judge QOPM performance, a hospital's actual performance is compared to the hospital's risk-adjusted expected performance based on achievable real-world benchmarks such as the average national performance level. The use of benchmarks for judging QOPM performance is essential because even the best performing providers who deliver optimal care will have a residual rate of negative quality outcomes. The payment impact of a QOPM can be used as a means of quantifying QOPM performance in financial terms (e.g., average payment for a readmission) allowing the financial impact of QOPMs to be summed together to provide a measure of quality outcome performance over multiple QOPMs.

Inherent in the QOPMs is the assumption that the QOPMs are under the control of hospitals and therefore potentially preventable. It would not be credible to use QOPMs to judge a hospital's performance if the hospital had no reasonable ability to control or influence QOPM performance. For example, a hospital readmission due to a traffic accident should not be included in the QOPM for hospital readmissions. Integral to each QOPM is a specification of the subset of admissions or emergency department visits that are considered "at risk" for the QOPM being potentially preventable. For example, only 62.8 percent of Medicare readmissions are considered potentially preventable and therefore at risk for a Potentially Preventable Readmission (PPR). For Potentially Preventable Complications (PPCs), the determination of potential preventability is done separately for each type of complication. For instance, only 58.7 percent of patients are considered at risk for aspiration pneumonia since conditions like seizures and head trauma aspiration pneumonia are not considered potentially preventable. Because the QOPM for inpatient admission through the emergency department includes only low severity medical patients, only 19.2 percent of all hospital admissions through the ED are considered at risk for the hospital admission being potentially preventable.

As described in the Geographic Variation Report*,* each patient is assigned to a QOPM-specific risk category. A national norm for each QOPM is calculated by summing the QOPM actual value for each risk category across all Medicare patients who are at risk for the QOPM and computing the mean rate per at risk patient (referred to as the QOPM norm value). For each QOPM, the expected value (E) for a hospital is the number of at-risk admissions or visits in the hospital in each risk category times the QOPM norm value for the risk category summed over all risk categories (indirect rate standardization). The difference between the actual value (A) and the expected value (E) represents good performance if (A-E) is negative (A<E) and poor performance if (A-E) is positive (A>E). %(A-E)/E is the percent that actual performance is better than expected (%(A-E)/E is negative) or worse than expected (%(A-E)/E is positive). $(A-E) expresses the %(A-E)/E in terms of its dollar impact as measured by the relative impact on Medicare payments for a QOPM (e.g., an excess hospital admission has a larger financial impact than an excess emergency department visit). $(A-E) can be summed across QOPMs to produce an overall measure of quality outcome performance. The sum of $(A-E) across QOPMs allows good performance on a QOPM to offset poor performance in another QOPM (poor post discharge return to ED performance can be offset by good admit through the ED performance).

Data

The data used in this report to determine QOPM performance is the same data used in the Geographic Variation Report: Medicare Fee-For-Service data (FFS) from the 3,279 Inpatient Prospective Payment System (IPPS) hospitals paid under the IPPS from FY17. The difference in performance (A-E) was expressed in financial terms ($(A-E)) by multiplying (A-E) by the average Medicare payment amount. The financial conversion factors for PPCs, PPRs, PPREDs and admissions through the ED were $12,196, $12,196, $693 and $3,233, respectively. PPCs are composed of 57 separate complications with each PPC having a weighting factor that is determined by the marginal cost increase due to the PPC. The admissions through the ED financial conversion factor was determined by excluding the cost of an ED visit with observation and adjusting for the lower severity of the admissions included (only low severity medical patients).

The data used in this report for the five utilization metrics that evaluate delivery system effectiveness was obtained from the 2017 Geographic Variation Public Use File produced by the Centers for Medicare & Medicaid Services (CMS)[3]. The Geographic Variation Public Use File contains Medicare FFS beneficiaries who were enrolled in both Part A and Part B and reports the five utilization metrics for each state. The Medicare inpatient per capita expenditures metric is a standardized amount that eliminates payment adjustments for regional labor costs, graduate medical education (GME), indirect medical education (IME), the proportion of poor and uninsured (i.e., disproportionate share payments (DSH)) and quality related payment adjustments such Value-based Purchasing (VBP).

The Geographic Variation Public Use File also contains the HCC (Hierarchal Condition Category) score for each state. HCC scores estimate how beneficiaries' FFS spending will compare to the overall average for the entire Medicare population. HCC scores are based on a beneficiary's age and sex; whether the beneficiary is eligible for Medicaid, first qualified for Medicare on the basis of disability, or lives in an institution (usually a nursing home) and the beneficiary's diagnoses from the previous year. The average risk score is set at 1.0 and beneficiaries with scores greater than 1.0 are expected to have above-average spending, and vice versa.

The major difference between the data used to determine QOPM performance and for the five utilization metrics used to evaluate delivery system effectiveness is that the QOPM data is only from IPPS hospitals while the Geographic Variation Public Use File includes data from both IPPS hospitals and non IPPS hospitals, such as critical assess hospitals and cancer centers.

Quality Performance Value (QPV)
For each state, Table 1 contains the %(A-E)/E for each of the four QOPMs for the national norm and was taken directly from Appendix D in the Geographic Variation Report. Using the data in Table 1, a composite inpatient episode quality outcome performance value was computed for each state as follows:

1. **QOPM Financial Impact** The financial conversion factors were used to determine the financial impact ($(A-E)) of the QOPM performance differences (%(A-E)/E) for each QOPM. The column labelled "SUM $(A-E)" is the sum of the financial impact of the four QOPMs (result expressed in millions).

2. **Per Discharge Impact** The sum of the financial impact of QOPM performance differences was converted to a per discharge amount and is contained in the column labelled "SUM $(A-E) per Disch." The QOPM per discharge amount ranges from a good performance per discharge of -$588.12 for Utah to poor performance per discharge of $418.26 for the District of Columbia.

3. **Normalize** The sum of the financial impact of QOPM performance differences per discharge ($(A-E) per discharge) for each state can be normalized to a scale with 1.0, meaning that the

actual QOPM performance per discharge amount is equal to the expected QOPM performance per discharge amount and values above 1.0 indicating poor QOPM performance per discharge (A>E) and values less than 1.0 indicating good QOPM performance per discharge (A<E). The normalization process is described in Appendix A.

The normalized QOPM performance per discharge is referred to as the Quality Performance Value (QPV).

Table 1: QOPM %(A-E)/E and the QPV by state

State	IPPS Hosps	IPPS Disch	%(A-E)/E PPC	%(A-E)/E PPR	%(A-E)/E PPRED	%(A-E)/E ED ADM	SUM $(A-E) (Mill)	SUM $(A-E) per Disch	QPV
Alabama	84	191,576	8.78	3.24	-4.64	2.05	18.9	98.91	1.17
Alaska	8	13,562	0.28	-20.7	27.31	-47.73	-7.3	-539.98	0.08
Arizona	63	163,729	-3.24	-11.38	5.03	-29.1	-54.5	-333.09	0.43
Arkansas	45	122,294	-4.82	3.66	5.67	-7.73	-5	-40.72	0.93
California	297	769,090	-4.83	1.76	3.86	-4.32	-29.6	-38.43	0.93
Colorado	45	109,204	-10.48	-19.38	7.62	-29.28	-48	-439.85	0.25
Connecticut	30	126,390	12.27	2.46	3.08	5.82	17.6	138.87	1.24
Delaware	7	36,117	12.94	-2.16	1.61	5.63	4.3	118.29	1.2
DC	6	42,835	42.1	13.88	7.13	3.35	17.9	418.26	1.71
Florida	168	761,456	-2.83	8.53	-8.54	36.25	212.1	278.55	1.47
Georgia	101	274,277	6.22	1.87	8.64	-12.95	-7	-25.43	0.96
Hawaii	12	21,769	4.28	-14.78	18.44	-32.96	-7.8	-360.21	0.39
Idaho	14	34,953	-13	-25.68	2.39	-35.44	-20.1	-575.66	0.02
Illinois	125	435,565	5	4.15	-7.75	8.91	52.9	121.57	1.21
Indiana	85	242,140	-1.26	-7.54	0.59	-10.82	-37.1	-153.2	0.74
Iowa	34	100,903	6.21	-9.32	-4.27	-9.32	-11.1	-110.45	0.81
Kansas	51	103,256	-18.69	-8.78	-7.49	-3.22	-23.8	-230.56	0.61
Kentucky	64	186,566	1.78	6.23	10.69	-13.8	-2.3	-12.32	0.98
Louisiana	90	157,068	-0.79	3.8	16.46	-12.51	-8.2	-52.34	0.91
Maine	17	45,328	1.3	-16.05	14.22	-26.53	-15.4	-339.16	0.42
Maryland	47	238,725	-26.78	-1.95	-2.67	0.12	-42.5	-177.93	0.7
Massachusetts	56	281,749	4.63	5.7	0.23	19.97	57.4	203.73	1.35
Michigan	94	375,028	-0.06	1.44	-0.04	4.91	16.6	44.31	1.08
Minnesota	50	176,977	-1.13	-12.57	-6.29	-18.18	-41.1	-232.23	0.61
Mississippi	60	132,717	4.53	6.71	8.81	-10.76	2.5	18.71	1.03
Missouri	72	237,724	-0.58	0.69	0.17	-7.9	-10.1	-42.45	0.93
Montana	14	30,211	-10.36	-23.37	-9.95	-27.42	-13.9	-460.38	0.22
Nebraska	23	65,574	-5.43	-15.25	-23.71	-1.31	-13.7	-208.22	0.65
Nevada	22	79,048	-2.54	10.29	0.45	17.96	14.7	186.58	1.32
New Hampshire	13	50,201	5.72	-5.8	1.75	-3.69	-2.2	-44.1	0.93
New Jersey	64	318,746	1.71	4.62	-12.64	24.53	64.4	202.02	1.34

State	IPPS Hosps	IPPS Disch	%(A-E)/E PPC	%(A-E)/E PPR	%(A-E)/E PPRED	%(A-E)/E ED ADM	SUM $(A-E) (Mill)	SUM $(A-E) per Disch	QPV
New Mexico	30	45,364	3.38	-8.83	11	-32.18	-13.1	-288.26	0.51
New York	149	561,058	14.07	8.26	-11.3	40.29	215.4	383.99	1.65
North Carolina	85	332,563	5.71	-4.27	9.1	-24.57	-59.4	-178.48	0.7
North Dakota	8	30,196	5.15	-17.01	-11.48	-12.88	-6	-199.81	0.66
Ohio	130	389,624	0.6	0.31	1.43	-7.06	-14.2	-36.44	0.94
Oklahoma	84	146,725	-1.54	-1.47	12.99	-20.82	-24	-163.34	0.72
Oregon	34	80,088	-5.85	-18.46	14.11	-29.99	-33.6	-418.92	0.29
Pennsylvania	150	443,701	-2.62	0.37	-10.54	20.58	42.9	96.67	1.16
Rhode Island	11	32,453	13.12	2.69	-5.12	16.22	6.5	200.91	1.34
South Carolina	54	172,271	-1.28	-1.61	12.54	-16.09	-22.6	-131.09	0.78
South Dakota	20	36,711	-7.84	-18.65	-22.59	-2.68	-9.4	-256.69	0.56
Tennessee	90	253,392	0.67	2.31	5.15	-5.81	-1.4	-5.39	0.99
Texas	309	689,785	-5.33	1.87	0.01	-1.53	-17.9	-25.99	0.96
Utah	31	50,506	-20.84	-26.18	1.18	-32.25	-29.7	-588.12	0
Vermont	6	18,046	-11.05	-8.07	12.72	-15.4	-4.6	-253.63	0.57
Virginia	74	287,591	-1.14	-1.89	8.91	-15.29	-36.4	-126.67	0.78
Washington	48	174,665	4.9	-15.34	10.33	-30.36	-55.6	-318.04	0.46
West Virginia	29	82,912	7.06	3.58	12.86	-12.4	0.4	5.26	1.01
Wisconsin	66	152,351	-2.37	-10.7	4.54	-19.41	-37.1	-243.84	0.59
Wyoming	10	13,107	-18.92	-16.86	7.89	-24.15	-6	-460.68	0.22

The geographic variation of the QPV is shown in the map in Figure 1. QPV values less than 0.9 are shown in green (lower than expected, good performance), QPV values between 0.9 and 1.1 are shown in yellow (consistent with expected) and QPV values greater than 1.1 are shown in red (higher than expected, poor performance). The pattern of QPV geographic variation is consistent with the QOPM geographic variation reported in the Geographic Variation Report with the Mountain and Pacific states performing better than the Middle Atlantic and East Central states.

Population Utilization Metrics

Table 2 contains the population utilization metrics for each state and the average HCC score, as well as the QPV. Because the population utilization metrics are impacted by the relative burden of illness of the population in each state, the population utilization metrics in each state were risk adjusted by dividing the population utilization metrics by the HCC score. Appendix B contains the risk adjusted utilization metrics normalized so that a value of 1.0 equals the national average value of the population utilization metrics.

Figure 1: Geographic performance variation by QPV

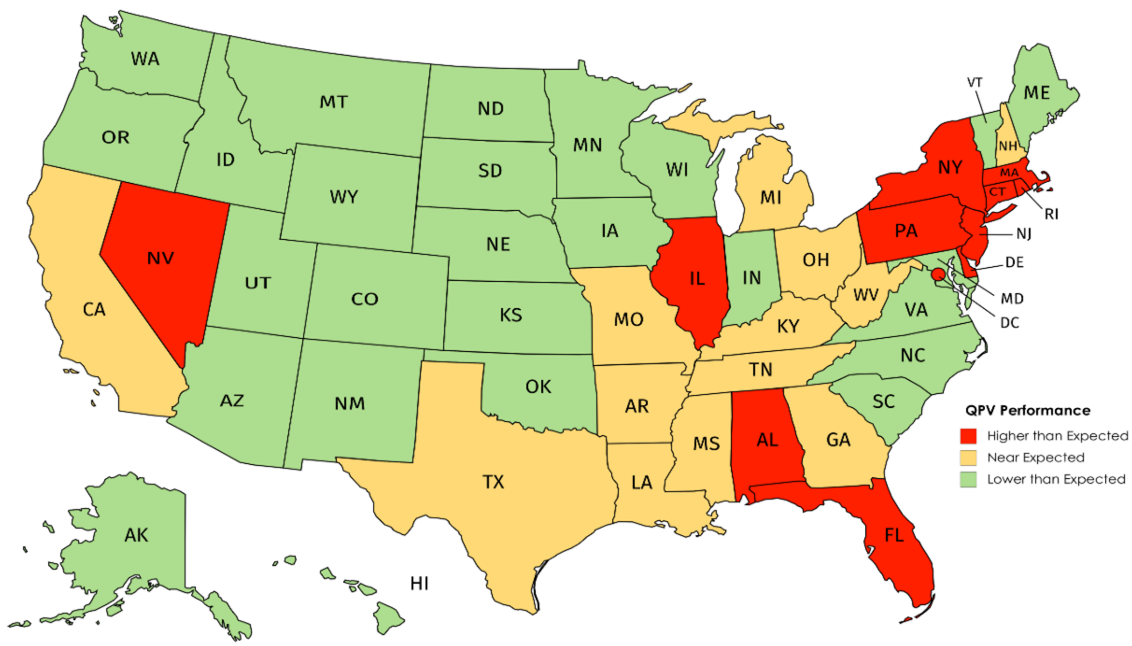


Table 2: Population utilization metrics, HCC score and the QPV by state

State	IP Stays Per 1000	IP Days Per 1000	IP Per Cap Std Cost	OP Per Cap Std Cost	Ratio OP/IP Per Cap	Avg HCC Score	QPV
Alabama	301	1,681	2923	1461	0.5	1.01	1.17
Alaska	285	1,457	2808	1556	0.55	0.95	0.08
Arizona	221	1,045	2344	1260	0.54	0.91	0.43
Arkansas	195	1,155	2245	1623	0.72	0.83	0.93
California	249	1,334	2680	1200	0.45	1.03	0.93
Colorado	214	976	2292	1522	0.66	0.87	0.25
Connecticut	286	1,607	2790	1626	0.58	1.04	1.24
Delaware	255	1,423	2628	1549	0.59	0.97	1.2
DC	303	2,011	3309	1337	0.4	1.15	1.71
Florida	304	1,574	2923	1216	0.42	1.06	1.47
Georgia	270	1,455	2775	1494	0.54	1.02	0.96
Hawaii	162	979	1921	1098	0.57	0.92	0.39
Idaho	204	917	2122	2000	0.94	0.87	0.02
Illinois	298	1,479	2887	1707	0.59	1	1.21
Indiana	285	1,416	2822	1794	0.64	1	0.74
Iowa	244	1,164	2361	1945	0.82	0.92	0.81
Kansas	279	1,295	2716	1742	0.64	0.92	0.61

State	IP Stays Per 1000	IP Days Per 1000	IP Per Cap Std Cost	OP Per Cap Std Cost	Ratio OP/IP Per Cap	Avg HCC Score	QPV
Kentucky	303	1,588	2964	1708	0.58	1	0.98
Louisiana	307	1,696	3024	1921	0.64	1.07	0.91
Maine	239	1,236	2330	2235	0.96	0.93	0.42
Maryland	266	1,523	2735	1679	0.61	0.99	0.7
Massachusetts	302	1,657	2793	1847	0.66	1.01	1.35
Michigan	314	1,631	3087	1741	0.56	1.06	1.08
Minnesota	268	1,362	2753	1886	0.69	0.98	0.61
Mississippi	307	1,622	2931	1834	0.63	1.02	1.03
Missouri	294	1,477	2911	1948	0.67	1.02	0.93
Montana	216	992	2161	2151	1	0.84	0.22
Nebraska	258	1,203	2596	1834	0.71	0.9	0.65
Nevada	267	1,412	2742	944	0.34	0.95	1.32
New Hampshire	246	1,278	2375	1961	0.83	0.86	0.93
New Jersey	285	1,665	2849	1341	0.47	1.05	1.34
New Mexico	208	1,056	2176	1467	0.67	0.91	0.51
New York	288	1,816	2974	1408	0.47	1.07	1.65
North Carolina	263	1,381	2601	1643	0.63	1	0.7
North Dakota	246	1,236	2528	2512	0.99	0.91	0.66
Ohio	298	1,452	2931	1837	0.63	1.01	0.94
Oklahoma	290	1,486	2981	1870	0.63	1	0.72
Oregon	205	1,005	2227	1547	0.69	0.88	0.29
Pennsylvania	290	1,518	2807	1661	0.59	1.01	1.16
Rhode Island	292	1,492	2669	1484	0.56	0.97	1.34
South Carolina	244	1,288	2530	1466	0.58	0.93	0.78
South Dakota	241	1,111	2340	2372	1.01	0.87	0.56
Tennessee	287	1,512	2833	1429	0.5	1	0.99
Texas	281	1,441	2860	1349	0.47	1.04	0.96
Utah	206	857	2201	1559	0.71	0.89	0
Vermont	220	1,109	2075	2134	1.03	0.83	0.57
Virginia	257	1,313	2594	1463	0.56	0.95	0.78
Washington	213	1,112	2301	1569	0.68	0.9	0.46
West Virginia	296	1,577	2918	1876	0.64	1	1.01
Wisconsin	242	1,149	2418	1980	0.82	0.95	0.59
Wyoming	219	1,001	2324	1726	0.74	0.82	0.22

Results

Table 3 correlates the QPV with each of the risk adjusted population utilization metrics ($p<.001$ for all five population utilization metrics). As shown in Table 3, there is a negative correlation of the QPV with the outpatient standardized cost and the ratio of Medicare outpatient per capita expenditures to Medicare inpatient per capita expenditures. Thus, poor QPV performance (QPV greater than 1.0) in a state tends to be associated with a state delivery system that is providing relatively less care on an outpatient basis. At the same time, poor QPV performance in a state tends

Table 3: Correlation of the QPV with risk adjusted population utilization metrics across states

IP Stays Per 1000	IP Days Per 1000	IP Per Cap Std Cost	OP Per Cap Std Coat	Ratio $OP/$IP Per Cap
r = .48	r = .82	r =.46	r = -.50	r = -.58

to be associated with a delivery system that is utilizing more per capita hospital stays, bed days and inpatient expenditures.

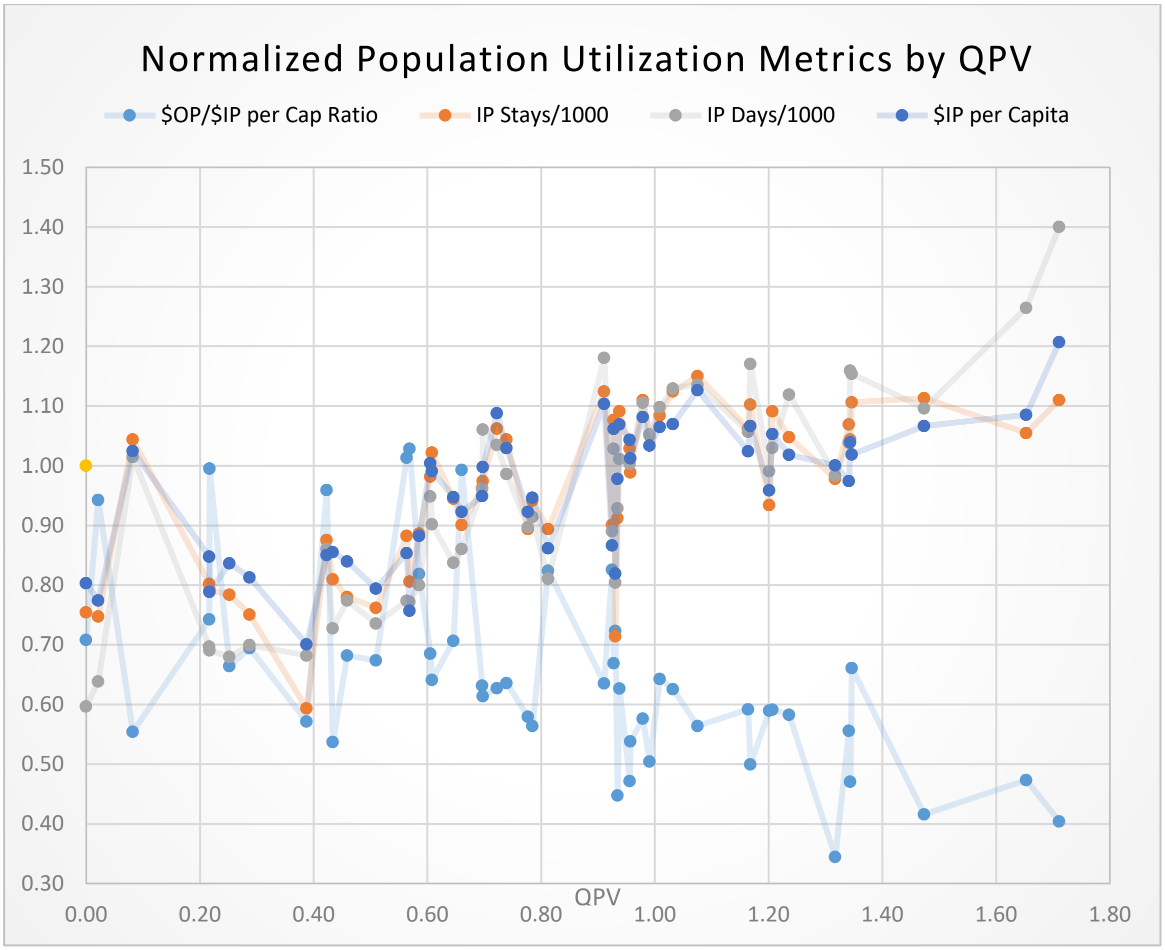
It is reasonable to expect that lower utilization of outpatient services in a state will result in more per capita hospital stays, bed days and inpatient expenditures (e.g., less same day outpatient surgery results in more inpatient surgery). While there is no obvious reason to expect that the greater volume of inpatient services due to a lower utilization of outpatient services will be delivered at a lower level of inpatient quality, the relationship between inpatient care and outpatient care is complex. For example, an underuse of observation in the ED can lead to more admissions from the ED which in turn impacts inpatient performance as measured by the QPV. While the interrelationship between inpatient and outpatient care is complex, in general, a greater volume of hospital services can be impacted by:

- Underutilization of outpatient services
- Poor quality outcome performance resulting in more bed days from excess complications and more admissions due to excess readmissions or excess admissions through the ED
- Excess bed day utilization due to poor length of stay management

To examine bed day utilization, the (A-E) and $(A-E) per discharge for length of stay (LOS) was computed for each state. In the computation of the A and E for LOS, patients who died, left against medical advice or were transferred out were excluded. Low outliers were removed and high outliers were capped at the high outlier value. See Appendix C for LOS results by state. The correlation between the QPV and the $(A-E) per discharge for length of stay is r=.58 (p<.001) meaning that states with poor QPV performance tend to have poor length of stay performance (use more bed days than expected). So states with poor QPV performance tend to underutilize outpatient services, have higher than expect length of stays and higher per capita hospital stays, bed days and inpatient expenditures.

To illustrate the relationship between the QPV and the population utilization metrics, Figure 2 contains a line graph of the risk adjusted population utilization metrics (normalized so that 1.0 is the national average) by the QPV value for each state. The normalized risk adjusted population utilization metrics used in Figure 2 are contained in Appendix C. The horizontal axis is the QPV for the states with the states ordered from the lowest QPV value to the highest. The pattern of decreasing outpatient utilization and increasing hospital stays, bed days and per capita inpatient expenditures as the QPV value increases is illustrated by the line chart. It should be emphasized that the relationships between the QPV and the population utilization measures shown in Figure 2 are observational and not necessarily causal or predictive. A lower utilization of outpatient services may contribute to a higher utilization of inpatient services in a population, but it cannot be concluded that it is the direct cause of the higher utilization. There are too many intervening factors that can also contribute to the higher utilization of inpatient services in a population. However, the observed relationship can provide insight into the functioning of the delivery system in a state.

Figure 2: Normalized population utilization metrics by QPV



Discussion

Because the QPV is based on the clinically credible QOPM measures of quality outcomes, in-depth information is available to facilitate quality improvement efforts. For example, in the 3M Clinical and Economic Research report *Geographic Variation in Hospital Quality Performance in Medicare by Disease and Procedure Categories*[4] contains detailed results for the four QOPMs in the QPV across a broad range of disease and procedure categories for each state. Since QOPM performance is based on the level of variation from expected performance (A-E), QOPM performance differences identify opportunities where real performance improvement is possible. QPV performance across geographic regions can be influenced by socioeconomic factors like income level. The QOPM risk adjustment controls for the clinical condition of the patient and not for socioeconomic factors. If the socioeconomic factors impacting performance were incorporated into the risk adjustment, performance problems with the care given to some socioeconomic groups would essentially be hidden, making poor performance such as higher readmission rates appear acceptable for those socioeconomic groups. It is important to identify such performance problems because broad community-wide actions may be needed to address them. In the context of a payment system, it would be appropriate for additional adjustments and payments to be made for such socioeconomic factors as is done with the disproportionate hospital share adjustment in IPPS.

Arguably, the most successful payment policy reform has been the 1983 implementation of the Diagnosis Related Group (DRG) based IPPS. As noted in the original DRG research, a fundamental objective of the DRGs was “the ability to link medical and administrative decisions”.[5] A major reason why IPPS had such a dramatic impact on hospital cost inflation[6] was that it proved to be an effective language that linked the clinical and financial aspects of hospital care, thereby facilitating effective communication among all stakeholders. As illustrated by DRGs, any effective approach to achieving value in healthcare—a positive outcomes at a reasonable cost—will require a “language of value.”

QOPM performance can be the basis for integrating cost and quality into an operational means of measuring value. Because QOPMs are clinically credible and express performance differences in financial terms, they can serve as the uniform language of value. Regulators can use QOPMs to design value-based payment systems.[7] Because most of the QOPMs and methods of risk adjustment have been successfully used in statewide payment and reporting systems, their scalability to large system applications has been demonstrated.

While this report focuses on Medicare patients, the QOPMs are applicable to other federal programs including Medicaid, Medicare Advantage and the Veterans Administration as well as commercial payers, thereby providing the foundation for a uniform and consistent approach to hospital quality assessment and payment that produces real value. Healthcare providers can use the QOPMs for internal management. Commercial payers and can use QOPM performance in provider rate setting negotiations and for establishing value-based incentive programs. Consumers can use QOPM performance in selection of providers. The overall effectiveness of the delivery system will be enhanced by having all stakeholders using a common language of value. With a common language of value that focuses on high impact outcomes where real quality improvement is possible, lower healthcare cost and better quality outcome performance can be achieved.

Conclusions

Implicit in the MedPAC recommendations is the need to identify a limited number of quality outcomes that have a broad impact across the entire delivery system. Although the QPV was intended as a measure of quality outcome performance during an inpatient episode, it can provide insights into the overall utilization of hospital resources within the population of a state. States with poor QPV performance (higher QPV) tend to have a low utilization of outpatient services, higher than expected length of stays and a high utilization of inpatient stays and bed days contributing to higher per capita inpatient expenditures. Quality outcome performance during inpatient episodes of care as measured by the QPV provides a general indication of the overall functioning and effectiveness of the hospital delivery system in a state.

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Appendix A: QPV Normalization

The normalization factor that is applied to the QOPM performance per discharge to compute the QPV is computed as follows:

P(s) = QOPM performance per discharge for state s
Q(s) = Conversion factor applied to P(s) to compute QPV(s)

A series of positive and negative P(s) values can be normalized to be between zero and 1.0 with a normalization factor equal to

$$F(s) = (P(s)-\text{MIN } P(s))/(\text{MAX } P(s)-\text{MIN } P(s))$$

When P(s) = 0 the actual performance per discharge for the state s is equal to the expected performance per discharge for the state. The value of F(s) when P(s) = 0 is

$$-\text{MIN } P(s)/(\text{MAX } P(s)-\text{MIN } P(s))$$

Dividing F(s) by this amount will convert the 0-1 scale of F(s) to a scale with 1.0 as the value at which actual performance per discharge for state s is equal to the expected performance per discharge for state s

$$Q(s) = F(s)/(-\text{MIN } P(s)/(\text{MAX } P(s)-\text{MIN } P(s)))$$

$$Q(s) = ((P(s)-\text{MIN } P(s))/(\text{MAX } P(s)-\text{MIN } P(s)))/(-\text{MIN } P(s)/(\text{MAX } P(s)-\text{MIN } P(s)))$$

$$Q(s) = (P(s)-\text{MIN } P(s))/(-\text{MIN } P(s))$$

From the Table 1 the P(s) with the minimum value of P(s) is -588.12.

$$QPV(s) = (P(s)+588.12)/588.12$$

QPV(s) has the following properties:

QPV of 1 means the the actual and expected QOPM performance per discharge are equal
QPV greater than 1 means poor QOPM performance per discharge (A>E)
QPV less than 1 means good QOPM performance per discharge (A<E)
The QPV has a value of zero for the minimum P(s) of -588.12
A positive value of P(s) equal to the minimum value of 588.12 would have a QPV(s) equal to 2.0

Since the relationship between QPV(s) and P(s) is linear, they have a correlation of 1.0.

Appendix B: Population Utilization Metric HCC adjusted and normalized

State	IP Stays Per 1000	IP Days Per 1000	IP Per Cap Std Cost	OP Per Cap Std Cost	Ratio OP/IP Per Cap	QPV
Utah	0.85	0.67	0.9	0.93	0.71	0
Idaho	0.86	0.73	0.89	1.05	0.94	0.02
Alaska	1.1	1.07	1.08	0.89	0.55	0.08
Wyoming	0.98	0.85	1.03	1.25	0.74	0.22
Montana	0.94	0.82	0.94	0.75	1	0.22
Colorado	0.9	0.78	0.96	1.12	0.66	0.25
Oregon	0.85	0.8	0.92	1	0.69	0.29
Hawaii	0.65	0.74	0.76	1.02	0.57	0.39
Maine	0.94	0.93	0.91	0.74	0.96	0.42
Arizona	0.89	0.8	0.94	0.73	0.54	0.43
Washington	0.87	0.86	0.93	0.94	0.68	0.46
New Mexico	0.84	0.81	0.87	0.76	0.67	0.51
South Dakota	1.01	0.89	0.98	1.47	1.01	0.56
Vermont	0.97	0.93	0.91	1.09	1.03	0.57
Wisconsin	0.93	0.84	0.93	1.15	0.82	0.59
Minnesota	1	0.97	1.03	1.35	0.69	0.61
Kansas	1.11	0.98	1.08	1.21	0.64	0.61
Nebraska	1.05	0.93	1.05	1.09	0.71	0.65
North Dakota	0.99	0.95	1.01	1.15	0.99	0.66
North Carolina	0.96	0.96	0.95	1.54	0.63	0.7
Maryland	0.98	1.07	1.01	1.08	0.61	0.7
Oklahoma	1.06	1.03	1.09	1.17	0.63	0.72
Indiana	1.04	0.99	1.03	1.05	0.64	0.74
South Carolina	0.96	0.96	0.99	1.23	0.58	0.78
Virginia	0.99	0.96	1	1.15	0.56	0.78
Iowa	0.97	0.88	0.94	1.22	0.82	0.81
Louisiana	1.05	1.1	1.03	1.64	0.64	0.91
New Hampshire	1.05	1.03	1.01	1.3	0.83	0.93
Missouri	1.06	1.01	1.04	0.64	0.67	0.93
Arkansas	0.86	0.97	0.99	1.46	0.72	0.93
California	0.89	0.9	0.95	0.82	0.45	0.93
Ohio	1.08	1	1.06	1.03	0.63	0.94
Texas	0.99	0.96	1	0.84	0.47	0.96
Georgia	0.97	0.99	0.99	1.05	0.54	0.96
Kentucky	1.11	1.11	1.08	1.77	0.58	0.98
Tennessee	1.05	1.05	1.03	1.16	0.5	0.99
West Virginia	1.08	1.1	1.06	1.2	0.64	1.01
Mississippi	1.1	1.11	1.05	1.12	0.63	1.03
Michigan	1.09	1.07	1.06	1.05	0.56	1.08
Pennsylvania	1.05	1.05	1.01	0.98	0.59	1.16
Alabama	1.09	1.16	1.06	1.01	0.5	1.17

State	IP Stays Per 1000	IP Days Per 1000	IP Per Cap Std Cost	OP Per Cap Std Cost	Ratio OP/IP Per Cap	QPV
Delaware	0.96	1.02	0.99	1.74	0.59	1.2
Illinois	1.09	1.03	1.05	0.91	0.59	1.21
Connecticut	1.01	1.08	0.98	0.83	0.58	1.24
Nevada	1.03	1.04	1.05	1.12	0.34	1.32
Rhode Island	1.1	1.07	1	1.65	0.56	1.34
New Jersey	0.99	1.1	0.99	0.99	0.47	1.34
Massachusetts	1.1	1.14	1.01	1.12	0.66	1.35
Florida	1.05	1.03	1.01	1.2	0.42	1.47
New York	0.99	1.18	1.01	1.33	0.47	1.65
DC	0.97	1.22	1.05	1.35	0.40	1.71

Appendix C: Length of Stay $(A-E) Per Discharge

State	IPPS Hosps	IPPS Disch	LOS %(A-E)/E	LOS (A-E) per Disch	LOS $(A-E) per Disch	QPV
Alabama	84	191,576	7.12	0.31	785.68	1.17
Alaska	8	13,562	13.82	0.6	1,548.95	0.08
Arizona	63	163,729	-11.48	-0.53	-1,359.60	0.43
Arkansas	45	122,294	-3.27	-0.14	-369.29	0.93
California	297	769,090	-1.87	-0.08	-217.55	0.93
Colorado	45	109,204	-13.11	-0.61	-1,560.50	0.25
Connecticut	30	126,390	4.04	0.18	460.3	1.24
Delaware	7	36,117	6.38	0.28	729.91	1.2
DC	6	42,835	19.79	0.94	2,416.39	1.71
Florida	168	761,456	3.58	0.16	398.31	1.47
Georgia	101	274,277	0.8	0.04	93.23	0.96
Hawaii	12	21,769	12.42	0.57	1,457.10	0.39
Idaho	14	34,953	-12.83	-0.57	-1,458.85	0.02
Illinois	125	435,565	-3.77	-0.17	-439.98	1.21
Indiana	85	242,140	-4.78	-0.22	-552.43	0.74
Iowa	34	100,903	-4.79	-0.21	-546.66	0.81
Kansas	51	103,256	-8.48	-0.38	-968.96	0.61
Kentucky	64	186,566	1.34	0.06	152.16	0.98
Louisiana	90	157,068	-0.54	-0.02	-61.75	0.91
Maine	17	45,328	0.27	0.01	30.71	0.42
Maryland	47	238,725	9.34	0.42	1,086.94	0.7
Massachusetts	56	281,749	1.42	0.06	157.86	1.35
Michigan	94	375,028	-2.76	-0.13	-322.09	1.08
Minnesota	50	176,977	-10.37	-0.48	-1,239.80	0.61
Mississippi	60	132,717	0.91	0.04	100.51	1.03
Missouri	72	237,724	-3.75	-0.17	-439.81	0.93
Montana	14	30,211	-10.29	-0.47	-1,211.16	0.22
Nebraska	23	65,574	-7.16	-0.33	-845.02	0.65
Nevada	22	79,048	-4.81	-0.22	-565.09	1.32
New Hampshire	13	50,201	-2.28	-0.1	-253.99	0.93
New Jersey	64	318,746	10.47	0.46	1,178.16	1.34
New Mexico	30	45,364	-6.83	-0.31	-784.91	0.51
New York	149	561,058	19.45	0.84	2,139.96	1.65
North Carolina	85	332,563	-0.81	-0.04	-94.01	0.7
North Dakota	8	30,196	-4.38	-0.2	-517.9	0.66
Ohio	130	389,624	-7.71	-0.35	-901.54	0.94
Oklahoma	84	146,725	-2.54	-0.11	-287.7	0.72
Oregon	34	80,088	-7.36	-0.33	-852.39	0.29
Pennsylvania	150	443,701	0.54	0.02	61.74	1.16
Rhode Island	11	32,453	-4.5	-0.2	-504.94	1.34

State	IPPS Hosps	IPPS Disch	LOS %(A-E)/E	LOS (A-E) per Disch	LOS $(A-E) per Disch	QPV
South Carolina	54	172,271	3.14	0.14	352.15	0.78
South Dakota	20	36,711	-7.93	-0.35	-891.81	0.56
Tennessee	90	253,392	-1.79	-0.08	-204.74	0.99
Texas	309	689,785	0.78	0.04	90.17	0.96
Utah	31	50,506	-21.35	-0.97	-2,490.71	0
Vermont	6	18,046	1.75	0.07	190.91	0.57
Virginia	74	287,591	-1.11	-0.05	-127.12	0.78
Washington	48	174,665	-5.51	-0.25	-640.86	0.46
West Virginia	29	82,912	4.02	0.18	448.62	1.01
Wisconsin	66	152,351	-7.8	-0.36	-912.82	0.59
Wyoming	10	13,107	-12.69	-0.54	-1,388.25	0.22

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