Chapter 2
Terminology and Applications: Hospital Performance Measures

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Introduction

Hospital performance measures are created and applied for a myriad of reasons. They range from purely financial—how much it costs to produce something, to purely clinical—the patient did or did not contract another condition before discharge. Inherent in the use of hospital performance measures is the desire to increase value. Health care value is defined as quality (output) divided by cost (input) [1]. To transform health care delivery, hospital performance measures should be viewed through the lens of value.

While cost and quality are often the basis of hospital performance measures, it is important to understand the context of hospital payment incentives. Most United States hospitals are subject to different payment incentives from Medicare, Medicaid, and commercial insurance, including Blue Cross plans, health maintenance organizations, etc. The payment incentives, particularly Medicare, can drive behavior that directly or indirectly affect hospital performance on any measure or series of measures. Maryland's All-Payer Demonstration Model is a unique exception that attempts to align incentives across all payers and is worth exploring further.

In addition to hospital payment incentives, to successfully transform health care delivery, hospital leaders must be aware of payment incentives for other providers. In particular, how payment incentives for other providers may not align with hospital incentives, creating barriers to innovation. It is often not the financial incentive to try something different, but rather the financial barrier that prevents groups of providers from aligning with another. Hospital utilization measures, and some hospital "quality" measures can be affected by payment incentives for other providers.

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At their core, hospital performance measures provide clinical, financial, and operational leaders tools to manage the daily hospital business, and tools to improve the long-term efficiency and effectiveness of health care delivery. Clear, accurate, and timely data capture is essential to any performance measure. Data building blocks for hospital measurement include basic cost accounting, to complex documentation and coding. In all cases, the measures are subject to the validity of the data reported, requiring examination of a measure's use to address variation among hospitals, within a specific hospital over time, or both.

Overview

This chapter outlines performance measures in *three categories: financial measures, clinical measures, and "combination" measures that attempt to address hospital value.* By definition, the first two categories are easily segregated. The last category may reflect volume, service mix, service use, or a combination of any of these, plus measures that are part clinical and part financial. Additionally, performance measure uses are discussed. Use of the measure may dictate the best application, e.g., absolute performance of hospitals relative to one another, or individual hospital performance over time. Other considerations include defining hospital "costs" as hospital expenditures, versus hospital payments, or costs to health plans and other payers for services rendered.

On the surface, hospital financial measures are straightforward calculations involving easily reportable data. Basic unit cost measures have been used by hospitals for years to manage operations, from supply spending to departmental efficiency. However, unit costs, or prices paid for hospital expenditures, reflect only one driver of hospital costs. The other driver of hospital costs is the volume of services used. Beginning with resource use under a per admission payment system, and ending with resource use in a per capita model, the volume of services used can have a profound effect on hospital costs and hospital payments.

Cost measures only make up the denominator in the value equation. *To provide value, hospitals must also demonstrate high quality.* Clinical performance measures are used to evaluate the quality of hospital care provided during the stay. These measures are generally classified into either *process measures—did you do something* evidence based to improve the patient's health, or *outcome measures—did the patient get better or worse* as a result of the hospital stay. In both categories, the underlying data inputs are crucial to how the measures are viewed and how they change over time.

"Combination" measures may encompass a wide range of calculations to determine relative performance. A simple utilization measure used to compare hospitals is case-mix adjusted length of stay, designed to measure hospital inpatient efficiency while adjusting for differences in service mix. On a case mix adjusted length of stay basis, the hospital will look more efficient with a decline in patient days. At a broader level, the same hospital may look no more or less efficient on a case mix adjusted

admission basis if variable costs, or payment levels, do not decline with the decline in patient days. In a payment system with strong financial incentives to reduce readmissions, a measure of clinical effectiveness, the hospital may actually keep the patient the same or even longer, if doing so avoids a readmission. In this case, the marginal cost of keeping the patient an extra day must be lower than the financial penalty of having the patient return to the hospital for a second admission.

Payment incentives to hospitals, and, payment incentives to other providers, affect the overall cost of care. In the example above, the hospital may reduce length of stay to improve inpatient efficiency by simply shifting service use to another setting like skilled nursing care or home health. The hospital generates a cost savings but there is a cost increase with the other service use. Depending on the downstream provider's financial incentives, the other provider's cost of care may be below, the same, or above the truncated hospital use. In the readmission example, the hospital faces two different financial incentives from Medicare. The hospital will receive payment for the additional admission (provided it is not a hospital acquired condition) yet could be subject to a penalty from Medicare if overall readmissions at the hospital place it in the bottom quartile of national readmission rates.

Finally, *the underlying data captured to report hospital performance measures is an important, if not the most important, driver of results.* Hospital financial data tend to be system generated and then analyzed on a per unit, per day, or per admission basis. These cost data are derived from the hospital's underlying direct and indirect cost. The direct cost of supplies and other items is easily tracked. Allocating hospital overhead to calculate unit costs including indirect costs is subject to the method of allocation. Clinical measures tend to come from hospital abstract data and are manually reported, e.g., Medicare value-based purchasing data, or from hospital medical record data that rely on physician documentation and the efficacy of hospital coding. Both areas deserve scrutiny to determine real effect on performance measures as they involve manual data capture and a level of professional judgment from the physician and the coder. Data used for risk-adjusted hospital comparisons is subject to availability and consistency across hospital, state, and national sources.

Financial Measures

Hospital financial measures have long been used to assess hospital performance, for both individual departments and the overall hospital. Hospitals with effective cost accounting systems can accurately track changes in unit cost performance over time. On an aggregate basis, hospitals can compare the cost of an admission or adjusted admission to each other, usually with some risk adjustment. However, the underlying cost per unit measures may be vastly different without the same cost allocations. At a very high level, one can also compare hospital and health care costs on a per beneficiary or per capita basis, though there are a number of factors that influence the validity of the denominator in this measure.

Table 2.1 Unit cost and direct cost

	Unit of Measure	Direct cost per unit	Units	Total cost
Med/surg unit	Patient days	$800.00	3	$2,400
Radiology	RVU's	20.00	50	1,000
Operating room	Minutes	40.00	75	3,000
Anesthesia	Minutes	0.50	75	38
Supplies	Direct Cost	15,000.00	1	15,000
Drugs	Direct Cost	100.00	1	100
Total cost per admission				$21,538

Unit Cost Measurement

At a basic level, hospitals can calculate the per unit input cost of service delivery. Table 2.1 provides an illustration of the direct cost per unit involved in an inpatient stay.

Even this is an inexact science since the staffing costs are typically averaged by dividing nursing unit expenses by the overall volume for a given period. The same is true for ancillary service use, though relative value units (RVUs) are used to equate the intensity of the service performed. Medical supply and drug costs can be calculated based on the actual use of billable supplies. Non-chargeable supplies, while usually 100 % variable, are likely lumped into billable supply costs, charged to the nursing unit and spread over the number of patients served.

Table 2.1 reflects the estimated direct cost of a total joint replacement. As shown in Table 2.1, the hospital incurred $21,538 amount for the overall stay. Of this amount, $15,000 was consumed in direct supply cost. The other direct costs for nursing and ancillary personnel are semi-variable as some level of minimum staffing is required to keep the unit open.[1] From a performance measurement standpoint, the hospital can compute the input costs per unit and try to improve its unit cost efficiency by reducing the input cost of supplies, labor, or both. While it may be difficult to compare absolute cost performance at this level to other hospitals, the hospital can easily measure its cost performance over time to determine if certain initiatives are working.

Table 2.2 reflects the results of two recent programs implemented by the hospital.

First, the hospital implemented a different staffing mix, increasing the number of nurse extenders and decreasing the number of nurses. This resulted in an average savings of $100 per day, or a 13 % reduction in direct room and board costs. Second, the hospital implemented a standardized supply program, reducing the cost of the implant used by $3,000, or 20 %. Overall all, the direct cost for the patient was reduced by 15 %, largely driven by the reduction in supply cost. Since these compu-

[1] For an excellent explanation of direct and indirect costs, and, fixed, variable, and semi-variable costs in hospitals, see Health Care Budgeting and Financial Management, Second Edition William J. Ward, Jr. Praeger, an imprint of ABC-CLIO ISBN 978-1-4408-4428-7.

Table 2.2 Direct cost before and after hospital cost reduction programs

	Before hospital programs			After hospital programs			
	Direct cost per unit	Units	Total cost	Direct cost per unit	Units	Total cost	Savings (%)
Med/surg unit	$800.00	3	$2,400	$700.00	3	$2,100	13
Radiology	20.00	50	1,000	20.00	50	1,000	0
Operating room	40.00	75	3,000	40.00	75	3,000	0
Anesthesia	0.50	75	38	0.50	75	38	0
Supplies	15,000.00	1	15,000	12,000.00	1	12,000	20
Drugs	100.00	1	100	100.00	1	100	0
Total cost per admission			$21,538			$18,238	15
Cost savings						$3,300	

tations reflect only a change in unit costs and not underlying volume, there is no need to adjust for the variability of costs with volume.

Table 2.3 overlays the indirect hospital costs. Indirect costs include pure fixed costs (depreciation, interest) and other highly fixed costs (administration, compliance, malpractice expense).

After adjusting for the indirect cost allocation, the total cost of the original example is now $29,076. When the savings programs are implemented, the hospital cost reduction was the same in absolute dollars, but the percentage savings was lower because the overall cost base is higher.

As reflected in the examples, hospitals can measure the unit cost inputs within the same service, with or without adjusting for indirect cost. Per unit costs are useful when measuring the performance of cost reduction initiatives over time, at particular location. The data are easy to gather and use to compute the result, assuming the same use.

Per Admission Measures

The next aggregation of hospital cost measurement is typically on a per admission basis. Unlike the unit cost example, the per admission measure has two cost input variables—unit cost and the number of units of service used during the stay. When aggregating data from multiple patients within a single service line, the data may also be risk or service mix adjusted, based on Medicare Severity Diagnosis Related Groups (MSDRGs) or some other equivalent of service mix.[2] More importantly, if the payment is the same on a per admission basis regardless of the utilization, any reduction in utilization should produce a financial return.

[2] The term "case mix" is also used interchangeably, referencing an admission or "case" admitted to the hospital.

Table 2.3 Direct and indirect costs before and after hospital cost reduction programs

	Before hospital programs				After hospital programs				
	Direct cost per unit	Indirect cost per unit	Units	Total cost	Direct cost per unit	Indirect cost per unit	Units	Total cost	Savings (%)
Med/surg unit	$800.00	$280.00	3	$3,240	$700.00	$280.00	3	$2,940	9
Radiology	20.00	7.00	50	1,350	20.00	7.00	50	1,350	0
Operating room	40.00	14.00	75	4,050	40.00	14.00	75	4,050	0
Anesthesia	0.50	0.18	75	51	0.50	0.18	75	51	0
Supplies	15,000.00	5250.00	1	20,250	12,000.00	5,250.00	1	17,250	15
Drugs	100.00	35.00	1	135	100.00	35.00	1	135	0
Total cost per admission					$29,076			$25,776	11
Cost savings								$3,300	

Table 2.4 reflects the same example used in the unit cost analysis.

In this case, the hospital recently improved its discharge efficiency and reduced its length of stay from 3 days to 2 days. However, we also introduce cost variability into the equation. As underlying volume increases or decreases, percentages of the direct and indirect costs are fixed, remaining constant with the change in volume. For illustrative purposes, we will assume that 80 % of the nursing costs are variable, reflecting some portion of fixed staffing cost on the nursing unit. In real world management, nursing unit costs reflect a "step function." In a step function, costs are fixed until the increase or decrease in volume justifies opening or closing of a nursing unit, respectively. We also assume that 90 % of the indirect overhead costs, administration, patient accounting, etc., are fixed as they remain relatively unchanged with volume. In this example, the other costs are fixed as they are assumed to be provided on the first or second day (surgery, X-ray, etc.).

As shown in Table 2.4, the hospital generated a 2 % cost reduction per admission by reducing the length of stay from 3 days to 2 days. On an individual admission, the financial performance improved slightly when compared to the unit cost example. If length-of-stay improvements are generated on a wide basis, the cost effect multiplies, particularly if declining volumes result in closing a unit as reflected in the step function. Some of the indirect cost is also further reduced (e.g., dietary, housekeeping, etc.), compounding the savings. As an alternative to closing a unit, additional financial benefits may accrue if the now empty beds are back filled with patients waiting in the queue for services.

The per admission measure can be useful when comparing costs among physicians in the hospital or when comparing costs across hospitals. Using Medicare case mix index (CMI), the hospital can aggregate patients by physician in a particular service line as a useful tool to compare the average cost per patient.[3] Comparing aggregate hospital efficiency can be accomplished by aggregating expenses generally (all hospital expenses per discharge) or by aggregating expenses for a particular service if the data are available (e.g., orthopedics, total joint replacements, etc.).

Table 2.5 compares case mix adjusted cost per admission between two physicians, assumed to practice the same type of service (orthopedics) but with a different mix of cases. Assume the two physicians perform only two types of cases, total joint

[3] Though CMI is a measure of the severity of cases treated, it is not a perfect measure. Medicare CMI is a measure of average resource use, based on the grouping of admissions into categories with similar service use (e.g., total joint replacement, influenza, etc.). However, the underlying case weights assigned to a particular MSDRG are based on Medicare claims data and therefore reflect Medicare patients only. Discharges from other payers may reflect higher or lower resource use. Applying Medicare CMI to compare all payer per admission costs across hospitals may not accurately reflect the true service mix as the patient populations can vary. MSDRGs though severity adjusted, measure severity adjusted resource use as determined by Medicare payments, and may not reflect patient complexity if applied to all patients. Other groupers, such as the 3M's All Patient Refined Diagnostic Related Group (APRDRG) logic use different coding logic and different groupings. Case weights may also vary depending on the discharges used to predict the underlying resource use. State Medicaid programs use different grouping logics and a different patient population than the Medicare grouper.

Table 2.4 Direct and Indirect Costs, Volume Changes, and Volume Variability

	Before hospital programs						After hospital programs						
	Direct cost per unit	% Variable	Indirect cost per unit	% Variable	Units	Total cost	Direct cost per unit	% Variable	Indirect cost per unit	% Variable	Units	Total cost	Savings (%)
Med/surg unit	$800.00	80	$280.00	10	3	$3240	$800.00	80	$280.00	10	2	$2572	21
Radiology	20.00	80	7.00	10	50	1350	20.00	80	7.00	10	50	1,350	0
Operating room	40.00	80	14.00	10	75	4050	40.00	80	14.00	10	75	4,050	0
Anesthesia	0.50	90	0.18	10	75	51	0.50	90	0.18	10	75	51	0
Supplies	15,000.00	95	5,250.00	10	1	20,250	15,000.00	95	5,250.00	10	1	20,250	0
Drugs	100.00	95	35.00	10	1	135	100.00	95	35.00	10	1	135	0
Total cost per admission						$29,076						$28,408	2
Cost savings												$668	

Table 2.5 Case mix adjusted cost per admission

	Physician 1	Physician 2
Average length of stay	5	3
Total costs	$750,000	$500,000
Total admissions	10	10
Unadjusted cost per admission	$75,000	$50,000
Medicare CMI	5.00	3.00
Case mix adjusted cost per admission	$15,000	$16,667

replacements (lower intensity) and spinal reconstruction (higher intensity). Using these assumptions, we can measure efficiency on a relative, per admission basis.

In this comparison, Physician 1 admitted 10 patients with an average length of stay of 5 days, with total costs of $750,000, or $75,000 per admission. Physician 2 also admitted 10 patients with an average length of stay of 3 days, with total costs of $500,000, or $50,000 per admission. Physician 1 reflected a case mix of 5.0, for a case mix adjusted cost per admission of $15,000. Physician 2 reflected a case mix of 3.0, for a case mix adjusted cost per admission of $16,667. On an unadjusted basis, Physician 1's cost per case is 50 % higher than Physician 2's cost per case. After adjusting for CMI, Physician 1's cost per case is actually 10 % lower than Physician 2's cost per case. *A strong understanding of risk adjustment is vital in evaluation of individual physicians as well as negotiating prospective payments.*

Per Capita or per Beneficiary Measures

At the highest level, hospital costs can be measured on a per beneficiary or a per capita basis. This type of measure is best used to compare aggregate costs for a group of hospitals in a wide geographic area. For example, statewide total hospital cost or the statewide total hospital payments could be calculated, divided by the total population, resulting in a per capita cost/payment that could be compared to other states. (Note: in-migration and out-migration will affect the denominator). The same measure could also be used to determine per beneficiary costs or payments for a defined number of beneficiaries in a health plan.

Unlike unit costs or even per admission costs, per capita spending is much more likely to be affected by the use of services rather than the underlying service cost. The Medicare Accountable Care Organization (ACO) model seeks to align incentives by improving population health and reducing avoidable resource use, rewarding the ACO with financial incentives that can be shared with the participating providers. The new Maryland All-Payer model uses the same concept to measure hospital spending, both on a per capita basis and on a Medicare per beneficiary basis.

Table 2.6 compares the year-over-year hospital spending performance of State A on a per capita basis. In this example, State A reduced hospital spending by reducing

Table 2.6 Year over year statewide hospital spending per discharge and statewide hospital spending per capita

State A	Year 1	Year 2	Change	% Change
Hospital payments	$10,000,000,000	$9,660,000,000	$(340,000,000)	−3.4
Discharges	800,000	736,000	(64,000)	−8.0
Payment per discharge	$12,500	$13,125	$625	5.0
Hospital payments	$10,000,000,000	$9,660,000,000	$(340,000,000)	−3.4
Population	5,900,000	6,077,000	177,000	3.0
Payment per capita	$1,695	$1,590	$(105)	−6.2

hospital discharges by 8 % while per admission costs actually rose. (For illustrative purposes, this assumes net zero in-migration and out-migration for hospital services.)

This type of measure is a departure from the historic focus on unit cost and per admission utilization controls. It is consistent with the triple aim goal to reduce costs by reducing per capita spending [2], regardless of the underlying cost inputs. The data may or may not be case mix adjusted, depending on the use. The Maryland model does not adjust for service mix. Rather it sets a fixed, annual growth ceiling for all payer per capita spending, and a variable Medicare per beneficiary spending target, relative to national hospital spending per beneficiary growth.

The Maryland demonstration model is in its third year. Though early in its implementation, the model has demonstrated early progress by exceeding the required targets in year 1 [3]. As service delivery evolves under this model, one might expect consolidation of services, particularly at hospitals with lower volumes that result in higher fixed costs. In other single payer countries, complex procedures are often cohorted at fewer locations to allocate indirect and fixed costs over a larger volume base. The impact of the new Maryland model on the hospital delivery is underway, though it may be several years before these significant types of market movements occur.

Hospital Clinical Quality Measures

As the US health care system transforms from volume to value, clinical performance measures play an increasingly important role in hospital management, payment incentive design and consumer awareness. Clinical performance measures tend to fall into two categories: evidence-based process of care (process) measures and outcome measures, though there is not a strict definition. A third category, patient perception of the hospital stay is by definition an "outcome measure," reflecting how the patient *felt* about his or her stay in the hospital. However, these are not clinical outcomes—hospital acquired infection, mortality, etc. There are advantages and disadvantages to either category, depending on the context of

measure use. Both clinical measure categories begin with the same idea: how do we quantify "hospital quality" to inform hospital stakeholders. *Over time, the focus on hospital performance has migrated to outcome measures, but there is conflicting evidence that measuring outcomes alone can improve quality* [4].

One challenge of using clinical performance measures is the sheer volume of quality data collected. QualityNet.org identifies and organizes CMS quality measures for different types of service providers [5]. Though comprehensive for CMS, other payers may require different data reporting. Hospital resources are consumed because of the vast reporting required. Hospital resources are not only used to collect and report quality data, but also to review, validate, audit, secure, and most importantly leverage the data to improve the hospital's relative performance.

This section focuses on CMS's Acute Care Hospital Quality Improvement Program Measures since they are consistent across all US hospitals. There are four main CMS quality incentive programs in the CMS quality improvement environment. They include:

- Hospital Inpatient Quality Reporting (IQR) program
- Hospital Value-Based Purchasing (VBP)
- Hospital-Acquired Condition Reduction Program (HACRP)
- Hospital Readmissions Reduction Program (HRRP)

These four programs combine both process and outcome measures. In addition to these programs, clinical performance measures are released on CMS's HospitalCompare website for public consumption.

Process Measures

Process of care measures emerged as the first generation of clinical data used to measure hospital performance. Medicare's Inpatient Quality Reporting (IQR) program was implemented in 2003 as part of the Prescription Drug Act. Initially, hospitals were required to submit process of care data to Medicare or receive a 0.4 % reduction to the annual Medicare Inpatient Prospective Payment System (IPPS) payment update. In 2008, hospitals faced a 2.0 % reduction to the annual payment update if the data were not reported.

Process measures used by CMS have evolved over time, based on the effectiveness of their adoption. A current IQR process measure is Fibrinolytic Therapy Received Within 30 min of Hospital Arrival for acute myocardial infarction (AMI) patients. Fibrinolytic therapy is a proven treatment for the management of AMI, reflecting improved outcomes by following the process [6]. Prior to 2015, there were several process measures for AMI treatment originally in IQR, including Aspirin at arrival and Beta-Blocker prescribed at discharge. These measures have been removed, not because they were determined to be ineffective, but because they were "topped out," as being followed close to 100 % of the time by all hospitals. These process measures are now voluntarily reported.

As referenced in the fibrinolytic therapy example, process of care measures are clinically accepted based on published and peer reviewed evidence. Once determined to be effective, the treatment protocol can be built into a hospital's process of care, with the expectation that the process will improve patient outcomes. As hospitals continually move toward value-based care delivery, process measures should be constantly plotted with respect to outcomes, to validate that the supposed process improvements are improving health outcomes. The topped out measures suggest that hospitals are following accepted process measures, yet outcomes could vary, reflecting other clinical improvements or different patient populations that appear similar on the surface.

Outcome Measures

One definition of a health care outcome measure states it as a measure of quality of medical care, the standard against which the end result of the intervention is assessed [7]. Another non-health care source defines an outcome measure as the determination and evaluation of the results of an activity, plan, process, or program and their comparison with the intended or projected results [8]. In either case, the outcome can be defined as the *result* of something.

Hospital outcome measures may apply to different patient populations within the hospital. Certain outcome measures have a limited denominator, or patient pool from which the measure is applied. For example, CMS is collecting hospital 30-day, all-cause mortality rates following AMI hospitalizations. In this example, the pool of patients is limited to patients that were hospitalized for AMI. Expanding further, CMS measures rates for central line-associated bloodstream infections (CLABSI) and catheter-associated urinary tract infections (CAUTI). These outcome measures reflect the entire pool of patients at the hospital, minus those admitted with an infection.

It is critical to understand how outcome measures can be affected by hospital interventions, the nature of the population and the intersection of both. One process measure is use of prophylactic antibiotics received within 1 h prior to surgical incision, a clinical or hospital intervention. It can be assumed that following this intervention should lead to better performance on various outcome measures including surgical site infections, or in the near term, hospital readmission for surgical site infections. Other outcome measures, such as 30-day readmission rate for heart failure patients may correlate with the severity of the patient population. Even of all process of care measures are followed during the initial hospital stay, if the patient has significant underlying complications, the readmission rate may be higher. Case mix adjustments can be used to risk adjust the population used in the 30-day heart failure readmission example, but CMI may not fully adjust for all underlying clinical differences.

Defining Value: The Intersection of Financial and Quality Measures

After separately exploring both financial and quality measures, we turn to applying both to determine hospital value. Value may be determined in the aggregate, overall cost versus overall quality, or in subcategories, process measures followed versus resulting outcomes. In both cases, the goal is to determine value, or the quality of care for the cost, or payment, incurred.

At the highest level, a simple way to examine value is to use an *XY* plot of hospital cost versus outcomes. Figure 2.1 reflects an aggregate plot of hospital cost per admission versus a composite outcome score.

In this example, there are four quadrants, relative to the average of the hospitals measured: high cost/high quality, high cost/low quality, low cost/high quality, and low cost/low quality. Though crude, this measure provides basic illustration of value.

On the cost side, a hospital's cost or payment per admission is inherently weighted by the average of all costs or payments for the patient population. Therefore, a hospital with a higher proportion of normal deliveries relative to intensive surgical procedures is expected to have a lower overall cost per admission. Developing a composite outcome measure is more subjective, depending on the method of weighting each outcome. Weighting the outcomes equally is one method, while a different method might weight the outcomes on the volume of each patient pool reflected in the outcome. In the normal delivery versus surgical case example, if the hospital has a higher proportion of deliveries, then one might weight the percentage of obstetric patients higher to weight the percentage of obstetric complications higher.

Adjusting one or both sides of the measures (cost or quality) may reveal a different picture. For example, large academic medical centers typically have higher

Fig. 2.1 Cost versus quality

costs than smaller community hospitals for three reasons: mix of patients, teaching costs, and disproportionate share costs. The first reason is straightforward, as academic medical centers tend to treat the most difficult and complex patients. The other two reasons affect cost both directly—actual resident salary costs, and indirectly—the underlying utilization from clinical training and from treating a poor population. As an example, the aggregate hospital cost measure could be adjusted by the percentage of Medicare add on payments for IME and DSH, attempting to eliminate the variation.

When adjusting the value measure, it is important to understand the actual measures used in the plot. Many clinical outcome measures are inherently risk or case mix adjusted, eliminating the need to further adjust for service mix differences. On the cost side, it could be argued that costs should also be adjusted by service mix to reflect the resources used to treat the hospital's patients. Depending of the use of the value measure, both may be valid. The unadjusted measure may be used to strictly determine quality as a result of spending, while the adjusted measure may be used to justify variation in costs related to underlying circumstances, e.g., the social benefits from additional resource use, such as physician training or treating an underprivileged population.

Below the aggregate level, the value measure can be divided into subclassifications related to hospital specialties. For example, a hospital specializing in open heart procedures may want to analyze its value relative to other open heart hospitals by comparing the average cost per discharge for AMI patients versus the 30-day readmission rate. In this example, the comparison attempts to limit the value proposition to a single specialty reflected in the purpose of the comparison.

If the cost and quality variables are analyzed separately, it may not be a value measure by simple definition, but could still prove instructive. For example, one could analyze the process of care measures versus outcomes to focus on the clinical quality. Plotting fibrinolytic therapy versus 30-day AMI readmissions is an example of this. On the cost side, one could analyze case mix adjusted length of stay versus the overall cost per admission to determine if length of stay is a predictor of costs. Over time, if length of stay decreases, one would expect the overall cost per case mix adjusted admission to decrease.

Payment Incentives and Underlying Data

Payment Incentives

When using hospital performance measures, payment incentives, whether for hospitals or for other providers, can impact cost and quality. Medicare's IPPS is based on an average payment per admission. Therefore, if a hospital reduces length of stay or other underlying resource use and in theory, the associated variable costs, the hospital becomes more efficient by retaining a higher marginal return on each per discharge payment. The hospital, especially if part of a larger integrated delivery

system, may use other services such as skilled nursing or home health to discharge patients to a lower cost setting, improving the hospital's performance.

In this example, one should examine the downstream financial and quality outcomes. On the quality side, analyzing the patient population in cohorts may be instructive to the resulting outcomes. For example, break the hospital discharges into several categories: discharges to skilled nursing, discharges to home health, and discharges to home. Plotting the hospital readmission rate from each classification may help the hospital identify areas of focus, if the readmissions rate from one classification is higher than the others. As discussed previously, a service mix adjustment from the pool of discharges might be applied to normalize for the variation in patient populations discharged to the various services.

In another example, length of stay could be plotted against the hospital's readmission rate in the aggregate or for a particular specialty. If the readmission payment incentive is stronger than the per admission efficiency incentive, the hospital might analyze length of stay to determine if keeping the patient longer is actually *more* efficient than improving hospital service use. If the readmission rate declines with longer length of stay, it would suggest that the additional length of stay is beneficial to reducing readmissions. Though they are both considered to be hospital performance measures, the two payment incentives must be thoroughly analyzed to determine the most efficient service use.

Another downstream effect may be to compare hospital spending to total spending, understanding the divergent nature of payment incentives. For example, if the hospital reduces length of stay by discharging patients to a skilled nursing provider near the end of the hospital stay, the hospital may improve its efficiency. However, if the skilled nursing provider is paid on a per diem basis, it does not have the same incentive as the hospital to reduce its length of stay. Medicare payments to SNFs are based on resource use per day, with a certain limit. Even with resource adjustments, the SNF is paid on a per day basis, in theory, with a financial incentive to keep the patient until the benefit expires. Here, the hospital may reduce length of stay by a few days, but it might lead to a longer stay in SNF than the last few days of the hospital stay.

On a per capita or per beneficiary spending basis, differing payment incentives may affect the total spending per capital or per beneficiary. Maryland's All-Payer model requires that the state generate $330 million in hospital savings over 5 years by maintaining the growth in hospital spending per Maryland Medicare beneficiary below the national average. Additionally, Maryland hospitals are limited to an annual global budget, or a fixed hospital revenue amount per year, no matter the change in hospital use. However, the All-Payer model also limits the growth in total spending per Maryland beneficiary to the growth in national spending per Medicare beneficiary over 2 years. Thus, Maryland hospitals are incentivized to reduce hospital use, but the Medicare total spending guardrail means that replacing hospital use with other services must result in overall system efficiency, not just hospital efficiency. CMS is also evaluating this type of total cost of care guardrail in other models, such as hospital physician gainsharing arrangements.

Underlying Data

Though the focus of this chapter is on the application and use of hospital performance measures, the underlying data used in these measures is critical to reflect actual performance. Without the appropriate data capture and reporting, hospital performance on a given measure may vary from period to period.

The data used for hospital measures are generally garnered from five sources:

- Medical records
- Patient surveys
- Hospital claims
- Hospital surveys
- Hospital costs

These five sources result in the data captured and reported on a variety of clinical and financial measures.

Medical records and hospital claims are used to determine performance on most clinical quality measures. Relying on documentation and coding, the medical record is the primary source used for underlying process of care and clinical outcome measures or a per patient basis. *The importance of timely, accurate physician, and nursing documentation cannot be overstated for its effect on performance measures.* In particular, conditions present on admission must be captured and reported. Otherwise the hospital's scores for hospital acquired conditions may be inaccurate. Medical record data abstraction involves manually capturing data from the medical record for reporting on process of care measures, whether the data are input into an electronic database such as Medicare's Electronic Clinical Quality Measurement (eCQM) format or reported separately. Abstracting personnel require appropriate training and oversight, and the hospital should review or audit the abstractions for accuracy.

Hospital claims data are used to measure aggregate patient outcomes and may also be used to aggregate payments to measure payment per unit of service. These data are generally more straightforward and easier to capture than medical record data, but are still critically important. Clinical performance measures such as 30-day measures of mortality and hospital readmissions are derived from claims data. Payment levels captured reflect third-party payment for services and may be aggregated on measures of financial performance. If both cases, accurate medical record numbers, dates of service, and charging will affect the resulting measures.

Patient surveys and hospital surveys are used to capture Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) and National Health Safety Network (NHSN) data. HCAHPS data reflect the patient's view of their treatment in the hospital, and may be more subjective because these data are based on a patient's perception of their hospital treatment. The NHSN survey data are used in structural measures of hospital effectiveness, such as the Hospital Survey on Patient Safety Culture and the Safe Surgery Checklist. Hospitals should have adequate processes in place to collect and report these data on a timely and accurate basis.

Hospital cost data are typically generated by hospital financial and information systems to capture the expenses of patient care. As outlined in the cost measures section, costs can be measured on a per unit, a per admission, or an overall hospital basis. The level of sophistication of any hospital's cost accounting, decision support, or other systems vary, making it difficult to compare performance across hospitals. Since the inception of cost-based reimbursement dating back to the late 1960s and early 1970s, the annual Medicare cost report summarizes the direct patient care and indirect overhead costs by hospital. Hospitals can use these data for cost comparison purposes, since it is relatively prescriptive for cost allocation. These data are aggregated in CMS's Hospital Cost Report Information System (HCRIS) data, summarized by Medicare cost center.

Conclusion

There are endless ways to define and measure hospital performance. Both cost and clinical quality measures serve as the basic inputs to the value equation. Hospital leaders, regulators, health plans, and other stakeholders should understand the use and application of the measure in question, along with understanding the payment incentives and data that drive performance.

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