Linking quality and cost indicators to measure efficiency in health care

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Contents

Purpose of the commissioned paper

The National Quality Forum has commissioned a paper to assess alternative approaches to link measures of quality and cost for the purpose of measuring efficiency in health care. This paper reviews various approaches—both established and novel— to measure efficiency. These include composite measure approaches and approaches that keep the quality and cost domains separate when assessing efficiency. The paper also considers the implications of alternative methods for profiling and scoring providers based on their measured efficiency. In addition to assessing the technical issues related to measuring and profiling efficiency, we will consider the implications for using alternative approaches in the context of various programs, such as the creation of tiered insurance networks and value-based payment.

A substantial literature has also been devoted to understanding and measuring efficiency in healthcare.[1] While questions of efficiency in healthcare have been of interest for decades,[2,3] this interest has accelerated in recent decades.[4] However, as identified by a recent systematic review commissioned by AHRQ, considerations of quality of care have been largely absent from this literature.[4] Instead, to assess efficiency researchers have used a variety of techniques to understand how a given output (e.g. a hospital day) can be optimized for a given set of health care inputs (e.g. physician labor, nurse labor). This is the concept of economic efficiency. While the study of economic efficiency in health care is of great importance, it is not the focus of this paper.

Instead, we seek to evaluate the specific case in which cost (borne by the payer) is the input of interest and quality of care is the output of interest. As such, we are interested in the assessment of efficiency only through the joint consideration of cost and quality. We will not

consider approaches to the measurement of efficiency in health care – such as brand prescribing rates or rates of MRI for patients with back pain – that seek to identify relative resource use and appropriateness.[5] There is also a large literature concerned with the relationship between costs and quality,[6-9] and a smaller literature on relationship between economic efficiency and quality.[10] While relevant to the concept of efficiency that we seek to understand, this literature is not primarily concerned with profiling individual providers on the basis of efficiency.

Our goal in writing the commissioned paper is to help build consensus about the key considerations and appropriateness of alternative approaches for combining quality and cost measures into quantitative measures of efficiency. This paper will serve as a foundation to inform the deliberations of a multi-stakeholder expert panel that will provide input on the methodological challenges to linking cost and quality measures and the best practices for combining cost and quality measures to assess efficiency of care.[11]

Definitions

This project will reference a number of common terms that may have different connotations for different audiences. Throughout this project, we will apply the definitions from the National Quality Forum's Patient-Focused Episodes of Care project:[12]

Quality of care: measures performance on the Institute of Medicine's (IOM) six aims for healthcare: safety, timeliness, effectiveness, efficiency[1], equity, and patient-centeredness.

Cost of care: measures total healthcare spending, including total resource use and unit price(s), by payor or consumer, for a healthcare service or group of healthcare services associated with a specified patient population, time period, and unit(s) of clinical accountability.

Efficiency of care: measures the cost of care associated with a specified level of quality of care. "Efficiency of care" is a measure of the relationship of the cost of care associated with a specific level of performance measured with respect to the other six IOM aims of quality.

Value of care: measures a specified stakeholder's (such as an individual patient's, consumer organization's, payor's, provider's, government's, or society's) preference-weighted assessment of a particular combination of quality and cost of care performance.

[1] Dennis noted that there is a circularity here in that efficiency is noted as being part of quality. He has a point.

Section 1. Why combining quality and cost measures to measure efficiency in health care matters

Improving the efficiency of health care delivery in the United States is critical. Recent attempts at system reform, such as pay-for-performance and public quality reporting, have failed to reduce cost growth.[13,14] By focusing primarily of quality measures of underuse – such as non-adherence with evidence-based care – these programs have not provided direct incentives for increased efficiency. Previous efforts to reign in cost growth through managed care, such as capitated payment and utilization review, were seen as attempts to reduce costs at the expense of quality of care.[15]

To address these shortcomings, the Patient Protection and Affordable Care Act created numerous initiatives that are intended to improve the *efficiency* of US health care –not quality or cost alone. These initiatives include the Physician Value-Based Payment Modifier,[16] Hospital Value-Based Purchasing,[17] The Medicare Advantage Quality Bonus Program,[18] Accountable Care Organization programs,[19] and the End-stage renal disease pay-for-performance program. More directly, legislation was introduced in 2009 to replace the standard update to physician payments with a geographically based "value index," which would adjust payments to physicians according to their relative quality and cost.[20]

On the private side, a number of insurers have developed products with tiered networks that are based on measures of efficiency. These products are structured to increase patient cost-sharing for using providers that are designated in a lower-efficiency tier. The first generation of these programs established tiers based almost exclusively on costs.[21] However,

insurers have developed a range of increasingly sophisticated approaches to combine indicators of costs and quality to categorize the efficiency of providers. These efforts are related to the rise of high-deductible health plans and consumerism. Patients need both quality and cost information in order to make informed choices about the services they need and the providers they should use. In addition, given the price sensitivity to plans currently sold in insurance exchanges created through the ACA,[22] there is some speculation that insurers are moving towards narrow networks in order to compete on price.[23] This will likely increase insurers' use of tiered networks based on measures of provider value. Other promising private sector efforts, such as reference pricing,[24] will likely need to explicitly integrate provider quality measurement to gain greater acceptance.

These reforms require both quality and cost performance to be measured and assessed together. These ongoing initiatives share a common set of goals: 1) To better identify high and low efficiency providers; 2) To foster incentives for providers to improve efficiency. Broader efforts to better identify the relative value of health care services are related, but rely on a different set of tools and policy measures (e.g. comparative effectiveness research).

However, the desire to use efficiency measures has outpaced scientific consensus about how best to incorporate these measures into accountability efforts. As shown in section 2 of this paper, this lack of consensus for combining cost and quality measures can be seen by the disparate use of measures of efficiency across the public programs. Also, while many of the private payer efforts to combine quality and cost have similar features, they differ in important ways.

The use of efficiency measures in United States health care has reached an inflection point. Efforts are moving ahead without a clear sense of the best approach to do so. The issues surrounding combining quality and cost measures are certainly challenging: one recent report described the state of efficiency measurement as "woefully inadequate."[25] Two high profile efforts tasked with grappling with these issues failed to recommend a strategy to do so.[26] Now is the time to develop a set of best practices to guide the future development, evaluation, and use of efficiency measures in health care.

Section 2. Options for combining quality and cost measures

Methods for environmental scan

We performed an environmental scan to identify existing approaches that were currently in use by Medicare, private payers, and other program sponsors that combine indicators of quality and cost measures to assess efficiency. We also identified novel approaches that link quality and cost indicators that are not currently in use by a program sponsor but have been developed by researchers. To be included, an approach must assess cost as an input and one or more measures of quality as the output.

We searched the PubMed databases for published articles in the English language that appeared in journals between January 1990 and April 2014. Search terms included "quality", "measuring," and "cost." We searched the bibliographies of retrieved articles looking for additional relevant publications. We then searched Google Scholar, the Cochrane Database, and conducted other general internet searches for the same search terms. This provided resources that were not limited to peer-reviewed journals.

We also solicited information from the National Quality Forum's Expert Panel on Linking Cost and Quality. The materials referred to us by the expert panel frequently led to the discovery of additional approaches. We also obtained detailed information on approaches that we knew had been initiated (for instance, in Medicare).

After identifying all of the programs that simultaneously assessed quality and cost, as well as approaches proposed by researchers, we identified and described a set of mutually exclusive approaches that combine quality and cost measures to measure efficiency. We then

described the basic features of these approaches. Next, we identified the programs that have used quality and cost indicators to profile the efficiency of providers. This includes programs that are currently running as well as those that are now defunct. For these programs, we obtained information on several parameters: the name of the program, the services evaluated (e.g. hospital only, physician only, all services), the level of attribution (e.g. hospital, physician practice, individual physician), the specification of quality, the specification of cost, and the approach used to combine quality and cost indicators.

Approaches used to combine quality and cost measures

We identified seven approaches that are currently in use or have been proposed by researchers to combine quality and cost indicators to measure efficiency.

The conditional model: This approach, described by Timbie and Normand as the "Univariate" approach[27] and by Tompkins et al. as the "Net-Incentive Payment Model"[28] assesses efficiency as the conditional combination of quality and cost. The approach proceeds in four steps: first quality is assessed either by a single indicator or by a composite measure; second cost is assessed, typically by a single measure of total costs; third, either or both of the quality and cost domains are classified into performance groups – frequently as "low", "average", or "high" – using specified criteria; fourth, the quality and cost classifications are combined to assess efficiency. A common approach is to define high efficiency providers as those that are classified as both high quality and low cost. Alternatively, the Net-Incentive Payment Model assess the difference in costs between providers within the same quality grouping. The Conditional Model is widely used by private payers to create tiers of providers based on their efficiency.

The Quality Hurdle Model and Cost Hurdle Model: A variation on the Conditional Model is the Quality Hurdle Model. This model follows the first three steps of the Conditional Model. Then, providers are subject to a minimum quality standard, the hurdle, before their cost performance is assessed. After meeting this minimum quality standard, providers may be judged on cost performance alone or may be evaluated based on their combination of quality and cost performance. A variation on the Quality Hurdle Model is the Cost Hurdle Model. Here, providers are evaluated on quality performance only after meeting a cost standard, which is typically defined as having costs that are below a specified growth rate. Hurdle Models are commonly used for shared savings programs.

The Unconditional Model. The unconditional model follows the first two steps of the Conditional Model. Then, the quality and cost domains are assigned weights and combined into a single metric. Thus, in the Unconditional Model, quality and cost are scored independently and then combined. This is the model currently used by Hospital Value-Based Purchasing.

The Regression Model: The regression model, proposed by Timbie and Normand,[27] profiles provider quality while conditioning on cost. While it is conceptually similar to the Conditional Model, it has the advantage of using regression analysis to account for the within-provider correlation between quality and cost outcomes. In contrast, the approach taken by the Conditional Model does not account for any correlation between the quality and cost domains. The regression model is not currently used by any program sponsor.

The cost-effectiveness model: The cost-effectiveness model, proposed by Timbie and Normand,[27] differs from the other approaches in that it assigns a dollar value to the patient

182 benefits accrued from quality domain. By doing so, this approach can dramatically change
183 efficiency profiles. For instance, using the Unconditional or Conditional Model, a hospital
184 with excellent mortality outcomes may be classified as having only moderate efficiency if it
185 also has high costs. However, if the benefit of increased survival is appropriately valued
186 and the absolute cost differences between this hospital and others are not great, this high
187 cost hospital may in fact have excellent efficiency: it is producing desirable health outputs
188 at a lower cost than other hospitals. A similar approach towards efficiency measurement
189 was developed by Kessler and McClellan to evaluate the cost-effectiveness not of
190 individual providers, but of the characteristics of hospitals.[29]

191 **The Data Envelopment Analysis or Stochastic Frontier Analysis Model**: This approach is
192 used to identify the efficient production of quality across all observed levels of cost.[30,31]
193 The efficient frontier is modeled and providers' efficiency can then be evaluated based on
194 their distance from the efficient frontier. One of the key advantages of this approach is
195 that it allows efficiency to be evaluated across continuous measures of cost and quality. It
196 therefore does not require classification of providers into categories based on what may be
197 arbitrary threshold values, a shortcoming of other approaches. This approach has been
198 widely used in academic research to assess economic efficiency in health care, although
199 almost exclusively in cases in which the output of interest is something other than quality
200 of care.[10] This approach is not currently used by any program sponsors to evaluate
201 provider efficiency.

202 **The Side-by-Side Model**: This approach does not combine the quality and cost domains in
203 any way. It follows the first two steps of the Conditional Model, displays the results in

summary form, and ends there. This model typically emphasizes the clear and intuitive display of indicators of quality and cost (e.g. star ratings). However, by leaving the specific combination of cost and quality unspecified when assessing efficiency, this model leads directly to value estimations by stakeholders.

Programs using cost and quality measures to assess efficiency

Table 1 describes 32 identified programs that link indicators of cost and quality to measure efficiency. For 10 of these, we were not able to obtain basic information on the specification of the program. We therefore describe the characteristics of 22 programs for which we were able to obtain sufficiently complete information.

Of these programs, 6 profiled physicians or physician practices, 5 profiled hospitals, 3 profiled both physicians and hospitals, and 8 profiled health systems or health plans. To combine quality and cost indicators, 4 of the identified approaches used the Conditional Model, 5 used the Unconditional Model, 4 used the Side-by-Side Model, and 6 used the Quality Hurdle or Cost Hurdle Model. The method used to combine quality and cost indicators was unclear for 3 programs.

220 **Table 1.** Summary of programs that combine quality and cost indicators to measure efficiency

	Name of program	Services evaluated	Level of attribution	Specification of quality	Specification of cost	Approach to combining quality and cost
1.	Aetna Aexcel [32]	12 categories of specialist services.[2]	Specialist and physician practice level	Volume (at least 20 episodes in the last year) clinical performance structure measures (use of technology, certification) completion of performance-based improvement module claims based measures (HEDIS, readmissions, in-hospital complications)	All costs attributed to specialists for specific episodes of care	Variation on Quality Hurdle model. Quality and volume are assessed first. If costs are lower than threshold based on peer performance, providers are designated for Aexcel network.
2.	Blue Cross and Blue Shield Blue Distinction Centers® for Specialty Care[33-35]	6 categories of specialty services[3]	Hospital	Nationally consistent measures based on structure, process, outcomes, and patient experience. Hospitals must meet quality thresholds for each domain. Measures were developed with input from the medical community.	All costs for specific episodes of care (including facility, professional, other). Each provider's cost of care is calculated on an episode basis, using allowed amounts based on Blue Plans' claims data. The cost of care criteria takes into account outliers, patient level risk factors, and geographic	Quality Hurdle Model

[2] Cardiology, Cardiothoracic surgery, Gastroenterology, General surgery, Neurology, Neurosurgery, Obstetrics and gynecology, Orthopedics, Otolaryngology/ENT, Plastic surgery, Urology, and Vascular surgery

[3] Six specialty care areas are included: Spine Surgery, Knee and Hip Replacement, Cardiac Care, Transplants*, Bariatric Surgery* and Complex and Rare Cancers*. The three specialty care areas with asterisks have Blue Distinction Centers; Blue Distinction Center+ designations will continue to roll out in other areas, beginning with Transplants in early 2014.

	Name of program	Services evaluated	Level of attribution	Specification of quality	Specification of cost	Approach to combining quality and cost
					variation, before each facility is assessed against a consistent national benchmark.	
3.	Blue Cross Blue Shield of Illinois and advocate health care[36]	All covered services for Advocate health care, a not-for-profit integrate system	System level	Performance for 12 measures	Global budget target	Combination of Quality Hurdle and Cost Hurdle Models.
4.	Blue Cross Blue Shield of Michigan Hospital P4P program[37]	Hospitalized patients with specific index admissions	Hospital	Composite index of collaborative Quality Initiatives, population based, performance, all-cause readmissions	Diagnosis standardized cost-per-case	Unconditional Model. Payments are based on the weighted sum of quality and cost domains
5.	Blue Cross Massachusetts Alternative Quality Contract [38]	All covered services	Alternative Quality Contract provider organizations	32 ambulatory measures, 32 hospital measures. 5 Quality "gates" for each measure, resulting in different bonus payments. Outcome measures are triple weighted. Non-linear function between quality score and payout. [39,40]	Global budget target	Unconditional Model. High quality is rewarded as a bonus, can equal up to 10% of global budget. [4]
6.	Blue Shield of California Network Choice program (discontinued) [41,42]	Inpatient	Hospitals	Patient experience, 14 process measures, participation in initiatives from Leapfrog	Inpatient costs	Unclear
7.	Buyers Health Care Action Group Purchasing Initiative[43,44]	All services	Care systems in Minneapolis/St. Paul	Patient experience and participation in quality improvement initiatives.	Total costs	Side-by-Side Model

[4] The AQC can be conceptualized two different programs that are not directly connected: a shared savings program and a quality bonus program.

	Name of program	Services evaluated	Level of attribution	Specification of quality	Specification of cost	Approach to combining quality and cost
8.	Cigna Care Designation[45]	22 categories of specialist services[5]	Physicians and physician groups	5 domains related to National Committee for Quality Assurance (NCQA) Physician Recognition; Group Board Certification; Composite quality index on adherence to 101 Evidence-Based Medicine (EBM) Rules; American Board of Internal Medicine Process Improvement Module Completion; Certified Bariatric Center Affiliated Surgeons.	Costs related to episode Treatment Group (ETG) methodology	Conditional Model. Providers are compared by specialty within markets.
9.	Cigna Collaborative Accountable Care[46]	All covered services	Large primary care or multispecialty practices, integrated delivery system, of physician-hospital organization.	Composite measure assessing adherence to evidence based medicine for preventive care, chronic care, and acute care.	Unclear	Quality Hurdle Model
10.	Health Partners Relative Resource Use[47]	Primary care, specialty care, and hospitals	Physicians, physician practices, and hospitals	Separate composite measures for primary care, specialty care, and hospitals. Components of composite differ for different types of services.	Uses NQF endorsed total cost of care measure. Encompasses all services with/without price standardization.	Side-by-Side Model
11.	Hospital Value-Based Purchasing	Part A and Part B Medicare services	Hospital	Sum of performance score for individual measures in various domains (outcomes, clinical process, and patient experience)	Episode covering standardized payments from 3 days prior and 30 days following	Unconditional Model

[5] Allergy and Immunology, Cardiology, Cardio-Thoracic Surgery, Colon and Rectal Surgery, Dermatology, Ear, Nose and Throat, Endocrinology, Family Practice, Gastroenterology, General Surgery, Hematology and Oncology, Internal Medicine, Nephrology, Neurology, Neurosurgery, Obstetrics and Gynecology, Ophthalmology, Orthopedics and Surgery, Pediatrics, Pulmonary, Rheumatology, and Urology

	Name of program	Services evaluated	Level of attribution	Specification of quality	Specification of cost	Approach to combining quality and cost
					hospitalization.	
12.	Leapfrog Hospital Rewards Program[48]	Patients hospitalized with AMI, pneumonia, or child birth, or receiving CABG or PCI.	Hospital	Composite score of multiple measures. Uses a two-level weighting approach based on potential of indicator to reduce mortality and the importance of the indicator to the employer.	Inpatient costs	Conditional Model
13.	Maine Health Management Coalition	Adult care, pediatric care, and hospital care	Physicians, physician practices, and hospitals	Composite measure based on Bridges to Excellence / Hospital Compare measures categorized into "low", "good", "better", and "best"	Whether practice is "working to control cost"	Side-by-Side Model
14.	Maryland multi-payer patient-centered medical home program[36]	All covered services	Primary care practices	21 quality measures; and reductions in use of high-cost services.	Total costs for assigned patients.	The Cost Hurdle Model.
15.	Medica and Fairview health services[36]	All covered services for Fairview Health Services, a non-profit health system	System level.	Minimum quality gate, then confidential algorithm	Global budget target	Unclear.
16.	Medicare Physician Group Practice Demonstration	Part A and Part B Medicare services	Integrated delivery systems	Performance for 32 ambulatory care performance measures.	Total costs per capita for aligned beneficiaries	Unconditional Model (it seems)
17.	Medicare Shared Savings and Pioneer Accountable Care Organization programs[49]	Part A and Part B Medicare services	Accountable Care Organization	Composite measure of patient/caregiver experience (7 measures); Care coordination/patient safety (6 measures); Preventive health (8 measures); At-risk population: Diabetes (1	Payment standardized total costs per capita for aligned beneficiaries	Quality Hurdle Model

	Name of program	Services evaluated	Level of attribution	Specification of quality	Specification of cost	Approach to combining quality and cost
				measure and 1 composite consisting of five measures); Hypertension (1 measure) Ischemic Vascular Disease (2 measures); Heart Failure (1 measure); Coronary Artery Disease (1 composite consisting of 2 measures).		
18.	NCQA relative resource use[50]	Condition-specific costs for people with specified chronic diseases.[6]	Health plan level by product (e.g. HMO, PPO)	Composite measure based on HEDIS indicators relevant to disease area	Annual condition-specific costs for all relevant services	Side-by-Side Model
19.	Physician Value-Based payment modifier	Part A and Part B Medicare services	Physician practice	Composite measure of clinical care, patient experience, population/community health, patient safety, care coordination, and efficiency.	Composite measure of total costs per capita for attributed beneficiaries, and for beneficiaries with specific chronic disease	Conditional Model
20.	Tufts Health Plan primary care "Blue Ribbon" program[51]	Primary care	Physician practice	7 HEDIS process of care measures and 7 patient experience measures. Calculate adjusted composite process scores (z-scores), and composite scores for patients experience (z-scores). Scores were then summed and renormalized.	Primary care Episode Treatment Groups	The Conditional Model. The quality and cost domains are standardized and combined with equal weighting. To be designated with the "Blue Ribbon", providers must be above the median on both the quality and cost domains, as well as the combined domain.

[6] Asthma, cardiovascular conditions, COPD, diabetes, and hypertension

	Name of program	Services evaluated	Level of attribution	Specification of quality	Specification of cost	Approach to combining quality and cost
21.	UnitedHealth Premium[52-54]	25 categories of specialist services.[7]	Physician, physician practices	Composite score based on evidence based medicine measures related to preventive care, appropriate care, chronic disease care, patient safety, sequencing of care, and care outcomes.	Risk adjusted total cost of care (population cost), and episode cost measurement.	The Unconditional Model. Provider designations are made separately for cost and quality based on statistical criteria. It's unclear how the different designations translate into payment or cost sharing differences.
22.	Virginia Cardiac Surgery Quality Initiative[55]	All cardiac surgical patients	Surgeon and hospital	Extensive structure (volume), process, and outcome (mortality and complication) measures.	Normalized hospital and surgeon charges[8]	Side-by-side Model. Comparisons are made for anonymized hospitals and are primarily on quality measures.
23.	Castlight health precise cost and	Unknown specifications	-	-		

[7] Allergy, Cardiology, Cardiology – Electrophysiology, Cardiology – Interventional, Endocrinology, Family Medicine, General Surgery, General Surgery - Colon/Rectal, Internal Medicine, Nephrology, Neurology, Neurosurgery – Spine, Ophthalmology, Obstetrics and Gynecology, Orthopedics - Foot/Ankle, Orthopedics – General, Orthopedics – Hand, Orthopedics - Hip/Knee, Orthopedics - Shoulder/Elbow, Orthopedics – Spine, Orthopedics – Sports Medicine, Pediatrics, Pulmonology, Rheumatology, and Urology

[8] Ref http://www.sciencedirect.com/science/article/pii/S0003497509005761]

	Name of program	Services evaluated	Level of attribution	Specification of quality	Specification of cost	Approach to combining quality and cost
	quality					
24.	Humana	Unknown specifications	-	-	-	-
25.	Massachusetts Group Insurance Commission value-tiering program[56,57]	-	-	Composite based on 79 quality measures relevant to particular providers	-	unclear
26.	Minnesota Smart Buy Alliance	Unknown specifications	-	-		
27.	PacifiCare Select Plan[41]	Hospitals, unknown specifications	-	-	-	-
28.	Puget Sound Health Alliance	Unknown specifications	-	-		
29.	Regence Blue Cross Blue Shield of Oregon Select Network[58,59]	Unknown specifications	-	-	-	-
30.	Tufts Health plan high performance network	Hospitals, unknown specifications	-	-	-	-
31.	Wellpoint	Unknown specifications	-	-	-	-
32.	Wisconsin Department of Employee Trust Funds Three-Tier Health Insurance Program	Unknown specifications	-	-	-	Unclear. Insurance tiers are created based on cost effectiveness. Patients have lower cost sharing for tiers deemed to be more cost effective.

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Section 3. Preliminary summary of findings and identification of key discussion points

Our environmental scan highlights a number of key issues related to combining quality and cost indicators to measure efficiency in healthcare.

First, there are numerous extant approaches and no clear consensus about best practices. Of the 21 identified programs, we documented five broad approaches to combine quality and cost indicators. There is considerable variation within these approaches. Many of the quality measures included in the quality domains include only measures that are endorsed by the National Quality Forum or by professional societies. The cost measures used to assess efficiency, however, have generally not been endorsed by the National Quality Forum.

Interestingly, the measure sets used to assess quality for many of the approaches taken by the private payers are more expansive than those used by the public payers. For instance, many of the private efficiency efforts profile specialist physicians, who have been largely ignored by public programs. The purpose of efficiency measurement is also different in the public and private efforts: the public efforts seek to use efficiency measurement to adjust provider payments whereas the private efforts use efficiency measurement to create tiered networks or for shared-savings programs.

The alternative approaches used to combine cost and quality measures have a number of pros and cons. The Conditional Model, the Unconditional Model, the Side-by-Side Model, and to a lesser extent the Hurdle Models all have the benefit of being relatively easy to understand. (Many of the program sponsors emphasized the importance of transparency, describing efficiency measurement in simple terms on their website but also publishing detailed

methodology reports.) However, these approaches suffer from two separate aggregation problems that may undermine their validity. First, quality is almost always defined using multiple measures, and some kind of weighting scheme is required to summarize the performance of providers on these measures. The opportunity model, in which weights are based on the number of patients that are eligible to receive a given measure, remains a common approach to create composite measures of quality. Another approach, used by the Alternative Quality Contract, assigns triple the weight to outcome measures relative to process measures. Both of these approaches to weighting measures, however, are largely arbitrary. A recent paper found that among 13 commonly used quality indicators, 7 of them accounted for 93% of the benefits to population health.[60] If weights assigned to individual performance measures do not reflect their importance to the health of patients, weighting schemes will, at a minimum, obscure the signal between observed quality and patient health.[61]

Second, as previously described, efficiency measurement has the potential to reach erroneous conclusions about the relative efficiency of providers when the relationship between measured quality and patient health is not well defined. If quality is measured by patient survival, then small improvements have the potential to yield large efficiency gains, even at large costs. However, if quality is measured by a series of measures that have little relationship with improved patient health, large improvements may not yield efficiency gains, even at small costs. [27]

For health care costs, there is a divergence in the practice of price standardization. The public programs (Hospital Value-Based Purchasing, the Physician Value-Based Payment

Modifier, and the ACO programs) standardize payments when measuring efficiency. The private plans vary with respect to price standardization, but tend not to standardize prices.

There also appears to be a general ambivalence on the part of program sponsors with respect to harmonization the quality and cost domains. This includes harmonization of the quality and cost domains for the same populations of patients (i.e., cost is often assessed for all patients while the quality measures apply to a narrower set of patients), for the same time intervals of measurement (i.e., the quality measures were assessed over much longer time windows than the cost measures), and the methods used to risk adjust for cost and quality outcomes (e.g. Hospital Value-Based Purchasing uses different approaches for quality and cost).

Over time, efficiency profiling appears to have shifted away from hospitals and towards profiling the efficiency physicians and physician practices. The early efforts in efficiency profiling focused on hospitals,[21] but many now profile physicians and physician groups. This may have to do with the increase in ambulatory measures and advances in physician attribution methodology but may also reflect the increased bargaining power of hospitals.

Importantly, for the examined approaches for combing quality and cost measurement, there is virtually no assessment of the reliability and validity of efficiency measurement.[4] In almost all cases, a single measure of efficiency is not defined. Instead, efficiency is defined through the joint consideration of quality and cost, with classification typically based on threshold values for both scales. While there is widespread recognition of the small n problem associated with efficiency measurement, the most common solution to this problem is to use a sample size cut-off as an exclusion criterion for providers' data to be profiled. Outside of Hospital Value-Based Purchasing, Bayesian reliability adjustment is not used to increase the

reliability of efficiency measurement, although Leapfrog has used reliability adjustment for some surgical mortality measures. [62]

Implications for the National Quality Forum measure endorsement process

To date, few stand-alone measures are being used to assess efficiency. Instead of endorsing specific efficiency measures, the National Quality Forum could instead choose to endorse a process to combine quality and cost indicators to measure efficiency. A number of measure developers have already developed detailed processes to measure efficiency that they could submit for National Quality Forum endorsement, either now or in the near future.

If the National Quality Forum decided to endorse approaches to efficiency measurement it could consider a number of guidelines. First, the National Quality Forum could stipulate that the quality and cost measures used to measure efficiency should have been previously endorsed. If not, the developer would have to provide a compelling reason. Second, the National Quality Forum could provide guidance with respect to whether specifications of quality and cost measures should be harmonized. This may result in the modification of the specifications of measures that have previously been endorsed by the National Quality Forum. Third, the output of the efficiency measures should meet the standards of scientific acceptability established by the National Quality Forum. Specifically, efficiency classifications should be reliable and valid, and statistical testing should be able to demonstrate this.

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