Prospective Value-Based Assessment Of New Health Care Technologies and Practices

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The last half of the 20th century presented a dramatic increase in new health care technologies and improved health care practices. The results have been largely predictable: People live longer and enjoy healthier lives, but they experience skyrocketing health care expenditures. The relationship between benefits and costs seems clear. You get what you pay for. Or do you?

As new technologies or interventions are developed and introduced, governments, providers, and payers determine whether the new technology or intervention should be permitted, used, or paid for, respectively. They are often trying to determine whether it is appropriate or whether it has value. The expected advantages and disadvantages of the new technology or practice are evaluated in terms of a variety of measures, including patient outcomes and costs. In the case of new technologies, this process often is performed prospectively, without the availability or use of evidence-based outcomes studies. Expected outcomes and costs must be projected. The assessment process involves answering questions such as:

- What are the advantages for patients?
- What are the expected costs for third-party payers?
- How will providers' revenues be affected?
- How are employment-related costs affected (e.g., disability income benefits, lost productivity)?
- Does the new technology represent an expected increase or decrease in long-term health care costs for the community as a whole?
- If there are additional costs involved, are they outweighed by the potential benefits?
- How can the perspectives of all parties be adequately represented in a single measure of value?

This paper discusses the process of value assessment, and presents a proposed value assessment methodology that can be used to evaluate any health care technology, procedure, drug, or medical management process.

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This paper has been peer reviewed by appropriate members of Managed Care's Editorial Advisory Board.

DEFINING "VALUE"

Key perspectives

"Value" must be defined in the context of a particular perspective or viewpoint. The definition of value varies by perspective, even though it is determined for a singular event. For example, a $100,000 experimental treatment that might extend the life of a terminally ill patient for a short time may have very high value to the patient, but may be attributed a lesser value by the patient's doctor, health insurance company, plan sponsor, or society.

In performing value assessment studies for new health care interventions, we recommend that value be assessed from several important perspectives, including those of patients, providers, third-party payers, and employers. In some cases, the perspectives of regulators or technology vendors may also be important. Each party will assess value differently, according to a variety of measurements. Table 1 presents some common measures that are used to assess value and indicates the perspectives from which each measure may be important. For example, measures associated with patient outcomes and convenience are usually important to patients and providers, but are less important to payers. On the other hand, the costs of health care services are important to patients and payers, but are of less concern to providers unless their revenues are affected.

In addition to the perspectives of each individual party, there is often a need to assess the net value from a community perspective. This type of assessment should consider all measures of value that may be important from any individual perspective, and the relative importance of each measure from the community's perspective. A demonstration of this process is presented later in this paper.

The pharmacy industry and government oversight agencies have developed evaluation approaches for testing new drugs. Most of these approaches focus on usefulness or effectiveness of the drug in easing a specific illness or condition. Few of these methodologies focus on the broader value index proposed in this document.

Time value/quality-adjusted life years

Although Table 1 describes a wide range of value measures, the list could

TABLE 1 Examples of measures used to assess value

	Measures that are important from each perspective		
	Patient	Provider	Payer
Patient convenience / satisfaction			
Pain during treatment	●	●	
Pain during recovery	●	●	
Treatment risks	●	●	
Complication rate	●	●	●
Hospital readmission rate	●		●
Blood loss	●	●	
Anesthesia risks	●	●	
Days in hospital	●		●
Duration of total treatment plan	●		
Quality of life improvement	●		
Mortality	●	●	
Provider ease of use			
Minutes per procedure	●	●	
Frequency of needing an assistant		●	●
Malpractice risk		●	
Health care costs / revenues			
Patient out-of-pocket expenses	●		
Third-party payer costs			●
Physician revenue			
Gross revenue		●	
Net profit		●	
Hospital revenue			
Gross revenue		●	
Net profit		●	
Work-related costs			
Days unable to work	●		●
Patient's lost wages	●		●
Disability income benefits paid			●
Cost of replacement labor			●

Notes: Many of theses measures can be expressed in more than one way. For example, third-party payer costs can be expressed as per encounter, per episode, per member per month, or in total dollars per year. Similarly, provider revenues can be expressed as per patient, per day, or in total dollars per year.

be much longer. It could include dozens of additional measures related to patient health status, frequencies of specific complications, or costs by phase of care or type of provider. Additionally, many of the measures can be expressed as a function of time. For example, improvements in patient health status can be measured in terms of the number of days needed to achieve various levels of functional status (e.g., walking with assistance, walking without assistance, or running), or in terms of the duration of a positive outcome (e.g., in the case of asthmatics, the number of months without being hospitalized).

The costs and expected values of all possible outcomes can also be discounted to reflect the *time value of money*, or the *time value of outcomes*. This adjustment can be applied to money (e.g., a dollar saved today has a greater value than a dollar saved 10 years from now), to health status improvements (e.g., one year of improved health today is worth more than one year of improved health 10 years from now), or to other measures. To illustrate, if we arbitrarily assume that an annual discount rate of 5 percent is appropriate, we can say that an intervention costing $5,000 two years from now has the same cost as an intervention costing $4,535 today. Different discount rates may be appropriate for different measures, especially in the case of financial measures versus quality-of-life measures. The discount rate used for financial measures should be related to market interest rates, whereas the discount rate used for quality-of-life measures should be associated with more subjective measures of personal utility.

The value of time is often incorporated into health care intervention assessments through the calculation of quality-adjusted life years, or QALYs, which reflect the change in a patient's quality of life over a given period of time. The QALY calculation is performed by assigning specific quality-of-life indices to a patient's health status at various points in time. The indices range from 0 to 1, with 0 indicating the lowest possible quality of life (i.e., death), and 1 indicating the highest possible quality of life. A medical intervention (e.g., new prescription drug that enables a person to lead a more active life) that increases a patient's quality of life from 0.50 to 0.75 for a period of five years is said to have a value of 1.25 QALYs ([0.75 – 0.50] x [5 years]) = 1.25 QALYs.

If the intervention that generated this outcome cost $5,000, then we can express its cost as $4,000 per QALY ($5,000 / 1.25).

Although the assignment of health status indices used in a QALY calculation is a highly arbitrary task, the final QALY measure does provide a pleasing quantification of value, and it is widely used in medical literature. It is limited in its ability to provide a uniform representation of value from differing perspectives. For example, a QALY measure may be very meaningful to a patient, but it does not explicitly recognize certain labor-related costs that may be important from the perspective of a self-insured employer (e.g., costs of disability income benefits).

The following sections of this paper describe a process to assess value and quantify it in the form of an index. This assessment process can incorporate any number of value measurements, including QALYs and the various other measures presented in Table 1, and it can present results that are meaningful from a variety of perspectives.

A PROPOSED VALUE-ASSESSMENT METHODOLOGY

The perspectives and measures presented in Table 1 provide a framework for assessing the relative values of competing health care technologies. For example, we can compare the value of a new technology to an existing technology by assigning qualitative or quantitative values to each of the measures in Table 1. The resulting report cards for each technology can then be compared to assess differences in value from each perspective.

The value assessment process should include at least the following steps:

Evaluate the technology from a clinical perspective. Evaluation by qualified clinicians, without any real or perceived conflict of interest regarding the technology, is needed to reliably assess how and when the new technology should be used, and to assess many of the measures associated with the patient perspective, such as pain, treatment risks, and quality-of-life improvements. From the clinical perspective, the most important question we need to answer is: Do we expect the new technology to provide better outcomes for the patients who use it? This evaluation process should clearly identify the following:

- Clinical indications for using the new technology
- Existing technologies that would be replaced, if any
- The comparison of the new technology to existing technologies with respect to specific outcome measurements, such as mortality, complication rates, infection rates, pain, blood loss, and recovery time
- Available treatment guidelines that need to be modified to incorporate the new technology
- Expected degree of patient acceptance of the new technology
- The ease with which providers are able to use the new technology
- Expected physician training time.
- Expected malpractice risk

Model-expected utilization and cost impacts. This modeling uses information from the clinical assessment to project the expected impacts on health care utilization and costs, and on employment-related costs. In measuring effects on health care costs, the most common treatment paths for the cohort of patients in question must first be identified. We can then project how those care paths would be altered by introduction of the new technology. Each care path should have an associated probability of occurrence, cost, duration of care, and other measures. The new technology may affect care paths through changes in hospital length of stay, shifts of services from inpatient to outpatient settings, changes in the probability of needing surgery, changes in the duration of recovery care, or any other changes in the care delivered.

Modeling should incorporate how the new technology will affect a patient's progression through various degrees of functional status and his ability to return to work. There are a variety of costs associated with a patient's inability to work, some of which may be important determinants of the technology's value from certain perspectives. For example, a small employer group that has a community-rated comprehensive health insurance plan may be relatively unconcerned about the total cost of the health care services it incurs, but very concerned about the duration of time that employees are unable to work. Therefore it is important to model the impact of the technology on such measures as time away from work, functional status at given points in time, lost productivity, disability income benefits, lost wages, and costs of replacement labor.

Identify key value measures, and assign values to them. This involves identifying measures of value that are important from each of the perspectives under consideration, and assigning scores to the new and existing technologies. Examples of such value measures were presented in Table 1. Qualitative measures, such as pain, may use descriptions such as "low," "moderate," or "high," whereas quantitative measures will typically include such units as dollar amounts, utilization rates, or probabilities. All measures can be discounted to reflect the amount of time before an expenditure, an outcome, or an event is expected to occur.

Quantify the overall value from each perspective. For each important perspective, we can group together the measures that are most pertinent, assign a numeric score to each measure, and then blend the scores together to get a composite "value index." From each perspective, we can then assess the relative net values of competing technologies by comparing their composite value indices.

Quantify the overall value from a community perspective. We can blend the value indices from each perspective to get an index that represents overall value to the community.

The next section of this report provides a demonstration of this value assessment process.

ILLUSTRATIVE CASE STUDY

Application of the concepts presented thus far can be illustrated in the form of a case study involving the evaluation of a new arterial stent that is purported to reduce the need for expensive coronary artery bypass graft operations (CABGs). At the end of the case study is a presentation of the value index calculation and its interpretation. To keep the illustration presented here relatively simple, we have not included any adjustments to discount the values of future costs or benefits.

All of the treatment paths and figures used in this case study have been created solely for the purpose of demonstrating our value assess-

ment process, and are not intended to be used for any other purposes.

Technology and patient population

A medical research firm has developed a new type of arterial stent that can be used in arteriosclerosis patients. The stent will provide an alternative to angioplasties, and it is expected to reduce the need for subsequent CABGs. The company claims that the stent can be safely inserted in an outpatient treatment setting. The retail cost of the new technology is $20,000 for reusable instrumentation needed to insert the stents, plus $1,000 for each stent.

The medical director of a local HMO is considering whether to recommend the new technology for payment by the HMO when used at its contracted hospitals. The following methodology was developed by the authors to independently assess the technology's value to the HMO, its patients, its providers, and to the community as a whole.

Clinical assessment

A team of clinical consultants reviews the new technology and concludes that it may offer a variety of advantages over existing treatment methods. Most of the potential benefits would be achieved by avoiding a CABG. The advantages include:

- Reduced anesthesia risk
- Reduced blood loss
- Reduced risk of complications or infection
- Reduced pain during recovery
- Reduced time in the hospital
- Easy insertion of the stent (the new device requires only 15 minutes for insertion, in addition to the time needed to perform the cardiac catheterization)
- Decreased rate of inpatient procedures (the stents can be inserted on an ambulatory basis in virtually 100 percent of patients)

Possible risks introduced by the new technology are primarily related to its lack of demonstrated success. They include slightly increased malpractice risk and unanticipated complications.

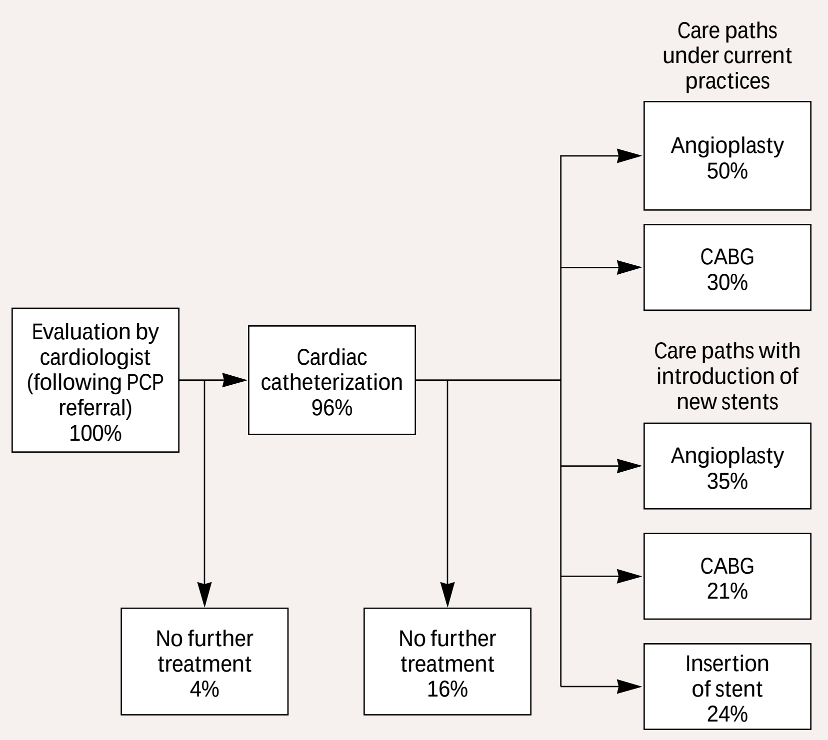
Episodic treatment model

With a clear understanding of the new technology and the types of patients on which it would be used, a team of clinicians and actuaries develops detailed descriptions of the care paths that these patients typically follow. Figure 1 provides a high-level overview of the most common treatment paths under two scenarios: current medical practice, and then with introduction of the new stent technology. Each path identifies the major types of treatments and the probabilities that they are needed.

Proponents of the new technology claim that by using the stents, a significant percentage of CABGs may be avoided. For illustrative purposes only, we have assumed that 30 percent of CABGs could be avoided through use of stents, and that 30 percent of angioplasty patients would also become stent patients. These assumptions are illustrated in Figure 1. For example, Figure 1 indicates that the new technology will reduce the probability of needing a CABG from 30 percent to 21 percent, implying a 30 percent reduction in the total number of CABGs (i.e., 1 – .21 / .30 = .30).

For purposes of this illustrative case study, we have modeled all care throughout the entire episode. We have assumed that an episode begins with a patient's initial referral from his PCP to a specialist and ends with a resolution to the problem. Alternatively, we could have chosen to focus our modeling efforts on only that portion of the episode that appears to be most affected by the new technology. For example, we could have chosen to ignore the costs of the initial visit to a cardiovascular specialist since those costs will not be affected by introduction of the new technology. The scope of the model needed usually depends on the perspectives of the interested parties. For example, from the perspective of a hospital, the costs of hospital services and their associated revenues will be of greatest interest. However, from the perspective of a workers' compensation health plan that accepts case rate cap-

FIGURE 1 Care Pathways for patients with chest pain



itation, it will be important to consider the costs of all care delivered throughout the episode.

Using the care paths as a guide, we then developed a highly detailed model of all care delivered throughout the episode. Table 2 is an excerpt from the full episodic treatment model. It provides a detailed description of the surgical and follow-up care that is expected to be delivered to patients who get the new stents. It shows the types and numbers of services that are delivered, the associated costs, the treatment setting, and the probability that each service is actually needed. By multiplying together the probabilities, the numbers of services, and the costs per service, we get the expected cost per service for each patient in the initial cohort.

TABLE 2 Excerpt from episodic treatment model: Insertion of arterial stents

Treatment phase: insertion of arterial stents | Cost basis: Illustrative fee levels | Cost center date: July 2, 2004

(a) Procedure frequency	(b) Treatment	(c) Provider type	(d) Procedure code	(e) Number of units	(f) Cost per unit	(g) Weighted price (a) x (e) x (f)
I. Pre-surgical care						
100.00%	1. Office visit, est. expanded focused	Physician	99213	1.0 visit	$33.64	$33.64
100.00%	2. CBC	Physician	85025	1.0 procedure	$7.59	$7.59
50.00%	3. Comprehensive metabolic panel	Physician	80053	1.0 procedure	$14.61	$7.31
50.00%	4. Basic metabolic panel	Physician	80048	1.0 procedure	$11.70	$5.85
100.00%	5. Urinalysis w/microscopy	Physician	81000	1.0 procedure	$4.37	$4.37
100.00%	6. Prothrombin time	Physician	85610	1.0 procedure	$5.43	$5.43
100.00%	7. Thromboplastin time, partial (PTT)	Physician	85730	1.0 procedure	$8.30	$8.30
100.00%	8. Lab studies, sedimentation rate	Physician	85651	1.0 procedure	$4.91	$4.91
					Subtotal:	**$77.40**
II. Surgery						
100.00%	1. Facility charge (outpatient)	Facility		1.0 case	$5,202.89	$5,202.89
100.00%	2. Facility charge for stent-insertion equipment	Facility		1.0 case	$86.67	$86.67
100.00%	3. Facility charge for stents	Facility		1.3 stent	$1,300.00	$1,690.00
100.00%	4. Transcatheter placement of stent (single vessel)	Physician	92980	1.0 procedure	$1,057.83	$1,057.83
30.00%	5. Transcatheter placement of stent (additional vessels)	Physician	92981	1.0 procedure	$297.29	$89.19
90.00%	6. Left heart catheterization	Physician	93510	1.0 procedure	$1,749.44	$1,574.50
90.00%	7. Injection procedure during cardiac catheterization	Physician	93543	1.0 procedure	$20.12	$18.11
10.00%	8. Left & right heart catheterization	Physician	93526	1.0 procedure	$2,331.93	$233.19
10.00%	9. Injection procedure during cardiac catheterization	Physician	93543	1.0 procedure	$20.12	$2.01
100.00%	10. EKG	Physician	93010	1.0 procedure	$11.11	$11.11
100.00%	11. X-ray exam, chest, 1 view (prof only)	Physician	71010–26	1.0 procedure	$9.57	$9.57
					Subtotal:	**$9,975.07**
III. Outpatient follow-up care						
100.00%	1. Office visit, est. expanded focused	Physician	99213	1.6 visit	$33.64	$53.82
40.00%	2. Exercise EKG	Physician	93015	1.0 procedure	$116.80	$46.72
40.00%	3. Stress echo	Physician	93350	1.0 procedure	$124.91	$49.96
40.00%	4. Myocardial imaging; multiple studies	Physician	78461	1.0 procedure	$254.82	$101.93
40.00%	5. Provision of diagnostic radiopharmaceuticals	Physician	78990	1.0 procedure	$163.62	$65.45
40.00%	6. Cardiac blood pool imaging; multiple studies	Physician	78483	1.0 procedure	$395.18	$158.07
100.00%	7. Antiplatelet medication	Rx		180.0 days	$0.03	$5.40
10.00%	8. Cardiac rehab	Physician	93798	14.0 procedures	$17.85	$24.99
					Subtotal:	**$506.34**

The costs are illustrative allowed charge levels that might be appropriate for a typical managed care plan.

Table 2 also includes charges related to the stents themselves. We have assumed that the facility will bill for the full retail price of the products, plus a 30 percent mark-up for the facility's profit. The per-patient charge for the reusable stent insertion equipment is based on a goal of recovering the purchase price over a three-year period, and assuming a caseload of 100 stent patients per year. As such, the per-patient charge for the stent insertion equipment is calculated as:

$20,000 x 130% / (300 patients)
= $86.67 per patient

Table 3 provides a summary of all health care costs projected with the episodic treatment model. Treatment costs are summarized under two simple scenarios: current medical practices, and medical care with maximum usage of the stents. The costs per patient for each type of treatment are assumed to be the same under each scenario. Only the mix of treatments varies. Because the use of stents reduces the percent of patients who need CABGs, which are much more expensive procedures, the composite cost per patient for the entire episode drops from $18,689 to $17,654. In a more complex analysis we might also include an adjustment to reflect intensification of costs in the remaining CABG patients, assuming that they will tend to be the most severe cases.

The costs and frequencies shown in Table 2, and throughout the rest of the episodic treatment model, can be developed from a variety of resources, including the HMO's actual claims data, other private or publicly available claims databases, treatment guidelines, medical literature, or from the consensus opinion of clinical and actuarial experts. A combination of resources probably provides the most credible results. Clinical judgment should always be incorporated to ensure that the treatment models are consistent with the HMO's own treatment guidelines and its perception of medically necessary care.

TABLE 3 Summary of treatment costs

	Current practices		With new stents	
	Percent of patients	Cost per patient	Percent of patients	Cost per patient
Initial visit to cardiologist	100	$893	100	$893
Catheterization	96	$6,142	96	$6,142
Insertion of stent	—	—	24	$10,559
Angioplasty	50	$9,123	35	$9,123
CABG	30	$24,462	21	$24,462
Composite cost per patient		$18,690		$17,654

As an alternative or as a complement to the episodic treatment model, we can also value changes in health care costs using the HMO's actual claims data. This approach involves grouping the claims into episodes of care for each arteriosclerosis patient. We can then simulate the effect that the new technology would have on each patient's care, and quantify any changes in terms of health care costs, days in the hospital, and so forth. Using the HMO's actual claims data in this fashion may add a sense of credibility or realism for some audiences. Alternatively, if the health plan did not have sufficient data, then some other large claims database could be used.

Disability cost models

In addition to the health care effects, the new technology may have some impact on the employment-related costs of poor health. Specifically, the effects may include one or more of the following:

- Lost wages for the employee
- Disability income costs for the employer, disability income insurer, or workers' compensation plan
- Replacement labor costs for the employer

We have assumed that the employer will need to hire replacement labor while the patient is away from work, as well as while the patient has returned to work but is operating at a reduced level of productivity. These assumptions should be adjusted to reflect the percent of patients who are wage earners, and the average mix of occupational demands within the patient population.

We modeled the employment-related costs using a variety of data resources and assumptions, including:

- Data regarding the progression of patient recovery through various degrees of functional status. The effect of the new technology on this progression can also be estimated using data related to the effects of previously introduced technologies, combined with clinical judgment;
- Average return-to-work times for arteriosclerosis patients, and the estimated effect of the new technology;
- Typical wage levels and disability income benefits, and
- Typical costs of temporary replacement labor.

The results of our modeling, as summarized in Table 4, indicate that employment-related costs would be reduced if the new stents are used. Costs are reduced because patients are able to return to work sooner, and once back to work, they spend less time working at reduced levels of productivity.

Calculation and interpretation of the value index

Once all of the valuation analyses have been done, the results can be summarized in a format such as that shown in Table 5. To calculate an overall or bottom-line measurement of relative value, we have developed a scoring system for each of the value measures shown in Table 5. The first two columns of Table 7 show the value indices assigned to each measure. The scores are numeric, ranging from 1 to 5, with 1 representing low value and 5 representing high value. Each score is assigned according to a set of rules, a portion of which is presented in Table 6.

Proper interpretation of the indices requires an understanding of the rules used to assign them (see Table 6), and recognition of the implicit perspectives. For example, for the measure labeled "Cost of All Health Care," we have assigned *higher* value indices to *lower* costs. This implies that we are attributing greater value to services with lower costs, which makes sense from the payer perspective. On the other hand, in the case of the "Hospital Gross Revenue" measure, we have assigned *lower* value indices to *lower* dollar amounts. This makes sense from the hospital perspective, since they want to maximize revenue.

Table 7 also shows sets of weights that are used to calculate the composite value indices from each perspective. The weights and indices for the community perspective are calculated by blending together the weights and indices from all other perspectives. The lower portion of Table 7 summarizes the composite

TABLE 4 Employment-related statistics per wage earning patient

	Current practices	With new stents
Calendar days unable to work	30	20
Gross lost wages	$3,288	$2,192
Disability income benefits	$2,192	$1,461
Cost of replacement labor	$3,945	$2,411

TABLE 5 Summary of value measures

	Current practices	With new stents
Treatment risks		
Mortality	1.00%	0.25%
Complication rate	5.00%	2.00%
Blood loss	Low	None
Anesthesia risks	Moderate	None
Patient cost and convenience		
Post-operative pain	Moderate	Low
(1) Days in hospital (ambulatory = 1 day)	3.81	3.20
Calendar days unable to work	30	20
(2),(3) Net lost wages	$548	$365
(4) Out-of-pocket health care expenses	$382	$335
(1) **Health care costs per patient**		
Cost of all healthcare	$18,689	$17,654
Hospital gross revenue	$12,794	$11,841
Cardiovascular specialist gross revenue	$4,867	$4,817
Nonmedical costs		
Malpractice risk	Current level	Higher
(3) Disability income benefits per case	$1,096	$731
(3) Cost of replacement labor	$1,973	$1,205

Notes:
(1) Includes all care throughout the episode.
(2) Equals total lost wages during post-surgical recovery, less disability income benefits.
(3) Average for all patients, assuming that 50% are wage earners.
(4) Assumes $10 copay per office visit, and $100 copay per hospital outpatient visit, and $500 copay per hospital inpatient admission.

TABLE 6 Partial list of rules used to assign value indices

Mortality

Mortality rate	Value index*
0%	5
5% +	1

Days in hospital

Days	Value index*
0	5
10 +	1

Post-operative pain

Pain	Value index
None	5
Low	4
Moderate	3
High	2
Severe	1

Total health care costs

Change in costs	Value index*
–20% or more	5
Current level	3
+ 20% or more	1

Calendar days unable to work

Days	Value index*
0	5
10	4
20	3
40	2
60+	1

Net lost wages

% of annual pay for wage earners	Value index*
0%	5
2%	4
5%	3
10%	2
15% +	1

Net lost wages are from Table 4 (i.e., Gross lost wages less disability income benefits). This amount is divided by an assumed annual income of $40,000 to get the percent of annual pay.

Linearly interpolate for all other values.

TABLE 7 Calculation of the value index

	Value indices		Weights used to calculate composite value indices				
				Providers			
	Current medical practices	With new stents	Patient	Hospital	Cardiovascular specialist	Payer	Community
Treatment risks							
Mortality	4.20	4.80	20%	10%	10%		10.0%
Complication rate	3.00	4.20	10%	10%	10%		6.0%
Blood loss	4.00	5.00	5%	2%	2%		2.4%
Anesthesia risks	3.00	5.00	5%	3%	3%		2.6%
Patient cost and convenience							
Post-operative pain	3.00	4.00	5%		5%		2.5%
Days in hospital (ambulatory = 1 day)	3.48	3.72	10%				4.0%
Calendar days unable to work	2.50	3.00	15%				6.0%
Net lost wages	3.75	4.09	20%				8.0%
Out-of-pocket healthcare expenses	2.47	2.66	10%				4.0%
Health care costs/revenues per patient							
Cost of all health care	3.00	3.55				80%	32.0%
Hospital gross revenue	3.00	2.26		75%			7.5%
Cardiovascular specialist gross revenue	3.00	2.90			65%		6.5%
Nonmedical costs							
Malpractice risk	3.00	2.00			5%		0.5%
Disability income benefits per case	3.90	4.27				10%	4.0%
Cost of replacement labor	3.64	4.14				10%	4.0%
Total value weights:			100%	100%	100%	100%	100.0%
Weights to composite indices by perspective:			40%	10%	10%	40%	100.0%

Composite value indices by perspective	Current medical practices	With new stents	Note
Patient perspective	3.36	3.99	Value indices range from 1 to 5, with 1 representing low value and 5 representing high value.
Provider perspective — hospital	3.14	2.85	
Provider perspective — cardiovascular specialist	3.14	3.34	
Payer perspective	3.15	3.68	
Community perspective	3.23	3.68	

value indices. From the community perspective, the new stents appear to represent a net value gain, with an overall value index of 3.68, versus 3.23 for current medical practices alone. As presented, the value index shows a 14 percent greater value for the proposed stent than current medical practice. The same conclusion would be drawn from each of the other perspectives, except that of hospitals. Because of the reduced number of CABGs, hospitals would lose a significant amount of revenue per patient, and may conclude that offering the stents would not be in their best short-term interests. Over the long term, they may be able to offset some losses by attracting new patients, but we have not included such a projection in this simple illustration.

Additional comments

Although the rules used to assign the value indices and the weights used to composite them are all somewhat arbitrary, the inherent value of the "value indices" approach lies in its ability to provide an explicit basis for quantifying the net effect of a wide range of measures that are otherwise very difficult to compare in aggregate. In other words, the methodology gets us to an overall or "bottom line" assessment. Because the assumptions used to reach the bottom line are explicit, they can be debated individually without diminishing our ability to quickly calculate that bottom line assessment. It is the opinion of the authors that a deterministic, formula-driven approach minimizes much of variability inherent in other approaches to determine value of emerging technologies.