

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA
President, Axene Health Partners, LLC

Introduction

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

Frequently someone must determine whether or not a new technology or intervention is a “good deal” or “in a patient’s best interest.” 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 cost 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 healthcare 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 healthcare technology, procedure, drug, or medical management process.

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

Defining “Value”

Key Perspectives

“Value” must be defined in the context of a particular perspective. 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, or plan sponsor.

In performing value assessment studies for new healthcare interventions, we recommend that value be assessed from several important perspectives, including those of patients, providers, and third-party payers. 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 measurements 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 may be less important to payers. On the other hand, the costs of healthcare services are important to patients and payers, but may be 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.

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

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	X	X	
Pain During Recovery	X	X	
Treatment Risks	X	X	
Complication Rate	X	X	X
Hospital Readmission Rate	X		X
Blood Loss	X	X	
Anesthesia Risks	X	X	
Days in Hospital	X		X
Duration of Total Treatment Plan	X		
Quality of Life Improvement	X		
Mortality	X	X	
Provider Ease of Use			
Minutes per Procedure	X	X	
Frequency of Needing an Assistant		X	X
Malpractice Risk		X	
Healthcare Costs/Revenues			
Patient Out-of-Pocket Expense	X		
Third-party Payer Costs			X
Physician Revenue			
Gross Revenue		X	
Net Profit		X	
Hospital Revenue			
Gross Revenue		X	
Net Profit		X	
Work-related Costs			
Days Unable to Work	X		X
Patient's Lost Wages	X		X
Disability Income Benefits Paid			X
Cost of Replacement Labor			X
<p><i>Note: Many of these 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.</i></p>			

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

Time Value and Quality-Adjusted Life Years

Although Table 1 describes a wide range of value measures, the list could 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 (i.e., a dollar saved today has a greater value than a dollar saved ten years from now), to health status improvements (i.e., one year of improved health today is worth more than one year of improved health ten years from now), or to other measures. To illustrate, if we arbitrarily assume that an annual discount rate of 5% 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 (i.e., $\$5,000 / (1.05 \times 1.05) = \$4,535$). 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 healthcare 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 quality of life indices to a patient's health status at various points in time. The indices range from zero to one, with zero indicating the lowest possible quality of life (i.e., death), and one indicating the highest possible quality of life. A medical intervention 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, calculated as:

$$(0.75 - 0.50) \times (5 \text{ years}) = 1.25 \text{ QALYs}$$

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

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

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 also, however, limited in its ability to provide a complete representation of value from certain 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 healthcare technologies. For example, we can compare the value of a new technology with 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 of assessment process should include at least the following steps:

- **Evaluate the technology from a clinical perspective.** Evaluation by qualified clinicians 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 to answer is: will the new technology provide better outcomes for 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
 - How the new technology compares with existing technologies in terms of specific outcome measurements, such as mortality, complication rates, infection rates, pain, blood loss, and recovery time
 - Available treatment guidelines that can be modified to incorporate the new technology
 - How easy it is for providers to use the new technology
 - Expected physician training time

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

- Expected malpractice risk
- **Model expected utilization and cost impacts.** This modeling uses information from the clinical assessment to project the expected impacts on healthcare utilization and costs, and on employment-related costs. In measuring healthcare cost impacts, 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 impact 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 the patient's 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 with community-rated comprehensive health insurance may be relatively unconcerned about the total cost of the healthcare services they incur, 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 measure 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.

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

- **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 relatively simple, we have not included any adjustments to discount the values of future costs or benefits.

All the treatment paths and figures used in this case study were created solely for the purpose of demonstrating our value assessment process, and are not intended to be used for any other purposes.

Description of 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 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 at a local HMO is considering purchasing the technology for use in the HMO's hospitals. He hires Axene Health Partners, LLC (AHP) to perform an independent assessment of the technology's value to the HMO, its patients, its providers, and to the community as a whole.

Clinical Assessment

A team of AHP clinicians 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

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

- Reduced blood loss
- Reduced risk of complications or infection
- Reduced pain during recovery
- Reduced time in the hospital
- The new device is easy to insert, requiring only 15 minutes per stent, in addition to the time needed to perform the cardiac catheterization
- The stents can be inserted on an ambulatory basis in virtually 100% of patients

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

Episodic Treatment Model

With a clear understanding of the new technology and the types of patients on which it would be used, AHP clinicians and actuaries work as a team to develop detailed descriptions of the care paths these patients typically follow. Chart 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% of CABGs could be avoided through use of stents, and that 30% of angioplasty patients would also become stent patients. These assumptions are illustrated in Chart 1. For example, Chart 1 indicates that the new technology would reduce the probability of needing a CABG from 30% to 21%, implying a 30% reduction in the total number of CABGs (i.e., $1 - .21 / .30 = .30$).

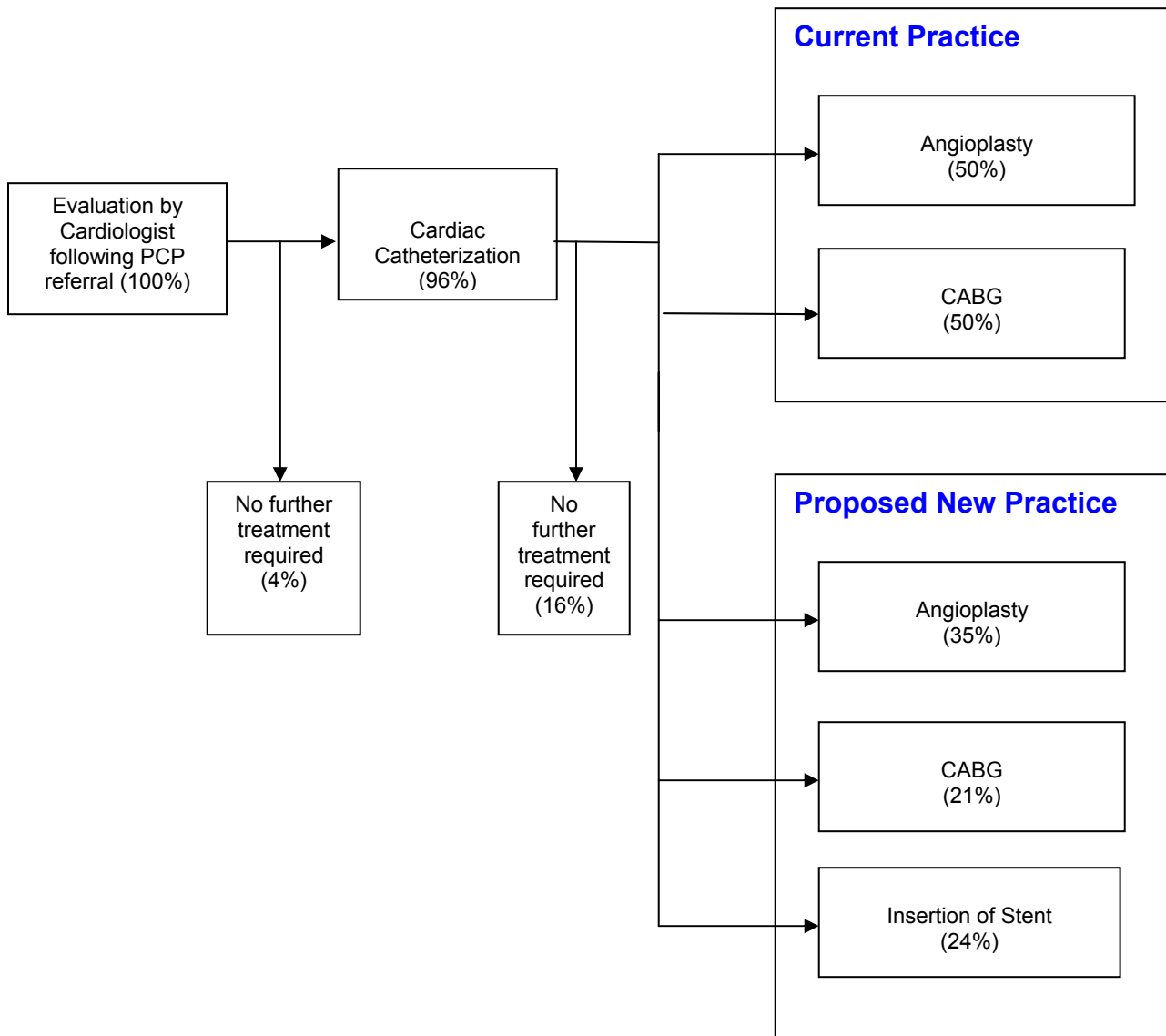
For purposes of this illustrative case study, we modeled all care throughout the entire episode. We assumed that an episode begins with a patient's initial referral from his PCP to a specialist, and ends with a resolution to the problem. Alternatively, we could have chosen to focus our modeling efforts 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 would 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 capitation, it will be important to consider the costs of all care delivered throughout the episode.

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

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 expected to be delivered to patients who get the new stents. It shows the types and numbers of services 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. The costs are illustrative allowed charge levels that might be appropriate for a typically managed care plan.

Chart 1 Care Pathways For Patients With Chest Pain



Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

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 1, 2000		
(A)	(B)	(C)	(D)	(E)	(F)	(G)
Procedure Frequency	Treatment	Provider Type	Procedure Code	Number of Units	Cost Per Unit	Weighted Price (A) x (E) x (F)
I Pre-surgical Care						
100.00%	1	Office Visit, Est. Expanded Forecast	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 /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 Stents	\$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 (add'l 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 Cath.	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 Cath.	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 Forecast	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	180.00 Days	\$0.03	\$5.40
10.00%	8	Cardiac Rehab	Physician 93798	14.0 Procedure	\$17.85	\$24.99
Subtotal:						\$506.34

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

Table 2 also includes charges related to the stents themselves. We assumed that the facility would bill for the full retail price of the products, plus a 30% 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:

$$\$20,000 \times 130\% / (300 \text{ patients}) = \$86.67 \text{ per patient}$$

Table 3 provides a summary of all healthcare 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 percentage 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.

Table 3
Summary of Treatment Costs

	<u>Current Practices</u>		<u>With New Stents</u>	
	Percent of Patients	Cost Per Patient	Percent of Patients	Cost Per Patient
Initial Visit to Cardiologist	100.00%	\$893	100.00%	\$893
Catheterization	96.00%	\$6,142	96.00%	\$6,142
Insertion of Stent	---	---	24.00%	\$10,559
Angioplasty	50.00%	\$9,123	35.00%	\$9,123
CABG	30.00%	\$24,462	21.00%	\$24,462
Composite Cost Per Patient		\$18,689		\$17,654

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 their perception of medically necessary care.

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

As an alternative or as a complement to the episodic treatment model, we can also value changes in healthcare costs using the HMO's actual claims data. This approach involves groupings the claims into episodes of care for each arteriosclerosis patient. We can then simulate the effect the new technology would have on each patient's care, and quantify any changes in terms of healthcare costs, hospital days, 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 database of claims could be used.

Disability Cost Models

In addition to the healthcare impacts, 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 assumed that the employer would 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 percentage 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 impact of the new technology on this progression can also be estimated using data related to the impacts of previously introduced technologies, combined with clinical judgment.)
- Average return to work times for arteriosclerosis patients, and the estimated impact of the new technology
- Typical wage levels, and disability income benefits
- Typical costs of temporary replacement labor

The results of our modeling, as summarized in Table 4, indicate that employment-related costs are reduced if the new stents are used. This is because patients are able to

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

return to work sooner, and once back to work, they spend less time working at reduced levels of productivity.

Table 4
Employment Relates 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

Calculation and Interpretation of the Value Index

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

Table 5
Summary of Value Measures

	Current Medical 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 & Convenience		
Post-operative Pain	Moderate	Low
Days in Hospital (ambulatory = 1 day) ¹	3.81	3.20
Calendar Days Unable to Work	30	20
Net Loss Wages ^{2, 3}	\$548	\$365
Out-of-Pocket Healthcare Expenses	\$382	\$335
Healthcare Costs/Revenues Per Patient ¹		
Cost of All Healthcare	\$18,689	\$17,654
Hospital Gross Revenue	\$12,794	\$11,841
Cardiovascular Specialist Gross Revenue	\$4,867	\$4,817
Non-Medical Costs		
Malpractice Risk	Current Level	Higher
Disability Income Benefits per Case ³	\$1,096	\$731
Cost of Replacement Labor	\$1,973	\$1,205

¹ Includes all care throughout the episode.
² Equals total lost wages during post-surgical recovery, less disability income benefits.

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

³ Average for all patients, assuming that 50% are wage earners.
⁴ Assumes \$10 copay per office visit, \$100 copay per hospital outpatient visit, and \$500 copay per hospital inpatient admission.

Table 6
Calculation of the Value Index

	Value Indices		Weights Used to Calculate Composite Value Indices				
	Current Medical Practices	With New Stents	Providers				
			Patient	Hospital	Cardio-vascular 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 & 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%
Healthcare Costs/Revenues per Patient							
Cost of All Healthcare	3.00	3.55				80%	32.0%
Hospital Gross Revenue	3.00	2.26		75%			7.5%
Cardio-vascular Specialist Gross Revenue	3.00	2.90			65%		6.5%
Non-Medical Costs							
Malpractice Risk Disability	3.00	2.00			5%		0.5%
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			
Patient Perspective			3.36	3.99	<i>Note: Value indices range from 1 to 5, with 1 representing low value and 5 representing high value.</i>		
Provider Perspective - Hospital			3.14	2.85			
Provider Perspective - Cardiovascular Specialist			3.14	3.34			
Payer Perspective			<u>3.15</u>	<u>3.68</u>			

**Prospective Value-Based Assessment of New Healthcare
Technologies and Practices**

By: David V. Axene, FSA, MAAA, FCA

Community Perspective	3.23	3.68
-----------------------	------	------

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

Table 7
Partial List of Rules Used to Assign Value Indices

Mortality		Days in Hospital	
Mortality Rate	Value Index	Days	Value Index
0%	5	0	5
5%+	1	10+	1
Linearly interpolate for all other values.		Linearly interpolate for all other values.	
Post-operative Pain		Total Healthcare Costs	
Pain	Value Index	Change in Costs	Value Index
None	5	-20% or more	5
Low	4	Current Level	3
Moderate	3	+20% or more	1
High	2	Linearly interpolate for all other values.	
Severe	1		
Calendar Days Unable to Work		Net Lost Wages	
Days	Value Index	% of Annual Pay For Wage Earners	Value Index
0	5	0%	5
10	4	2%	4
20	3	5%	3
40	2	10%	2
60+	1	12%+	1
Linearly interpolate for all other values		Linearly interpolate for all other values.	
<i>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 % of annual pay.</i>			

Proper interpretation of the indices requires an understanding of the rules used to assign them (see Table 7) and recognition of the implicit perspectives. For example, for the measure labeled “Cost of All Healthcare,” we 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 assigned lower value indices to lower dollar amounts. This makes sense from the hospital perspective, since they want to maximize revenue.

Table 6 also shows sets of weights 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.

Prospective Value-Based Assessment of New Healthcare Technologies and Practices

By: David V. Axene, FSA, MAAA, FCA

The lower portion of Table 6 summarizes the composite value indices. From the community perspective, the new stents appear to represent a new value gain, with an overall value index of 3.68, versus 3.23 for current medical practices alone. 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 somewhat arbitrary, their value lies in their ability to provide an explicit basis for quantifying the net effect of a wide range of measures that are otherwise difficult to compare in aggregate. In other words, they get us to the bottom line. 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.

For more information, please contact the author at david.axene@axenehp.com and the firm's website at www.axenehp.com.