

# Value in cardiovascular care

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## ABSTRACT

Healthcare value, defined as health outcomes achieved relative to the costs of care, has been proposed as a unifying approach to measure improvements in the quality and affordability of healthcare. Although value is of increasing interest to payers, many providers remain unfamiliar with how value differs from other approaches to the comparison of cost and outcomes (ie, cost-effectiveness analysis). While cost-effectiveness studies can be used by policy makers and payers to inform decisions about coverage and reimbursement for new therapies, the assessment of healthcare can guide improvements in the delivery of healthcare to achieve better outcomes at lower cost. Comparison on value allows for the identification of healthcare delivery organisations or care delivery settings where patient outcomes have been optimised at a lower cost. Gaps remain in the measurement of healthcare value, particularly as it relates to patient-reported health status (symptoms, functional status and health-related quality of life). The use of technology platforms that capture health status measures with minimal disruption to clinical workflow (ie, web portals, automated telephonic systems and tablets to facilitate capture outside of in-person clinical interaction) is facilitating use of health status measures to improve clinical care and optimise patient outcomes. Furthermore, the use of a value framework has catalysed quality improvement efforts and research to seek better patient outcomes at lower cost.

Value is a ubiquitous concept. Outside of healthcare, individuals frequently compare the benefits of different products or services relative to their monetary cost. Within healthcare, value is a relatively new concept that is defined by the patient outcomes achieved relative to the cost of care required to achieve those patient outcomes (figure 1).<sup>1</sup> In this value equation, patient outcomes are the numerator and the total cost of care required to achieve those outcomes is the denominator. Healthcare value can be increased through better patient outcomes while keeping costs stable, maintaining patient outcomes while reducing costs or achieving better outcomes at lower cost. With rising healthcare expenditures and variation in patient outcomes, there is increasing emphasis on improving healthcare value.

In this review, we first discuss how value in healthcare can be defined, the implications of different definitions for healthcare value and how healthcare value differs from other quality measures. Next, we describe how healthcare value serves a different purpose than cost-effectiveness in the comparison of healthcare cost and outcomes. We then offer approaches to the comparison of healthcare value and conclude with successful examples of a healthcare value framework applied in practice. We hope this review will lead to a better understanding of a value framework for healthcare and how the

application of this can be used to accelerate the achievement of optimal patient outcomes at lower cost.

## WHAT IS VALUE IN HEALTHCARE?

We favour the definition of value as proposed by Porter,<sup>1</sup> and framed in figure 1 of this review. In this definition, outcomes reflect the 'health circumstances most relevant to patients'.<sup>1</sup> For example, important outcomes for patients with coronary artery disease would at least include rates of overall survival, myocardial infarction, heart failure, coronary revascularisation and measures of symptom control and quality of life.

Other definitions of healthcare value exist and a prominent alternative definition includes quality of care in the numerator of the value equation.<sup>2</sup> This modification to the definition of healthcare value has important implications. First, many healthcare quality measures reflect care delivery processes that are weakly linked to patient outcomes.<sup>3,4</sup> As a result, improving the quality of care as assessed by process measures may have little tangible impact on patient health. Second, there is concern that the proliferation of process measures of care quality has resulted in significant measurement burden and may stifle further improvement.<sup>5</sup> Emphasis on patient outcomes provides greater focus and directs efforts towards measures that matter to the patient. Although achieving high-quality care is important, the impact of quality improvement efforts can be measured through the unifying lens of healthcare value.

Patient experience is also important in considering healthcare value.<sup>6</sup> Although opinions differ on whether patient experience should be included in the numerator of the value equation, patients who achieve good health outcomes at the expense of a poor care delivery experience would generally identify this as low value care. The potential to achieve good health outcomes with poor care delivery experience or vice versa highlights an important aspect of healthcare value measurement; the value equation cannot be easily distilled into a single summary measure as a number of separate, and potentially conflicting, outcomes need to be considered in relation to the costs of care in the measurement of healthcare value. As such, patient experience can be measured and quantified without diminishing insights on achievement of patient health outcomes. For that reason, we believe patient experience should be considered in the outcomes of healthcare and incorporated in the numerator of the value equation. Transparency in the presentation of health outcomes, patient experience and costs will guide meaningful comparisons and identify potential trade-offs in care delivery choices.



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$$\text{VALUE} = \frac{\text{OUTCOMES}}{\text{COST}}$$

**Figure 1** The value equation. Outcomes include the totality of patient health outcomes (eg, mortality, morbidity, patient-reported health status measures defined as symptom burden, functional status and health-related quality of life) and patient experience. Measures of quality (eg, safety, effectiveness and timeliness) may contribute to higher value through achievement of better health outcomes. Costs include the monetary value of all resources used to provide care, including all personnel, medical supplies (drugs, devices and equipment) and space.

### DIFFERENTIATING VALUE FROM COST-EFFECTIVENESS

As new therapies are developed, it is important to understand the incremental health benefit and cost of the new therapy relative to established treatments. Answering this question helps inform the cost-effectiveness of a new therapy, defined as the additional health benefit gained in relation to the economic cost.<sup>7</sup> Cost-effectiveness studies can be used by policy makers and payers to inform decisions about coverage and reimbursement for new therapies.<sup>8</sup>

In comparison to cost-effectiveness, healthcare value is intended to guide improvements in the delivery of healthcare to achieve better outcomes at lower cost.<sup>9</sup> Comparison on value allows for the identification of healthcare delivery organisations or care delivery settings where patient outcomes have been optimised at a lower cost.<sup>10</sup> If a new therapy is integrated into care delivery in a way that improves patient outcomes without increasing cost, reduces costs while maintaining outcomes or improves outcomes at lower cost, the new therapy can be said to improve healthcare value. Similarly, modifications in when, where and how care is delivered may have implications on the costs and outcomes achieved. Comparison in a value framework allows for the identification of the settings, personnel and processes of care that achieve optimal health at lowest cost.

### PATIENT HEALTH OUTCOMES: MEASURING WHAT MATTERS TO THE PATIENT

Patients with illness seek to quickly and efficiently return to a state of optimal health that is maintained long term. But what health outcomes need measurement to reflect optimal health?

In the measurement of healthcare value, some have proposed a hierarchy of patient outcomes under the premise that some outcomes are irrelevant if other more proximal outcomes are not achieved.<sup>1,9</sup> In this framework, patient mortality and health status (ie, symptom burden, functional status and health-related quality of life) serve as the first step in the hierarchy. Additional measures related to the time required to achieve optimal health, complications of care delivery and how well health status is sustained become secondary measures in this hierarchy.

Although conceptually straightforward, an outcome hierarchy has the potential to simplify complexities in how patients emphasise outcomes differently depending on their goals of care. For some patients, the rapidity of symptom relief may be more important than longevity. A more unifying approach may be to measure the full spectrum of outcomes important to patients with a given clinical condition and defer to individual patients for outcome prioritisation. This approach is consistent with the approach of the International Consortium for Health Outcomes Measurement, which has developed patient-centred standardised outcome measurement sets for a range of conditions, including three in cardiovascular disease.<sup>11,12</sup>

In the consideration of outcomes, it is also important to remember that much of healthcare is not intended to help

patients live longer or reduce the risk of future morbidity, but instead seeks to reduce symptoms while improving functionality and health-related quality of life. For example, percutaneous coronary intervention (PCI) for patients with stable angina has no impact on mortality or risk of recurrent myocardial infarction, but is instead intended to improve symptoms, functionality and quality of life.<sup>13</sup> A similar intent guides the use of ablation procedures for symptomatic atrial fibrillation<sup>14</sup> or peripheral arterial revascularisation for intermittent claudication.<sup>15</sup> Standardised measures of patient-reported health status (including symptoms, functional status and health-related quality of life) offer a valid, sensitive and reproducible approach to assess health outcomes from the patient's perspective.<sup>16</sup> Examples of condition-specific patient-reported health status measures are provided in table 1. Although these measures are now routinely incorporated in clinical trials to establish treatment efficacy, patient-reported health status measures are infrequently captured in routine clinical care.

In the past, patient-reported health status measures have required the administration of time-consuming paper-based survey instruments, making use in clinical practice burdensome, and many patient-reported health status measures lacked readily interpretable scores to guide clinical care.<sup>17,18</sup> Increasingly, health status measures are being refined to allow the administration of shorter instruments through platforms that minimise disruption to clinical workflow (ie, web portals, automated telephonic and tablets to facilitate capture outside of in-person clinical interaction)<sup>19–21</sup> with summary scores that can be used to inform clinical practice, improve clinical care and optimise patient outcomes.<sup>16,20,21</sup>

One example of how patient-reported health status measures are being used in routine care delivery comes from the University of Rochester Medical Centre Orthopaedics, where use of computer-assisted technology supports efficient delivery of Patient Reported Outcome Measurement Information System (PROMIS) measures.<sup>22</sup> This occurs without additional burden to the provider and minimises burden to the patient by applying item-response theory in which follow-up questions are selected based on the response to the prior question to save time without compromising accuracy or validity. The scores are then imported into an electronic health record for real-time viewing and clinical decision-making by the clinician. Using this process, nearly 60 000 unique orthopaedic patients were administered the PROMIS and resulting scores have been used to guide treatment decisions in more than 150 000 patient encounters.<sup>22</sup> For example, as a patient recovers from orthopaedic surgery, their PROMIS scores can be compared with expected scores based on recovery trends for similar patients who have undergone similar surgery. If the patient is doing better than expected, they may be better served by a home exercise programme rather than more expensive formal physical therapy. If the patient is doing worse, additional physical therapy or assessment for a complication may be warranted.<sup>22</sup>

An example use of patient-reported outcome measures in care of patients with cardiovascular disease comes from the US Veterans Administration (VA) among patients undergoing elective PCI. Elective PCI is intended to improve patients' symptoms and angina-related quality of life; however, improvements in patients' health status from these procedures are not routinely quantified in clinical practice using standardised measures. As a result, the ability to define and improve the value of these procedures is limited. The VA Patient-Reported Health Status Assessment (PROST) system uses an interactive voice response system to administer, capture and score disease-specific health status surveys via telephone.<sup>20</sup> The

**Table 1** Examples of patient-reported health status measures

| Clinical condition        | Instrument  | No of Items in questionnaire and domains covered  | Time frame represented |
|---------------------------|---|---|------------------------|
| Coronary artery disease   | MacNew Heart Disease Health-related Quality of Life <sup>50</sup> | 27 items with 3 domains: physical limitations, emotional function social  | Previous 2 weeks       |
|                           | SAQ-7 <sup>51</sup>   | 7 items with 3 domains: physical limitations, angina frequency, quality of life   | Previous 4 weeks       |
| Atrial fibrillation       | AF-QoL <sup>52 53</sup>   | 18 items with 3 domains: psychological, physical and sexual activity  | Previous month         |
|                           | AFEQT Questionnaire <sup>54</sup>                                 | 20 items with 4 domains: symptoms, daily activities, treatment concern and treatment satisfaction   | Previous 4 weeks       |
| Heart failure             | MLHFQ <sup>55</sup>   | 21 items with 3 domains: physical, emotional and overall quality of life  | Previous 4 weeks       |
|                           | KCCQ-12 <sup>56</sup>   | 12 items with 3 domains: symptom frequency, physical and social limitations and quality-of-life impairment  | Previous 4 weeks       |
| Peripheral artery disease | PAQ <sup>57</sup>   | 20 items with 5 domains: physical limitations, symptoms, social function, treatment satisfaction and quality of life  | Previous 4 weeks       |
|                           | VascuQoL-6 <sup>58</sup>  | 6 items with 5 domains: pain, symptoms, activities, social and emotional  | Previous 2 weeks       |
| Stroke                    | Short Form-Stroke Impact Scale 3.0 <sup>59</sup>                  | 16 items with 8 domains: strength, hand function, activities of daily living/instrumental activities of daily living, mobility, communication, emotion, memory and thinking and participation | Previous week          |
|                           | Stroke-Specific Quality of Life Scale-12 <sup>60</sup>            | 12 items with 12 domains: social role, mobility, energy, language, self-care, mood, personality, thinking, upper extremity function, family role, vision and work/productivity                | Previous week          |

AFEQT, Atrial Fibrillation Effect on Quality of Life; MLHFQ, Minnesota Living with Heart Failure Questionnaire; PAQ, Peripheral Artery Questionnaire; VascuQoL-6, Vascular Quality of Life Questionnaire-6; SAQ-7 = Seattle Angina Questionnaire-7AF-QoL = Atrial Fibrillation Quality of LifeKCCQ-12 = Kansas City Cardiomyopathy Questionnaire-12

system is triggered by the electronic health record to administer these surveys prior to elective coronary procedures and at 1 and 6 months of follow-up from the procedure. This process allows for efficient capture of health status measures pertinent to elective PCI without adding to clinical burden. Health status measures captured by PROST are being incorporated in the electronic health record to both (1) ensure that patients who undergo elective PCI have a health status deficit expected to improve with the procedure and (2) allow longitudinal monitoring for patients with health status decline that might be improved with targeted therapies.<sup>20</sup> In the consideration of patient health status, one final aspect warrants attention: health status measures must directly reflect the experience of the patient. Clinicians are very familiar with the importance of capturing patient symptoms and functional status as part of the patient interview. A careful patient interview will forever remain a cornerstone of good medical practice; in the words of Osler, 'Listen to your patient, he is telling you the diagnosis'.<sup>23</sup> However, there are clear shortcomings to the use of a provider-based assessment of health status in ascertaining the value of healthcare. First, a provider-based assessment of health status lacks adequate specificity and reproducibility.<sup>24 25</sup> This is a reflection of differences in how each provider conducts the patient interview, resulting in variation in the measure that is unrelated to the patient's health.<sup>16</sup> Second, a provider-based assessment reflects the physician's interpretation of symptoms, functional status and health-related quality of life; it does not directly reflect the patient's experience. Comparison of provider-based and patient-reported health status have shown significant disagreement and highlight the shortcomings of a provider-based outcome measure.<sup>26–28</sup> Standardised patient-reported health status measures offer a valid, reliable and sensitive approach to the measurement of outcomes that matter to the patient in support of achieving high-value care.<sup>16</sup>

## COSTS OF CARE

The rising costs of healthcare are a strong motivator for improvements in healthcare value. However, our current understanding of the true costs of healthcare are poor.<sup>29</sup> Increasing attention to the measurement and comparison of the actual costs of healthcare is needed.

The costing perspective advocated in cost-effectiveness analysis is that of the societal perspective.<sup>30</sup> As a result, the perspective of a governmental payer is often adopted, with reimbursement used as a surrogate for costs. Although advantageous for payers in defining payment thresholds for new therapies, this approach is inadequate in the measurement and comparison of healthcare value. Reimbursement has little relationship to the actual costs of providing care to individual patients.<sup>29 31</sup> Accordingly, reimbursement has little relationship to the true value of healthcare.

Care delivery systems often further conflate the relationship between reimbursement and costs. Financial departments of healthcare organisations often aggregate costs based on cost to charge ratios or relative value units, rather than determining the actual cost of resources used to provide care to individual patients.<sup>31 32</sup> This aggregate approach lacks adequate granularity, or a relationship to actual patient care delivery, necessary to support improvements in care efficiency. What is needed are insights on the actual costs of all the resources used to provide care for specific patients, including personnel, medical supplies (drugs, devices and equipment) and space.<sup>31 33 34</sup>

In table 2, we offer a simplified hypothetical example of how aggregate costs based on reimbursement can lead to erroneous conclusions about the actual costs of care delivery. In our example, we compare two care teams within the same care delivery organisation in the delivery of PCI care for the same patient. In this example, the healthcare delivery organisation was reimbursed \$15 000 for the performance of PCI. However, this does not

**Table 2** Patient-level costing to identify opportunities for efficiency gains

|                                  | Team 1   | Team 2    |
|----------------------------------|----------|-----------|
| Reimbursement                    | \$14 000 | \$14 000  |
| Procedural time                  | 60 min   | 30 min    |
| Interventionalist (\$1000/hour)  |          |           |
| Interventionalist 1              | \$1000   |           |
| Interventionalist 2              |          | \$500     |
| Nurses (\$500/hour)              |          |           |
| Nurse 1                          | \$500    | \$250     |
| Nurse 2                          | \$500    |           |
| Lab tech (\$200/hour)            |          |           |
| Lab tech 1                       |          | \$100     |
| Lab tech 2                       |          | \$100     |
| Stent type                       |          |           |
| Stent A                          | \$1000   |           |
| Stent B                          |          | \$250     |
| Cath lab time                    | 1 hour   | 0.5 hours |
| Cath lab cost (\$1000/hour)      | \$1000   | \$500     |
| Postprocedural time              | 12 hours | 6 hours   |
| Postprocedure cost (\$1000/hour) | \$12 000 | \$6000    |
| Actual cost                      | \$16 000 | \$7700    |

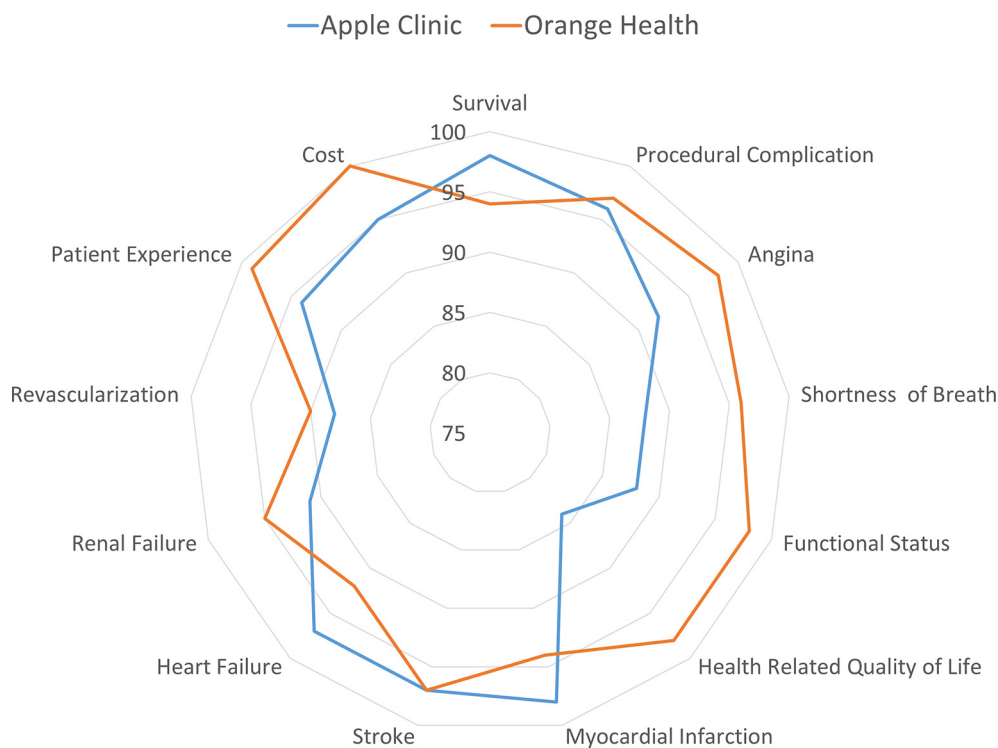
reflect the actual costs of care as represented by the personnel, supplies, space and time required to provide the care. Interventionalist 1 prefers a team with two nurses, which has a higher per hour cost than the team of interventionalist 2, which is made up of one nurse and two lab techs. Furthermore, the team of

interventionalist 2 is more efficient, completing the procedure in half the time. Using time-driven allocation for costs, implications of efficiency gains on both variable cost (staffing) and fixed costs (cath lab) become apparent. Interventionalist 2 also prefers a less expensive coronary stent and shorter length of postprocedural observation, contributing to lower total cost when compared with the team of interventionalist 1. These differences in cost, and opportunities for efficiency gains, are lost in when costs are represented with aggregate measures, rather than attributed directly to the care of individual patients.

### COMPARING VALUE

As the outcomes embodied in the value equation are varied and depend on the clinical condition in question, a summary measure of healthcare value is not readily created. Instead, a tabular comparison of individual outcomes and total cost is needed to express the full measure of healthcare value for a given clinical condition. In this way, healthcare value is similar to a cost-consequences analysis, in which individual outcome measures are reported separately.<sup>35 36</sup> However, a tabular presentation of data may be difficult to readily interpret and compare across multiple care delivery organisations or across different time intervals. An alternative approach is through the use of radar plots, which facilitates the graphical comparison of all outcomes and costs of care (see figure 2).<sup>37</sup>

The granular comparison of individual outcomes is another way in which healthcare value differs from typical cost-effectiveness analyses. In cost-effectiveness analyses, it is typical to summarise outcomes using an overall metric (ie, quality adjusted life years).<sup>30</sup> Although this summary measure



**Figure 2** Radar-plot comparison of healthcare value 30 days after percutaneous coronary intervention (PCI). This radar plot shows an example comparison of healthcare value following PCI for two different hypothetical healthcare organisations. The outer bound of the plot is scaled to represent perfect outcomes (ie, 100% survival, 0% procedural complications, complete resolution of angina, etc.) and costs are plotted as the reciprocal, scaled so that 100 represents the lowest cost option. In this example, the cost of care at Apple Clinic was \$5000 and while the cost at Orange Clinic was \$4500. Scaling the cost of Orange Clinic to 100, the Apple clinic is 95 since \$4500 is 95% of \$5000. In this example, cost and outcomes reflect a 30-day time period; comparisons over time can be created by repeating this plot for different time intervals of interest.



can be helpful for payers and policy makers in the comparison of treatments, it can be difficult to interpret<sup>38</sup> and is less useful to individual patients who may weight individual aspects of the outcome differently. By avoiding aggregation of patient outcomes into a summary measure, patients can make decisions about which treatment, care delivery setting or care delivery organisation provides care that is most aligned with their care preferences.

### USING A HEALTHCARE VALUE FRAMEWORK TO MEASURE AND ACHIEVE BETTER OUTCOMES AT LOWER COST

Examples of the application of a healthcare value framework are increasing in the literature. These include studies that have defined the patient-centred outcomes and actual costs of care for prostate brachytherapy in the management of prostate cancer,<sup>39</sup> identified high-cost/high-variability targets for process and quality improvement in total knee and total hip arthroplasty,<sup>31</sup> optimised the use of resources and reduced costs of care in low-resource settings,<sup>40</sup> improved efficiency of a preoperative assessment centre<sup>41</sup> and supported the cost-conscious redesign of care in urology and neurosurgery.<sup>34</sup>

Although a large number of studies in cardiovascular disease have compared patient outcomes across care delivery organisations and settings, few studies of cardiovascular disease have compared patient outcomes and cost within a value framework. The authors of this review have previously conducted analyses comparing costs of care and patient outcomes following PCI within the US Veterans Healthcare Administration.<sup>42–43</sup> These studies highlighted tremendous variation in costs across VA hospitals despite similar patient mortality and readmission outcomes across facilities, suggesting an opportunity to improve value by reducing costs at high-cost facilities without compromising outcomes. However, as described above in the discussion of health status measures for elective PCI, the intent of many coronary procedures is to improve health status, rather than mortality. As a result, the lack of granular data on health status limits a true understanding of variation in PCI value across facilities. The VA PROST system was designed in part to capture PCI relevant health status measures and inform the entire spectrum of outcomes important to the patient in comparison of value.<sup>20–44</sup>

In another example of the value framework applied to cardiovascular care, a quality improvement activity sought to improve PCI outcomes at lower cost by addressing PCI bleeding complications. Bleeding is a common complication of PCI, contributes to worse patient outcomes and increases costs of care.<sup>45</sup> A number of bleeding avoidance strategies in PCI have been identified, but an existing risk-treatment paradox resulted in lower bleeding risk patients being more likely to receive expensive bleeding avoidance strategies, while higher risk patients were less likely to receive therapies to reduce bleeding events.<sup>46</sup> The application of a real-time clinical decision support tool that calculated patient-specific bleeding risk and consensus recommendations for bleeding avoidance strategies resulted in risk-concordant use of bleeding avoidance strategies with reductions in bleeding events with similar costs of care.<sup>47</sup> In another study, the use of time-driven activity-based costing is being used to inform differences in the cost of coronary artery bypass surgery at three different hospitals and identify potential targets of cost reduction.<sup>33</sup>

Achieving high-quality care may require restructuring clinical care delivery<sup>10</sup> and thinking beyond traditional care delivery settings and modalities. For example, the increasing ubiquity of

mobile technology and wearable devices may create novel and potentially lower cost approaches to longitudinal monitoring, care delivery and optimisation of patient health.<sup>48</sup> Incentivising high-value care will also require changes to reimbursement structures,<sup>49</sup> particularly in care settings where fee-for-service is the predominant reimbursement modality. Regardless, application of a value framework in healthcare quality improvement and research will serve to drive improvements in care that will achieve optimal patient outcomes at lower cost.

### CONCLUSION

A value framework has the potential to guide improvements in healthcare delivery to achieve better outcomes at lower cost. In light of increasing costs of healthcare, despite variable and suboptimal outcomes, these improvements are desperately needed. The application of a value framework that includes a broad spectrum of patient-reported outcomes and actual costs of care are nascent in quality improvement and research publications, but existing examples demonstrate the potential of the value framework to drive meaningful change in the cost and outcomes of care.

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