Managing Specialty Care in an Era of Heightened Accountability: Emphasizing Quality and Accelerating Savings

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ABSTRACT

Objectives: Engaging specialists in accountable care organizations (ACOs) may make them more responsive to pressures to lower costs and raise quality. This paper introduces a novel accountable care design in cardiology.

Study Design: Preliminary study using baseline data.

Methods: The Accelerating Clinical Transformation for Creating Value and Controlling Cost in Cardiology concept study involved providers employed by the Providence Medical Group, Oregon. First, using claims data from 2009 through 2011, we created a historic budget to capture cardiovascular disease (CVD)-related costs for attributed patients on a per patient per year basis. Second, we introduced a validated quality metric, the Clinical Performance and Value vignette, to a sample of cardiology providers to examine clinical practice variation in treating coronary heart disease (CHD), coronary heart failure (CHF), and atrial fibrillation (AF). Lastly, we analyzed reimbursement claims paid for CHD, CHF, and AF, and forecasted potential cost savings from reductions in clinical variation.

Results: Examining historic costs, we found they were stable over time, but variable by provider and disease. Quality scores, measured against evidence-based cardiology guidelines, ranged from 48.9% to 85.4% (mean = 66.8%; SD = 5.4%), and the prevalence of unnecessary testing was 46% in CHD, 71% in CHF, and 30% in AF. We project that reducing unnecessary care by 15% to 25% would yield $200,000 to $498,000 in savings ($50-$83 per patient visit) annually. And, if the top 10% of providers as determined by CVD-related costs reduced their costs by 25%, savings would be an additional $283,512 per year.

Conclusions: This accountable care design framework is timely for cardiology and could be applied for other specialty conditions, such as cancer.

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Specialty care accounts for the vast majority of healthcare spending and its use is a major driver of cost over time. The United States spends the most on cardiovascular disease (CVD)—$273 billion in total direct costs in 2010.[1] Cardiologists are leaders in adopting evidence-based medicine to improve clinical quality and practice effectiveness, thereby improving clinical outcomes,[2] patient satisfaction,[3] mortality, and morbidity.[4,5] However, despite this impressive, professional society-endorsed evidence base and the equally impressive clinical and economic utility of adhering to the cardiology evidence, a "translational gap" between evidence and practice remains.[6,7] Notably, there is widespread practice variation in cardiology that presents an opportunity to improve quality and rein in costs.

To improve care and slow cost growth, payers are increasingly turning to using shared savings models, which introduce more aggressive risk-sharing with incentives for quality.[8,9] Shared savings involve an *ex ante* discussion with a payer and agreement on expected spending—usually historically determined—weighed against actual savings with some formula for sharing the difference if there is indeed any savings.[10] Shared savings arrangements have been effective at lowering input costs such as drugs, implants, and imaging studies from the standpoint of hospitals and facilities,[11,12] yet the overall impact of cost savings to the healthcare system has not been clearly demonstrated.[13]

Payments based upon a condition and then linked to shared savings for specialists and primary care providers, however, could encourage managing care across place and time so that profitability can be linked to both efficient delivery of services for an acute clinical episode, and a shift in utilization to lower-cost venues such as the clinic or even the home. Ultimately, shared savings may have their greatest impact if they are condition-focused and reduce utilization by limiting exacerbations requiring readmission, diagnostic testing, or recurrent treatment.

It is surprising that although specialists are at the forefront of evidenced-based practice initiatives, along with being important cost centers in merging payment models, they are not the basis for organizing accountable care organizations (ACOs); to date, efforts to control costs and manage care have been centered on primary care practice. However, as the number of complicated patients grows—particularly those with chronic conditions such as CVD who require specialty care and often multi-specialty care—arguably a shift of focus is required to organize care around the patient and condition rather than the provider and the facility. Yet, there are few examples of how specialists can be engaged with physician leadership and share accountability and savings with all other providers caring for a particular condition.

Take-Away Points

- This paper reports on an innovative approach to controlling an important driver of costs: namely, appropriate specialty care utilization within specialty capitated payment arrangements.
- We introduced a "specialty accountable care organization" (ACO) design concept among cardiology providers employed in a large Pacific Northwest health system in which we used a cardiology-specific subcapitation and potential shared savings design and introduced a quality measurement system.
- We believe this report will have implications for a large number of ACOs and similar organizations nationwide, and be of interest to readers as a model for how shared accountability for quality and cost across the delivery system can be implemented.

A specialty ACO requires that the risk level and payment for providers be set in a practical and equitable fashion that does not compromise quality. While at the system level a global budget may exist for an ACO, importantly, the responsibility for cost control is not totally borne by individual physicians. The portion of shared savings "at risk" for physicians, and thus the incentive, would ideally be for quality based upon adherence to guidelines describing which best practices are linked to better clinical outcomes.[14] An opportunity to test this concept might exist in the treatment of CVD, because currently, more than 60% of US cardiologists are employed or are in negotiation for employment.[15]

We argue that the receipt of shared savings payments must be conditional upon meeting a series of practice-based quality standards. The challenge has been how to determine (and raise) the quality thresholds. A newer and increasingly adopted method for measuring and improving quality through serial measurement and feedback is the Clinical Performance and Value (CPV) vignette, an open-ended simulated case in which a provider is asked to care for a presenting patient and is then scored based on practice guidelines. CPV vignettes are the basis for qualifying for shared savings for cardiology care reported here.

The Accelerating Clinical Transformation for Creating Value and Controlling Cost in Cardiology (ACT-C3) Project is a novel accountable care design in cardiology, centered on CPV vignettes, in which our aim was to introduce a methodology to determine historic costs and identify areas of savings, all while maintaining a focus on evidence-based quality of care. The design requires a measurement of clinical practice and the establishment of a quality threshold in order to participate in any shared savings.

METHODS

The Accelerating Clinical Transformation for Creating Value and Controlling Cost in Cardiology (ACT-C3) Project

Sponsored by Providence Health & Services—a nonprofit healthcare system consisting of a network of health plans, 27 nonprofit hospitals, 214 physician clinics, and a broad range of clinical programs and affiliated services—researchers at the University of California (San Francisco) and from the Providence Medical Group formed the Accelerating Clinical Transformation for Creating Value and Controlling Cost in Cardiology (ACT-C3) Project to design a new model for the care of patients with CVD.

The cardiologists, hospitalists, and nurse practitioners in the project were employed by the Providence Medical Group (PMG), the physician organization that centralizes operational infrastructure and promotes clinical best practices. PMG Oregon has the largest cardiovascular medicine group in Portland, with the PMG cardiovascular medicine division employing about 34 cardiovascular physicians and 20 advanced practice providers.

ACT-C3 completed pilot investigations in 2 general areas: business (costs) and clinical (quality). For the examination of costs to the payer, we created a historic budget for CVD care—named "CardioGrouper"—that would be used to determine the total spending threshold for a shared savings agreement between a payer and the medical group; savings would accrue to the whole medical group. Using the Clinical Classification Software (CCS) from the Agency for Healthcare Research & Quality (AHRQ), we pulled specific CVD diagnosis codes and then used patient-level claims data from several plans to capture all CVD-related claims for attributable patients on a per patient per year basis. We examined these data

for a 3-year span from 2009 to 2011 (described in Part 1 below).

The clinical activities centered on the CPV vignettes, a measure used to examine quality (described in Part 2 below) by determining correct scores for clinical scenarios based on American College of Cardiology (ACC) guidelines. Our motivation was to make the CPV vignette score the basis for qualifying into the shared savings program via achieving a minimum threshold of quality performance. By incorporating this quality requirement into our design model, we were assuming that an increased use of evidence-based practice standards, as measured by CPV vignette scores, would lead to better outcomes and costs. We then analyzed clinical variation alongside historic spending identified by our CardioGrouper to model potential cost savings opportunities (described in *Part 3* below). The ultimate goal of this care design project is to show how these opportunities can lead to new payer-provider contracts, wherein savings would be shared among the purchasers or payers, cardiology providers, and the delivery system.

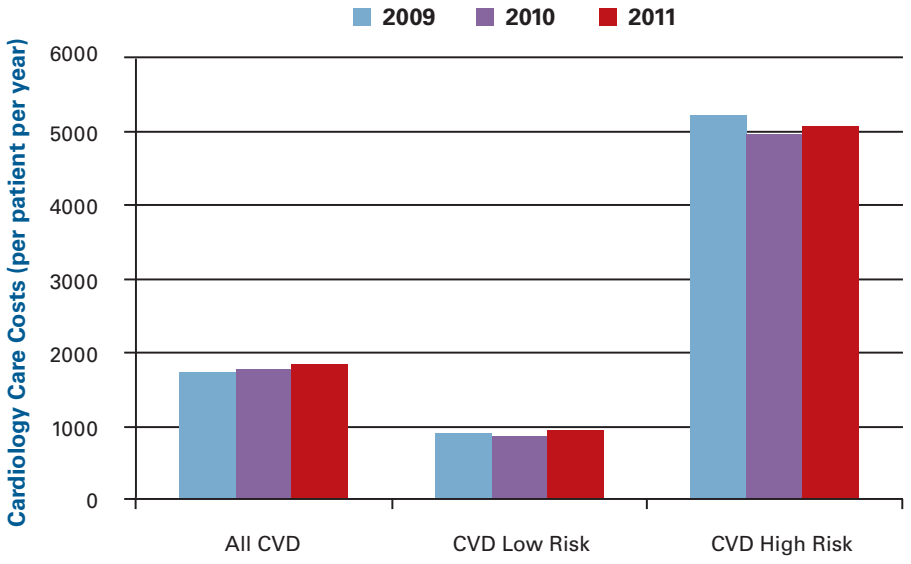
Part 1: Establishing the historic budget—looking at reimbursement over time to establish a spending target for the CVD service line. Costs incurred to payers as claims paid were determined specifically for CVD on a per patient per year basis—we called this the CardioGrouper. We defined "attributable patients" as adult patients seen in the Portland service area with unique member identification for Providence Health Plan. Patients were stratified into those with and without a CVD diagnosis using the list of CVD-specific diagnosis codes from AHRQ CCS developed by the Healthcare Cost and Utilization Project for *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*), CCS-7 (diseases of the circulatory system, excluding 7.5; diseases of veins and lymphatics). Patients thus identified were then stratified into low versus high risk, defined by whether the patient had been seen by a cardiologist with a new visit code during the claims year. We defined risk this way because a visit to a cardiologist for cardiovascular disease is a reasonable threshold for signaling that additional expert care was required.

We determined the historic budget (ie, historic reimbursed charges) by taking all attributed patients and aggregating all their CVD-related patient-level claims paid. To capture the total service line claims paid for each attributed patient, we took common CVD procedural lists from existing cardiology practice groups and reconciled them against CCS Services and Procedural categories relevant to CVD (13,820 Current Procedural Terminology codes in total, used to identify the patients). To capture CVD-specific inpatient claims paid, we used a select list of 59 Major Diagnostic Category 5, cardiology-specific diagnostic-related groups. In total, all CVD-related claims associated with inpatient facility, outpatient procedure, or professional services were included. Using 2011 Providence Medicare Advantage plan data, we then analyzed the CVD cost—defined as the claims paid to the provider—for patients with all CVD diagnoses and by disease for our 3 target clinical conditions: 1) coronary heart disease (CHD), 2) coronary heart failure (CHF), and 3) paroxysmal atrial fibrillation (AF).

We analyzed the cost to the payer (claims paid) by condition for the 2 main cardiology groups employed by the Providence Medical Group, which we refer to as Group A and Group B (the groups are comparable in number of clinical staff, patient load, and referral base), to ascertain if the costs were stable over time. In addition, we stratified claims paid by patient risk, where low risk is defined as having had no new cardiology visit in the year of analysis, and high risk as having had a cardiology new-patient visit in that year. We further examined test utilization by looking at the number of cardiovascular tests per patient per year. We compared utilization (15 different CVD tests) between Groups A and B for our 3 different target conditions. We used a Bonferroni approach to adjust for multiple testing and established a significance level of $P < .0001$.

Part 2: Measuring quality to capture details of practice variation. The ACT-C3 project used CPV vignettes, which are a case mix–adjusted method to measure performance, identify practice variation, and affect behavioral change that would ultimately lead to reducing unnecessary utilization and controlling cost of care.[16-19] The CPV vignette measurement and feedback system consists of open-ended simulated cases in which a provider is asked to care for a patient presenting with 1 of the 3 conditions: CHD, CHF, or paroxysmal AF (see **eAppendix**, available at **www.ajmc.com**). We used clinical practice guidelines developed by the ACC to prepare the performance criteria for the 3 different cases. The CPV vignettes were completed by a group of 24 providers—employed by Providence Medical Group—consisting of advanced practice providers (nurse practitioners and physician assistants), physician hospitalists, and physician cardiologists sampled from the provider roster of the PMG. The 24 participating providers were approached to participate in the study and each one agreed. All 3 CPVs were taken at one time so there was no opportunity to improve one's test-taking ability and thereby one's score just by getting better at testing. There was no subsequent follow-up testing in the

Figure 1. Cardiology Care Costs (mean costs per patient) Across Time and Patient Risk, 2009 to 2011



CVD indicates cardiovascular disease.
Mean costs per patient over 2009, 2010, 2011 for all CV was $1787 (SD = $48); for low risk, $904 (SD = $29); for high risk, $5097 (SD = $125).
Source: Authors' calculations from Providence Medicare Advantage claims data.

findings reported here. Scores generated from the cases were reported as the percentage of criteria correct divided by the total number of criteria for each case. The scoring of the vignettes was completed by a team of trained physicians who were blinded to the identities of the providers taking the vignettes.

Part 3: Projecting cost savings. As in Part 1, using 2011 claims data from the Providence Medicare Advantage population, we analyzed the claims paid for the 3 clinical cases of interest: CHD, CHF, and AF. Costs (to the payer) were attributed to an individual cardiologist based on the evaluation and management new visit code with 1 of the 3 diagnoses and then aggregated on a per patient per year basis. We then identified providers who generated costs above the 90th percentile of charges and applied various cost reduction scenarios to determine the potential savings if these providers were to bring their costs down.

The scenarios used the quality and variation data from the CPV vignettes, such as the prevalence of unnecessary testing (defined above as ordering a test whose result would not change clinical management, as identified in the ACC guidelines). To assign costs for each ordered test for each clinician, we used local charge rates. For this analysis (in Part 3) of the potential savings from reduced clinical variation, we relied on the peer-reviewed literature, noting the emerging body of literature that links evidence-based practice to fewer unnecessary tests and treatments.[20-23] Using this literature for our cost savings projection, we assumed a 15% to 25% reduction in unnecessary testing due to improvements in adherence to cardiology practice guidelines resulting from the measurement and feedback program. We then applied this value (15%-25%) to project the impact of reduced unnecessary testing on overall costs to the payer. Lastly, we used practice data to estimate a range of 4000 to 6000 new patients seen by both cardiology groups annually.

RESULTS

Part 1: Establishing the historic budget—looking at reimbursement over time to establish a spending target for the CVD service line. Using the CardioGrouper, we found that for the CVD service line, costs to the payer were stable over time (2-tailed independent *t* test comparing all costs in 2009 vs 2010, $P = .46$; 2010 vs 2011, $P = .06$; 2009 vs 2011, $P = .95$) but were variable by patient risk (2-tailed independent *t* test comparing low vs high risk for years 2009, 2010, and 2011 data all resulted in $P < .0001$) (reimbursements graphed in Figure 1).

When we looked at the per patient utilization of cardiovascular tests for each specific diagnosis by group, we noted no significant differences in the frequency of patient visits (new or follow-up visits per 100 patients per year) between the practice groups. We found test utiliza-

Table. Test Utilization (number of procedures per patient) by Diagnosis for Groups A and B, 2011

	AF		CHF		CHD	
	Group A	Group B	Group A	Group B	Group A	Group B
Number of patients	**59**	**91**	**22**	**22**	**65**	**82**
Ablation	0.03	0.06	0.10	0.00	0.07	0.00
Cardioversion	0.07	0.14	0.10	0.03	0.00	0.01
Coronary angiogram	0.03	0.02	0.01	0.21	0.24	0.18
Device interrogation	0.07	0.15	0.00	0.05	0.03	0.02
Echocardiogram	0.16	0.03	0.03	0.08	0.12	0.04
EKG	0.93	1.86	0.97	1.11	0.61	1.25
E&M new	1.02	1.16	1.38	1.04	1.29	1.13
E&M established	3.12	2.66	3.18	2.55	2.55	1.97
E&M hospital	0.35	0.56	2.63	2.16	0.45	0.31
NIVL	0.00	0.02	0.00	0.00	0.03	0.04
Pacemaker	0.02	0.11	0.10	0.05	0.00	0.00
Holter monitor	0.19	0.19	0.10	0.00	0.05	0.06
Nuclear stress test	0.07	0.02	0.07	0.00	0.20	0
Treadmill	0.12	0.03	0.17	0.00	0.39	0.01[a]
PTCA	0.04	0.02	0.00	0.00	0.14	0.05

AF indicates atrial fibrillation; CHD, coronary heart disease; CHF, coronary heart failure; E&M, evaluation and management; EKG, electrocardiogram; NIVL, noninvasive vascular lab; PTCA, percutaneous transluminal coronary angioplasty.
[a] $P < .0001$, all Bonferroni adjusted for multiple tests.
Source: Authors' calculations from Providence Medicare Advantage claims data.

tion between groups for the exercise treadmill test (2-tailed independent *t* test comparing Group A with Group B; $P < .0001$) differed significantly after adjusting for physician case load (Table).

Part 2: Measuring quality to capture details of practice variation. We measured the quality of care for 24 CVD providers. Eleven were cardiologists, 9 were hospitalists, and 4 were advanced practice providers who exclusively cared for patients with CVD. Of these providers, 58% were men; 75% had 6 or more years of experience practicing cardiology, 91% saw more than 20 CVD patients per week, and 68% had more than 80% of their practice in CVD.

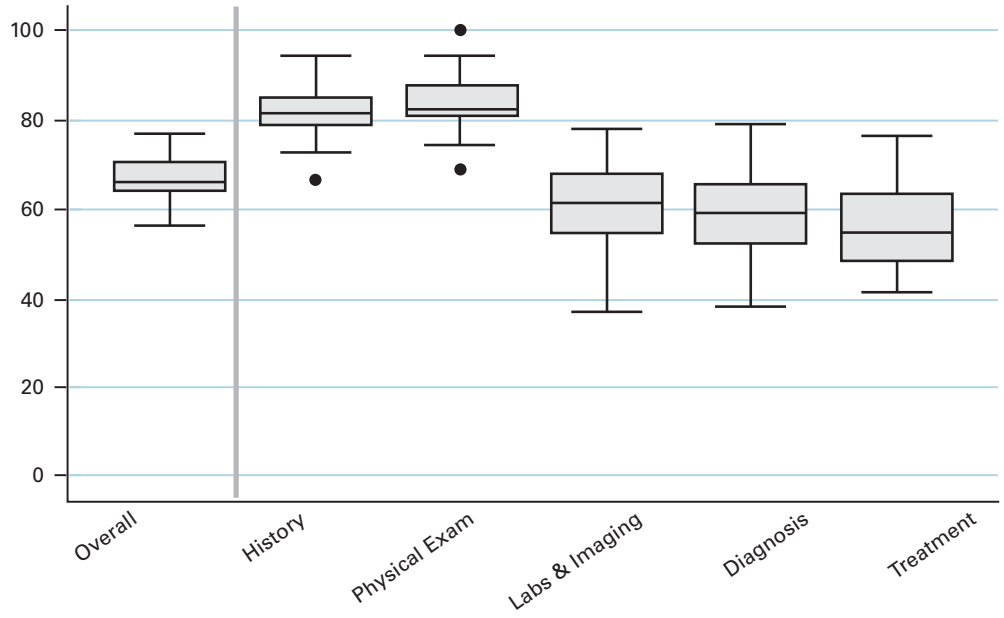
The overall quality of care, as measured by CPV scores for the 3 cases, revealed that conformity to ACC guidelines varied, ranging from 48.9% to 85.4% correct with a mean of 66.8% and a standard deviation of 5.4% (Figure 2). Scores were highest for history and physical exam domains, whereas ordering labs/imaging, diagnosis, and treatment scores were lowest overall. Scores by case type also varied and are shown in Figure 3. There was a substantial amount of unnecessary testing for each vignette: 46% of the CHD, 71% of the CHF, and 30% of the AF cases had unnecessary testing.

Part 3: Projecting cost savings. Looking at the utilization patterns of individual physicians for the 3 CVD diagnoses and the variation found in the case mix–adjusted CPV cases, we found significant inter-provider variability in cost and practice, respectively. We first calculated that if the top 10% of providers, as determined by CVD-related charges reimbursed (CardioGrouper per patient per year), reduced their charges by 25%, savings would be $283,512 per year. Potential cost savings calculated using the variation determined by the CPV results yielded similar estimates. First, based on provider claims data and the prevalence of unnecessary testing established by the vignettes, we estimated that providers incur between $233 and $482 (average = $331) per patient per year in unnecessary testing across the 3 disease types. Reducing unnecessary care by 15% to 25% yields between $200,000 and $498,000 savings (or $50-$83 per patient visit) annually.

DISCUSSION

With the ACT-C3 project, we identified provider practice variation using the CPV vignettes as a measurement tool, then projected potential savings opportunity for the payer using condition-specific historic reimbursement. If referring providers and cardiovascular specialists are to share accountability in performance, utilization, and costs, the payment incentive must be shifted away from fee-for-service. We propose here that setting a cardiology-specific spending target for a payer for a given patient pop-

■ **Figure 2.** Range of CPV Vignette Overall Scores (n of participating practitioners = 24)



CPV indicates Clinical Performance and Value.
Highest scores indicate the best matching with accepted care guidelines.
Source: Authors' calculations from CPV vignette scores earned by sample of Providence providers that treat cardiology patients.

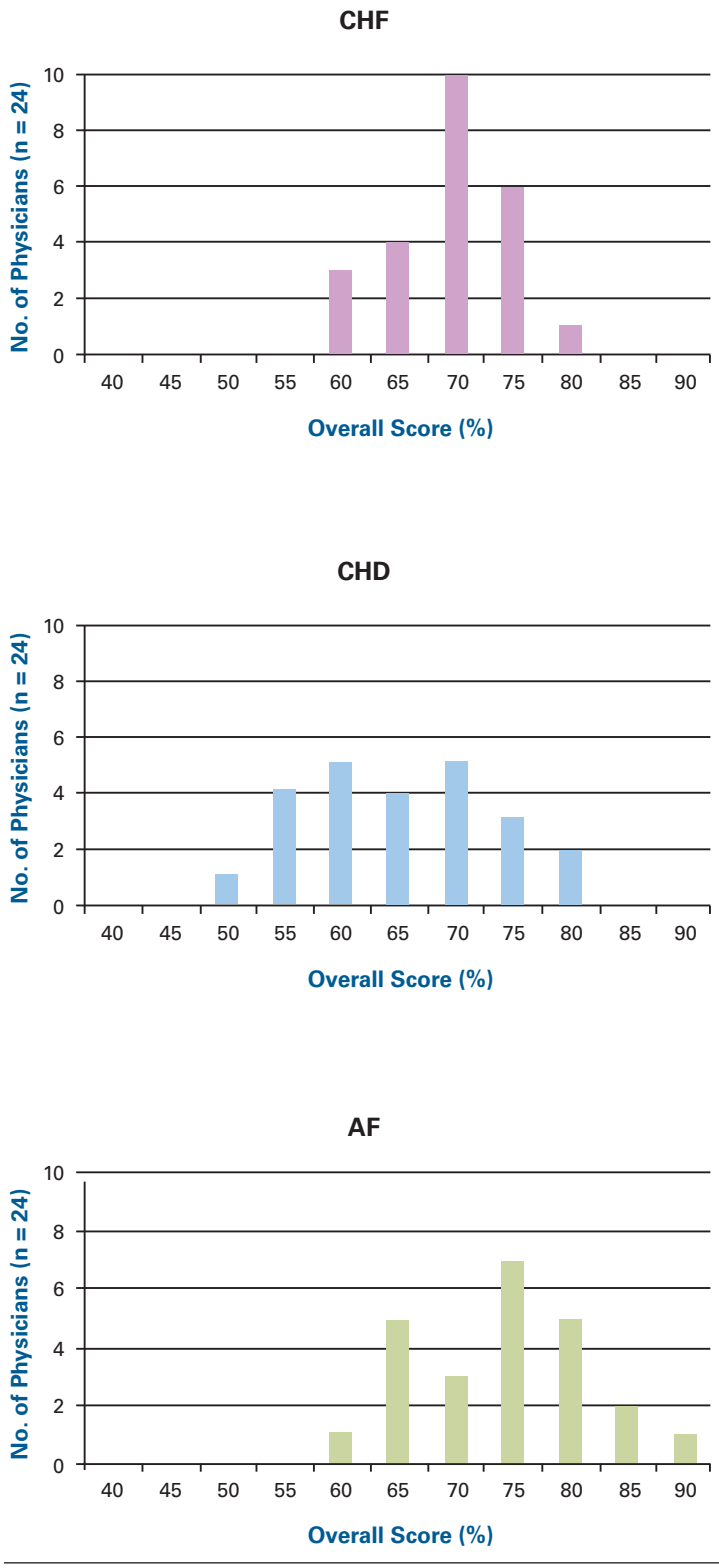
ulation is feasible. This spending target could then be used for negotiation between payer and delivery system and providers toward a shared savings plan. The program envisions collaborative management of patients with shared savings conditioned upon quality measured by CPV vignette-standardized cases. Under this arrangement, the focus of care management is on the quality of care and on greater efficiency (such as the reduction in unnecessary testing) and provides the basis for savings to be shared between the payer and providers, including cardiologists.

We propose that a blended payment model in specialty care—one that combines an at-risk shared savings payment and is conditioned on quality—has the potential to reduce costs by improving clinical practice patterns. We think it is vital to the success of new payment models to have goal congruence between the reimbursement scheme (transaction between payer and provider groups) and the compensation model (how a provider group motivates its individual providers). Given the importance of cardiology, payers might find a "cardiology ACO" or "specialty ACO" to be a useful way to initiate a shared savings program. For an existing ACO or a delivery system under global contract, a specialty ACO might want to create a business line sub-ACO (or subcontracts) to accelerate care delivery transformation and control specialty cost.

A focus on quality in an ACO should require an emphasis on patient care and care processes, beyond organizational infrastructure.[24] Current ACO models may be workable in the short term, but we think they are an unsustainable business model due to their lack of sufficient focus on specialty cost and its reimbursement. Without reengineering the care process and payment incentives, delivery systems are increasingly realizing that a large body of employed providers contributes to rising financial liabilities or incentives to increase expensive specialty service volume.

An estimated 227 provider organizations have established ACO contracts with payers, be it Medicare, Medicaid, or private.[25] To our knowledge, ours is the first to propose a specialty-based ACO. With this pilot study, we argue that clinical variation in practice is what we ought to target, with the ultimate goal of improving quality, which thereby may have positive benefits on reducing costs. We do, however, recognize that the directional association between quality and cost cannot be taken for granted.[26] In reality, higher quality can correct for underutilization and thus may raise costs, just as it decreases overutilization and eliminates unnecessary care thus decreasing costs.[18] Cardiology patients are often the costliest ones, requiring long-term monitoring and close clinical management.

Figure 3. CPV Vignette Scores by Case Type



AF indicates atrial fibrillation; CHD, coronary heart disease; CHF, coronary heart failure; CPV, Clinical Performance and Value.
Highest scores indicate the best matching with accepted care guidelines.
Source: Authors' calculations from CPV vignette scores among Providence providers that treat cardiology patients.

There are important challenges in our model. Practice groups and delivery systems in general contract with a myriad of payers—each with different contracts and their own conversion factors, and many of which are not cost- or quality-based or patient centered. Thus, novel programs such as this one—which require reorienting care delivery to focus on coordinating evidence-based care around clinical conditions rather than procedures and visits, gathering and monitoring clinical quality data—require commitment from a "lead payer," which was the Providence Health Plan in this study. The challenge for the longer term is that other payers will benefit from this care transformation but are not obligated to share in the savings.

There were a number of other obstacles to implementation. In this preliminary concept study, there appeared to be a great deal of administrative uncertainty to changing care delivery processes in anticipation of the tipping point of payment models. Care transformation relies heavily on physician leadership and payer data. In some systems, this degree of innovation and the aspirations to raise quality and lower cost may prove impractical, in our experience, because leadership is either not adequately trained or not sufficiently aware of the interplay between payers, providers, and clinical quality. There are also contracting challenges for the payers who are being asked to layer a specialty-care shared saving program on top of existing contracts. There are also challenges on the provider side, as specialists and primary care providers must find an equitable and efficient way to share resulting savings according to the effort and contributions of each. This challenge is mitigated in a system that employs specialists and generalists, and in our opinion should not be adjudicated by the payer.

Limitations

First, we relied on Providence Medicare Advantage (MA) claims data for our analysis of costs (Parts 1 and 3), and thus our generalizability may be limited to the extent that the conditions around an MA ACO are different from those of the Medicare Shared Savings

Plans that are all in traditional fee-for-service Medicare. With only baseline data on quality (the CPVs) and costs, we are not able to exactly measure how costs change with increased adherence to guidelines; we assumed the link between evidenced-based care and improved outcomes based on the literature,[27-34] and applied an assumed value for our cost projections in Part 3. While the results in Part 3 are just projections, we believe such projections remain an important way for any organization that seeks to create a shared savings program based on care standardization (ie, improving evidence-based practice) to understand the implications of its work, and offer a compelling and easy-to-understand view of the monetary opportunities when they take this on. Lastly, a technical challenge that all programs will have to overcome is the lag between historical cost data and, in this study, the CPV data. We propose further study to obtain serial measurement data. As we link costs to adherence, we will also want to include clinical outcomes, such as fewer hospital days, fewer readmissions, and lower mortality rates.

CONCLUSIONS

Our study is a first step in demonstrating that in the era of heightened accountability for costs and outcomes, a focus on the patient and quality is key and requires bringing all the players to the table, specialists and nonspecialists alike. We offer the potential of a new accountability model centered on particular clinical conditions where savings are shared across all providers treating the condition and predicated on a case mix–adjusted, validated measure of quality.

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Author Disclosures: Dr Peabody is the owner and president of QURE Healthcare, which holds the trademark for the CPV vignettes measurement tool referenced in this paper. Dr Shimkhada is also employed by QURE Healthcare. Dr Huang is an employee of Providence Health & Services. Dr Rosenthal reports no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

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eAppendix

The CPV vignette measurement and feedback system consists of written cases completed by providers. The results from "caring" for these simulated patients are reported back after each session to the individual providers. CPV vignettes have been validated as a quality measure of a provider's ability to evaluate, diagnose, and treat specific diseases and conditions.[1] CPV vignette validation has been done in various settings against standardized patients, demonstrating that the results indeed reflect actual practice as well as changes in actual practice.[1, 2] The vignettes are written, open-ended cases in which a provider is asked to care for a presenting patient. Evaluation of that care occurs in 5 domains: 1) taking a medical history, 2) performing a physical exam, 3) ordering tests, 4) making a diagnosis, and 5) prescribing a treatment plan.

CPV vignettes measure the details of the clinical care process. Trained physician abstractors blinded to the vignette-taker's identity score each vignette. Each provider receives individual feedback on his or her scores. The scores of all the providers at each site are aggregated and analyzed for adherence to guidelines, utilization, and overall quality. These results are given to the department leads so they can see individual-level performance, benchmarked performance, and trends. The key to this system is that vignettes are readministered regularly to capitalize on the feedback. In the interval between testings, providers are incentivized to modify their practice and conform with evidence-based standards, while shifting to more efficient utilization patterns identified in the feedback.[3]

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eAppendix Table. Descriptions of the 3 CVD CPV Vignette Cases

	Case 1: CHD	**Case 2: CHF**	**Case 3: AF**
Description	In this scenario, a patient with cardiovascular risk factors presents with atypical chest pain. The most cost-effective risk stratification should be an exercise treadmill test with aggressive medical management. In practice, more expensive imaging studies are commonly done under the current incentives.	The hospitalized patient in this vignette with new-onset, severely decompensated CHF was undertreated with potential premature discharge. Patients with undertreated CHF are at high risk of readmission, a common cause for morbidity and healthcare cost.	This is a patient with new-onset, symptomatic lone atrial fibrillation. Ideal management plan should include decisions around anticoagulation, appropriate rate vs rhythm control, need and timing for electrophysiologic referral, and consideration for radiofrequency ablation.
History and physical examination	Female, aged 58 years, with dyslipidemia, obesity, and hypertension, who presents with on-and-off chest pain, unrelated to meals or physical activity. Physical examination is unremarkable.	Male, aged 67 years, with hypertension who presents with a 3-month history of increasing dyspnea on exertion and lower-extremity edema. Physical examination reveals laterally displaced point of maximal impulse, mitral regurgitation murmur, and lower-extremity edema.	Male, aged 48 years, with episodes of lightheadedness, nausea, and palpitations. He was tried on diltiazem and then atenolol by his primary care physician but he is experiencing increasing frequency of symptoms. Physical examination is unremarkable.
Diagnostic workup	After routine laboratory testing, the physician needs to determine the most appropriate and cost-effective risk stratification strategy. Based on the stress test result given, the clinician needs to determine whether to proceed to diagnostic coronary angiography and vascularization based on published appropriate-use criteria.	Clinicians are expected to identify high-risk features of decompensated, under-treated CHF based on the lab results, chest x-ray, and echocardiogram findings provided. Appropriate diagnostic testing for potential etiology of new-onset CHF and risk stratification is being evaluated.	Thyroid function test, serum electrolytes, and electrocardiogram were normal. The event recorder showed paroxysmal atrial fibrillation.
Examples of unnecessary items	• Measurement of high-sensitivity C-reactive protein • Holter monitoring • Carotid intima-media thickness measurement • Coronary artery calcium score	• Cardiac magnetic resonance imaging • Repeat echocardiogram in the absence of change in clinical symptoms • Anti-anginal therapy (metabolics) • Nitrate therapy	• Clopidogrel plus aspirin • Anticoagulation in low-thrombotic or high-bleeding-risk population • Vitamins, supplements, antioxidants • Left atrial appendage closure

	• Cardiac rehabilitation • Metabolic antianginal medication (trimetazidine, ranolazine, nicorandil, ivabradine) • Vitamins A, C, E; antioxidant, coQ10 supplements • Dipyridamole	• Inotropics (long-term) • Home oxygen therapy • Antiarrhythmic therapy • Vitamins A, C, E; antioxidant, coQ10 supplements • Metolazone • Endomyocardial biopsy (routine) • Anticoagulation therapy	

AF indicates atrial fibrillation; CHD, coronary heart disease; CHF, coronary heart failure; CPV, Clinical Performance and Value; CVD, cardiovascular disease.