

Managing Total Knee Replacement Under Value-Based Payments

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In response to unsustainable increases in health care costs, payment reform models, developed by both public and private payers, have shifted from paying for volume to paying for value. Through these models, primary care groups are now at the forefront of health care redesign to include not only high-quality but also highly efficient care.^{1,2}

Results for these programs over the past decade suggest modest improvements of 1% to 3% cost reductions for Medicare beneficiaries.³⁻⁷ A recent global survey highlighted several reasons for the slow progress in value-based care, including the need for alignment of incentives and performance metrics and shared real-time data.⁸ In light of this, the Center for Medicare and Medicaid Innovation and others are accelerating efforts to increase savings to levels that create sustainability in these programs partly by enhancing operating capabilities to align beneficiaries and providers.⁹ With the majority of these initiatives operating in environments where incentives are not aligned between volume and value, it becomes more imperative to have precise clinical measures of performance for primary groups operating under value payments to communicate with specialists and institutions largely operating under volume payments. Because specialty decisions, and spending, far outweigh primary care spending, models that allow primary care groups to align specialists with value-based payments in a patient-centered manner are increasingly important.¹⁰ Waste in health care, which has been characterized as underutilization of care that improves patient outcomes and overutilization of care that does not improve (and may harm) patient outcomes, has been well described.^{11,12} Engaging specialists who are still operating within a fee-for-service (FFS) environment requires agreement on where waste that does not contribute to patient outcomes can be safely removed.¹³

In this article, we describe the development of performance measures that provide knowledge of variation that may constitute waste in the delivery of care for knee osteoarthritis (KOA) and knee replacement (KR). We illustrate the use of the knowledge generated from this approach in developing aligned goals and shared data between a primary care group and the orthopedic surgery groups

ABSTRACT

OBJECTIVES: To evaluate opportunity gaps and set outcome goals in knee replacement (KR) between a primary care group taking financial risk for managing its patients and 6 fee-for-service (FFS) orthopedic groups that serve their patients.

STUDY DESIGN: The opportunity gap analysis was a cross-sectional evaluation of the outcomes of interest on a risk-adjusted basis using orthopedic groups, the primary care group's patients, and regional comparisons. The impact evaluation was a historical cohort comparison tracking outcomes of interest over the time frame of the intervention.

METHODS: Using risk-adjusted Medicare data, we defined opportunity gaps in the following outcomes: density of KR surgery, site of KR surgery, postacute care placement, and complications.

RESULTS: Opportunity gap analysis demonstrated the following variation on a regional basis: a 2-fold difference in density of KR, a 3-fold difference in outpatient surgery, and a 2.5-fold difference in institutional postacute care placement. In the impact evaluation comparing 2019 with 2021, the primary care group's patients had reduced density of KR surgeries from 15.5 per 1000 to 13.0 per 1000, an increase in outpatient surgery from 31.0% to 81.6%, and a reduction in institutional postacute care utilization from 16.0% to 6.1%. Less pronounced trends were seen in the region for all Medicare FFS patients. These results were achieved with stable complication rates, which had an observed/expected ratio of 0.61 in 2019 and 0.63 in 2021.

CONCLUSIONS: We achieved alignment of incentives through use of performance information with specific goals and promise of referrals to value-based partners. This approach resulted in improved value to patients with no evidence of harm and is translatable to other specialty care and markets.

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TAKEAWAY POINTS

Progress has been slow in realizing transformation through value-based payments. We describe a structured approach that aligns the incentives in a setting with both value-based and fee-for-service payments. By using concise estimates of regional, orthopedic group, and primary care physicians' patients' outcomes—including frequency of total knee replacement, site of surgery, postacute care utilization, and complications—to guide opportunity gap analysis and goal setting, we demonstrate the following:

- ▶ A model for at-risk primary care groups to engage orthopedic surgeons in evaluating clinical and financial efficiencies in knee osteoarthritis care
- ▶ Development of a learning collaborative between orthopedic surgical groups and primary care physicians with continued focus on specific performance measures
- ▶ Improvement in clinical and financial outcomes for the patients served by the primary care group

the provision of nonsurgical alternatives to knee pain and functional limitations, selection of surgical treatment and patient optimization that would provide patients with alternatives to hospital exposure and reduce their risk of complications, and functional recovery that was tailored to patient needs in the setting where they were most comfortable. Using this approach, we identified 3 specific processes and associated outcome measures allowing us to evaluate variation. The goal of the analysis was to provide clinicians with knowledge of their performance across selected outcomes of interest after adjustment for patient factors,

that serve their patients. We describe process changes to align care that is centered on the best patient outcomes and to provide a roadmap to our approach in the context of the barriers anticipated, solutions used, and results demonstrated to date.

METHODS

Setting

Central Ohio Primary Care (COPC), a primary care–focused group in Columbus, Ohio, is composed of more than 400 physicians. COPC has a history of managing populations utilizing the patient-centered medical home model and CMS Comprehensive Primary Care (CPC) Plus initiative.¹⁴ In 2018, COPC took full financial risk for more than 30,000 Medicare Advantage (MA) covered lives and has moved to add 26,000 more covered lives through Direct Contracting (DC) with CMS in 2020.¹⁵ In addition to primary care physicians, COPC physician shareholders include physical medicine and rehabilitation clinicians.

Within central Ohio, there are 6 independent or hospital-employed orthopedic groups providing services to COPC patients as fee-for-service physicians. We approached the reorganization of KOA care within the community by engaging primary care and orthopedic clinicians, under the guidance of physical medicine and rehabilitation physicians, in an evaluation of current outcomes with the intent of referring COPC patients to 2 groups only.

Study Design

By evaluating the patient's journey with KOA through value stream mapping, we identified several areas of focus to engage patients on joint decision-making in terms of treatment pathways in KOA and KR.¹⁶ The use of value stream mapping in a value-based payment environment allows care redesign that focuses on patient outcomes and safety. Using risk-adjusted data to identify opportunity gaps removed patient-driven variation and allowed the evaluation of processes of patient selection for surgery, site of surgery, and recovery from surgery. We specifically identified inefficiency, defined as underutilization of evidence-based practices that improve patients' outcomes or overutilization of services that do not improve patient outcomes. Areas identified included early identification of KOA and

help them understand the impact of the care on patients, engage them in the modifiability of their performance, and set goals relative to the following outcome measures:

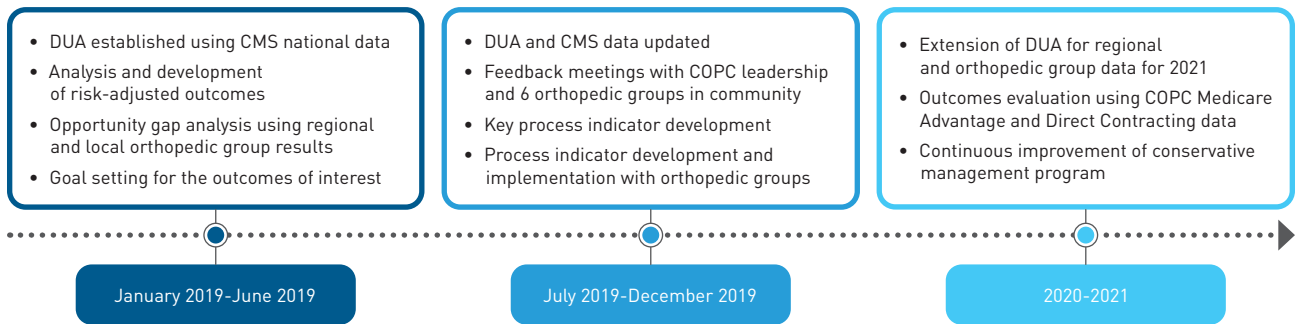
1. Patient selection for conservative management vs surgical KR. Outcome: density of knee replacement in comparative populations.
2. Selection of site where surgery for patients receiving KR was performed. Outcome: risk-adjusted outpatient/ambulatory surgery center utilization within COPC, regions, and orthopedic groups.
3. Management of post-KR functional recovery, complications, and rehospitalization. Outcomes: risk-adjusted postacute skilled nursing facility (SNF) or inpatient rehabilitation utilization, collectively termed institutional postacute care (IPAC) within COPC, regions, and orthopedic groups; and risk-adjusted hospitalizations for complications following surgery within COPC, regions, and orthopedic groups.

Databases

We used 2 sources of data to understand local and national variation in the outcomes of interest and to develop risk stratification and adjustment techniques to remove variation attributed to patient factors.

Under a Data Use Agreement with CMS, we acquired national Part A, SNF, Outpatient Hospital, and Denominator files for 2017 through 2019 and the last 6 months of 2021 to construct the outcome measures at the community, hospital, and orthopedic group levels. COPC had all claims available for its CPC Plus population for 2017 through the third quarter of 2019, which were scored using national parameter estimates to define opportunity gaps within COPC patients. COPC had data from MA plans and DC claims data for 2019 through 2021, which were used, unadjusted, to show trends of outcomes within COPC patients over time. KR surgery was defined using *International Classification of Diseases, Tenth Revision* procedure codes for inpatient surgery and Healthcare Common Procedure Coding System codes for outpatient surgery during the time frame. Clinical characteristics were defined for use in risk adjustment using the Agency for Healthcare Research and Quality's Clinical Classification System software.¹⁷

FIGURE. Timeline of the Initiative



COPC, Central Ohio Primary Care; DUA, Data Use Agreement.

TABLE 1. Baseline Performance Across Regions, Orthopedic Groups, and COPC, 2017-2019

Baseline results: opportunity gap analysis	Total KR surgery per 1000 Medicare beneficiaries annualized	Percent of KR surgery at outpatient hospital			Percent of inpatient surgery discharged to an institutional postacute care setting			Complication rehospitalization		
	Observed rate	Observed rate	Expected rate	O/E rate	Observed rate	Expected rate	O/E rate	Observed rate	Expected rate	O/E rate
Region range of results	6.54-13.31	13.93%- 56.50%	26.51%- 32.31%	0.50-1.87	14.74%- 38.61%	19.88%- 25.49%	0.73-1.77	1.15%- 2.74%	1.89%- 2.26%	0.59-1.18
Columbus region	12.00	22.48%	26.51%	0.85	22.46%	22.08%	1.02	1.66%	2.00%	0.83
Orthopedic group range of results	—	6.72%- 54.98%	20.73%- 27.90%	0.28-2.01	14.34%- 40.00%	19.44%- 26.93%	0.64-1.88	0.00%- 2.50%	1.88%- 3.48%	0.00-1.21
COPC results	14.00	31.07%	29.51%	1.05	19.27%	22.01%	0.88	1.15%	1.87%	0.61

COPC, Central Ohio Primary Care; KR, knee replacement; O/E, observed/expected.

Analysis

We developed risk-adjustment models using standard techniques across the outcomes of interest to remove patient-driven variation and provide clinical measures that were deemed actionable.

We modeled patient demographics, comorbidities, and other procedures using national CMS data and applying modified machine learning.¹⁸ Models for complications followed methodology defined by CMS for Hospital Compare and included 6 complications and mortality.¹⁹ Comparative regions were specified using defined core-based statistical areas and selected to align with communities where agilon health, a partner with COPC in value-based care transformation, is active with other primary care groups.^{20,21}

To communicate relative performance across regions and orthopedic groups, we summed expected probabilities for each outcome of interest using the listed categories and compared with observed rates as an observed/expected (O/E) ratio. COPC CPC Plus data were scored using parameter estimates from the national data to determine O/E ratios for patients within CPC Plus. Unadjusted COPC MA and DC data were used to evaluate the impact of the program on patient outcomes.

RESULTS

Results of the initiative are described in 3 components that follow the timeline of the project displayed in the **Figure**. The first component includes exploratory analysis across the selected outcomes of interest, the second component includes key process changes developed and executed to affect the outcomes of interest, and the third component includes change in selected outcomes during implementation of the key process changes.

First Component: Evaluation of Opportunity Gaps and Goal Setting Using Comparative Data

Table 1 is a summary of the performance within the outcomes of interest across the comparison communities, orthopedic groups serving COPC patients, and COPC patients. It demonstrated marked variability in outcomes after adjustment for patient demographics and comorbidity. There was a 2-fold range in variability in density of surgeries across the selected communities, with CPC Plus patients having the highest rates; these differences persisted when evaluating specific populations such as non-dual-eligible patients

TABLE 2. Performance Across Regions and Orthopedic Groups, July-December 2021

Regions and orthopedic groups	Percent of total KR surgery as outpatient hospital			Percent of inpatient/outpatient surgery discharged to an institutional postacute care setting			Complication rehospitalization		
	Observed rate	Expected rate	O/E rate	Observed rate	Expected rate	O/E rate	Observed rate	Expected rate	O/E rate
Region range of results	47.57%-93.48%	62.29%-71.59%	0.71-1.38	6.31%-15.96%	5.64%-12.32%	0.61-2.72	0.00%-5.71%	1.11%-3.14%	0.0-2.74
Columbus region	80.90%	65.81%	1.23	14.29%	8.04%	1.78	2.15%	2.74%	0.78
Orthopedic group range of results	66.02%-87.50%	58.69%-68.08%	1.00-1.45	4.17%-32.43%	6.08%-11.96%	0.35-5.34	—	—	—

KR, knee replacement; O/E, observed/expected.

and by age group. Evaluating variation of risk-adjusted outcomes using O/E rates demonstrated a 3-fold variation in site of surgery, a 2.4-fold difference in IPAC utilization, and a 2-fold variation in rehospitalization on a community basis. There were larger variations at the orthopedic group level.

The variation seen across these outcomes formed the basis of a series of meetings with orthopedic groups in the community. During the meetings, current orthopedic group performance was presented. Concerns around differences in outcomes were allayed by describing the risk-adjustment process and provision of elements in the models. Discussions regarding evidence-based approaches to care redesign led to the definition of key processes in patient-centered care, which led to the selection of specific goals that were negotiated with the groups. These included:

1. A KR density of 12 per 1000 COPC patients annually, based on comparative regional performance by providing patients with an alternative to surgery in the treatment of KOA
2. An O/E ratio of outpatient surgery of 2.25, which roughly correlated with a 70% rate of outpatient surgery by better evaluation of the necessity to expose patients to a hospital inpatient stay
3. An O/E ratio of 0.7 for IPAC utilization and 0.8 for complication rehospitalization by better functional recovery, patient selection, and patient optimization prior to surgery for those patients selected

Second Component: Summary of Key Process Changes

We worked with the orthopedic groups and key COPC leadership to evaluate the impact of the above goals on patient care and link the above outcomes with specific key process changes to achieve the set goals. An evaluation of current approaches to KOA demonstrated a lack of a systematic nonsurgical approach to the pain and functional limitations caused by the disease. COPC physical medicine specialists developed a musculoskeletal (MSK) program for KOA based on results of a randomized clinical trial that included, first, evaluation of the knee pain, and then its treatment, with physical therapy, education, focused nutrition counseling, and behavioral health counseling to address concomitant issues affecting KOA-related pain.²²

The process of site selection for surgery shifted with advances in technology and surgical technique for KR and changes in CMS regulations regarding inpatient surgeries. Process changes guided by the orthopedic groups accelerated the selection of outpatient surgery as demonstrated safely by other organizations.²³

Implementation of programs such as prehabilitation and more intense focus on at-home postsurgical recovery using physical therapy programs evaluating the patient’s preoperative functional status and home environment as well as intense focus on patient functional recovery have demonstrated reduction in use of SNFs and recovery at home after KR surgery.²²⁻²⁵

Approaches to complication reduction are available and rely on both patient selection and medical optimization prior to surgery with a focus on cardiovascular, infectious, and thromboembolic risks.

Third Component: Program Evaluation

As **Table 2** demonstrates, there was a large shift in site of service and IPAC utilization. The observed rate of outpatient surgery increased from 22.5% to 81.0% and the observed rate of IPAC utilization decreased from 22.5% to 14.3% in the Columbus region. Adjusting for patient differences, the O/E outpatient surgery rate in Columbus increased by 44% (from 0.85 to 1.23); in comparison with other regions, Columbus had a higher rate of outpatient surgery, with a mean O/E ratio of 1.09 in all regions. Although IPAC use decreased overall, in Columbus it increased on an O/E basis by 47% (from 1.02 to 1.78) within the region; in comparison with other regions, Columbus had a higher rate of IPAC utilization, with the mean O/E ratio being 1.29 in all regions. Compared with other regions, Columbus had a complications O/E ratio of 0.78, which is less than expected; the rate was stable between the 2 periods.

Table 3 displays trended unadjusted results for COPC patients between 2019 and 2021. The rate of KR dropped in 2020, consistent with effects of the COVID-19 pandemic, but returned to a rate of 13 per 1000, which was 16% lower than in 2019. Interestingly, the rate of KR declined more in the MA population, for whom COPC has been focused on patient engagement and population management since 2018, than in the DC population, which came under risk-bearing contract in 2020. We noted an increase in outpatient surgery of 163%, with 82% having outpatient surgery in 2021, and a reduction

TABLE 3. COPC Medicare Advantage and Direct Contracting Results, 2019-2021

Year	2019	2020	2021	Percent difference 2019-2021	P
Mean beneficiaries per year	58,533	64,480	66,221	—	—
KR surgeries in population	905	776	861	—	—
KR surgeries / 1000 beneficiaries	15.46	12.03	13.00	-15.91%	.0002
Observed outpatient surgery	31.04%	77.02%	81.57%	162.80%	<.0001
Observed IPAC	16.04%	8.89%	6.08%	-62.10%	<.0002

COPC, Central Ohio Primary Care; IPAC, institutional postacute care; KR, knee replacement.

in SNF utilization of 62%, with 6.1% of patients having IPAC use after KR in either the inpatient or outpatient setting.

DISCUSSION

The Center for Medicare and Medicaid Innovation has launched at least 54 models over the past decade that have been focused on reducing health care expenditures while preserving or enhancing the quality of care.⁹ Public and private payer initiatives have provided learning environments for groups such as COPC to transform health care delivered to their patients, but they have lagged in showing meaningful results.

We demonstrate a focused approach to improving patient outcomes at the same time as reducing the cost of care. By providing baseline performance information and expectations of goals based on risk-adjusted data, we facilitated change in patient care. The COVID-19 pandemic accelerated these changes nationally in 2020, as evidenced in the large changes in site of service and recovery. COPC patients experienced a greater rate of observed outpatient surgery and a greater reduction in observed IPAC use than national rates; these trends continued moving into 2021 after widespread availability of COVID-19 vaccination. COPC's rate of KR fell in 2020 and did not return to the baseline rate of 2019 in 2021; we attribute this to the MSK program's effect on patient choice for KOA treatment. Informal surveys of patient satisfaction with the structured program were very favorable, with one patient expressing their gratitude for having a solution "other than knee replacement." In the randomized controlled trial that we used to develop the program, 75% of patients who received nonsurgical management did not have KR after 1 year, indicating that they felt adequate pain relief and functional improvement without surgery. We plan to track the long-term outcomes to determine the value of the program to patients and within risk-bearing contracts.

Our learnings from this work reinforce the need for a structured approach to identifying spending that does not contribute to patient outcomes, which has been described as waste. When waste is identified, applying the techniques of quality improvement including

opportunity gap analysis, key process indicator development, and program evaluation provides the best pathway to successful care transformation. Within the initiative, we identified barriers to success in 3 areas—incentives to transform, knowledge around opportunities to transform care, and structure around behavior change—which we characterize as culture. Listed below are solutions that we discovered to address each of these barriers:

- COPC's at-risk contracts create the financial incentive to reduce the waste in health care spending for its patients. These contracts allowed COPC's development of a conservative KOA management program to provide patients a choice other than surgery. They also provided a method of aligning COPC interests with those of orthopedic groups by providing increased referrals to groups demonstrating better outcomes through models of centralized referrals and transparency in outcomes across groups. To accelerate this work, COPC has established relationships with just 2 orthopedic groups and expanded the clinical focus to spine surgery.
- Measuring overutilization has been characterized as "challenging, given the difficulty of defining appropriate care."¹¹ By evaluating variation after adjustment for patient factors, we were able to quickly bring acknowledgment that waste existed in the care of COPC patients among all participants. By working with the data in a transparent manner, the data limitations could be minimized and trust achieved among the stakeholders. This process created a shared knowledge around opportunity gaps in patient outcomes and aligned performance measurement.
- The behaviors entrenched by decades of FFS incentives in the health care community create a strong headwind for transformation of care. Although there has been a meaningful investment from public and private payers in primary care transformation through initiatives such as the patient-centered medical home and CPC, there has been much less focus on transforming other portions of the delivery system. By capitalizing on aligned incentives, knowledge of opportunities, and shared process data, we were able to demonstrably engage orthopedic specialists operating in a largely FFS environment on an initiative to remove wasteful spending across care for KOA.

Limitations

Due to the shift from outpatient hospital surgery to ambulatory surgery centers and data unavailability for ambulatory surgery centers nationally, we did not calculate density of KR for comparison regions in 2021 as we did for baseline analysis. Assuming national trends of growth in KR resumed after the reduction caused by COVID-19 in 2020, the reduction seen in the COPC population is most likely significant.²⁶ Differences in rates of change in the MA vs DC populations allow us a window into a difference-in-difference with similar populations; the larger decline in KR rates between 2019 and 2021 in the MA group suggests an effect of the MSK program in

patients under risk management, or a likelihood of MA patients to be more engaged in the MSK program.

We did not risk adjust the temporal data from COPC due to unavailability of files. Having risk-adjusted baseline data allows us to interpret the trended data with certainty that the COPC population does not represent a unique population, as the expected rates are within range of the Columbus region.

The approach that we outline in this manuscript is a summary of one approach in which a primary care group partners with a specialty group to understand variation in care and its contribution to waste. It should be considered a work in progress in the experiment that payment reform is providing health care to create a more efficient patient-centered delivery system.

Our approach is consistent with emerging models of primary care groups taking a leadership role in managing health care delivery by redesigning care both within their practices and more broadly within other physicians and institutions that may care for their patients.²⁷

CONCLUSIONS

Current payment reforms that are bringing financial risk to primary care groups have shown marginal impact in reducing the costs of health care. Reducing spending in health care requires the identification of waste through either underutilization of services that improve patient outcomes or overutilization of services that do not improve patient outcomes. Focusing on specific clinical outcomes in KOA and using risk adjustment to remove patient variation engaged orthopedic surgeons on specific goals of care for COPC patients. By ensuring increased referrals to orthopedic groups aligning with specific goals in KOA care, we have created partnerships between physicians who have differing payment incentives. ■

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