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The Population Health Value Framework: Creating Value by Reducing Costs of Care for Patient Subpopulations With Chronic Conditions

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Abstract

Problem

With the growth in risk-based and accountable care organization contracts, creating value by redesigning care to reduce costs and improve outcomes and the patient experience has become an urgent priority for health care systems.

Approach

In 2016, UCLA (University of California, Los Angeles) Health implemented a system-wide population health approach to identify patient populations with high expenses and promote proactive, value-based care. The authors created the Patient Health Value framework to guide value creation: (1) identify patient populations with high expenses

and reasons for spending, (2) create design teams to understand the patient story, (3) create custom analytics and spending-based risk stratification, and (4) develop care pathways based on spending risk tiers. Primary care patients with three chronic conditions—dementia, chronic kidney disease (CKD), and cancer—were identified as high-cost subpopulations.

Outcomes

For each patient subpopulation, a multispecialty, multidisciplinary design team identified reasons for spending and created care pathways to meet patient needs according to spending risk. Larger, lower-risk cohorts received necessary

but less intensive interventions, while smaller, higher-risk cohorts received more intensive interventions. Preliminary analyses showed a 1% monthly decrease in inpatient bed day utilization among dementia patients (incident rate ratio [IRR] 0.99, $P < .03$) and a 2% monthly decrease in hospitalizations (IRR 0.98, $P < .001$) among CKD patients.

Next Steps

Use of the Patient Health Value framework is expanding across other high-cost subpopulations with chronic conditions. UCLA Health is using the framework to organize care across specialties, build capacity, and grow a culture for value.

Problem

Faced with new payment models from commercial payers and the Medicare Access and Children's Health Insurance Program Reauthorization Act of 2015, U.S. health care systems are looking for ways to meet increasing market demand for value, defined as reduced total costs of care with improved clinical outcomes and patient experience.[1] Strong incentives include the growth of risk-based financial contracts in which health care systems face potential financial losses if value improvement goals are not met across a population. With so much at stake for patients and health care systems, redesigning care to create value has become an urgent priority. Health care systems are struggling most with how to

reduce total costs of care, as there are few existing models to adapt locally.

Effective approaches to creating value will incorporate an understanding of patients' needs and meet them through interventions at all risk tiers to achieve short- and long-term returns.[2] An approach that addresses only the most expensive 1% of patients (accounting for 22% of expenditures) may not reduce spending as these patients' complex medical and social needs require significant resources.[2] Such an approach also focuses efforts on individual patients rather than building the infrastructure for populations. Approaches for reducing long-term costs and unnecessary care must include efforts across all risk tiers, including middle-risk patients (the 19% of patients accounting for 58% or more of health care expenditures)[3,4] and bottom-risk patients (the 80% of patients accounting for 20% of expenditures), who require health care screening and condition-specific preventive therapies. Many health care systems seek an understanding of how to effectively target their resources to subpopulations of patients who can most benefit from

interventions. Progress toward identifying these subpopulations and implementing interventions, however, can be impeded by limited resources when health care systems' departments function independently within silos.

Here, we report how we reconceptualized care delivery for patients with three expensive chronic conditions across our large health care system as part of a multipronged strategy (including bundles, pharmaceuticals, etc.) to reduce expenses. We believe that population health approaches such as ours can reduce total costs of care and improve value. At UCLA (University of California, Los Angeles) Health, population health means being accountable to our full population so that patients receive high-quality care at lower cost regardless of care site and whether they are seen primarily by primary care or specialty teams. We describe our system-wide Population Health Value (PHV) model designed to reduce expenses and create value through identifying causes of spending across populations; identifying key opportunities with the input of clinicians, staff, and patients; leveraging available data; and creating multispecialty,

multidisciplinary care pathways based on risk tiers.

Approach

In August 2016, we began to develop a strategy to identify patient populations across UCLA Health with high expenses across all risk tiers and to promote proactive value-based care. UCLA Health is associated with the David Geffen School of Medicine at UCLA and encompasses 4 hospitals, 150 ambulatory clinics, and over 2,000 clinical faculty.

We focused on patients in the UCLA primary care network, which includes 40 UCLA-owned clinical practices caring for more than 350,000 patients. UCLA Health is accountable for approximately half of these patients through risk-based and accountable care organization contracts, spanning commercial health maintenance organizations and Medicare Advantage (57,500 patients and 9,300 patients, respectively), commercial preferred provider organizations (66,000 patients), and the Medicare Shared Savings Program (35,000 patients). We targeted high-cost subpopulations of patients with chronic conditions because these patients touch our system multiple times—each of which is an opportunity to intervene. For these subpopulations, a new leadership team focused on understanding and delivering holistic care to address patients' complex medical, behavioral, and social needs.

We developed a four-step PHV framework to guide value creation within these subpopulations by reducing expenses while also improving clinical outcomes and the patient experience.

Step 1: Identify patient subpopulations with high expenses and reasons for spending

We identified three subpopulations with high expenditures—patients with dementia, chronic kidney disease (CKD), and cancer—by looking at total spending, spending per patient per month (PMPM), and patient-specific utilization data from internal and claims sources. Causes of spending were determined in commercial and governmental contracts, including acute and chronic care delivered in the inpatient, ambulatory, and postacute settings (Table 1). We reviewed these data in August 2016

(CKD) and in April 2017 (dementia and cancer), before launching interventions.

Step 2: Create design teams to understand the patient story

Process mapping demonstrated that patients in these subpopulations could interact with as many as 20 care team members within a few months. The care teams included office staff, clinicians, trainees, and patients and their caregivers. Existing primary care coordinators gained patient input on value improvement program development[5] because drawing on the wisdom of these patients was important to understand key opportunities and engage patients.

We convened multispecialty, multidisciplinary PHV design teams beginning in August 2016 (CKD) and April 2017 (cancer and dementia). Each design team incorporated patient input in its decisions and included key care team members with whom patients regularly interact. For example, the dementia design team included program staff, primary care clinicians, and geriatricians—all of whom are vital to implementing initiatives that target large groups of lower-risk patients—as well as advance care planning and palliative care specialists, psychiatrists, and neurologists, who engage with late-stage patients (Figure 1).

In addition to patient care experts, the design teams included value improvement, analytics, operations, and health information technology (IT) experts. This merging of expertise enabled teams to make rapid decisions and, later, implement changes. Design teams were cochaired by the clinical leadership of each discipline and the health care system medical director of quality improvement (R.G.).

Step 3: Create custom analytics and spending-based risk stratifications

For each subpopulation, we created custom analytics that use administrative and clinical data (e.g., International Classification of Disease Revision–9 or –10 [ICD-9 and ICD-10] codes, problem lists and discharge diagnoses, natural language processing, medications, labs) to define targeted populations, better measure care, and understand causes of spending. This process occurred during August–September 2016 (CKD) and April–May 2017 (dementia and cancer).

Customized metric development at UCLA Health involved conceptualizing and validating the definitions for populations, goals, and process measures with clinicians.[6] The design teams identified improvement opportunities based on their clinical experience and case-level analysis. Each measure incorporated all payer types because we aimed to provide equitable care regardless of insurance type. These data could be shared with primary and specialty clinicians since they used the same electronic health record (EHR).

We then developed risk stratification metrics specific to the subpopulation, which underwent iterative improvements given that risk modeling is a developing field.[7] Patient- and caregiver-reported outcomes were incorporated when available. For example, in dementia, we included behavioral problems, severe functional impairment, and access to resources in addition to utilization and concurrent condition data. We defined five patient-expenditure risk strata that correlated with our natural distribution of spending for the three conditions: the top 1% (tier 1), 2%–5% (tier 2), 6%–20% (tier 3), 21%–60% (tier 4), and 61%–100% (tier 5) of spending.

Step 4: Develop targeted care pathways based on spending risk tiers

We then developed interventions to address patient needs identified at each risk tier. These were implemented during October–December 2016 (CKD) and June–September 2017 (dementia and cancer). We believed that the greatest opportunities to produce value would be to focus in the short run on middle-risk patients (tiers 2 and 3) and in the long run on low-risk patients (tiers 4 and 5).[3] We identified that patient care in our health care system was often fragmented between primary and specialty clinicians, potentially leading to care duplication or missed opportunities during care transitions. Therefore, the multispecialty, multidisciplinary PHV design teams mapped comanagement strategies and care pathways by primary and specialty practitioners and their care teams for each risk level (Chart 1). Key elements included leveraging midlevel practitioners and care coordinators, health IT infrastructure, and other shared resources to reach the subpopulations of patients who may

Table 1

Characteristics of Three High-Cost Subpopulations of Patients Prior to 2016–2017 Implementation of Population Health Value Care Pathways at UCLA Health

Characteristics	Dementia[a] (N = 4,348)	CKD[b] (N = 17,172)	Cancer[c] (N = 27,757)
Patients			
Age, mean (SD)	85.0 (9.0)	73.5 (14.9)	62.9 (15.3)
Male, no. (%)	1,464 (34.0)	8,286 (48.3)	9,574 (34.5)
Race, no. (%)[d]			
Caucasian	2,722 (62.6)	10,533 (61.3)	15,269 (55.0)
Asian and Pacific Islander	370 (8.5)	1,501 (8.7)	3,662 (13.2)
Black	346 (8.0)	1,482 (8.6)	1,147 (4.1)
Other	535 (12.3)	2,167 (12.6)	5,456 (19.7)
Ethnicity: Hispanic, no. (%)[d]	375 (8.6)	1,489 (8.7)	2,234 (8.0)
Comorbidities by CMS definition,[e] mean no. (SD)	5.5 (3.5)	4.7 (3.2)	0.6 (0.8)
Payer mix, no. (%)			
Medicare Shared Savings Program	3,110 (71.5)	9,368 (54.6)	11,605 (41.8)
Commercial HMO and Medicare Advantage	468 (10.8)	2,963 (17.3)	1,483 (5.3)
PPO	193 (4.4)	3,171 (18.5)	11,956 (43.1)
Medicaid	72 (1.7)	364 (2.1)	788 (2.8)
Other	505 (11.6)	1,306 (7.6)	1,925 (6.9)
Key drivers of spending	ICU and inpatient bed days	ICU and inpatient bed days and ED visits	Imaging, pharmaceuticals, ICU and inpatient bed days, and ED visits
Populations			
Average PMPM[f] spending in FY 2017 dollars	1,768	5,559	3,723
Risk tier, no. of patients[g]			
Tier 1 (1%)	44	172	277
Tier 2 (2%–5%)	174	689	1,110
Tier 3 (6%–20%)	652	2,575	4,440
Tier 4 (21%–60%)	1,739	6,868	10,965
Tier 5 (61%–100%)	1,739	6,868	10,965

Abbreviations: UCLA indicates University of California, Los Angeles; CKD, chronic kidney disease; SD, standard deviation; CMS, Centers for Medicare & Medicaid Services; HMO, health maintenance organization; PPO, preferred provider organization; ICU, intensive care unit; ED, emergency department; PMPM, per patient per month; FY, fiscal year; ICD, International Classification of Diseases; GFR, glomerular filtration rate.

[a]Data from an April 2017 snapshot prior to intervention implementation. The dementia population includes UCLA primary care patients who met at least one of the following criteria: (1) Patient had one or more notes in the electronic health record describing positive diagnosis of dementia (defined by ICD-9 and ICD-10 codes) *and* met one of the following: (a) patient age 40–65 *and* had 2 or more dementia diagnoses *or* (b) patient age ≥ 65 and had at least 1 dementia diagnosis. (2) Patient was a participant of the UCLA Health Alzheimer's and Dementia Care program.

[b]Data from an August 2016 snapshot prior to intervention implementation. The CKD population includes UCLA primary care patients with a GFR < 60 within 2 previous years (outpatient labs) with one of the following: no GFR ≥ 60 in the last 2 months, medical record documentation of inpatient or outpatient hemodialysis, or CKD included in an inpatient problem list, inpatient discharge diagnosis, or outpatient encounter diagnosis.

[c]Data from an April 2017 snapshot prior to intervention implementation. The cancer population includes UCLA primary care patients with ICD-9 and ICD-10 codes corresponding with a cancer type.

[d]Race and ethnicity were self-reported, and data were not available for all patients.

[e]CMS comorbidities include Alzheimer's disease and related dementia, arthritis, asthma, atrial fibrillation, autism spectrum disorders, cancer, CKD, chronic obstructive pulmonary disease, depression, diabetes, heart failure, hepatitis, HIV/AIDS, hyperlipidemia, hypertension, ischemic heart disease, osteoporosis, schizophrenia and other psychotic disorders, and stroke. (*Source*: CMS. Chronic conditions. https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Chronic-Conditions/CC_Main.html. Revised May 2017. Accessed March 20, 2019.)

[f]PMPM spending was calculated from total annual spending, including (1) institutional, facility, inpatient, and outpatient costs; (2) professional costs; (3) pharmaceuticals costs; and (4) ambulance, transportation, and durable medical equipment costs.

[g]Risk tiers refer to spending risk. For example, tier 1 refers to patients in the top 1% of spending, and tier 5 refers to patients in the top 61%–100% of spending.

benefit most from specific interventions.[8] In dementia care, the model focused on reorganizing the care team to optimize system efficiency and to leverage specialists' expertise (e.g., freeing neurologists to see complex patients by moving memory testing to geriatricians) (Figure 1 and Chart 1).

Outcomes

In contrast to the cautiousness with which improvement projects are often received, the PHV design teams were enthusiastic from the start. We believe that this positive reaction was due to several factors:

- orienting value improvement efforts around the patient experience and clinical outcomes, which assured team members that efforts would serve patients meaningfully;

- breaking down silos and working across specialties, which created a team atmosphere;

- focusing on clinical issues in the design teams, while the analytics team supported the technical work; and

- advancing research, data-driven educational programs and growing national recognition of UCLA Health in value improvement.

Interventions for each subpopulation affected the entire primary care patient population and the UCLA Health providers caring for them. Each subpopulation had unique characteristics, causes of spending, and complexities in approaching system-wide value improvement, as detailed below.

Dementia

Before implementation of the PHV interventions, patients with dementia (n = 4,348) incurred $1,768 PMPM spending (Table 1). Key reasons for spending included inpatient and intensive care unit (ICU) bed days. These patients often presented with acute infections and altered mental status. Although hospitalization was clinically indicated, our analysis showed that individuals with known care goals had less intensive therapy and reduced length of stay. In response, the dementia design team stratified patients with dementia into five risk tiers and developed three care pathways.
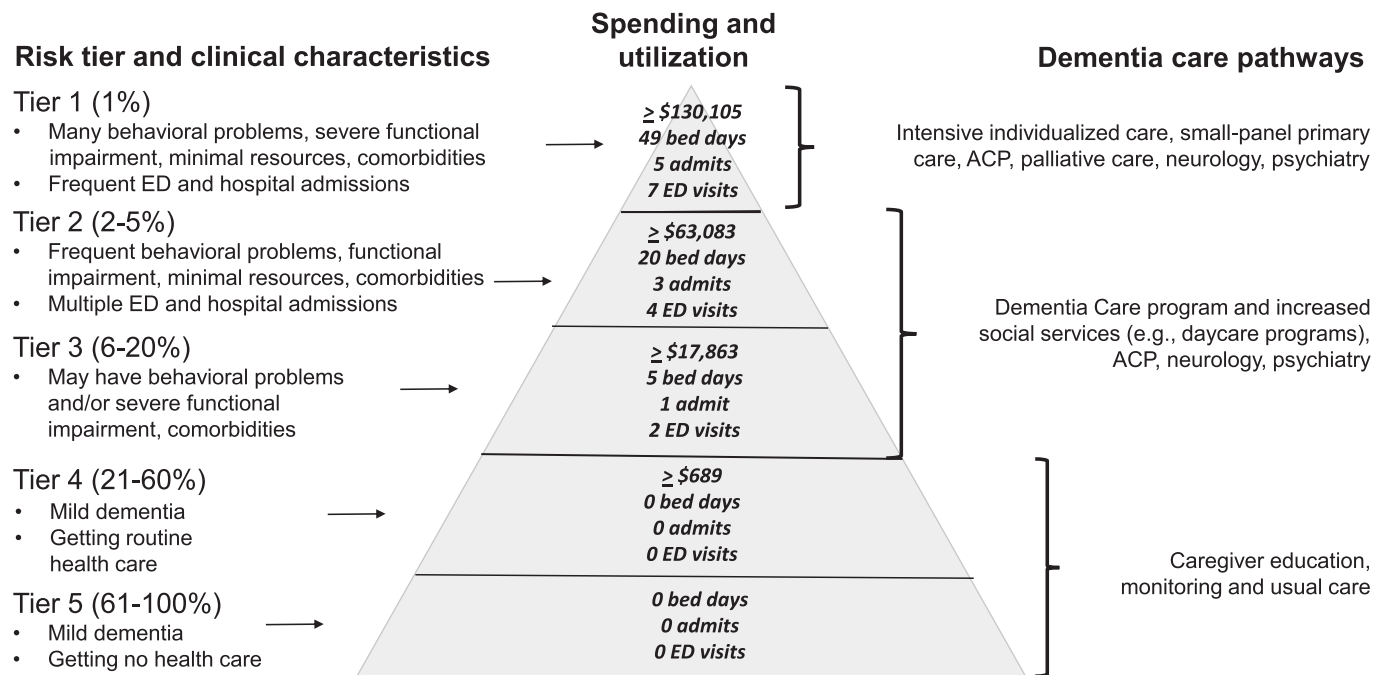
Risk tier and clinical characteristics

Spending and utilization

Dementia care pathways

Tier 1 (1%)
- Many behavioral problems, severe functional impairment, minimal resources, comorbidities
- Frequent ED and hospital admissions

≥ $130,105
49 bed days
5 admits
7 ED visits

Intensive individualized care, small-panel primary care, ACP, palliative care, neurology, psychiatry

Tier 2 (2-5%)
- Frequent behavioral problems, functional impairment, minimal resources, comorbidities
- Multiple ED and hospital admissions

≥ $63,083
20 bed days
3 admits
4 ED visits

Tier 3 (6-20%)
- May have behavioral problems and/or severe functional impairment, comorbidities

≥ $17,863
5 bed days
1 admit
2 ED visits

Dementia Care program and increased social services (e.g., daycare programs), ACP, neurology, psychiatry

Tier 4 (21-60%)
- Mild dementia
- Getting routine health care

≥ $689
0 bed days
0 admits
0 ED visits

Tier 5 (61-100%)
- Mild dementia
- Getting no health care

0 bed days
0 admits
0 ED visits

Caregiver education, monitoring and usual care

Figure 1 Dementia risk stratification and management at UCLA Health. In 2017, the dementia design team at UCLA Health defined patients with dementia using ICD codes and natural language processing as part of the Population Health Value framework. A risk stratification algorithm was developed for utilization and total spending thresholds over one year (center triangle) that aligned with five spending risk tiers (left), which are described by clinical characteristics and support systems. Dementia care pathways (right) were then created for patients according to tier. Abbreviations: ACP indicates advance care planning; UCLA, University of California, Los Angeles; ICD, International Classification of Disease.

Patients in tiers 4 and 5 (low risk) receive dementia education that leverages patient portals and online materials to better align patient and caregiver expectations about disease progression and to monitor care. Once patients develop advanced disease or inpatient utilization, they enter tier 3, and the EHR will trigger a suggested referral to the Alzheimer's and Dementia Care (ADC) program. The ADC program targets patients in tiers 2 and 3 (middle risk) and provides nurse practitioner co-management of dementia care.[9] These patients also receive increased social services, goals of care discussions, and referrals to neurology and behavioral health when appropriate. Patients who enter tier 1 (top 1% of spending) often require intensive care management. The ADC team reviews these individual patients' clinical and social needs and creates nuanced, creative solutions to coordinate care across primary and multiple specialty care teams, reduce high utilization, and initiate palliative care (Figure 1 and Chart 1).

The dementia intervention was implemented across the UCLA primary care network between June and September 2017. Early evaluation compared average monthly inpatient bed days per 1,000 patient-years between the 18 months prior (December 2015–May 2017) and 12 months after (October 2017–September 2018) intervention implementation. This preliminary analysis showed a 1% monthly reduction in inpatient bed days (incident rate ratio [IRR], 0.99; 95% confidence interval [CI], 0.98–1.00; $P < .03$) among the 4,348 patients.

CKD

Before implementation of the PHV interventions, patients with CKD (n = 17,172) accounted for $5,559 PMPM spending (Table 1). Key reasons for spending included hospitalizations and emergency department (ED) visits. Patients with stage 4 and 5 CKD were often hospitalized for emergent dialysis without proactive care coordination and protocols to expedite ambulatory evaluation or placement of catheters. The CKD design team included multidisciplinary staff with patient input, nephrologists, interventional radiology, and dialysis center staff. They defined five risk tiers with three associated care pathways.

The health system hired a CKD care coordinator, who focuses on expediting ambulatory care and increasing access to ambulatory interventional radiology services to expedite evaluation of malfunctioning catheters. This individual coordinates with the extensivist primary care physicians who manage patients in tier 1 (top 1% of spending) (Chart 1).

The CKD intervention was implemented across the UCLA primary care network during October–December 2016. Early evaluation compared average monthly hospitalizations per 1,000 patient-years between the 18 months before (April 2015–September 2016) and 12 months after (January–December 2017) intervention implementation among 1,502 patients with stage 4 or 5 CKD. This preliminary analysis showed a nearly 2% reduction in monthly hospitalizations (IRR, 0.98; 95% CI, 0.98–0.99; $P < .0001$).[10]

Cancer

Before implementation of the PHV interventions, there were 27,757 patients with cancer who accounted for $3,723 PMPM spending (Table 1). In addition to ED visits, hospitalizations, and bed days, imaging and pharmaceuticals accounted for large proportions of spending, especially in end-of-life care. Breast, lung, and colorectal cancer patients in their last six months of life drove spending. These patients were frequently offered chemotherapy (37%), were often hospitalized (47% with 22% ICU), and had poor documentation

Chart 1

Goals and Care Pathways, Based on Risk Tiers, for Three High-Cost Patient Subpopulations With Chronic Conditions, UCLA Health

Risk tier[a]	Dementia	Chronic kidney disease (CKD)	Cancer
	Goals		
All risk tiers	Reducing bed days	Reducing bed days and ED visits	Aligning patient goals of care with treatment plans and reducing bed days, ED visits, advanced imaging, and chemotherapy in the last 6 months of life
	Care pathways		
Tier 1 *(top 1% of spending)*	• Extensivist primary care[b] • UCLA ADC program[c] NPs review individual patients' needs to create creative solutions to reach goals (e.g., coordinating complex care planning with patient's decision makers, coordinating with social workers for rapid outpatient placement, coordinating with neurology and behavioral health for rapid treatment of new dementia-related behavioral or psychiatric symptoms)	• Extensivist primary care[b] • Dedicated CKD care coordinator colocated with nephrologists • Early notification of clinical decline or missed dialysis for proactive management (e.g., increasing diuretic medication, reschedule missed dialysis) • Focus on rapid coordination of peritoneal dialysis, dialysis closer to home	• Extensivist primary care[b] • Care coordinator focused on high-cost, high-needs patients • Focus on reducing unnecessary duplicate advanced imaging • Focus on palliative care, goals of care, and reducing utilization (chemotherapy, advanced imaging, hospital use) in the last 6 months of life
Tiers 2 and 3 *(top 2%–20% of spending)*	• UCLA ADC program[c] NPs comanage dementia care with primary care clinicians and connect patients and caregivers to increased social services and referrals to neurology and behavioral health	• Dedicated CKD care coordinator and nephrologists focus on case management, expediting referrals and appointments, coordinating communication between clinicians and staff, and closing gaps in care • Extended ambulatory interventional radiology suite hours to place and declot dialysis catheters	• Care coordination to expedite referrals and appointments and close gaps in care • Focus on advance care planning, including training every practicing oncologist with standardized patients and data transparency with clinicians • Focus on reducing unnecessary surveillance or duplicate advanced imaging
Tiers 4 and 5 *(top 21%–100% of spending)*	• Dementia Information and Referral Service delivers education about dementia to better align patient and caregiver expectations about disease progression • Patient is escalated in risk tier and referred to UCLA ADC[c] if there is disease progression or a hospital admission	• Best practice alert in electronic health record to meet evidence-based kidney preservation therapies • Diagnosis of CKD stage 3b or higher triggers a nephrology referral and early education about dialysis	• Patient education and expectation setting about cancer • Discussions initiated about advance care planning and goals of care • Focus on reducing unnecessary surveillance and duplicate imaging

Abbreviations: UCLA indicates University of California, Los Angeles; ED, emergency department; NP, nurse practitioner.

[a]Risk tiers refer to spending risk. For example, tier 1 refers to patients in the top 1% of spending, and tier 5 refers to patients in the top 61% to 100% of spending.

[b]The extensivist primary care model includes focused high-utilizer primary care physicians to provide comprehensive and coordinated care to patients with multiple complex medical issues. Primary care extensivists have coordinated relationships with specific specialists and care team staff in inpatient and ambulatory sites of care. The extensivists also have a specific care coordinator who helps them with care transitions and communication between clinicians and other hospital, clinic, or nursing facility staff.

[c]The UCLA Alzheimer's and Dementia Care (ADC) program includes an NP who comanages dementia care with primary care clinicians and connects patients and caregivers to increased social services and referrals to neurology and behavioral health.

of care goals (40% documented). Across all risk tiers and cancer stages, they sometimes received unnecessary duplicative or surveillance imaging in short intervals because of lack of coordination and protocols. The cancer design team included key staff with patient input, oncologists, surgeons, radiologists, and radiology oncologists who focused on spending drivers and defined three care pathways for five risk tiers (Chart 1). An initial evaluation will be conducted when preliminary data are available.

Next Steps

We are using this PHV strategy across other high-cost subpopulations with chronic conditions, and we are iteratively improving the CKD, dementia, and cancer care pathways. We are developing models for future capture of missing data (e.g., patient-reported outcomes). We are also developing models to recalculate components of spending based on standardized prices within our subpopulations because some payers provide limited data transparency. We are focusing on opportunities that can

maximize financial benefit overall, and we believe these efforts can create long-term value. However, some efforts may reduce revenues to certain system entities.

Our four-step PHV framework for creating value has helped us begin to organize care across specialties, build capacity, and grow a culture for value at UCLA Health. We believe this model is a novel approach that could be adapted by other health care systems to improve quality and cost-effectiveness of care for high-expense subpopulations.

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