

Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Four Quality and Cost Measures Based on 2012 Choosing Wisely Recommendations ⁽¹⁾

Area	Pragmatic interpretation	Measure of interest and timeframe for cost measure	Eligible Population
Palliative Care	Limit use chemotherapy and radiation therapy at end of life.	Use of radiation therapy or chemotherapy in the 30 days prior to death	<ul style="list-style-type: none">▪ Solid tumor▪ Patient died (any cause) Enrolled with at least one claim in the 3 months prior to death
Breast Staging	Do not use PET, CT, and radionuclide bone scans in the staging of early breast cancer	Use of PET, CT, or bone scan +/- 2 months of diagnosis	<ul style="list-style-type: none">▪ Breast cancer▪ Female▪ AJCC stage 0-2▪ First primary tumor Enrolled with at least one claim +/- 2 months of diagnosis
Breast Surveillance	For individuals who have completed curative breast cancer treatment, do not use routine blood tests for certain biomarkers and advanced imaging tests (PET, CT, and bone scans) for surveillance.	Use of PET, CT, bone scan, or tumor markers (CEA, CA 15-3, CA 27.29) through the surveillance period. Note: Not used in cost composite.	<ul style="list-style-type: none">▪ Breast cancer▪ Female▪ AJCC stage 1 or 2▪ First primary tumor▪ Received (1) mastectomy, or (2) lumpectomy following by radiation therapy within 90 days▪ Has a surveillance period starting at the beginning of a 4 month gap in treatment (mastectomy, lumpectomy, radiation, chemotherapy) and ends 13 months later or at the start of new treatment (whichever is earlier) Enrolled during surveillance period
Colony Stimulating Factors (CSF)	Avoid administering white-cell stimulating factors to patients undergoing chemotherapy who have less than a 20% risk for febrile neutropenia	Use of CSF within 21 days of start of chemotherapy	<ul style="list-style-type: none">▪ Breast, Colorectal, or Non-small cell lung cancer▪ First primary tumor▪ Not in situ stage▪ Received low FN risk chemotherapy based on the combination of agents received in the first 10 days of first line chemotherapy Enrolled with at least one claim at diagnosis though 2 months after start of chemotherapy

eTable 2. Characteristics of Oncology Organizations

Organization type	Number of physicians in the organization	Number of medical oncologists	Payer Mix (%) as estimated by the organization		
			Medicare	Medicaid/ Self-insured	Commercial
Multispecialty group owned and employed by non-profit health system	~1600	10	58	11	27
Multispecialty group owned and employed by non-profit health system	~300	7	50	12	38
Physician owned multispecialty group	~500	8	50	10	40
Physician owned multispecialty group	160	8	48	2	50
Physician owned multispecialty group	52	34	57	0	43
Physician owned medical oncology group	16	16	60	0	40
Public hospital employed physicians	4	2	78	2	20

The practices participating in our study, including the practice’s description of their organizational type, the number of physicians and number of medical oncologists, and their estimate of their payer mix. Note that all studied practices provided high quality care as defined by the American Society of Clinical Oncology’s (ASCO) Quality Oncology Practice Initiative (QOPI) Certification Program⁽²⁾ or by high levels of adherence to ASCO’s “Choosing Wisely” care processes⁽¹⁾.

eMethods. Data Source Descriptions and Cost Data Computation Methods

a. Western Washington State: Choosing Wisely Adherence and Cost (stage-specific, but not risk-adjusted for co-morbidities)

Cost and Quality Data Sources

To identify low cost, high quality performers in Western Washington, we worked with the Hutchinson Institute for Cancer Outcomes Research (HICOR), a research institution in Seattle that focuses on improving the effectiveness and value of cancer prevention and treatment strategies through collaborative research. HICOR developed an enhanced database that combined epidemiological data with claims data. They started with the Western Washington Cancer Surveillance System (CSS). CSS is part of the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program. CSS collects comprehensive information on cancer staging, initial treatment, and survival. Western Washington's CSS covers a population of approximately 4.5 million and records approximately 27,000 cancer cases each year.

HICOR linked CSS data with Premera Blue Cross data. Premera Blue Cross is a not-for-profit commercial insurer with approximately 1.2 million enrollees. For linked records, claims were extracted for eligible individuals including inpatient and outpatient services, and outpatient pharmacy. Using data from January 2007 to May 2014, HICOR developed algorithms to pragmatically measure adherence to the five 2012 ASCO Choosing Wisely (CW) recommendations. HICOR was able to characterize performance for 14 oncology groups in Western Washington, excluding groups with fewer than 5 episodes on any measure.

CERC and HICOR collaborated to convene a panel of national experts to propose a methodology using existing HICOR measures to assess variation in oncology performance. Both Choosing Wisely adherence and total cost of care measures were used to identify high performers and average performers.

Choosing Wisely Adherence Measures and Composite Development

Based on the expert panels advice, we worked with HICOR to develop a standardized composite building on HICOR's adherence measures for 4 of the 5 2012 ASCO Choosing Wisely Recommendations (eTable 1). We did not include the measure related to prostate cancer on advice from the expert panel, as urologists rather than medical oncologists typically lead care for these patients.

Patients were assigned to their primary oncology provider by aggregating cancer related claims over a recommendation-specific period of interest to define an episode of care (e.g. breast cancer staging was +/- 2 months of diagnosis). Analysts at HICOR removed all but the first radiation oncology claim and removed claims from diagnostic centers (imaging and pathology). Patients were attributed to the Tax ID number (TIN) with the highest claim count. Clinics required at least 5 attributed patients to be included in the analysis.

The medical group's overall observed/expected (O/E) episode ratio was calculated by comparing the adherence rate attributed to the medical group to their expected rate. The expected rate for a practice was defined as the average clinic rate for each measure. A composite score for each clinic was derived by dividing the weighted observed/expected ratio by the clinic volume.

Exemplar groups were in the top quartile on the adherence composite. Comparator groups were drawn from the middle quintile of the distribution.

Cost Measures and Composite Development

Using the panel's guidance, we sought to develop a cost composite that assessed total cost of care related to the time periods relevant for 3 of the 5 Choosing Wisely measures.

To analyze costs, we developed a time-based episode to capture total cost of care related to each CW measure. Costs were measured using all costs paid by the insurer during the period of interest for each measure described in eTable 1.

For total cost of care, in addition to excluding prostate staging we also excluded breast cancer surveillance. We excluded breast cancer surveillance as we were not able to risk adjust for age and co-morbidities, which could result in justified variations in the cost of treatment for this measure which has a long time period and covers a time when cancer costs are likely to be secondary to other medical costs.

The medical group's overall observed/expected (O/E) episode cost ratio was calculated by comparing the total cost of episodes attributed to the medical group to their expected cost. The expected cost for a medical group is defined as the average episode cost. A composite score for each clinic was derived by dividing the weighted observed/expected ratio by the clinic volume.

Exemplar groups were in the top tercile on the cost composite. Comparator groups were drawn from the middle quintile of the distribution.

Cost-Quality Matching, Desk Audit, & Purposeful Sampling

Two groups performed in the top tercile on adherence and the lowest tercile on costs (we identified these as "wise choosers" or high value practices) and one performed at the median on adherence and cost (we identified this practice as a comparator). None had any reputational issues. Our pool was too small to do any purposeful sampling. We were able to recruit and visit all three groups.

b. Indiana and Ohio: QOPI Certification and Episode Cost (not stage-specific, but risk and severity adjusted)

In parallel to our HICOR collaboration, we also pursued an opportunity to understand performance in another region of the country using a different methodological approach. We worked with Anthem and the Quality Oncology Practice Initiative (QOPI) registry sponsored by the American Society of Clinical Oncology (ASCO). Anthem agreed to share their existing analysis to provide us with cost performance data for oncology practices in Ohio and Indiana.

Cost data source

The Anthem cost methodology leverages OptumInsights' Episode Treatment Groups (ETGs),³ an approach to measure cost and/or resource utilization across episodes of care. ETGs are rule-based algorithms that combine related services into clinically homogenous units that describe complete episodes of care, enabling comparisons between providers. Using claims data, the ETG methodology captures all relevant inpatient, outpatient, pharmaceutical, and ancillary services provided during a patient's treatment and organizes them into episodes of care. At the patient level, ETGs recognize comorbidities, complications, age, and gender, enabling accurate case mix adjustment.

Like the 3M's Clinical Risk Groupings (CRGs) used in our study of primary care and longitudinal management specialties, ETGs can be used to calculate a risk-and-severity adjusted, observed-to-expected ratio for each attributed episode, enabling the calculation of an overall cost efficiency index for each practice. Unlike CRGs, they do not always include all costs for a patient within a given time period, but use algorithms to identify claims that are likely to be related only to specific diagnoses or procedures. Anthem's use of ETGs in Oncology includes both chronic CRGs, which are tied to a specific time period, and acute CRGs, which are based on an index event.

The episodes contained within the ETG calculation excluded the following:

- Acute incomplete
- Outliers flagged by grouper (had episode costs outside the typical range belonging to that specific combination of ETG, severity level, and treatment indicator)
- Preventive care
- Non-specific signs and symptoms
- Invalid ETGs
- Phantom episodes (contains claims with valid but unrelated diagnosis codes)
- Zero-Dollar Paid episodes
- Encounters
- Non-Par provider episodes

Anthem provided total allowed costs for 206 oncology practices located in Ohio or Indiana (135 in Ohio, 71 in Indiana). The data included claims with allowed costs incurred between July 1, 2010 and June 30, 2012. However, weighted mean ETG indices and their 90% confidence intervals were only included for groups with at least 20 episodes, so we excluded the 56 practices without ETG values.

This resulted in an initial pool of 150 oncology practices (90 in Ohio, 60 in Indiana). From there, we excluded 19 practices for not specializing in hematology and medical oncology and another 14 practices for having fewer than 30 total episodes.

Potential high value practices on cost were defined as those with confidence intervals that fell entirely below the mean. Potential comparators on cost were defined as those with confidence intervals that overlapped with the mean. This left us with 28 high value practices (17 in Ohio, 11 in Indiana) and 71 comparators (39 in Ohio, 32 in Indiana).

Quality

To assess quality, we partnered with ASCO's quality improvement registry, the Quality Oncology Practice Initiative (QOPI). QOPI provides a system for practices to measure processes of care semiannually, using retrospective medical record abstraction methodology. ASCO shared 2014 QOPI data for 16 de-identified practices in Indiana or Ohio. After a review of the data and consultation with experts, we decided to use QOPI certification as a threshold for quality because quality performance between QOPI certified sites was not well differentiated. As a result, the distinction between high performers and average performers in Indiana and Ohio is based solely on cost performance. All of the sites visited have reached the threshold for quality set by ASCO as part of its quality improvement program as described below.

The QOPI Certification Program (QCP) recognizes medical oncology and hematology practices that perform well on QOPI measures. For practices that opt into the program, QCP provides a 3-year certification if the practice (1) submits data for 5 required modules (breast, colorectal, non-small cell lung cancer, care at the end of life, symptom/toxicity management) during one collection round, (2) follows QOPI sampling methodology and meets chart sample size targets, (3) complies with the 20 certification standards based on the ASCO/ONS standards for safe chemotherapy administration, and (4) obtains an overall quality score of 75% based on the combined score on 26 measures. Nationwide, there are 272 QOPI Certified practices with six in Indiana and seven in Ohio. Ten of these 13 QOPI certified practices were found within our cost data. However, only eight of them met our cost criteria.

Cost-Quality Matching, Desk Audit, & Purposeful Sampling

From our original pool of practices tiered as cost high value practices and comparators, we found that three exemplar practices and five comparator practices were also QOPI Certified.

At the desk audit stage, we removed one comparator practice because of a provider identification issue. We had originally identified the practice within our own cost data as a comparator, but we found that only one physician within the practice had QOPI certification. Upon further investigation, we saw that the one QOPI certified physician did not show up in our data, and instead that we had identified the practice based on his colleagues' cost performance. We dropped this site from our pool. None of the sites had reputational issues.

We then used purposeful sampling to focus our recruitment efforts on two comparators who had a high number of attributed patient episodes and performance just better than the mean on cost. These criteria ensured a high level of confidence that these practices had average cost performance. Ultimately, we recruited and visited these two comparators and two of the three possible high value practices, reaching our target.

Qualitative analysis of interviews

The study team was blinded during the data collection, which included the debrief and written report after the site visit and the assessments of what most likely accounted for the site's preferable performance. In the synthesis, the team was unblinded and compared and contrasted the listed features in the high performers first. After identifying the "strongest" signals in the high performers (common features), in the second step the team compared the high performers (high value) to middle-ranked, comparator sites to determine distinguishing versus required features (necessary but not sufficient for high performance).

eReferences

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