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Hutchinson Institute for
Cancer Outcomes Research

COMMUNITY CANCER CARE IN WASHINGTON STATE

Quality and Cost Report 2019

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The Hutchinson Institute for Cancer Outcomes Research (HICOR®) developed the Community Cancer Care in Washington State: Quality and Cost Report 2019 to improve quality and lower costs in cancer care. HICOR is a scientific research institute based at Fred Hutchinson Cancer Research Center. HICOR's mission is to improve cancer prevention, detection and treatment in ways that will reduce the economic and human burden of cancer. The report promotes transparency by providing an analysis of quality measures linked to cost on selected indicators of care. HICOR hopes that the information in this report will facilitate the development of interventions aimed at improving care quality, reducing variability in care, and lowering the costs of cancer care for patients and the health care system.

This work has been reviewed by the Institutional Review Boards of Fred Hutchinson Cancer Research Center and Washington state, and is covered by data use agreements with the Centers for Medicare & Medicaid Services, Premera Blue Cross, Cambia Health Solutions Inc., Washington State Healthcare Authority, State of Washington Department of Health, Washington State Cancer Registry and the Cancer Surveillance System.

Rules of use

Report data ***may not*** be used for clinic or payer advertising or marketing.

For at least one year after release of this report, its data ***may not*** be used for the following:

- Establishing coverage networks
- Designing employee benefit packages
- Negotiating contracts without mutual agreement from all involved parties

Acknowledgments

This report is a culmination of many years of collaboration with patients, providers, payers, researchers and guideline experts to define and measure value in cancer care. We would like to thank the individuals involved in HICOR's Value in Cancer Care Working Groups, Data Methods Committee and Steering Committee for helping us achieve community alignment in our priorities and our methodologies for performance measurement.

We would like to sincerely thank Fred Hutchinson Cancer Research Center for funding this report.

How to cite this report

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FROM THE HICOR DIRECTORS

The Hutchinson Institute for Cancer Outcomes Research (HICOR) is pleased to release its second Community Cancer Care in Washington State: Quality and Cost Report for 2019. The new report provides updated findings for quality metrics that were first reported in our 2018 report. These metrics cross the spectrum of cancer care, from initial treatment to surveillance to end of life care.

The report was generated from a database that combines cancer registry and health insurance claims data for Washington state residents who have been diagnosed with cancer between 2015 and 2018. It provides a picture of how hospitals and clinics that provide cancer care are performing and how they compare to the statewide average on selected indicators. The report's methodologies have been updated to reflect national best practices for performance reporting. These methodologies and HICOR's unique linked database ensure that the results are clinically meaningful, useful and comparable across institutions.

In communicating this information, HICOR aims to reach several audiences:

- **Providers**, who can use the information to improve quality, reduce spending on interventions that do not work and invest in those that do
- **Employers and employees**, who contribute to health insurance premiums that pay for cancer care in an environment of escalating health care costs
- **Public and private health insurers**, who manage benefits and payments to providers on behalf of their members
- **The general public**, which supports social insurance programs (Medicare and Medicaid) through taxes and insurance premiums

HICOR's goal for providing these metrics has always been to encourage sharing of best practices and stimulating innovations in the delivery of cancer care that are aimed at improving the quality of care and lowering costs. Quality reports can create powerful incentives for improvement, but it is only the first step in a process that involves a tremendous number of individuals whose work impacts cancer patients. Since the release of the first Community Cancer Care Report in 2018, we have heard from many oncology practices that our metrics have helped to facilitate their efforts to provide better care to their patients.

We are truly gratified by these communications. We will continue to provide support for all our stakeholders as we work toward our shared goal of achieving better health, better care and lower costs by spurring collaboration, research and innovation.

Scott Ramsey, MD, PhD
Director

Veena Shankaran, MD
Co-Director

WHAT'S NEW

- **New years of data** – The 2019 report covers care delivered between 2015 through 2017
- **Restated rates for reporting years 2014-2016** – We have restated the 2018 report's results (i.e. care delivered between 2014-2016] in Appendix G using this report's updated methodology. These results are designed to provide clinics with a comparable set of results to see year-over-year changes.
- **Revised list of metrics** – Individual clinic rates are no longer reported for metrics where the entire region is performing at high-levels or the statistical models indicate no significant differences in results. When there are differences in cost, the regional average mapped to cost is reported. The following metrics are affected by this change:
  - **Measure 1B: Recommended Treatment for Breast Cancer** – Differences in cost are reported at the clinic level. Regional rates are still reported.
  - **Measure 3: Follow-Up Testing after Cancer Treatment** – Metrics related to advanced imaging are no longer reported. Measure 3 focuses on tumor marker testing for patients who have completed breast cancer treatment.
- **Updated data processing and methodology** – The following is a list of changes applied to this year's report:
  - Medicare patients with simultaneous fee- for-service and managed care enrollment flags have been removed.
  - Only administration and drug procedure codes count towards chemotherapy utilization
  - To better match the clinical diagnoses used by physicians to determine end of life care, the comorbidity time range at end of life has been changed from 12 months prior to death to include the period from 6 months to 1 month prior to death.
  - Census tract-level median Income was replaced with Area Deprivation Index (ADI)[1] as a risk adjustment variable in the analytical models.
  - The list of cancer sites for hospitalization metrics was expanded.
  - Updates were made to the clinic list for clarity: Seattle Cancer Care Alliance is now reported as UW Medicine & Physicians (incl SCCA), The Everett Clinic is now reported as Providence Regional Cancer Partnership, and Yakima Valley Memorial is reported as a separate clinic.

As with all quality reporting, small changes in rates of utilization can impact year-to-year rankings. To help readers interpret the results, all graphs now highlight clinics with scores that are 5% above or below the regional average. The 5% rate was chosen after consultation with the Value in Cancer Care Steering Committee.

Additionally, the list of clinics included in each metric fluctuates due to differences in the minimum number of patients in each clinic meeting eligibility requirements.

Table 1 shows the change in regional rates for the updated reporting years. Note that 2014-2016 results have been restated to match the methodology in this year's report.

Changes to Regional Rates	2014-2016	2015-2017
Measure 1A: Recommended Treatment for Breast, Colorectal and Lung Cancer		
1A.1: Recommended therapy based on cancer type	85.0%	84.8%
1A.2: Anti-nausea medication during chemotherapy	97.5%	97.6%
Measure 1B: Recommended Treatment for Breast Cancer		
1B.1: Recommended therapy based on ER/PR and HER2 Status	89.5%	90.0%
1B.2: Anti-nausea medication during chemotherapy	98.2%	98.1%
Measure 2: Hospitalization During Chemotherapy		
2.1: Emergency Department (ED) visits during chemotherapy	29.8%	31.0%
2.2 Inpatient (IP) stays during chemotherapy	36.9%	37.0%
Measure 3: Breast Cancer Tumor Marker Testing Following Treatment		
3.1: Breast cancer tumor marker testing following treatment	24.3%	22.7%
Measure 4: End of Life Care		
4.1: Chemotherapy in the last 14 days of life	5.6%	5.7%
4.2: Multiple Emergency Department (ED) visits in the last 30 days of life	15.3%	16.2%
4.3: Intensive Care Unit (ICU) stay in the last 30 days of life	24.2%	24.7%
4.4: Hospice care 3 or more days prior to death	61.3%	61.4%

1. Reference Appendix D for Area Deprivation Index (ADI).

CONTENTS

EXECUTIVE SUMMARY

The HICOR team is pleased to provide the second edition of our publicly accessible statewide report of clinic-level quality and cost measures for cancer care. The report is designed to facilitate discussion among clinicians providing cancer care, insurance plan administrators and employer groups who purchase insurance, and patients and their families — those who are most impacted by cancer care delivery. We believe that public reporting is the first step toward improving and achieving health care's triple aim for cancer care — better health, better care and lower costs — by spurring collaboration, research and innovation.

The Community Cancer Care Report includes metrics that are identified as meaningful and actionable by community leaders who are involved in paying for, providing and receiving cancer care. The information in this report is, therefore, a selective view of a very complex world. Other issues not included in this report — such as doctor-patient communication, respect for patient preferences and quality of life — are also critical aspects of cancer care. The metrics themselves are not intended to inform individual medical care decisions.

The results presented in this report draw from a patient-level database that links enrollment and claims records from commercial and public health insurance plans with clinical information from Washington state cancer registries. HICOR's linked database includes approximately 70 percent of all cancer patients who received care in Washington state between 2015 and 2017.

The report displays quality measures and associated costs across the spectrum of cancer care. The quality measures include recommended treatment immediately following diagnosis, emergency department and inpatient hospital admissions during treatment, appropriate use of surveillance testing for patients who have been treated with curative intent, and care for patients in the last 30 days of life. Where possible, we have aligned community input with recommendations and evidence-based guidelines from national organizations such as the National Comprehensive Cancer Network and the American Society of Clinical Oncology, and quality initiatives such as the Quality Oncology Practice Initiative.

Overall, the findings are similar to those reported in 2018; however, there are some noteworthy differences in this new report that we would like to highlight. First, we have updated our methodology to reflect the most recent nationally recognized practices for performance reporting. For example, we have improved risk adjustment by replacing Median Income with the more comprehensive and representative Area Deprivation Index (ADI).[1] In addition, we no longer report individual clinic rates where clinic-to-clinic variability is very low; specifically for the metrics concerning Recommended Treatment for Breast Cancer and Follow-Up Testing after Cancer Treatment. Finally, we have updated our display to highlight clinics with performance that is 5% above or below the regional average.

The 2019 results indicate that there are still areas where there is room for improvement in cancer care delivery. Over half (52.8%) of cancer patients have an emergency department visit or require hospitalization during their first six months of chemotherapy treatment. At end of life, the use of hospice care is highly variable. In addition, many cancer patients spend their final days in the intensive care unit instead of at home or in lower-intensity settings. Mapping quality with cost data allows us to identify and learn from practices that deliver the highest quality and lowest cost care in the state. As with the last report, we find areas where quality is relatively uniform across clinics but costs vary widely, suggesting that efficiencies can be gained without sacrificing quality. For other measures, there is a relatively strong relationship between higher quality and lower cost, suggesting that improvements in quality can also reduce expenditures. In particular, end of life care continues to show this relationship.

The table on the next page provides an overview of our results.

1. Reference Appendix D for Area Deprivation Index (ADI).

Reporting Years: 2015-2017

	Measure Population	Regional Quality Average [Clinic-level Range[1]]	Summary Quality Score Range[2]	Regional Average Episode Cost Per Patient [Clinic-level Range[1]]
Measure 1A: Recommended Treatment for Breast, Colorectal and Lung Cancer				
1A.1: Recommended therapy based on cancer type	2709	84.8% [82.4% to 86.5%]	-4.6% to 2.1%	$80,688 [$70,894 to $90,209]
1A.2: Anti-nausea medication during chemotherapy	3352	97.6% [94.0% to 98.7%]		
Measure 1B: Recommended Treatment for Breast Cancer				
1B.1: Recommended therapy based on ER/PR and HER2 Status	1747	90.0%	Not Applicable	$86,464 [$69,027 to $98,668]
1B.2: Anti-nausea medication during chemotherapy	1132	98.1%		
Measure 2: Hospitalization During Chemotherapy				
2.1: Emergency Department (ED) visits during chemotherapy	7252	31.0% [27.2% to 36.5%]	-9.3% to 8.0%	$59,152 [$48,054 to $71,383]
2.2 Inpatient (IP) stays during chemotherapy	7252	37.0% [30.4% to 44.3%]		
Measure 3: Breast Cancer Tumor Marker Testing Following Treatment				
3.1: Breast cancer tumor marker testing following treatment	1011	22.7% [3.7% to 46.2%]	-23.4% to 19.0%	$15,554 [$14,485 to $16,869]
Measure 4: End of Life Care				
4.1: Chemotherapy in the last 14 days of life	8678	5.7% [3.3% to 11.1%]	-20.0% to 21.3%	$18,920 [$15,791 to $21,845]
4.2: Multiple Emergency Department (ED) visits in the last 30 days of life	8678	16.2% [13.6% to 19.1%]		
4.3: Intensive Care Unit (ICU) stay in the last 30 days of life	8678	24.7% [12.8% to 40.4%]		
4.4: Hospice care 3 or more days prior to death	8678	61.4% [50.4% to 72.1%]		

[1] *All metric quality and cost clinic-level ranges have been risk-standardized for patient factors and clinic size.*
[2] *The range represents clinic performance with zero as the regional average.*

STAKEHOLDER ENGAGEMENT

HICOR developed the quality and cost measures in this report in collaboration with hospitals and clinics delivering cancer care, health insurance plan administrators, patient partners, researchers, health care quality organizations, policymakers and government leaders in Washington state.

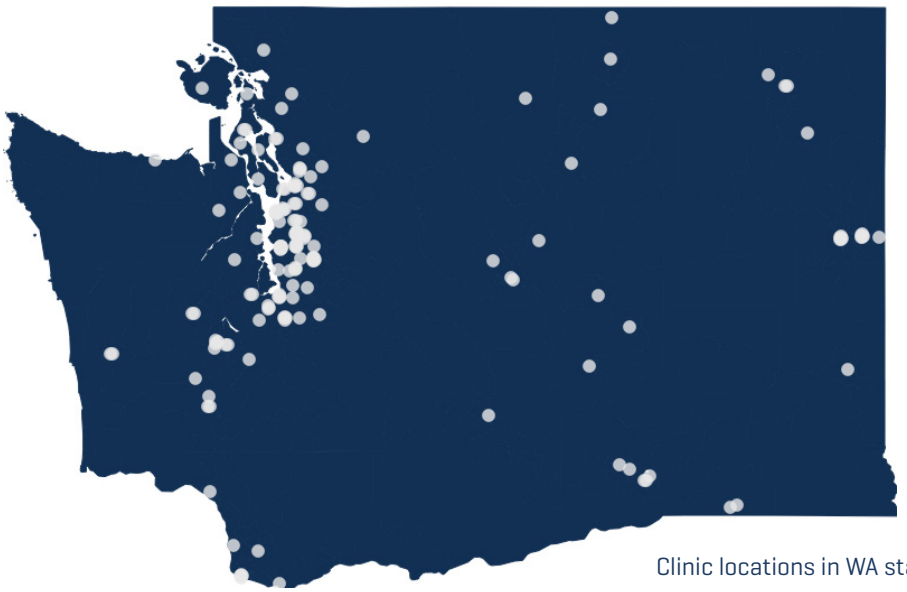
We based our community engagement practices on recommendations from national bodies such as the Centers for Medicare & Medicaid Services (CMS) and the National Committee for Quality Assurance (NCQA). These organizations encourage stakeholder involvement in the development process to ensure that measures are accurate, appropriately constructed and responsive to stakeholder needs.

HICOR has established a number of standing committees to provide guidance on our reporting efforts. The committees include representatives from the stakeholder groups noted above and meet regularly with the HICOR team to align our research agenda and measure development with community priorities. In addition to a Steering Committee charged with overall guidance and a Data Methods Committee charged with providing input on methodology development, a Research Working Group advises HICOR on research projects focused on improving cancer care. In 2018, HICOR received funding from the Patient Centered Outcomes Research Institute (PCORI) to develop a framework to enhance patient engagement in community reporting and research. A Patient Advisory Committee was formed to collaborate on these efforts.

HICOR shares methodology and early results with these committees in order to incorporate their feedback. In 2015, the committees and working groups reviewed region-level quality measures. In 2016, they reviewed episode cost measures for the region. In 2017, HICOR shared the names of high-performing clinics on these quality and cost measures. At every stage, we shared our findings privately to cancer clinics for review and quality control.

Our overarching goals for this effort are straightforward: identify opportunities to improve cancer care delivery, facilitate the sharing of best practices in our community, and encourage collaboration between the oncology community and researchers in order to evaluate new models of care.

We are sincerely grateful to the cancer care providers, patient partners, health insurance representatives and others who have generously donated their time, expertise and perspective to this process. HICOR is committed to ongoing collaboration with our stakeholders to ensure that our work is meaningful and relevant to our community.



Clinic locations in WA state

2014
1st Value in Cancer Care (VCC) Summit
Identified high-priority areas for value measure development

2015
2nd VCC Summit
Presented regional quality measures

2016
3rd VCC Summit
Presented regional quality and cost measures

2017
4th VCC Summit
Presented initial quality report for high-performing clinics

2018
5th VCC Summit
Publicly released the *Community Cancer Care in Washington State: Quality and Cost Report 2018*

2019
6th VCC Summit
Presented issues around Cancer Care in the Community - Integrating the Patient Voice

HOW TO READ AND INTERPRET THE REPORT

The report provides select indicators of cancer care quality and cost for 30 hospital systems and clinics in Washington state. Results for hospital systems and clinics are shown relative to the regional average.

Interpreting the Results

• **The regional average for each quality measure is not a benchmark.** The regional average is included to provide a regional reference point when viewing individual clinic results. All graphs highlight clinics with scores that are 5% above or below the regional quality average. The 5% rate was chosen after consultation with the Value in Cancer Care Steering Committee.

• **Cost represents the total amount paid by the insurer to all health care providers over the episode of care represented by the measure.** Cost includes payments for cancer-directed and non-cancer care. Cost reflects the amount of services provided and the payment per unit of service. Both payment levels and use of services vary from facility to facility.

• **The report does not provide medical advice on how to treat an individual patient.** No medical advice or conclusions about individual care should be drawn from this report. Patients with questions about their health care should contact their providers.

• **The results in this report should be accurately cited.** Users of the report should make precise statements about the results and acknowledge the difference between the regional and the clinic-level outcomes. Example statement: "Over half [52.8%] of cancer patients were either admitted to an emergency department or had a hospital inpatient stay in the six months following the initiation of chemotherapy." Clinic-level results have been risk standardized — that is, adjusted for clinic size and patient characteristics — to facilitate comparison across clinics. Example statement: "29.0% of patients at Clinic X had an emergency department visit during the first six months after the start of chemotherapy, after adjusting for clinic size and patient characteristics."

• **How to cite this document**: Hutchinson Institute for Cancer Outcomes Research. Community Cancer Care in Washington State: Quality and Cost Report 2019. © 2019 Fred Hutchinson Cancer Research Center, Seattle, WA.

• **The results in this report are intended to improve cancer patient care.** As a way to mitigate unintended consequences that would impact patient access in the short term, report recipients are required to adhere to strict rules around the usage of the report data for a one year period. Specifically, they are prohibited from establishing networks based on the information, designing employee benefits packages, negotiating contracts (without mutual agreement), or engaging in advertising or marketing based on the data shared in the report.

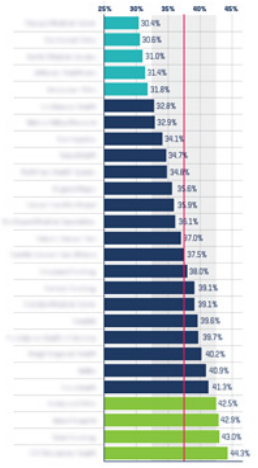
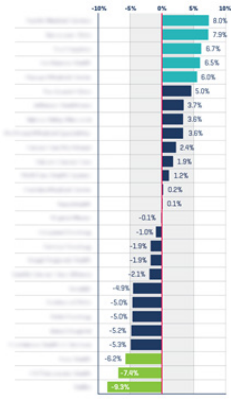
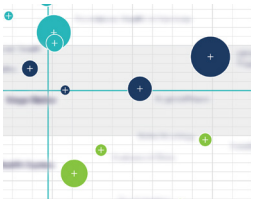
Understanding the Methodology Section

The Methodology section explains how we developed the measures and metrics used in this report. It summarizes the critical steps in metric construction, including the patient population, reporting years, metric specifications, patient attribution to clinics, standardizing individual quality metrics and costs, and constructing a summary quality score. This section includes links to the Appendices for additional technical information.

Understanding the Results Section

Summary results are reported for four measures. Each measure combines the results of up to four individual metrics. For example, the Hospitalization During Chemotherapy measure uses two metrics: 1) Emergency department (ED) visits during chemotherapy and 2) Inpatient (IP) stays during chemotherapy. The table on page 10 describes the key features of the Results section.

HOW TO READ THE REPORT

ICON	ITEM	ITEM DESCRIPTION	EXAMPLE
	Lists the quality metrics in each measure. For more detailed metric definitions, see Appendix B.	This item is helpful for understanding what is being measured and reported.	**MEASURE 1A: RECOMMENDED TREATMENT FOR BREAST, COLORECTAL AND LUNG CANCER** Recommended therapy based on cancer type
	Risk-Standardized Rates of Individual Quality Metrics Scale: Measured 0 to 100% utilization. The x-axis may represent a more narrow scale. Higher quality is always at the top of the figure. Text at the top of each risk-standardized rate indicates one of the following: **Lower rates = higher quality** or **Higher rates = higher quality**	This item is helpful for understanding each clinic's results before combining into a summary quality score. Comparing the highest and the lowest risk-standardized rate also provides a picture of the differences in quality across clinics. **Citing the results:** "26.1% of patients at Clinic X received recommended therapy based on cancer types, after adjusting for clinic size and patient characteristics." The red line indicates the regional average for this individual metric. The grey shading to the right and left of the red line indicates 5% below and above the regional average. The teal bars indicate clinics that are greater than 5% below the regional average while the green bars indicate clinics that are greater than 5% above the regional average. Pay close attention to the numbers: 1. The difference between clinics can be small. 2. The scales may change.	 ≥ 5% below average ≥ 5% above average
	Summary Quality Score The summary quality score combines individual clinic results into one quality score. Overall performance is reported relative to the regional average.	This item provides a more comprehensive picture of clinic quality within a care topic area. Comparing the highest and the lowest quality score also provides a picture of the differences in overall quality across the clinics. **Citing the results:** "Clinic X's summary quality score was 2.4% points above the regional average." The red line indicates the regional average for this individual metric. The grey shading to the right and left of the red line indicates 5% below and above the regional average. The teal bars indicate clinics that are greater than 5% below the regional average while the green bars indicate clinics that are greater than 5% above the regional average.	 ≥ 5% below average ≥ 5% above average
	Summary Quality Score and Costs Displays the summary quality score on the y-axis and cost on the x-axis to facilitate a comparison of each clinic's quality score and costs.	This item is helpful in evaluating the relationship between quality and cost. It can help identify practices that deliver higher-quality and lower-cost care. The grey shading of the y-axis indicates clinics that fall within 5% above and below the summary quality score regional average. Pay close attention to the x-axis (cost) scale. The scale varies between graphs.	

METHODOLOGY | OVERVIEW

Eligible Patients

- Washington state adult cancer patients enrolled in:
  - Medicare
  - Premera Blue Cross
  - Regence BlueShield
  - Uniform Medical Plan
- Reporting Years: 2015–2017
- Additional specifications based on the particular measure

Eligible Clinics

- Attribute patients to clinics
- Clinics with at least 40 or 50 patients per metric

QUALITY

INDIVIDUAL METRICS

- Apply Hierarchical Generalized Linear (HGLM) statistical model
- Include risk adjustment if appropriate
- Clinic risk–standardized rate = $\left[\frac{\text{Clinic predicted rate}}{\text{Clinic expected rate}}\right] \times \text{Region average}$

QUALITY SCORE

- If lower score = higher quality, subtract region average from clinic risk–standardized rate
- If higher score = higher quality, subtract clinic risk–standardized rate from region average
- Clinic's quality score = sum of the above differences for each quality metric in the composite

COSTS

- Include all costs during the episode
- Winsorize costs at the 5th and 95th percentiles by cancer type
- Apply Hierarchical Generalized Linear (HGLM) statistical model
- Include risk adjustment
- Clinic risk–standardized average episode cost per patient = $\left[\frac{\text{Clinic predicted average episode cost per patient}}{\text{Clinic expected average episode cost per patient}}\right] \times \text{Region average}$

Display quality score against costs

METHODOLOGY

HICOR followed national guidance and best practices for measure development and public reporting, drawing from the Centers for Medicare and Medicaid's Measure Management System,[1] the National Quality Forum's Measure Developer Guidebook,[2] and performance measurement literature.[3] For individual quality metrics, we reported risk-standardized rates, which have been used for over a decade to assess hospital performance.[4, 5,6,7] We followed national guidance and best practice principles in developing the risk-adjustment models, constructing a quality score summarizing clinic performance on quality measures, and determining patient attribution to clinics. For more detailed information about HICOR's methodology, see the Appendices.

METRIC SELECTION AND DEVELOPMENT

The measures used in this report represent priority areas identified by regional stakeholders and supported by evidence-based care guidelines issued by organizations such as the National Comprehensive Cancer Network (NCCN) and the American Society of Clinical Oncology (ASCO) and quality initiatives such as the Quality Oncology Practice Initiative (QOPI).[8] To select individual metrics, HICOR first reviewed available metrics from national quality improvement programs in oncology such as QOPI, the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA),[9] the Oncology Care Model (OCM),[10] and the American Board of Internal Medicine (ABIM) / ASCO Choosing Wisely Campaign.[11] To develop the specifications for each individual metric, we reviewed the National Quality Forum (NQF) and the National Quality Measures Clearinghouse for similar metrics with published specifications. If specifications were not publicly available or there was a lack of consensus at the national level, we constructed our own algorithms with clinical and technical expert review.

HICOR metric specifications represent a refinement of national metrics due to our access to unique data sources and population size. Many national metric specifications are designed for measurements using electronic health records or use only health insurance claims. We were able to refine metric specifications by using clinical and insurance records available in our database, which links cancer registry data and insurance claims. Access to cancer registry data allowed for the addition of cancer stage as a risk adjustor and enabled the results to account for different stage cases mixes between clinics. To capture sufficient numbers for reporting quality in the regional population, we combined metrics of appropriate treatment across multiple cancers into a broad measure. To increase the statistical reliability of our measures, we have reported results over a three-year period, a performance period used by Centers for Medicare and Medicaid (CMS) and other quality reporting organizations.[12]

The measures provide a limited view of the larger, complex environment of cancer care. The report does not include all possible quality measures and does not directly measure patient experience.

DATA SOURCES AND MEASURE CONSTRUCTION

Data Sources

HICOR's database combines clinical information from two Washington state cancer registries with health utilization and cost data from health insurers in the state. The Washington State Cancer Registry (WSCR) and the Western Washington Cancer Surveillance System (CSS) collect comprehensive information on staging, initial treatment and survival for individuals diagnosed with malignancies in Washington state, excluding non-melanoma skin cancer. HICOR links data from these cancer registries with enrollment files from Premera Blue Cross, Regence BlueShield, the Washington State Uniform Medical Plan and Medicare. When an enrollment file matches a cancer registry file, HICOR extracts all health care claims for that individual, including inpatient and outpatient service and outpatient pharmacy claims.

Patient Population

The metrics include adult patients who were enrolled in a participating health insurance plan during the metric's time period of interest. Individuals without a known date of diagnosis and those diagnosed via autopsy or death certificate were excluded.

METHODOLOGY

Reporting Years

This report includes measurement results for 2015 to 2017. However, some metric specifications require inclusion of individuals who were diagnosed before 2015 or who had part of their measurement period in 2014, in order to capture the primary period of care for the years 2015 to 2017.

Reporting years by measure:

- Measure 1A and 1B: Appropriate Cancer Treatment — Diagnosis date between January 1, 2014, and December 31, 2016
- Measure 2: Hospitalization During Chemotherapy — Receipt of first outpatient chemotherapy between January 1, 2015, and December 31, 2017
- Measure 3: Breast Cancer Tumor Marker Testing Following Treatment — Finished treatment (surgery, chemotherapy, radiation therapy) between January 1, 2015, and December 31, 2016
- Measure 4: End of Life Care — Date of death between January 1, 2015, and December 31, 2017

Metric Specifications

Each metric has clinical specifications designed to capture the outcome measured. Appendix B provides the metric source, the exact outcome being measured, the eligible patient population and the time period used for attributing patients to clinics.

PATIENT ATTRIBUTION AND REPORTING REQUIREMENTS

Patient Attribution to Clinics

For each measure, we attribute patients to one clinic. Appendix A outlines the patient attribution specifications. The principle behind this methodology is to capture the clinic most likely to direct the majority of the patient's cancer care during the measure's period of interest. Clinics are identified using Tax ID Numbers (TINs) or CMS Certification Numbers (CCNs) on health insurance claims.

Minimum Number of Patients per Clinic

To improve statistical reliability, we require a minimum number of eligible patients for each measure. This requirement includes:

- At least 40 eligible patients in the Treatment (Measures 1A and 1B) and Follow-up (Measure 3) measures
- At least 50 eligible patients in the Hospitalization (Measure 2) and End of Life Care (Measure 4) measures

Standardizing Individual Quality Metrics

We calculate a clinic risk-standardized rate for each individual metric within a measure. The risk-standardized rate is calculated using the following equation:

$$\text{Clinic-level risk-standardized rate} = \left(\frac{\text{Predicted rate}}{\text{Expected rate}}\right) \times \text{Observed regional average}$$

This calculation measures whether a clinic had higher or lower rates than expected given its patient mix. This ratio is then rescaled by the regional average for interpretation with respect to the average outcome in the region. Risk standardization accounts for differences in the numbers of patients per clinic, differences in patient characteristics across clinics, and outliers in the data. Appendix D includes more information about risk standardization and other technical specifications.

Summary Quality Score

The summary quality score represents a clinic's overall quality relative to the regional average. The summary quality score is calculated by first measuring the difference between a clinic's risk-standardized rate and the regional average for each individual metric within the measure, and then summing the differences for each quality metric. For more details, see Appendix C.

Health Insurance Plans:

Premera Blue Cross

Regence BlueShield

Washington State Uniform Medical Plan

Medicare

Cancer Registries:

Washington State Cancer Registry (WSCR)

Western Washington Cancer Surveillance System (CSS)

Cost

We calculate a clinic risk-standardized average episode cost per patient associated with each measure. Cost includes all reimbursements paid by health insurers during the episode and may include non-cancer costs. The calculation and rationale are similar to the clinic risk-standardized rate above. For more details, see Appendix C.

Summary Quality Score and Cost Display

We display the clinic-level quality score on the y-axis and cost on the x-axis to facilitate a comparison of these outcomes in our community. For more information about this figure, see "How to Read and Interpret the Report" on pages 9 and 10.

1. Centers for Medicare and Medicaid Services. Blueprint for the CMS Measures Management System. Version 13.0. May 2017. https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/Downloads/Blueprint-130.pdf

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Results

MEASURE 1

Recommended Cancer Treatment

Cancer patient outcomes are better when cancer care providers follow evidence-based recommendations for treatment. By measuring how well clinics follow recommendations for treating breast, colorectal and lung cancer, this measure provides insight into how well clinics follow cancer treatment recommendations overall.

Evidenced-based clinical practice guidelines, or standards of care, are available for the treatment of all major cancers. Guidelines encompass treatment that is intended to cure or control the cancer (depending on the stage of the disease) as well as to ease symptoms caused by drug therapies and the cancer itself. Treatments can include chemotherapy, surgery, radiation, immunotherapy, targeted therapy and hormone therapy, among others.

The recommended treatments that U.S. cancer care providers follow are typically those issued by professional organizations such as the American Society of Clinical Oncology (ASCO) and the National Comprehensive Cancer Network (NCCN). They reflect the consensus opinion of panels of clinicians and oncology researchers (and sometimes patient advocates), based on the most current data. They are frequently updated to reflect new data and clinical information.

This section of the report describes and displays metrics that summarize provider adherence to a number of recommended cancer treatments. The first several metrics measure adherence to treatment guidelines for breast cancer, colon and rectal cancer, and non-small cell lung cancer. A final metric measures the use of anti-nausea treatment during chemotherapy for all of the above cancers.

Measure 1A reports results on treatment adherence for breast, colorectal and lung cancers combined.

Measure 1B reports on treatment adherence for breast cancer.

METHODS

We reviewed more than 30 potential metrics for Recommended Cancer Treatment. For most metrics, our database had too few patients for meaningful statistical analysis. Therefore, in order to measure recommended treatment broadly, we combined several metrics to construct two new metrics that apply to three of the most common cancer types: breast, colorectal and non-small cell lung cancer. The two combined metrics are **Recommended therapy based on cancer type** (Figure 1A.1) and **Anti-nausea medication during chemotherapy** (Figure 1A.2).

MEASURE 1A: RECOMMENDED TREATMENT FOR BREAST, COLORECTAL AND LUNG CANCER

Recommended therapy based on cancer type

Breast Cancer

- Receipt of chemotherapy within 120 days of diagnosis for ER/PR negative patients (stage IC-III)
- Hormone therapy (tamoxifen or aromatase inhibitor) within 365 days of diagnosis for ER/PR positive patients (stage IC-III)
- Receipt of trastuzumab based on HER2 status (stage IC-III)

Colorectal Cancer

- Receipt of chemotherapy within 120 days of diagnosis for colon cancer patients (stage III)
- Receipt of chemotherapy within 270 days of diagnosis for rectal cancer patients (stage II-III)

Non-Small Cell Lung Cancer

- Receipt of chemotherapy within 60 days of surgery (stage II-IIIA)
- No bevacizumab use for metastatic tumors within three months of diagnosis

Anti-nausea medication during chemotherapy

- Receipt of serotonin antagonist within seven days of moderate- or high-emetic risk chemotherapy

Population: Breast, colorectal and lung cancer patients undergoing cancer treatment

Reporting Years: 2015–2017

Time Period: The treatment period begins at the start of active treatment (surgery, chemotherapy or radiation therapy) and continues until there is a four-month gap in treatment. The period may end earlier if the patient died or treatment extended beyond 12 months.

1: RECOMMENDED CANCER TREATMENT

Appendix B lists the metric definitions in greater detail, along with their sources.

The treatment period begins at the start of active treatment (surgery, chemotherapy or radiation therapy) and continues until there is a four-month gap with no recorded treatment. The period may end earlier if the patient died or treatment extended beyond 12 months.

For all metrics, the eligible population includes adult patients in Washington state who were enrolled with Premera Blue Cross, Regence BlueShield, the Washington State Uniform Medical Plan or Medicare during the treatment period.

For **Recommended therapy based on cancer type** (Figure 1A.1), the criteria applied to each metric are based on the cancer types listed below and recommended guidelines for treating that cancer.

For **Anti-nausea medication during chemotherapy** (Figure 1A.2), the metric population ("denominator") is patients who received chemotherapy classified as moderate- or high-risk for nausea and vomiting (according to NCCN antiemesis guidelines) and had insurance from the month of diagnosis to one month after initiation of chemotherapy. For the metric population, the measure of interest ("numerator") is receipt of a recommended high-potency anti-nausea medicine (serotonin antagonist) within seven days of initiating chemotherapy.

Breast cancer:

For **Recommended therapy based on HER2 status**, the metric population ("denominator") is adult females with breast cancer whose HER2/neu status was recorded (either positive or negative), who were diagnosed with American Joint Committee on Cancer (AJCC) stage T1c or II-III cancer and had insurance coverage including a claim for chemotherapy within 365 days of diagnosis. The treatments of interest ("numerator") were receipt of trastuzumab, lapatinib or pertuzumab within 365 days of diagnosis.

For **Recommended therapy based on ER/PR status**, the metric population ("denominator") is females ages 18-79 with AJCC stage IB-III cancer and a record of their estrogen-receptor/progesterone-receptor (ER/PR) status (positive or negative) who had health insurance coverage for 120 days (for ER and PR negative patients) or 365 days (for ER or PR positive patients) after diagnosis. ER/PR negative patients were included only if they had a lumpectomy or mastectomy in the 120 days after diagnosis. The treatment of interest ("numerator") depended on the ER/PR status of the patient and was either 1) for ER/PR negative patients, receiving two or more chemotherapy agents within 120 days of diagnosis, with the second agent administered within three days of the first or; 2) for ER/PR positive patients receiving hormone therapy within 365 days of diagnosis.

Colorectal cancer:

For **Receipt of chemotherapy within 120 days of diagnosis for stage III colon cancer patients**, the metric population ("denominator") is patients ages 18-79 with AJCC stage III colon cancer who had health insurance coverage for 120 days after diagnosis. The treatment of interest ("numerator") is receipt of chemotherapy within 120 days of diagnosis.

For **Receipt of chemotherapy within 270 days of diagnosis for stage II-III rectal cancer patients**, the metric population ("denominator") is patients with AJCC stage II or III rectal cancer who had health insurance coverage for 270 days after diagnosis. The treatment of interest ("numerator") is receipt of chemotherapy within 270 days of diagnosis.

Non-small cell lung cancer:

For **Receipt of chemotherapy within 60 days of surgery**, the metric population ("denominator") is non-small cell lung cancer patients, AJCC stage II–IIIA, who had health insurance coverage and a record of lung cancer resection surgery within two months of diagnosis. The treatment of interest ("numerator") is receipt of chemotherapy within 60 days of surgery.

For **No bevacizumab use for metastatic tumors within three months of diagnosis**, the metric population ("denominator") is patients with AJCC stage IV or registry stage distant non-small cell lung cancer with squamous histology who had health insurance coverage from diagnosis to either 90 days after diagnosis or death. The treatment of interest ("numerator") is receipt of bevacizumab within 90 days of diagnosis.

CLINIC ATTRIBUTION

Patients were assigned to clinics during the treatment period using the Clinic Attribution methodology specified in Appendix A.

SUMMARY QUALITY SCORE

The summary quality score indicates a clinic's overall performance on all relevant metrics relative to the regional average. The score is calculated using a two-step process: measuring the difference between a clinic's standardized rate and the regional average for each metric, and then summing the differences for each quality metric. See Appendix C for more details.

MEASURE 1A

Recommended Treatment for Breast, Colorectal and Lung Cancer

We combined the Measure 1A metrics to generate a Recommended Cancer Treatment Summary Quality Score (Figure 1A.3). In the graph, zero represents the regional average. A positive score indicates performance that is better than the regional average. A negative score indicates performance that is below the regional average.

COST

Costs for the treatment period are measured and compared against the summary quality score in the Recommended Cancer Treatment Summary Quality and Cost Score (Figure 1A.4). The cost is the amount paid by insurers to all health care providers for the cancer patients included in the measure. See Appendix C for more details.

RISK ADJUSTMENT

Risk standardization accounts for differences in the number of patients per clinic, differences in patient characteristics across clinics, and outliers in the data.

"Process metrics" concern recommended use or non-use of tests or treatments, and thus are not typically risk adjusted. We adjusted each metric for cancer type to account for differences in the percentage of breast, colorectal and lung cancer patients across providers.

The chart on this page lists the risk adjustors, including those made to cost during the treatment period.

For more detail about risk adjustment see Appendix D.

Measure 1A Risk Adjustors: Recommended Treatment for Breast, Colorectal & Lung Cancer

	Recommended Therapy & Anti-Nausea Meds	Cost
Sex		X
Charlson Score (0, 1, 2+)[1]		X
Medicare Indicator		X
Medicare × Age		X
Medicare × Dual Eligibility		X
Colorectal Cancer Indicator	X	X
Lung Cancer Indicator	X	X
# Days in Period		X
Radiation Receipt Indicator		X
Surgery Receipt Indicator		X

1. Reference Appendix D for Charlson Score.

MEASURE LIMITATIONS

Quality:

- These metrics offer a limited snapshot of treatment. Other important components of care are not included in this measure.
- These metrics do not account for individual patient preferences for treatment. Some patients may opt not to receive treatment.

Cost:

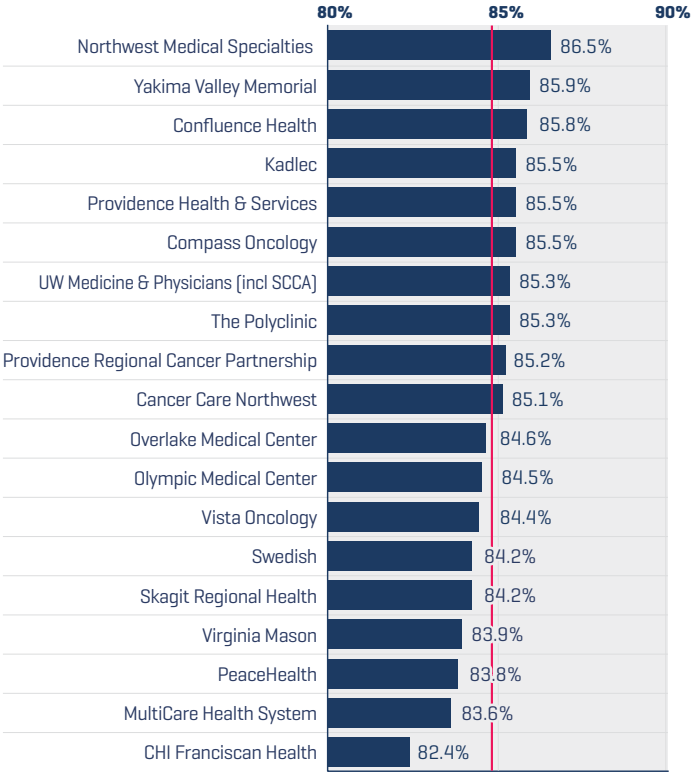
- Costs are adjusted for receipt of chemotherapy, radiation and surgery but do not distinguish among the variations in types of treatment.
- The cost measure does not include patients' out-of-pocket responsibility for copays or deductibles.

1A: RECOMMENDED TREATMENT FOR BREAST, COLORECTAL AND LUNG CANCER

Figure 1A.1: Recommended therapy based on cancer type

Risk-Standardized Rate:

Higher rate = higher quality



REGIONAL AVERAGE: 84.8%

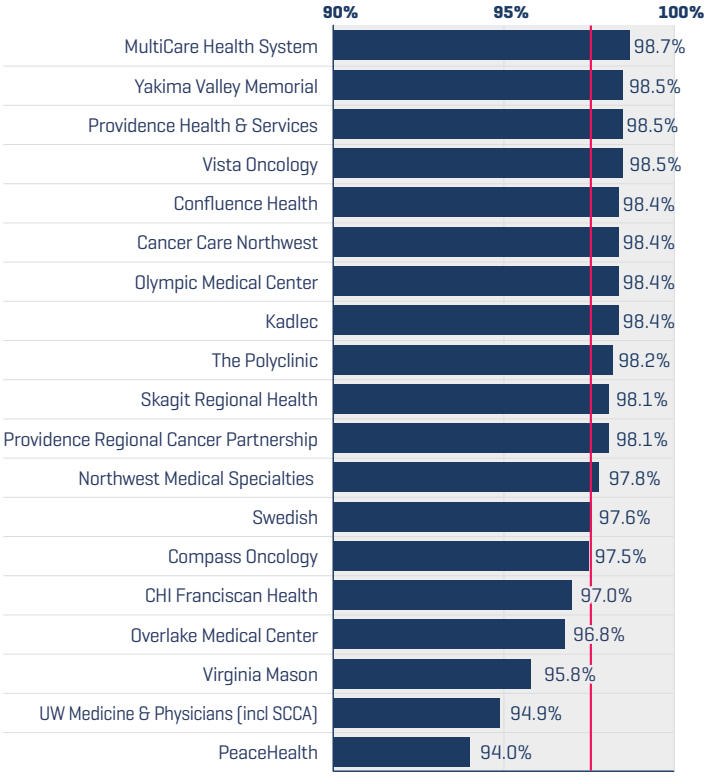
N=2709

RANGE: **82.4% to 86.5%**

Figure 1A.2: Anti-nausea medication during chemotherapy

Risk-Standardized Rate

Higher rate = higher quality



REGIONAL AVERAGE: 97.6%

N=3352

RANGE: **94.0% to 98.7%**

RESULTS (1A.1 & 1A.2)

The **Recommended therapy** metric (1A.1) includes 2,709 patients, and the **Anti-nausea** metric (1A.2) includes 3,352 patients.

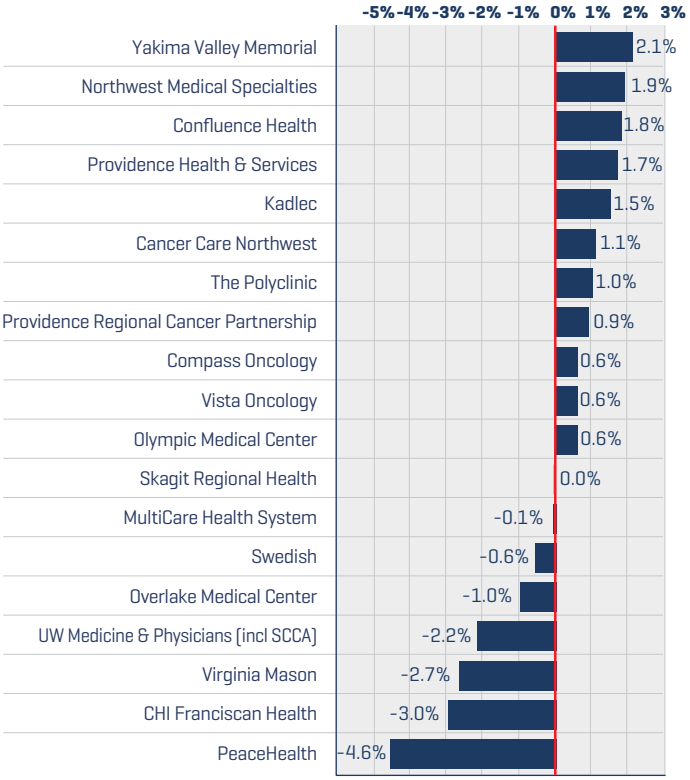
On average, 84.8 percent of patients received recommended therapy based on cancer type. There is a 4.1 percentage point difference between the highest and the lowest clinic rate, suggesting minimal difference in receipt of recommended treatment among clinics. In general, patients are receiving appropriate therapy based on their cancer type.

On average, 97.6 percent of patients received appropriate anti-nausea medication during chemotherapy. There is a 4.7 percentage point difference between the highest and the lowest clinic rate, suggesting minimal difference in receipt of anti-nausea medication among clinics. In general, patients are receiving the medication they need to help manage potential nausea symptoms.

Figure 1A.3: Recommended treatment for breast, colorectal and lung cancer

Summary Quality Score

Positive score = better than the regional average
Negative score = below the regional average



Zero represents clinic performance at the regional average

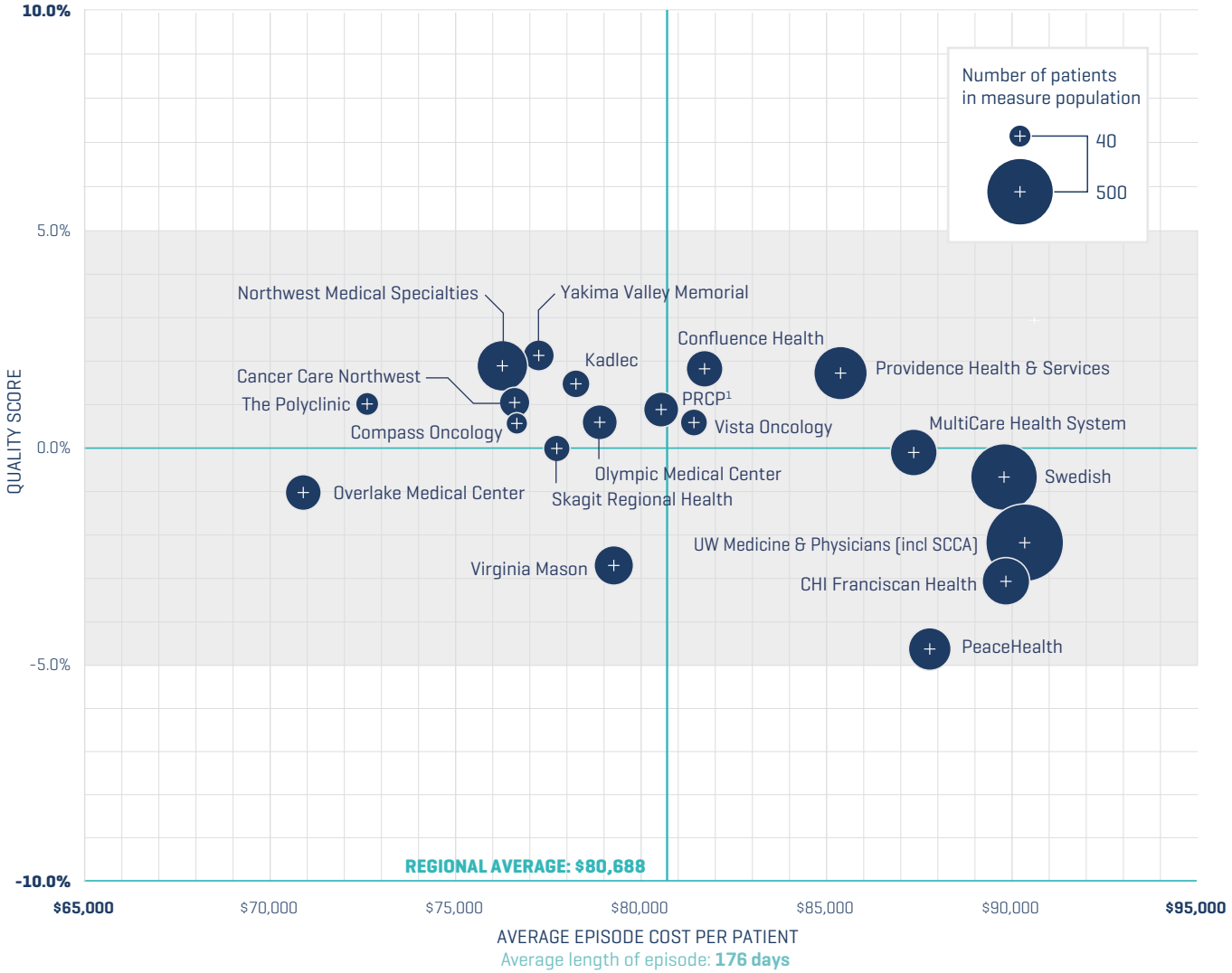
RANGE: **-4.6% to 2.1%**

RESULTS (1A.3)

The summary quality scores, indicating clinic performance relative to the regional average for both metrics, show a difference of 6.7 percentage points between the highest-performing clinic and lowest-performing clinic. The majority of the clinics are clustered around the regional average.

Figure 1A.4: Recommended treatment for breast, colorectal and lung cancer

Summary quality score and cost



Summary Quality Score Range: **-4.6% to 2.1%**

Cost Range: **$70,894 to $90,209**

RESULTS (1A.4)

Patients included in both metrics (**Recommended therapy** and **Anti-nausea**) are combined for the cost measure, resulting in a population of 2,927 patients included in the average episode cost per patient.

The regional average for cost of care over the period is $80,688, with an average treatment episode length of 176 days. The cost range is $19,315 ($70,894 to $90,209). The quality scores, indicating clinic performance relative to the regional average for both metrics, show a difference of 6.7 percentage points between the highest-performing clinic and lowest-performing clinic — a moderate difference. The majority of the clinics are clustered around the regional average for quality.

There is a negative relationship between episode cost and the quality score, suggesting that there may be an opportunity to lower costs without sacrificing quality.

[1]Note that PRCP stands for Providence Regional Cancer Partnership

MEASURE 1B

Recommended Treatment for Breast Cancer

Breast cancer is the most common cancer in Washington state. As such, there were sufficient numbers of patients to analyze quality and cost information separately for breast cancer.

METHODS

Quality metrics for Measure 1B are identical to the breast cancer metrics described earlier for Measure 1A.

As a result of high rates of adherence to guidelines and low clinic-to-clinic variability for recommended treatments for breast cancer, we are no longer reporting quality metrics at the clinic level.

COST

Costs for the treatment period are measured and compared against the summary quality score in the **Recommended Treatment for Breast Cancer Summary Cost** (Figure 1B). The cost is the amount paid by insurers to all health care providers for the cancer patients included in the combined metric. See Appendix C for more details.

RISK ADJUSTMENT

Risk standardization accounts for differences in the number of patients per clinic, differences in patient characteristics across clinics, and outliers in the data.

"Process metrics" concern recommended use or non-use of tests or treatments, and thus are not typically risk adjusted. Cost metrics are typically risk adjusted to account for patient factors that might vary from clinic to clinic and also affect the likelihood of variation in cost. The chart on this page lists the risk adjustors for cost during the treatment period.

For more details about risk adjustment, see Appendix D.

Measure 1B Risk Adjustors: Recommended Treatment for Breast Cancer		
	Recommended Therapy Based on ER/PR & HER2 Status and Anti-Nausea Meds	Cost
Commercial Insurance Indicator		X
Commercial × Age		X
AJCC Stage		X
# Days in Period		X
Surgery Receipt Indicator		X

MEASURE 1B: RECOMMENDED TREATMENT FOR BREAST CANCER

Recommended therapy based on ER/PR and HER2 status for breast cancer

- Receipt of chemotherapy within 120 days of diagnosis for ER/PR negative patients (stage IC-III)
- Hormone therapy (tamoxifen or aromatase inhibitor) within 365 days of diagnosis for ER/PR positive patients (stage IC-III)
- Receipt of trastuzumab based on HER2 status (stage IC-III)

Anti-nausea medication during chemotherapy

- Receipt of serotonin antagonist within seven days of moderate- or high-emetic risk chemotherapy

Population: Breast cancer patients undergoing cancer treatment

Reporting Years: 2015–2017

Time Period: The treatment period begins at the start of active treatment (surgery, chemotherapy or radiation therapy) and continues until there is a four-month gap in treatment. The period may end earlier if the patient died or treatment extended beyond 12 months.

MEASURE LIMITATIONS

Quality:

- These metrics offer a limited snapshot of treatment. Other important components of care are not included in this measure.
- These metrics do not account for individual patient preferences for treatment. Some patients may opt not to receive treatment.

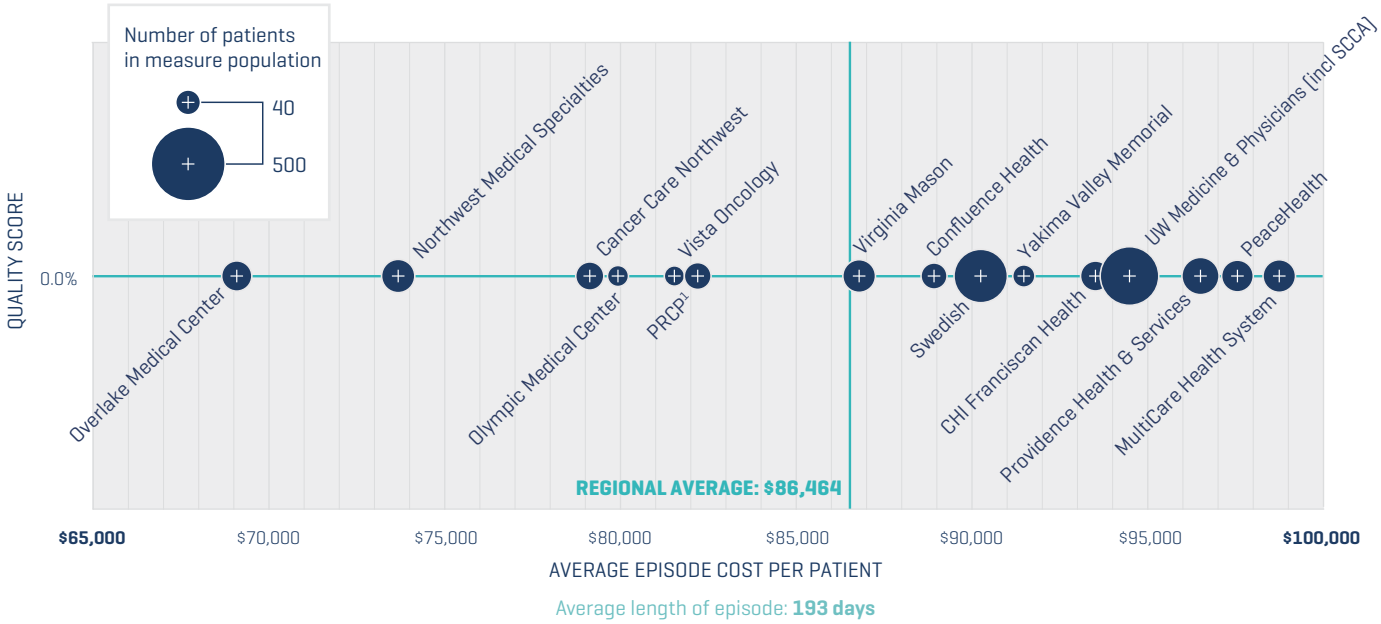
Cost:

- Costs are adjusted for receipt of chemotherapy, radiation and surgery but do not distinguish among the variations in types of treatment.
- The cost measure does not include patients' out-of-pocket responsibility for copays or deductibles.

1B: RECOMMENDED TREATMENT FOR BREAST CANCER

For the Washington state region, 90.0% are receiving appropriate therapy based on ER/PR and HER2 status, with 98.1% receiving serotonin antagonist within seven days of moderate- or high-emetic risk chemotherapy. Clinic-level breakdowns are not shown as they do not vary significantly from the regional average. Cost of care during the treatment period does vary between clinics and results are presented below.

Figure 1B: Recommended treatment for breast cancer



Average length of episode: **193 days**

Cost Range: **$69,027 to $98,668**

RESULTS (1B)

The regional average cost of care is $86,464, and the average treatment episode length is 193 days. The cost range is $29,641 ($69,027 to $98,668). There is no difference in quality measures among clinics, suggesting that there may be an opportunity to lower costs without sacrificing quality.

[1]Note that PRCP stands for Providence Regional Cancer Partnership

MEASURE 2

Hospitalization During Chemotherapy

Hospitalization during chemotherapy includes visits to the emergency department or an inpatient hospital stay (excluding stays for cancer-directed surgeries) during the time that a patient receives chemotherapy. Cancer clinics that are the most successful at managing their patients' symptoms during chemotherapy will have the lowest rates of emergency department and hospital stays.

Many cancer patients who receive chemotherapy experience symptoms that require urgent attention, such as pain or nausea. Although cancer clinics often can manage these symptoms through telephone calls and urgent clinic visits, cancer patients often seek care in the emergency department (ED) instead of the cancer clinic. The reasons are many and can include limited clinic hours, lack of understanding of symptom self-management and lack of access to oncology-specific urgent care resources. Untreated symptoms may also lead to inpatient (IP) hospitalization. In a 2017 study, HICOR researchers demonstrated that nearly 50 percent of ED visits by cancer patients are for a potentially preventable cancer-related cause.[1]

The drawbacks of ED care for chemotherapy-related problems are numerous and can include long wait times in crowded and uncomfortable settings, lack of ED staff expertise in managing chemotherapy-related side effects, exposure to infections that can be dangerous to immune-compromised patients, and high costs. ED visits can disrupt the continuum of care received from oncology providers. If a patient's symptoms are severe or if clinicians cannot manage them during an ED visit, the patient may require admission to the hospital.

A lower rate of ED visits and IP admissions for patients undergoing chemotherapy is a marker of higher-quality care, suggesting better symptom management, better support services and better access to cancer clinic-based urgent care services.

METHODS

The Hospitalization During Chemotherapy measure employs two metrics: **Emergency Department (ED) visits during chemotherapy** (Figure 2.1) and **Inpatient (IP) stays during chemotherapy** (Figure 2.2).

The metrics are described in this text and in the box on this page. Appendix B lists the metric definitions in greater detail, along with their sources.

For both metrics, the eligible population ("denominator") is adult patients in Washington state who were enrolled with Premera Blue Cross, Regence BlueShield, the Washington State Uniform Medical Plan or Medicare at the time of their diagnosis through six months following the start of chemotherapy. Patients who received a bone marrow transplant were excluded.

The outcome of interest for **Emergency department (ED) visits during chemotherapy** is an ED visit for any reason within 180 days of the first chemotherapy claim ("numerator"). Patients who were admitted to the hospital at the time of their ED visit were not included in the ED metric.

The outcome of interest for **Inpatient (IP) stays during chemotherapy** is a hospital IP admission for any reason except cancer-directed surgeries within 180 days of the first chemotherapy treatment ("numerator").

CLINIC ATTRIBUTION

Patients were assigned to clinics during the six-month period following the start of chemotherapy using the Clinic Attribution methodology specified in Appendix A.

MEASURE 2: HOSPITALIZATION DURING CHEMOTHERAPY

Emergency department (ED) visits during chemotherapy

- ED visit without subsequent inpatient admission within six months of first chemotherapy

Inpatient (IP) stays during chemotherapy

- Hospital IP admission for any reason within six months of first chemotherapy

Population: Cancer patients receiving chemotherapy

Reporting Years: 2015–2017

Time Period: Six months following the start of chemotherapy

1. Panattoni L, Fedorenko C, Greenwood-Hickman MA, et al. Characterizing Potentially Preventable Cancer- and Chronic Disease–Related Emergency Department Use in the Year After Treatment Initiation: A Regional Study. Journal of Oncology Practice 2018 14:3, e176-e185.

2: HOSPITALIZATION DURING CHEMOTHERAPY

SUMMARY QUALITY SCORES

The summary quality score indicates a clinic's overall performance on all relevant quality metrics relative to the regional average. The score is calculated using a two-step process: measuring the difference between a clinic's risk-standardized rate and the regional average for each metric and then summing the differences for each quality metric. See Appendix C for more details.

We combined the two metrics to generate a **Hospitalization Quality Score** (Figure 2.3) and a **Hospitalization Quality and Cost Score** (Figure 2.4). In the graph, zero represents the regional average. A positive score indicates performance that is better than the regional average. A negative score indicates performance that is below the regional average.

COST

Costs for the six-month period following the start of chemotherapy are measured and compared against the summary quality score (Figure 2.4). The cost is the amount paid by insurers to all health care providers for the populations included in the combined metric. See Appendix C for more details on cost methodology.

RISK ADJUSTMENT

As "outcome metrics," ED visits or IP stays are typically risk adjusted to account for patient factors that might vary from clinic to clinic and also affect the likelihood of an event. We also adjusted for cancer type to account for differences in the percentage of breast, colorectal, prostate and liquid tumor cancer patients treated in the cancer clinics. The chart on this page lists the risk adjustors, including those made to cost during chemotherapy.

For more details about risk adjustment, see Appendix D.

MEASURE LIMITATIONS

Quality:

- The metrics measure all hospital ED and IP admissions, excluding IP admissions for cancer-directed surgery. It is therefore possible that some of the ED and IP admissions were for reasons unrelated to the patient's cancer treatment.
- Risk adjustment is designed to account for factors that are outside of the cancer clinics' control that could influence ED and IP admissions. Some of these factors (such as the availability of family support) are not available in our databases and therefore pose a limitation in our methodology.

Cost:

- The cost measure does not include patients' out-of-pocket responsibility for copays or deductibles.

Measure 2 Risk Adjustors: Hospitalization During Chemotherapy

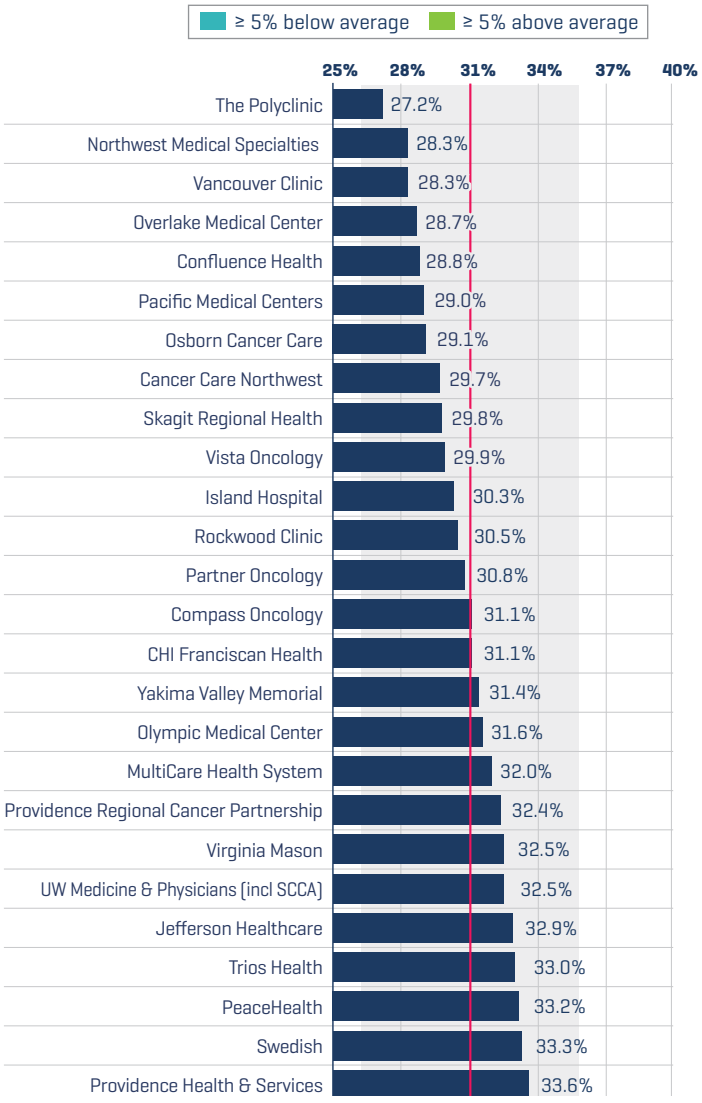
	ED During Chemo	IP During Chemo	Cost
Age (continuous)	X	X	
Sex	X	X	X
Charlson Score (0, 1, 2+)[1]	X	X	X
Area Deprivation Index (ADI)[2]	X		
Medicare Indicator			X
Medicare × Age			X
Medicare × Dual Eligibility	X	X	X
AJCC Stage	X	X	X
Breast Cancer Indicator	X	X	X
Colorectal Cancer Indicator	X	X	
Lung Cancer Indicator	X		
Prostate Cancer Indicator		X	X
Gynecologic Cancer Indicator	X	X	X
Pancreas Cancer Indicator		X	X
Bladder Cancer Indicator			X
Liver Cancer Indicator			X
Melanoma Cancer Indicator			X
Oral Cancer Indicator			X
Liquid Tumor Indicator	X	X	X
# Days in Period		X	X
# Chemo Administrations	X	X	X
Radiation Receipt Indicator	X	X	X
Surgery Receipt Indicator	X	X	X

1. Reference Appendix D for Charlson Score.
2. Reference Appendix D for Area Deprivation Index (ADI).

2: HOSPITALIZATION DURING CHEMOTHERAPY

Figure 2.1: ED visits during chemotherapy

Risk-Standardized Rate | **Lower rate = higher quality**

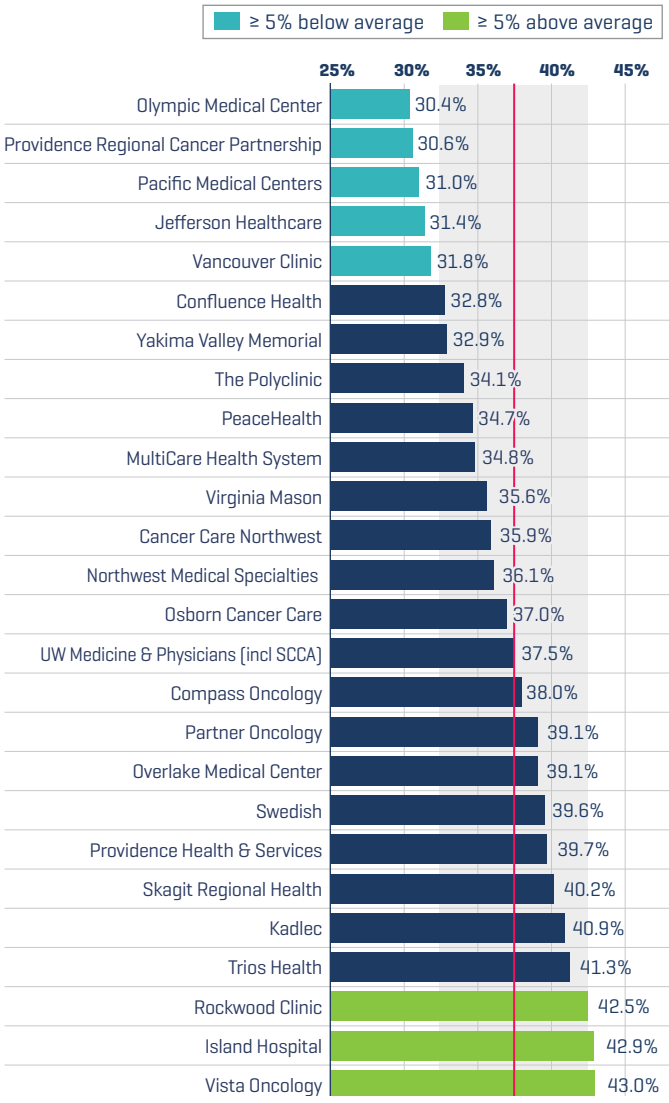


N=7252

REGIONAL AVERAGE: **31.0%**
RANGE: **27.2% to 36.5%**

Figure 2.2: Inpatient (IP) stays during chemotherapy

Risk-Standardized Rate | **Lower rate = higher quality**



N=7252

REGIONAL AVERAGE: **37.0%**
RANGE: **30.4% to 44.3%**

RESULTS (2.1 & 2.2)

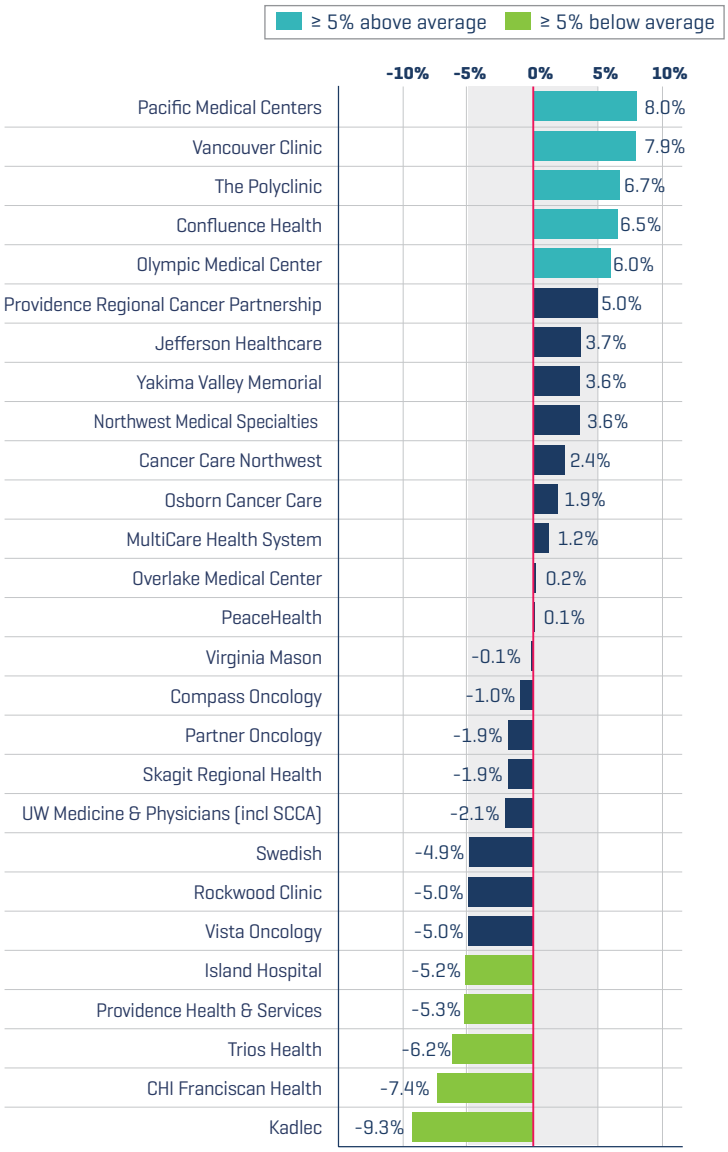
There are 7,252 cancer patients included in this measure.

On average, 31 percent of cancer patients had an ED visit during chemotherapy. There is a 9.2 percentage point difference between the highest and the lowest clinic rate, suggesting meaningful differences in how cancer clinics manage patients during chemotherapy.

On average, 37.0 percent of cancer patients had an inpatient stay during chemotherapy. There is a 13.9 percentage point difference between the highest and the lowest clinic rate, suggesting meaningful differences in how cancer clinics manage patients during chemotherapy.

Figure 2.3: Hospitalization during chemotherapy

Summary Quality Score | Positive score = better than the regional average
Negative score = below the regional average



Zero represents clinic performance at the regional average

RANGE: **-9.3% to 8.0%**

RESULTS (2.3)

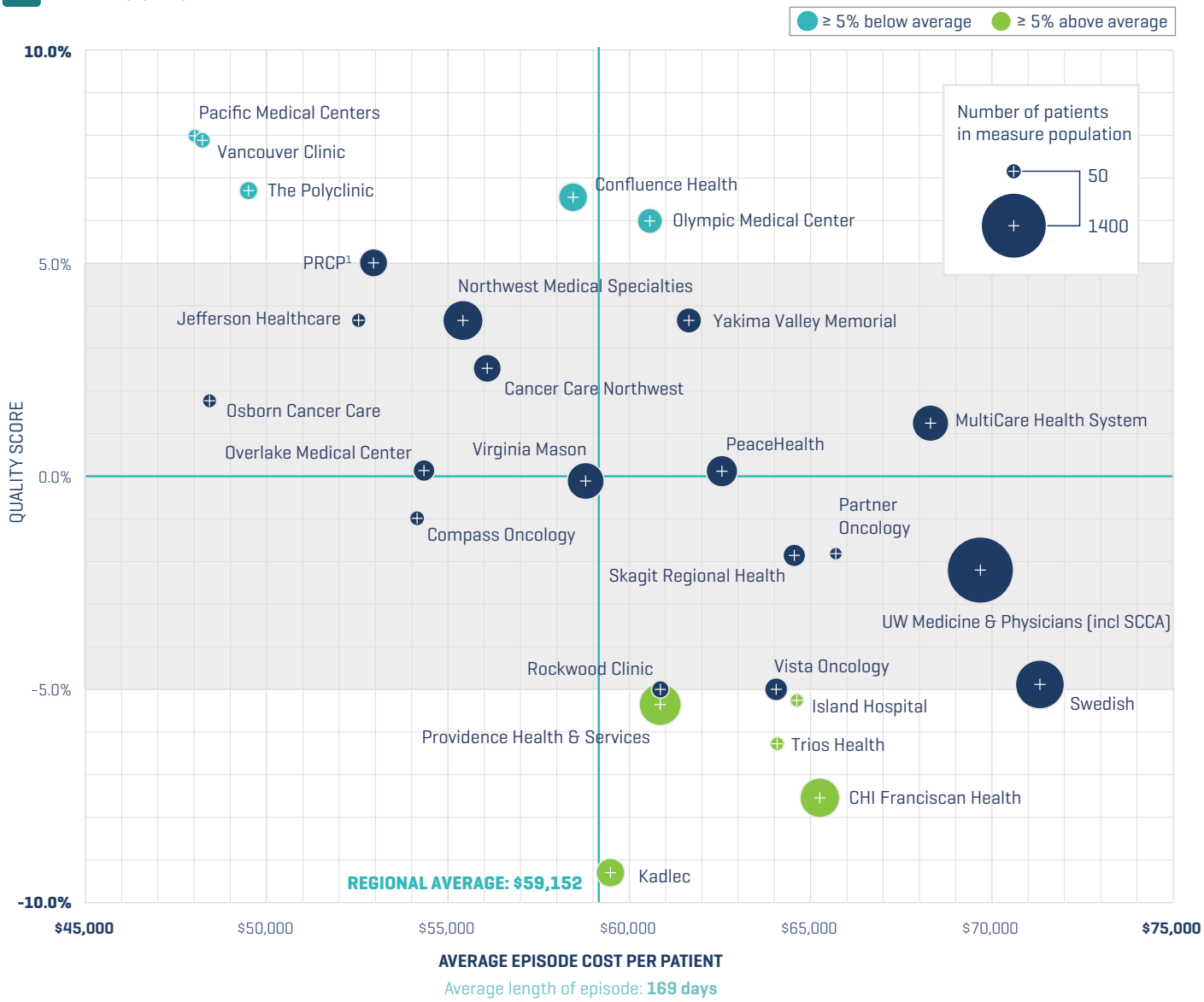
The summary quality scores, indicating clinic performance relative to the regional average for both metrics, show a difference of 17.3 percentage points between the highest-performing clinic and lowest-performing clinic.

In some cases, clinics with above-average results on one quality metric (e.g., ED visits) had below-average results on the other metric (e.g., IP stays) or vice versa. This finding suggests that strategies aimed at reducing one problem may have less of an impact on the other.

2: HOSPITALIZATION DURING CHEMOTHERAPY

Figure 2.4: Hospitalization during chemotherapy

Summary quality score and cost



RESULTS (2.4)

The regional average cost of care over the period of interest is $59,152, for an average observation period of 169 days. The cost range is $23,329 ($48,054 to $71,383). The quality scores, indicating clinic performance relative to the regional average for both metrics, show a difference of 17.3 percentage points between the highest-performing clinic and lowest-performing clinic, which is a meaningful difference.

There is a strong negative relationship between episode cost and quality score, suggesting that efforts to improve quality may also lower costs during this period of cancer care.

[1]Note that PRCP stands for Providence Regional Cancer Partnership

MEASURE 3

Breast Cancer Tumor Marker Testing Following Treatment

Studies have shown no benefit from the routine use of tumor marker testing for patients with earlier-stage cancers who were treated with curative intent and have no symptoms. Unnecessary testing may lead to misdiagnosis and overtreatment, as well as increased costs.

The American Society of Clinical Oncology (ASCO) recommends against routine use of serum tumor markers for patients who have completed treatment for early-stage breast cancer and do not have symptoms. Use of these tests when not indicated may cause harm. For example, false-positive tests may expose patients to additional, unnecessary invasive tests and procedures, radiation exposure, misdiagnosis, anxiety and increased costs.

Note in prior years we also measured the use of advanced imaging in breast, colorectal, and lung cancer patients. These metrics are no longer included in our report.

METHODS

The Breast Cancer Tumor Marker Testing Following Treatment measure includes one metric: **Breast cancer tumor marker testing following treatment** (Figure 3.1).

The metric is described within the text below and in the box on this page. Appendix B lists the metric definition in greater detail, along with its sources.

The follow-up period focuses on the initial (13-month) period after the end of active treatment (surgery, chemotherapy or radiation therapy), but may end earlier if the patient died or restarted active treatment. Patients must have a four-month gap in active treatment to be considered to have completed active treatment.

For this metric, the eligible population ("denominator") is adult women in Washington state with breast cancer who were enrolled with Premera Blue Cross, Regence BlueShield, the Washington State Uniform Medical Plan or Medicare at the time of their diagnosis through the end of the initial follow-up period. Patients were diagnosed at an early stage (AJCC stage I-IIIA) and received curative treatment.

For **Breast cancer tumor marker testing following treatment** (Figure 3.1), the measure of interest ("numerator") is patients who had a tumor marker test (cancer antigen 15-3 [CA 15-3], cancer antigen 27.29 [CA 27.29], or carcinoembryonic antigen [CEA]) during the defined follow-up period.

MEASURE 3: BREAST CANCER TUMOR MARKER TESTING FOLLOWING TREATMENT

Breast cancer tumor marker testing following treatment

- Serum tumor marker test (CEA, CA 15-3, CA 27.29) for breast cancer (stage I-IIIA) during first 13 months of follow-up

Population: Breast cancer patients who completed active treatment

Reporting Years: 2015–2017

Time Period: The follow-up period focuses on the initial (13 month) period after the end of active treatment (surgery, chemotherapy or radiation therapy), but may end earlier if the patient died or restarted active treatment. Patients must have a four-month gap in active treatment to be considered to have completed treatment.

CLINIC ATTRIBUTION

Patients were assigned to clinics during the initial follow-up period using the Clinic Attribution methodology specified in Appendix A.

SUMMARY QUALITY SCORE

The summary quality score indicates a clinic's overall performance on all relevant metrics relative to the regional average. The score is calculated using a two-step process: first, measuring the difference between a clinic's standardized rate and the regional average for each metric; second, summing the differences for each quality metric. See Appendix C for more details.

This measure has only one metric, so the summary quality score for **Breast Cancer Tumor Marker Testing Following Treatment** [Figure 3.2] reflects the results for a single metric. In the graph, zero represents clinic performance at the regional average. A positive score indicates performance that is below the regional average.

3: BREAST CANCER TUMOR MARKER TESTING FOLLOWING TREATMENT

COST

Costs for the initial follow-up period are measured and compared against the summary quality score (Figure 3.3). The cost is the amount paid by insurers to all health care providers for the cancer patients included in the combined metric. See Appendix C for additional cost methodology.

RISK ADJUSTMENT

Risk standardization accounts for differences in the number of patients per clinic, differences in the numbers of patients per clinic, differences in patient characteristics across clinics, and outliers in the data.

"Process metrics" concern recommended use or non-use of tests or treatments, and thus are not risk adjusted. Cost metrics are typically risk adjusted to account for patient factors that might vary from clinic to clinic and also affect the likelihood of variation in cost. The chart on this page lists the risk adjustors for cost during the follow-up period.

For more details about risk adjustment, see Appendix D.

Measure 3 Risk Adjustors:
Breast Cancer Tumor Marker Testing Following Treatment

	BC Tumor Marker	Cost
Charlson Score (0, 1, 2+)[1]		X
Medicare × Dual Eligibility		X
Commercial Insurance Indicator		X
Commercial × Age		X
# Days in Period		X

1. Reference Appendix D for Charlson Score.

MEASURE LIMITATIONS

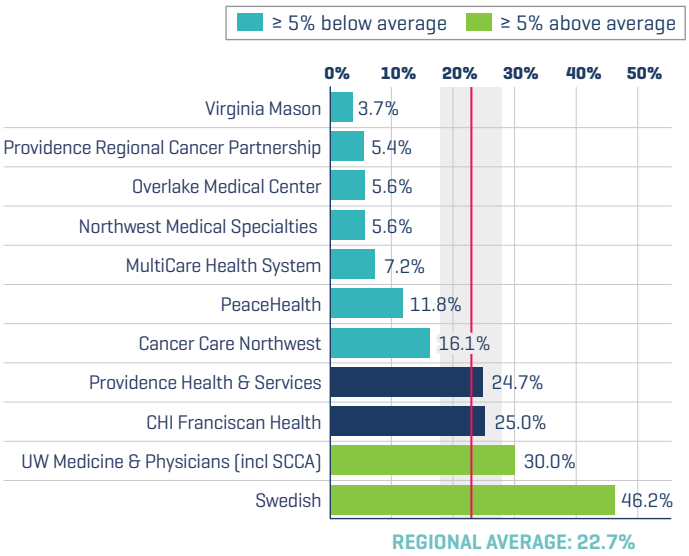
Quality:

- This metric focuses on use of non-recommended tumor marker testing for asymptomatic patients. In some cases, tumor marker tests are recommended to evaluate a patient with symptoms or exam findings that are suggestive of a recurrent or new cancer. The insurance claims database cannot distinguish between tests that were done to evaluate symptoms and tests that were performed on patients with no symptoms.
- These metrics do not capture recommended follow-up care.

3: BREAST CANCER TUMOR MARKER TESTING FOLLOWING TREATMENT

Figure 3.1: Breast cancer tumor marker testing following treatment

Risk-Standardized Rate | **Lower rate = higher quality**



N=1011

RANGE: **3.7% to 46.2%**

RESULTS (3.1)

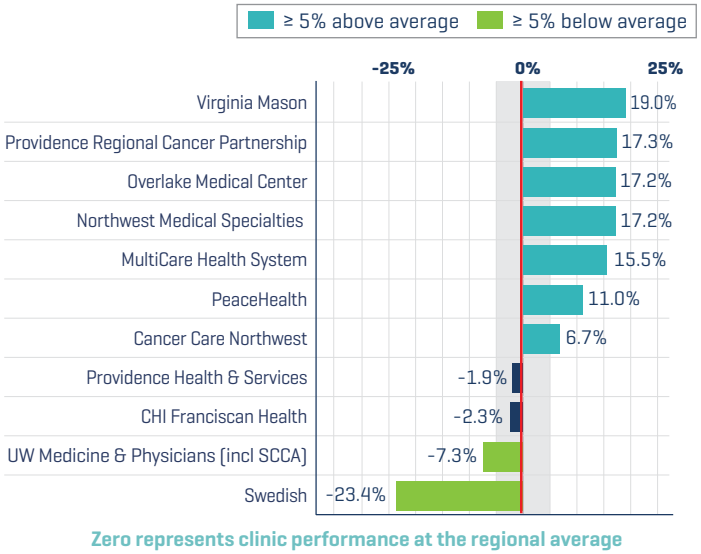
This measure includes 1,011 breast cancer patients.

On average, 22.7 percent of breast cancer patients received tumor marker tests (CA 15-3, CA 27.29, CEA) in the 13 months following treatment. There is a 42.5 percentage point difference in the rate of tumor marker test ordering between the highest-performing clinic and the lowest-performing clinic, demonstrating wide variability of practice patterns relative to national recommendations

3: BREAST CANCER TUMOR MARKER TESTING FOLLOWING TREATMENT

Figure 3.2: Breast cancer tumor marker testing following treatment

Summary Quality Score | Positive score = better than the regional average
Negative score = below the regional average



Zero represents clinic performance at the regional average

N=1011

RANGE: **-23.4% to 19.0%**

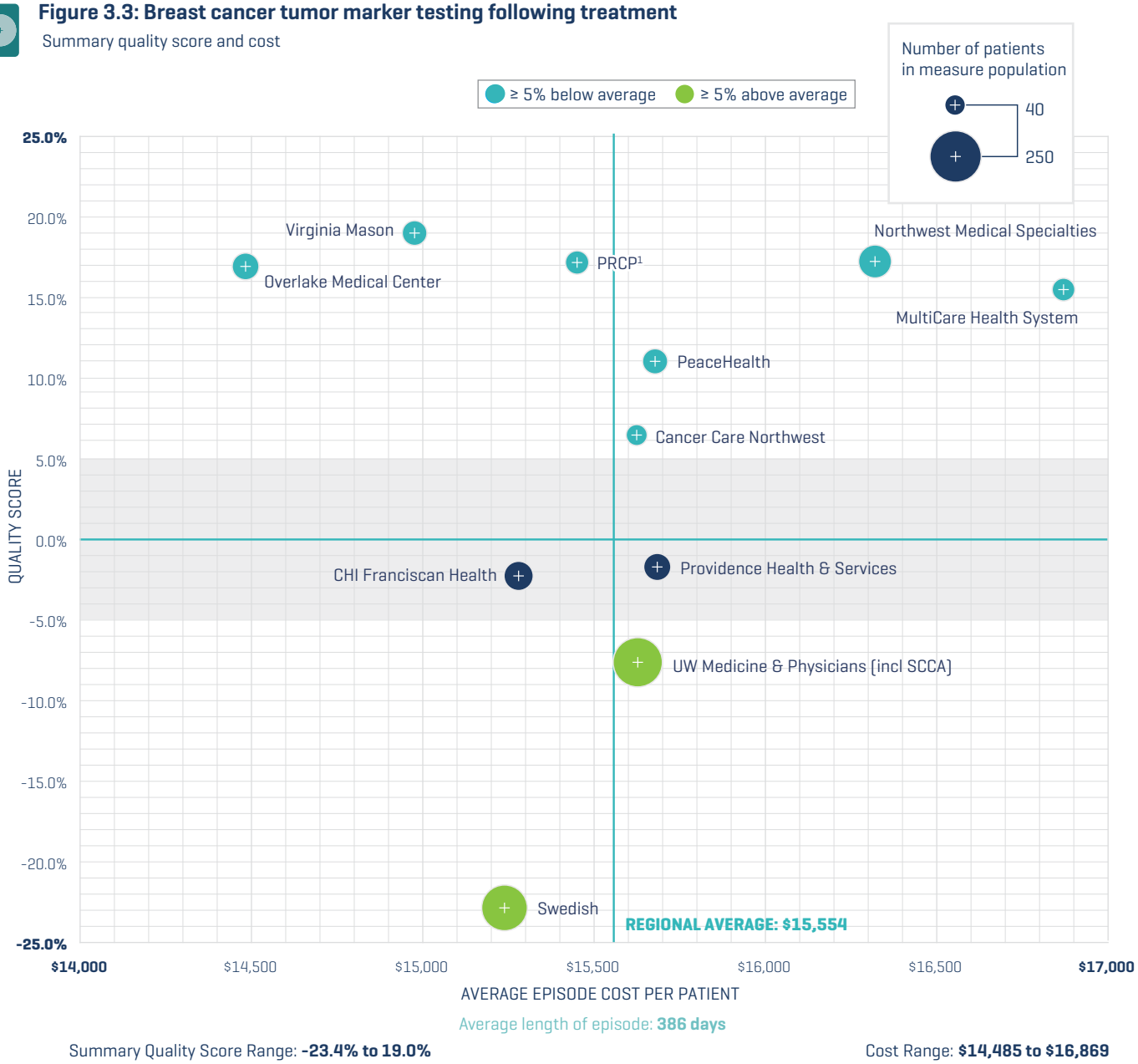
RESULTS (3.2)

The summary quality scores, indicating clinic performance relative to the regional average, show a difference of 42.5 percentage points between the highest-performing clinic and lowest-performing clinic — a wide variation.

3: BREAST CANCER TUMOR MARKER TESTING FOLLOWING TREATMENT

Figure 3.3: Breast cancer tumor marker testing following treatment

Summary quality score and cost



Summary Quality Score Range: **-23.4% to 19.0%**

Cost Range: **$14,485 to $16,869**

RESULTS (3.3)

The regional average cost of care over the period is $15,554, and the average length of a follow-up episode is 386 days. The cost range is $2,385 ($14,485 to $16,869). The quality scores, indicating clinic performance relative to the regional average, show a difference of 42.5 percentage points between the highest-performing clinic and lowest-performing clinic — a wide variation.

There is a no relationship between episode cost and the quality score.

[1]Note that PRCP stands for Providence Regional Cancer Partnership

MEASURE 4

End of Life Care

Aggressive cancer-directed treatment for patients with advanced, incurable cancer can be harmful, traumatic and costly without providing benefit. Studies have shown that symptom-focused palliative care is much more beneficial to patients at this stage of their disease.

Appropriate end of life care depends on each patient's needs and should reflect thoughtful consideration of quality of life and the risks and benefits of continued treatment. Aggressive care — including chemotherapy, radiation, invasive procedures, emergency department (ED) visits and intensive care unit (ICU) admissions — can be harmful and traumatic to patients and are unlikely to benefit those who are nearing the end of life.

At the end of life, symptom-focused palliative care, including hospice care, has been shown to improve quality of life and even modestly prolong survival compared to aggressive treatment. It is up to clinicians to clearly communicate to patients the potential benefits, risks, side effects and costs of pursuing aggressive treatment as well as the potential benefits of palliative care.

The End of Life Care measure tracks the use of chemotherapy, multiple ED visits and ICU admissions as indicators of aggressive end of life care and includes hospice admissions as an indicator of recommended, higher-quality care.

METHODS

The End of Life Care measure employs four metrics: **Chemotherapy in the last 14 days of life** (Figure 4.1), **Multiple emergency department (ED) visits in the last 30 days of life** (Figure 4.2), **Intensive care unit (ICU) stay in the last 30 days of life** (Figure 4.3) and **Hospice care three or more days before death** (Figure 4.4).

The metrics are described below and in the box on this page. Appendix B lists the metric definitions in greater detail, along with their sources.

For all four metrics, the eligible population ("denominator") is adult patients in Washington state with solid tumors who were enrolled with Premera Blue Cross, Regence BlueShield, the Washington State Uniform Medical Plan or Medicare in the last six months of life. Patients were diagnosed with solid tumor cancers (no leukemia, lymphoma or myeloma), AJCC stage II-IV or registry stage regional or distant, at the time of their diagnosis.

MEASURE 4: END OF LIFE CARE

Chemotherapy in the last 14 days of life

- Receipt of any chemotherapy in the last 14 days of life

Multiple emergency department (ED) visits in the last 30 days of life

- More than one ED visit in the last 30 days of life

Intensive care unit (ICU) stay in the last 30 days of life

- Hospital ICU admission for any reason in the last 30 days of life

Hospice care three or more days prior to death

- Two or more inpatient or outpatient hospice encounters, with the first encounter at least three days prior to death

Population: Cancer patients at end of life

Reporting Years: 2015–2017

Time Period: Patient's last 30 days of life.

For **Chemotherapy in the last 14 days of life**, the measure of interest ("numerator") is patients who received chemotherapy in the last 14 days of life.

For **Multiple emergency department (ED) visits in the last 30 days of life**, the measure of interest ("numerator") is patients who had more than one ED visit in the last 30 days of life.

For **Intensive care unit (ICU) stay in the last 30 days of life**, the measure of interest ("numerator") is patients who had a hospital ICU admission for any reason in the last 30 days of life.

For **Hospice care three or more days before death**, the measure of interest ("numerator") is patients who had two or more claims for inpatient or outpatient hospice care, with the first claim at least three days before death.

4: END OF LIFE CARE

CLINIC ATTRIBUTION

Patients were assigned to clinics providing care in the last 180 days of life using the Clinic Attribution methodology specified in Appendix A.

SUMMARY QUALITY SCORE

The summary quality score indicates a clinic's overall performance on all relevant metrics relative to the regional average. The score is calculated using a two-step process: first measuring the difference between a clinic's standardized rate and the regional average for each metric; second, summing the differences for each quality metric. See Appendix C for more details.

We combined the four metrics to generate an **End of Life Quality Score** (Figure 4.5). In the graph, zero represents the regional average. A positive score indicates performance that is better than the regional average. A negative score indicates performance that is below the regional average.

COST

Costs for the last 30 days of life are measured and compared against the summary quality score (Figure 4.6). The cost score is the amount paid by insurers to all health care providers for the cancer patients included in the combined metric. See Appendix C for additional cost methodology.

RISK ADJUSTMENT

As "process metrics," chemotherapy and hospice care at the end of life are not risk adjusted. The "outcome metrics," multiple ED visits and ICU stays, are typically risk adjusted to account for patient factors that might vary from clinic to clinic and also affect the likelihood of the event of interest. The chart on this page lists the risk adjustors used for cost at end of life**.**

For more details about risk adjustment, see Appendix D.

MEASURE LIMITATIONS

- Patients have a variety of preferences for chemotherapy and hospice use at the end of life. The metrics do not account for individual preferences.
- The population includes cancer patients who died from any cause, not just cancer. Sometimes, patients die unexpectedly from severe adverse events, even when performance status is good and they are early in the disease course. To reduce the impact of this limitation, patients who had local-stage disease at the time of diagnosis were excluded from the analyses.
- In some cases, the cancer clinic may not have been managing the patient at the end of life. Providers who are multi-specialty or who offer primary care services may be more likely to manage patient care at the end of life.

Measure 4 Risk Adjustors: End of Life Care

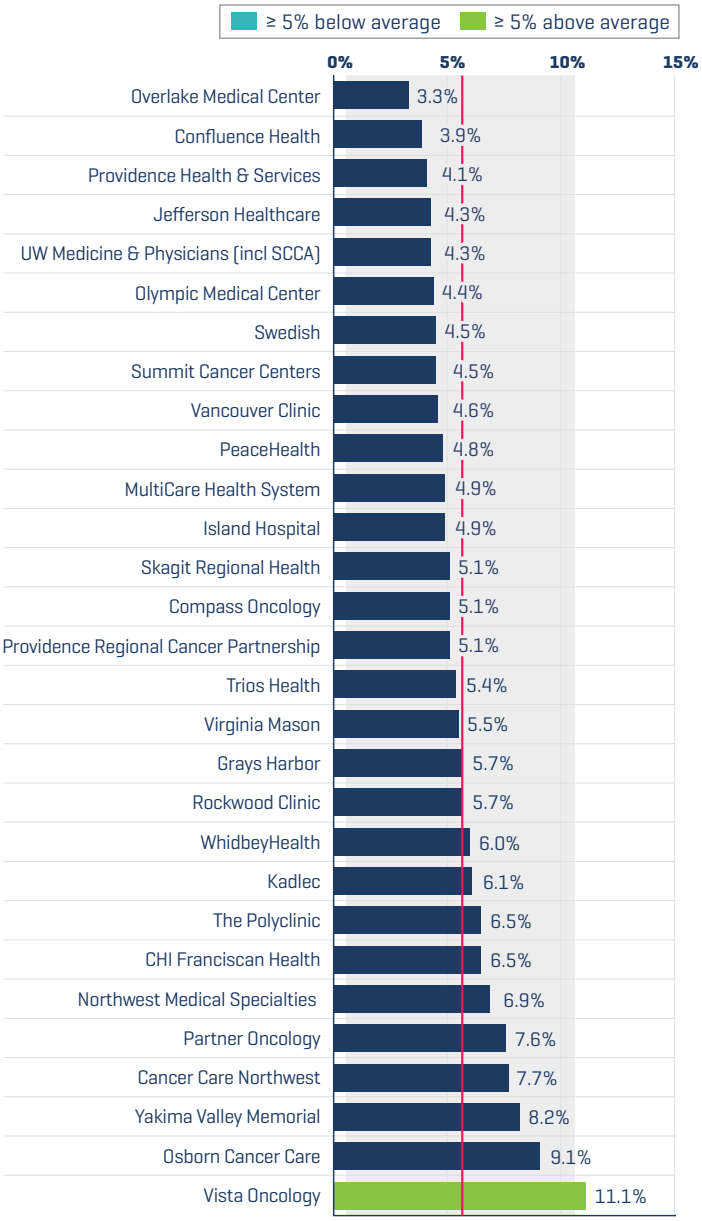
	Chemo in Last 14 Days & Hospice	Multiple ED in Last 30 Days	ICU in Last 30 Days	Cost
Age (continuous)		X	X	
Sex		X	X	X
Charlson Score[1] (0, 1, 2+)		X	X	X
Area Deprivation Index (ADI)[2]		X		
Medicare Indicator				X
Medicare × Age				X
Medicare × Dual Eligibility				X
Colorectal Cancer Indicator				X
Lung Cancer Indicator			X	X
Prostate Cancer Indicator		X		X

1. Reference Appendix D for Charlson Score.
2. Reference Appendix D for Area Deprivation Index (ADI).

4: END OF LIFE CARE

Figure 4.1: Chemotherapy in the last 14 days of life

Risk-Standardized Rate | **Lower rate = higher quality**



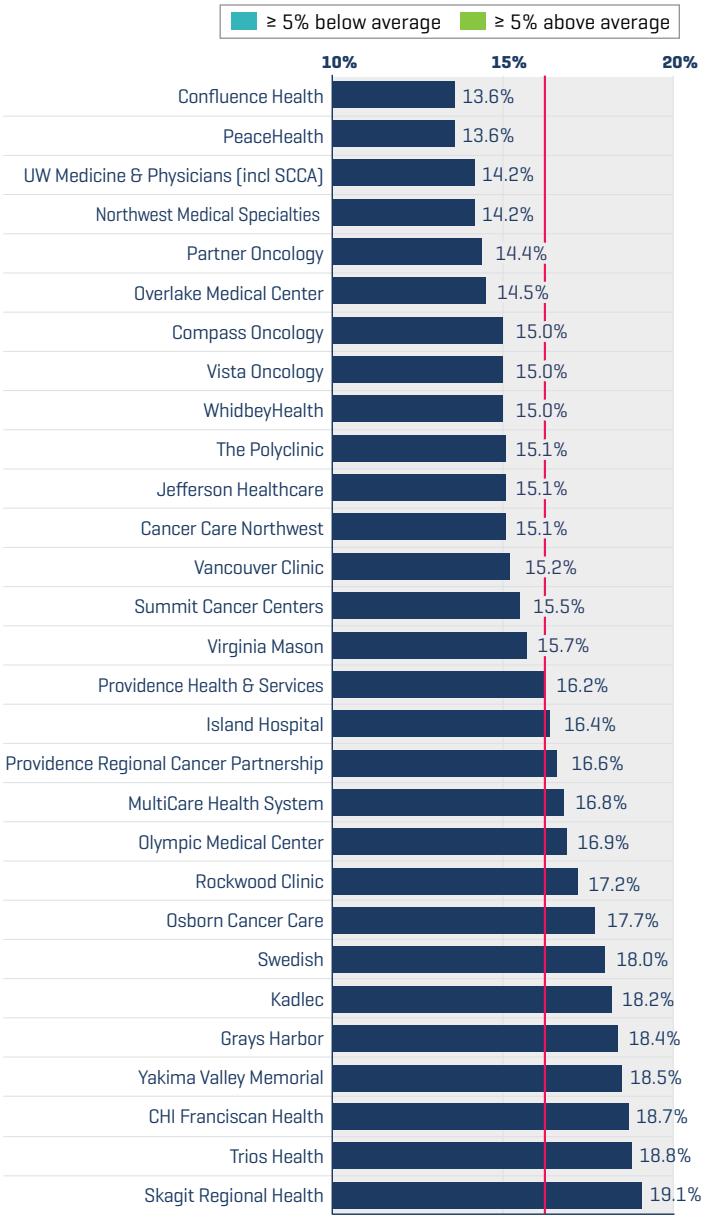
N=8678

REGIONAL AVERAGE: 5.7%

RANGE: **3.3% to 11.1%**

Figure 4.2: Multiple emergency department (ED) visits in the last 30 days of life

Risk-Standardized Rate | **Lower rate = higher quality**



N=8678

REGIONAL AVERAGE: 16.2%

RANGE: **13.6% to 19.1%**

RESULTS (4.1 & 4.2)

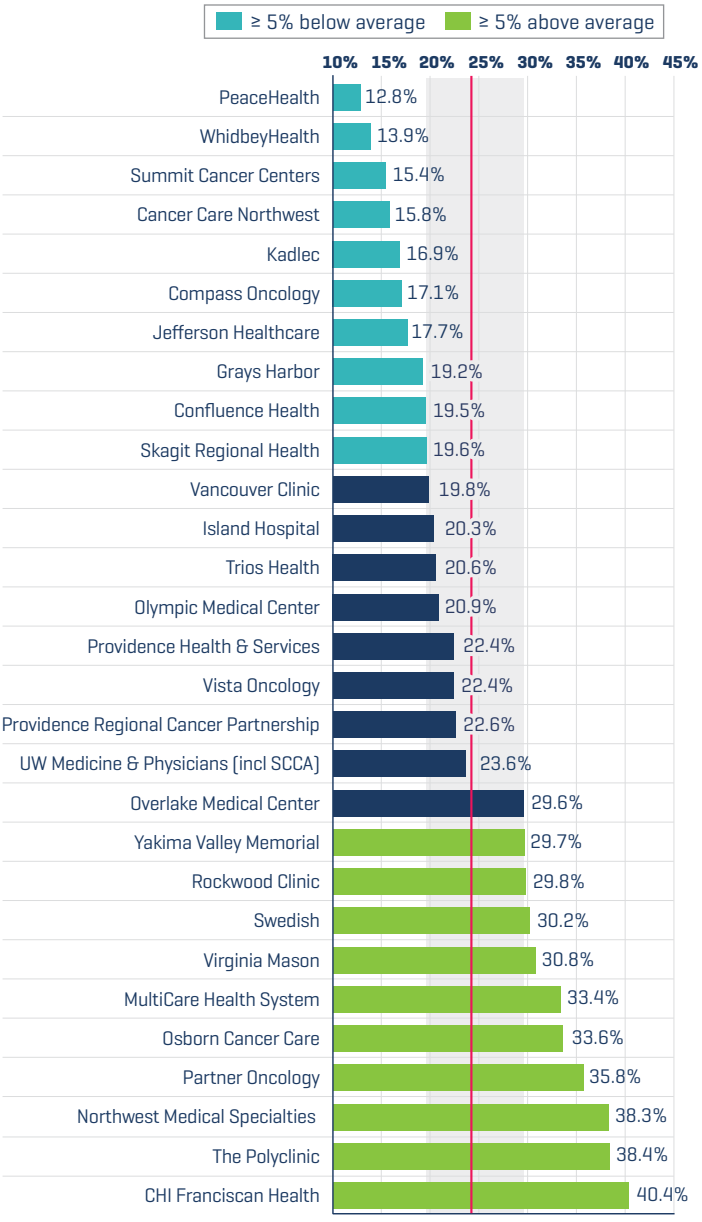
This measure includes 8,678 cancer patients.

On average, 5.7 percent of cancer patients received chemotherapy in the last 14 days of life. There is a 7.9 percentage point difference between the highest-performing clinic and lowest-performing clinic, showing a moderate difference in aggressive end of life care.

On average, 16.2 percent of cancer patients had more than one ED visit in the last 30 days of life. There is a 5.5 percentage point difference between the highest-performing clinic and lowest-performing clinic, suggesting minimal differences in how clinics manage patients at the end of life.

Figure 4.3: Intensive care unit (ICU) stay in the last 30 days of life

Risk-Standardized Rate | **Lower rate = higher quality**



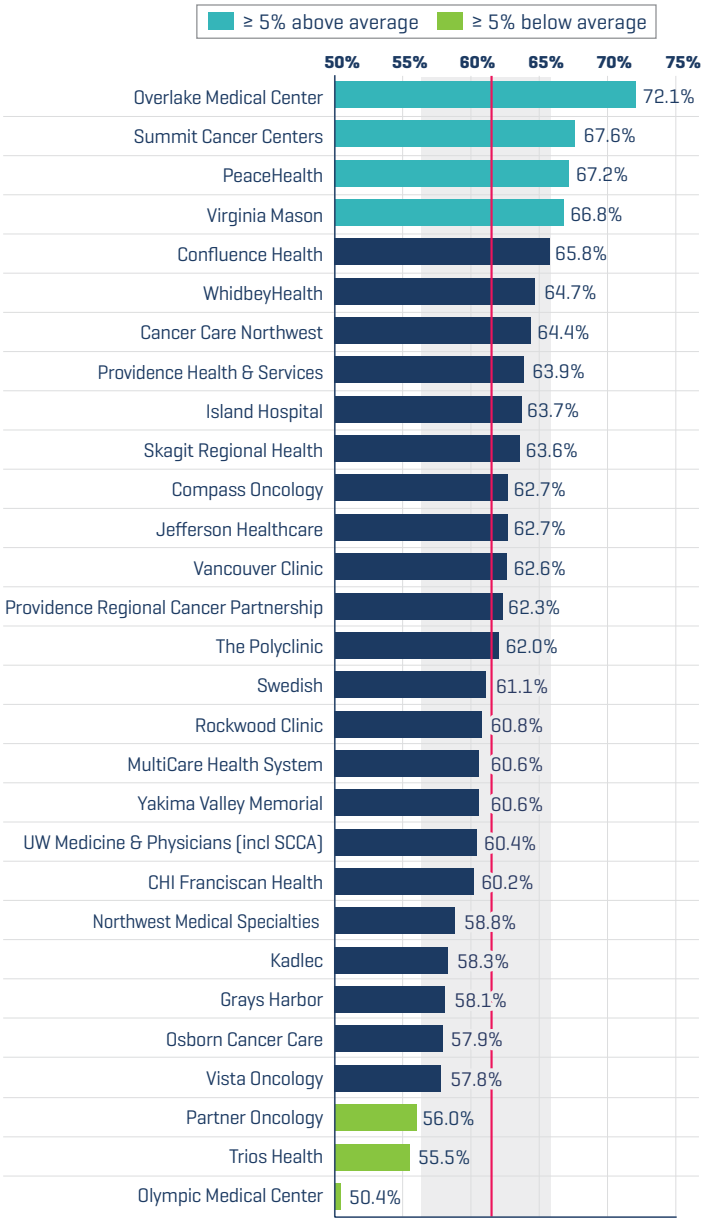
N=8678

REGIONAL AVERAGE: 24.7%

RANGE: **12.8% to 40.4%**

Figure 4.4: Hospice care 3 or more days prior to death

Risk-Standardized Rate | **Higher rate = higher quality**



N=8678

REGIONAL AVERAGE: 61.4%

RANGE: **50.4% to 72.1%**

RESULTS (4.3 & 4.4)

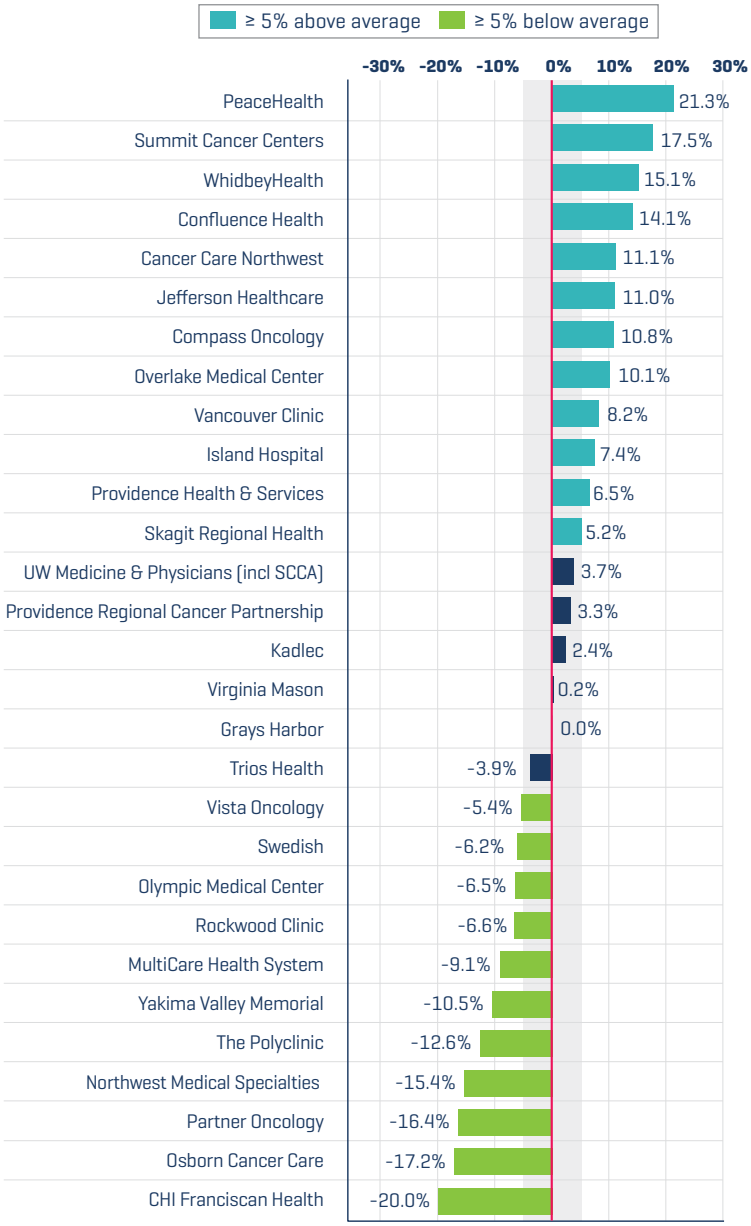
On average, 24.7 percent of cancer patients had an ICU stay in the last 30 days of life. There is a 27.6 percentage point difference between the highest-performing clinic and lowest-performing clinic, suggesting considerable differences in how clinics manage the intensity of care for their patients at the end of life.

On average, 61.4 percent of cancer patients enrolled in hospice care three or more days prior to death. There is a 21.7 percentage point difference between the highest-performing clinic and lowest-performing clinic, suggesting considerable differences in how clinics manage referrals to hospice care for their patients at end of life.

4: END OF LIFE CARE

Figure 4.5: End of Life Care

Summary Quality Score | Positive score = better than the regional average
Negative score = below the regional average



Zero represents clinic performance at the regional average

RANGE: **-20.0% to 21.3%**

RESULTS (4.5)

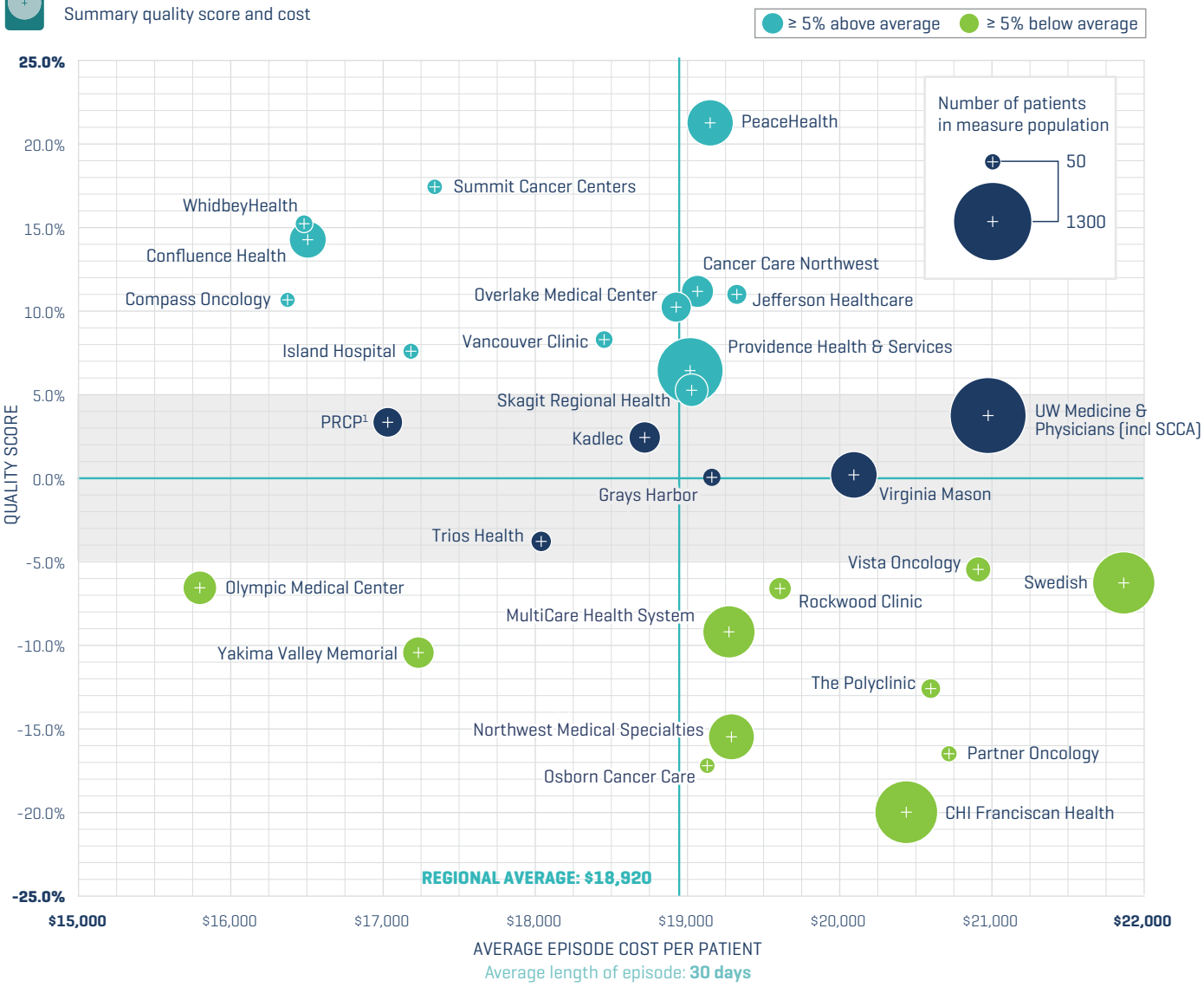
The summary quality scores, indicating clinic performance relative to the regional average for all four end of life metrics, show a difference of 41.4 percentage points between the highest-performing clinic and lowest-performing clinic.

The ICU and hospice metrics had the greatest impact on the summary quality score.

Clinics that perform better on hospice care tend to have lower rates of chemotherapy, multiple ED visits, and ICU stays. End of life care shows the greatest variation in quality among all measures in this report.

Figure 4.6: End of Life Care

Summary quality score and cost



Summary Quality Score Range: **-20.0% to 21.3%**

Cost Range: **$15,791 to $21,845**

RESULTS (4.6)

The regional average cost of care over the period of interest is $18,920 for the last 30 days of life. The cost range is $6,053 ($15,791 to $21,845). The quality scores, indicating clinic performance relative to the regional average for all four metrics, show a difference of 41.4 percentage points between the highest-performing clinic and lowest-performing clinic.

There is a negative relationship between episode cost and quality score, indicating that higher quality is associated with lower costs for this period of cancer care.

ICU stays and hospice care, the two main factors influencing the summary quality score, are opposing factors influencing costs (ICU stays = high cost, hospice = low cost).

[1]Note that PRCP stands for Providence Regional Cancer Partnership

Appendices

APPENDIX A: PATIENT ATTRIBUTION TO CLINICS

For each measure, HICOR attributes patients to one clinic. The principle behind this methodology is to capture the clinic most likely to be directing the patient's cancer care during the measure's period of interest. Clinics are identified using Tax ID Numbers (TINs) or CMS Certification Numbers (CCNs) on health insurance claims. Specific clinic's TINs and CCNs are available upon request. Similar to OCM's patient attribution methodology, we prioritize claims for physician encounters by attributing episodes to the clinic associated with the most Evaluation & Management (E&M) visits with a cancer diagnosis during the period of interest. HICOR's patient attribution also adopts MACRA's episode attribution methodology, using similar for E&M visit and claim exclusion criteria methodology.

Steps in Assigning Patient to Clinics

1. Identify the relevant time period used to assign patients to clinics. Time periods are dependent on the metric and are listed in the Individual Metric Definitions .
2. Find appropriate cancer related paid claims (ICD 9 diagnosis codes 140-209, 230-234, 273.3; ICD 10 diagnosis codes C00-D09, D46) for the time period of interest. Exclude the following claims:
    - Durable Medical Equipment claims and Prescription Drug Event claims in the Medicare data
    - Claims from diagnostic centers (e.g., labs, imaging and pathology)
    - Claims from ambulance services
    - Claims from physician groups that service multiple clinics
3. Using the claims identified in step 2, assign each patient a clinic:
    - First pass: Use Evaluation & Management codes to identify the provider guiding care (CPT 99201-99205, 99211-99215, 99217-99239, 99241-99255, 99354-99359, 99374-99380, and 99441-99444)
    - If the first pass does not identify a provider, do a second pass on all claims after removing all but the first radiation oncology claim (CPT codes 77261-77799 and 77014)
4. Add clinic group based on Tax ID Number (TIN) or CMS Certification Number (CCN).

    Note: TINs are available in commercial claims and Medicare Part B Carrier claims. CCNs are available in Medicare Inpatient, Outpatient, Skilled Nursing Facility, Home Health, and Hospice claims.
5. Count the number of claims for each clinic group.
6. Select the clinic group with the highest count for each patient. If there is a tie, select the clinic that has claim(s) closest to the index date. Index dates (e.g. diagnosis date, first surgery date) are chosen specifically for each metric.

A note on clinic ownership change: Patients attributed to a clinic whose ownership changed before Jan. 1, 2017, are attributed to the new owner's clinic group. Clinics with an ownership change after Jan. 1, 2017, are identified as separate clinics. Clinics with an ownership change that continue to operate separately (maintained separate TINs and CCNs) are left as separate clinics in the results.

APPENDIX B: INDIVIDUAL METRIC DEFINITIONS

General inclusion criteria:

- Diagnosed or treated with cancer in Washington state
- Known date of diagnosis, and not diagnosed at autopsy or by death certificate
- Enrolled in Premera Blue Cross, Regence BlueShield, WA State Uniform Medical Plan or Medicare

HICOR METRIC	SOURCE	NUMERATOR	DENOMINATOR	CLINIC ATTRIBUTION PERIOD
Measure 1A: Recommended Cancer Treatment for Breast, Colorectal and Lung Cancer (Summary Quality Score)				
Recommended therapy based on cancer type	*See below for appropriate therapy metrics for each cancer type*			
Anti-nausea medication during chemotherapy	**QOPI** SMT26	• Claim for serotonin antagonist within seven days of moderate- or high-emetic-risk chemotherapy (according to NCCN antiemesis guidelines)	• Age 18+ • Colorectal, female breast, or non-small cell lung cancer • Known stage • Claim for chemotherapy classified as moderate- or high-emetic risk • Medical coverage in month of diagnosis to one month following initiation of chemotherapy • Exclude stage 0 and unknown stage	HICOR Treatment Period*
Breast Cancer				
Recommended therapy based on ER/PR and HER2 status	**MACRA** #450 **OCM**-10 **QOPI** BR55 **NQF** #1858	• HER2/neu positive: Claim for trastuzumab, lapatinib, or pertuzumab within 365 days of diagnosis • HER2/neu negative: No claim for trastuzumab, lapatinib, or pertuzumab within 365 days of diagnosis	• Age 18+ • Female • Breast cancer • First or only cancer • AJCC stage T1c or AJCC stage II-III breast cancer • Known HER2/neu status • Alive 365 days after diagnosis • Medical coverage in 12 months following diagnosis • Claim for chemotherapy within 365 days of diagnosis • Exclude patients receiving anthracycline-based chemotherapy or radiation therapy in days 335-365 following diagnosis	HICOR Treatment Period*
	OCM-9 **QOPI** BR53 **NQF** #0559	• ER/PR Negative: Claim for two or more chemotherapy agents within 120 days of diagnosis; second agent given within three days of first agent	• Age 18-79 • Female • Breast cancer • First or only cancer • Known stage AJCC T1cN0M0 or IB-III breast cancer • Known ER and PR status • Alive 120 days (ER/PR negative) or 365 days (ER/PR positive) after diagnosis • Exclude phyllodes (9020) and rare (8940, 8950, 8980, 8981) histology types • Exclude tumors size ≤1cm2 & AJCC N0 • Alive with medical coverage for 120 days (ER/PR negative) or 365 days (ER/PR positive) after diagnosis • ER/PR negative: Lumpectomy or mastectomy in the first 120 days from diagnosis • ER/PR positive: Exclude patients receiving chemotherapy or radiation therapy in days 335-365 after diagnosis; exclude patients who received oophorectomy in year following diagnosis	HICOR Treatment Period*
	OCM-11 **QOPI** BR58 **QOPI** BR59 **NQF** #0220 **NQF** #0387 **PQRS** #71	• ER/PR Positive: Hormone therapy (tamoxifen, aromatase inhibitor or as defined by cancer registry) within 365 days of diagnosis		

* See page 46 for definitions of HICOR Treatment Period and HICOR Follow-up Period

APPENDIX B: INDIVIDUAL METRIC DEFINITIONS

HICOR METRIC	SOURCE	NUMERATOR	DENOMINATOR	CLINIC ATTRIBUTION PERIOD
Colorectal Cancer				
Receipt of chemotherapy within 120 days of diagnosis for stage III colon cancer patients	**OCM**-8 **QOPI** CRC68 **NQF** #0223 **NQF** #0385	• Claim for chemotherapy within 120 days of diagnosis	• Age 18-79 • Colon cancer • First or only cancer • AJCC stage III • Alive 120 days after diagnosis • Medical coverage for 120 days after diagnosis	HICOR Treatment Period*
Receipt of chemotherapy within 270 days of diagnosis for stage II-III rectal cancer patients	**QOPI** CRC72	• Claim for chemotherapy within 270 days of diagnosis	• Age 18-79 • Rectal cancer • First or only cancer • AJCC stage II-III • Alive 270 days after diagnosis • Medical coverage for 270 days after diagnosis	HICOR Treatment Period*
Non-Small Cell Lung Cancer				
Receipt of chemotherapy within 60 days of surgery	**QOPI** NSCLC80 & 81	• Claim for chemotherapy within 60 days of curative surgery	• Age 18+ • Non-small cell lung cancer • First or only cancer • AJCC stage II-IIIA • Claim for curative surgery • Medical coverage from diagnosis to two months following surgery	HICOR Treatment Period*
No bevacizumab use for metastatic tumors within three months of diagnosis	**QOPI** NSCLC86a	• No claim for bevacizumab within three months of diagnosis	• Age 18+ • Non-small cell lung cancer • First or only cancer • AJCC stage IV or registry stage distant • Squamous histology • Medical coverage from diagnosis to three months after diagnosis or death	HICOR Treatment Period*
Measure 1B: Recommended Treatment for Breast Cancer (Summary Quality Score)				
Anti-nausea medication during chemotherapy		*See the above measure Recommended Treatment for Breast, Colorectal, and Non-Small Cell Lung Cancer for specifications related to breast cancer quality metrics on page 42.*		
Recommended therapy based on HER2 status				
Recommended therapy based on ER/PR status				
Measure 1: Recommended Cancer Treatment (Cost)				
Total cost during treatment		• All amounts paid by insurers to health care providers during HICOR Treatment Period*	Measure 1A: Patients eligible for any Recommended Treatment for Breast, Colorectal and Non-Small Cell Lung Cancer quality metrics Measure 1B: Patients eligible for any Recommended Treatment for Breast Cancer quality metrics	HICOR Treatment Period*

* See page 46 for definitions of HICOR Treatment Period and HICOR Follow-up Period

APPENDIX B: INDIVIDUAL METRIC DEFINITIONS

HICOR METRIC	SOURCE	NUMERATOR	DENOMINATOR	CLINIC ATTRIBUTION PERIOD
Measure 2: Hospitalization During Chemotherapy (Summary Quality Score)				
Emergency department (ED) visits during chemotherapy	**OCM**-2	• ED claim without subsequent inpatient admission (≤1 day) within 180 days of first chemotherapy claim	• Age 18+ • All cancers except leukemia • First or only cancer • Medical coverage in month of diagnosis & for six months from first chemotherapy claim (or until death) • Claim for outpatient chemotherapy within 180 days of diagnosis • No bone marrow transplant between diagnosis and 180 days after first outpatient chemotherapy	Start: First outpatient chemotherapy End: Start date + 180 days
Inpatient (IP) stays during chemotherapy	**OCM**-1	• Hospital IP admission not related to a cancer-directed surgery within 180 days of first chemotherapy claim	• Age 18+ • All cancers except leukemia • First or only cancer • Medical coverage in month of diagnosis & for six months from first chemotherapy claim (or until death) • Claim for outpatient chemotherapy within 180 days of diagnosis • No bone marrow transplant between diagnosis and 180 days after first outpatient chemotherapy	Start: First outpatient chemotherapy End: Start date + 180 days
Measure 2: Hospitalization During Chemotherapy (Cost)				
Total cost within six months of initial chemotherapy		All amounts paid by insurers to health care providers from first outpatient chemotherapy through 180 days	Patients eligible for Hospitalization During Chemotherapy quality measure	Start: First outpatient chemotherapy End: Start date + 180 days

Definition of Chemotherapy:

Chemotherapy utilization is measured using administrative and drug procedure codes. Chemotherapy includes traditional chemotherapy, immunotherapy, and biologics. The drugs could be delivered either through an IV or orally. Chemotherapy does not include hormone therapy (e.g. tamoxifen) or supportive care (e.g. colony stimulating factors).

* See page 46 for definitions of HICOR Treatment Period and HICOR Follow-up Period

APPENDIX B: INDIVIDUAL METRIC DEFINITIONS

HICOR METRIC	SOURCE	NUMERATOR	DENOMINATOR	CLINIC ATTRIBUTION PERIOD
Measure 3: Breast Cancer Tumor Marker Testing Following Treatment (Summary Quality Score)				
Breast cancer tumor marker testing following treatment	**QOPI** BR62c1 & BR62c2	• Claim for tumor marker test (CEA, CA 15-3, CA 27.29) during HICOR Follow-up Period*	• Age 18+ • Female • Breast cancer • First and only cancer • AJCC stage I, II, IIIA • Received curative treatment (mastectomy, or lumpectomy plus radiation within 90 days) • Medical coverage from diagnosis through end of follow-up period*	HICOR Follow-up Period*
Measure 3: Breast Cancer Tumor Marker Testing Following Treatment (Cost)				
Total cost during follow-up period		All amounts paid by insurers to health care providers during HICOR Follow-up Period*	**Measure 3:** Patients eligible for Breast Cancer Tumor Marker Testing Following Treatment quality metric	HICOR Follow-up Period*

* See page 46 for definitions of HICOR Treatment Period and HICOR Follow-up Period

APPENDIX B: INDIVIDUAL METRIC DEFINITIONS

HICOR METRIC	SOURCE	NUMERATOR	DENOMINATOR	CLINIC ATTRIBUTION PERIOD
Measure 4: End of Life Care (Summary Quality Score)				
Chemotherapy in the last 14 days of life	**MACRA** #453 **QOPI** EOL48 **NQF** #0210	• Claim for any chemotherapy in the last 14 days of life	• Age 18+ • Patient died • Solid tumors only (excludes leukemia, lymphoma and myeloma) • Includes AJCC stage II/III/IV or SEER stage regional/distant • Medical coverage six months prior to death through date of death	Last 180 days of life
Multiple Emergency Department (ED) visits in the last 30 days of life	**MACRA** #454 **QOPI** EOL49 **NQF** #0211	• More than one ED visit in the last 30 days of life	• Age 18+ • Patient died • Solid tumors only (excludes leukemia, lymphoma and myeloma) • Includes AJCC stage II/III/IV or SEER stage regional/distant • Medical coverage six months prior to death through date of death	Last 180 days of life
Intensive Care Unit (ICU) Stay in the last 30 days of life	**MACRA** #455 **QOPI** EOL49a **NQF** #0213	• Hospital ICU admission for any reason in the last 30 days of life	• Age 18+ • Patient died • Solid tumors only (excludes leukemia, lymphoma and myeloma) • Includes AJCC stage II/III/IV or SEER stage regional/distant • Medical coverage six months prior to death through date of death	Last 180 days of life
Hospice Care Three or More Days Prior to Death	**MACRA** #457 **OCM**-3 **QOPI** EOL44 **NQF** #0216	• Two or more inpatient or outpatient hospice claims, with the first claim at least three days prior to death	• Ages 18+ • Patient died • Solid tumors only (excludes leukemia, lymphoma and myeloma) • Includes AJCC stage II/III/IV or SEER stage regional/distant • Medical coverage six months prior to death through date of death	Last 180 days of life
Measure 4: End of Life Care (Cost)				
Total cost in last 30 days of life		All amounts paid by insurers to health care providers in last 30 days of life	Patients eligible for any End of Life Care quality metrics	Last 180 days of life

Definitions of HICOR Care Periods:

TREATMENT PERIOD:

Start: First treatment. Treatment is defined as surgery, chemotherapy or radiation therapy.
End: Earliest of:

1. 12 months following first treatment, or
2. Start of follow-up period. The follow-up period begins at the start of a four-month gap in treatment (i.e., surgery, chemotherapy or radiation therapy).

FOLLOW-UP PERIOD:

Start: Beginning of a four-month gap in treatment. Treatment is defined as surgery, chemotherapy or radiation therapy.
End: Earliest of:

1. 13 months following start of follow-up period, or
2. Start of new treatment (i.e., surgery, chemotherapy or radiation therapy).

APPENDIX C: CALCULATING SUMMARY QUALITY SCORE AND COST

HICOR uses a variety of recognized methods for measuring performance and cost, including methods to account for differences in the numbers of patients per clinic, patient characteristics, and outliers in the data. The methods include calculating risk-standardized rates, combining individual quality metrics into a quality score, and calculating risk-standardized average episode costs per patient based on claims paid by the health insurer to the clinic.

Quality Metrics: Calculating Risk-Standardized Rates

HICOR generates clinic-level risk-standardized rates for each individual quality metric using a Hierarchical Generalized Linear (HGLM) statistical model with a binary distribution and a logit link function. Each clinic's risk-standardized rate is calculated as the ratio of the clinic's predicted rate to the clinic's expected rate multiplied by the regional rate (as shown in the box on the right). The Centers for Medicare and Medicaid Services use the HGLM model to report hospital outcomes, as do numerous other organizations involved in performance reporting.[1, 2] The HGLM model accounts for the fact that patients are clustered within clinics in order to generate more accurate estimates of clinic quality. The model also accounts for differences in the number of patients per clinic by shrinking observed outcomes toward the regional average based on how reliable the outcome is. For clinics with large numbers of patients, outcomes tend to be measured more reliably and have less shrinkage toward the regional average. However, larger clinics also have a larger impact on the regional average. On the other hand, the outcomes for clinics with fewer patients tend to be less reliable and have more shrinkage, but these clinics also have a smaller impact on the regional average.

The HGLM model includes clinic-level random intercept variables as measures of a clinic's quality of care along with patient-level risk adjustors, when appropriate (see Appendix D). Random intercepts are a specific type of variable that are inferred mathematically from a statistical model using other directly observable data (e.g., outcomes, patient characteristics). The clinic's predicted and expected rates are determined from the HGLM model and include the clinic's predicted number of outcomes based on its patient mix. However, the clinic's predicted rate also includes its predicted random intercept, while the clinic's expected rate can be obtained by averaging the clinic's predicted rates over the distribution of clinic-level random intercepts.

$$\text{Clinic-level risk-standardized rate} = \left(\frac{\text{Predicted rate}}{\text{Expected rate}}\right) \times \text{Observed regional average}$$

Clinic's predicted rate = Clinic-level random intercept + predicted outcomes based on the clinic's patient mix

Clinic's expected rate = Average of the clinic's predicted rates

When lower outcomes are better, as in the case of the Hospitalization During Chemotherapy metrics, a (predicted/expected) ratio < 1 indicates that the clinic is performing better than expected given its patient mix, while a (predicted/expected) > 1 indicates that the clinic is performing worse than expected. When higher outcomes are better, as in the case of Treatment metrics, a (predicted/expected) < 1 indicates that the clinic is performing worse than expected. Note that we employed a slight statistical correction to the calculation of the expected rate in the case of tumor markers to account for the large skew in the unadjusted clinic rates.

Quality Score: Combining the Quality Metrics

A quality score is often included in quality measurement[3] because it summarizes a clinic's overall performance and can provide a broader assessment of quality of care. Quality scores can also improve statistical reliability, partly through increasing the numbers of patients, and have been shown to more accurately predict future hospital performance compared with a single risk-adjusted outcome measure.[4] There is no standard way to calculate a quality score.[5] HICOR's approach compares the clinic's risk-standardized rate to the regional average for each metric. If a low score indicates higher quality, we subtract the regional average from the clinic's risk-standardized rate. In this case, a risk-standardized rate that is lower than the regional average indicates that the clinic performed

better than the regional average. If a high score indicates higher quality, we subtract the clinic's risk-standardized rate from the regional average. In this case, a risk-standardized rate that is higher than the regional average indicates that the clinic performed better than the regional average.

A clinic's quality score is the sum of the above differences between the risk-standardized rate and the regional average for each quality metric in the measure (e.g., End of Life, Appropriate Treatment). For example, for the End of Life Care quality score, we combine the clinic's performance on each of the individual metrics — Chemotherapy in the last 14 days of life, Multiple Emergency department (ED) visits in the last 30 days of life, Intensive care unit (ICU) stay in the last 30 days of life, and Hospice care three or more days before death — into a single quality score. See the box to the right.

As shown in the example in the table below, a quality score of 0% may reflect that the clinic performed at the regional average for both metrics, or that it performed better than the regional average for one metric and equivalently worse than the regional average for the other metric (Clinic C). A quality score above 0% may reflect that a clinic performed better than the regional average for both metrics (Clinic A), or that it performed better than the regional average for one metric and worse than the regional average for the other metric, but there was a smaller difference for the second metric (Clinic B). A quality score below 0% has the opposite explanation (Clinic D).

If low score = higher quality, subtract regional average from clinic risk-standardized rate

If high score = higher quality, subtract clinic risk-standardized rate from regional average

Clinic's quality score = sum of above differences for each quality metric in the measure

We chose this quality score because the ranges of the risk-standardized rates (e.g., the highest minus the lowest) can vary considerably across the metrics in the same measure. Some metrics had smaller and possibly less meaningful differences in quality across clinics, while others had larger and possibly more meaningful differences. For example, in the actual End of Life Care measure, we found that the range for Chemotherapy in the Last 14 Days of Life was 7.8% (11.1% – 3.3%), while the range for Hospice care three or more days prior to death was 21.73% (72.1% – 50.4%). In the case of Chemotherapy in the last 14 days of life, no clinic received a large difference (Regional Average – Risk-Standardized Rate) toward its summary quality score, reflecting that this measure had a relatively smaller difference in outcomes. However, in the case of Hospice care, the clinics that performed either far above or far below the regional average received a larger difference (Risk-Standardized Rate – Regional Average) toward their summary quality score, reflecting that this measure had a larger difference in outcomes.

Example: How to Calculate a Summary Quality Score from Two Metrics

	Metrics Where Low Scores = Higher Quality (e.g., Multiple ED Visits)		**Metrics Where High Scores = Higher Quality** (e.g., Hospice Use)		**Measure** (e.g., End of Life)
	Risk-Standardized Rates (RSR)	**Region Average – RSR**	Risk-Standardized Rates (RSR)	**Region Average – RSR**	**SUMMARY QUALITY SCORE**
Clinic A	4%	**1%**	11%	**7%**	8%
Clinic B	6%	**-1%**	9%	**5%**	4%
Clinic C	7%	**-2%**	6%	**2%**	0%
Clinic D	10%	**-5%**	3%	**-1%**	-6%
	Regional Average = 5%		*Regional Average = 4%*		

APPENDIX C: CALCULATING SUMMARY QUALITY SCORE AND COST

Given our community public reporting perspective, we use a different quality score than the one used in the Oncology Care Model (OCM).[6] In the OCM, each clinic receives between 0 and 10 points for each metric, based on the rankings of its risk-standardized rates compared to its peers. However, the OCM demonstration program includes over 190 clinics. The program uses only quality metrics with sufficiently large variation in outcomes and its quality score includes more metrics. In the national context, these features help ensure that differences in the points correspond to meaningful differences in clinic quality. In contrast, this report has at most 29 clinics per metric, and fewer metrics in our quality scores. We also report the outcomes of all metrics, regardless of the range in risk-standardized rates, to provide information on where meaningful differences in quality may exist in our state. Applying the OCM's scoring system would not account for the variation in the range of outcomes we found.

Costs: Calculating Risk-Standardized Average Episode Costs per Patient

To calculate costs, we determine an average per-patient cost for the episodes associated with a measure. All of the measures, except Measure 1 (Recommended Cancer Treatment) have the same population in each quality metric and the costs. For Measure 1, we include the costs of all patients in the different metrics.

Costs include all reimbursements paid by the health insurers during the episode, which may include non-cancer costs. We adjust costs for inflation to 2018 using the annual average Consumer Price Index. We also account for outliers by winsorizing costs at the 5th and 95th percentiles by cancer type and metric where applicable. Winsorizing sets all costs below the 5th percentile to the level of the costs at the 5th percentile and all costs above the 95th percentile to the level of costs at the 95th percentile.[6] We then use an HGLM model with a log link and gamma distribution, because it accounts for the skewed distribution of costs and yields only positive predictive values.

All costs are risk adjusted (see Appendix D). Each clinic's risk-standardized average episode cost per patient is the ratio of the clinic's predicted costs to the clinic's expected costs multiplied by the regional average costs (similar to the calculation of the risk-standardized rates for the quality metrics). Due to our aim of community public reporting, our approach to calculating costs is different from MACRA[7] and the OCM,[6] including different risk adjustors and the fact we do not benchmark costs to previous years.

1. Ash AS, Fienberg SE, Louis TA, et al. Statistical Issues in Assessing Hospital Performance. Commissioned by the Committee of Presidents of Statistical Societies. The COPSS-CMS White Paper Committee. Revised on Jan 27, 2012. https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/Downloads/Statistical-Issues-in-Assessing-Hospital-Performance.pdf

2. Dimick JB, Ghaferi AA, Osborne NH, et al. Reliability Adjustment for Reporting Hospital Outcomes with Surgery. Annals of Surgery, 2012;255(4), 703-7.

3. National Quality Forum. Measure Developer Guidebook for Submitting Measures to NQF. Version 4.0. August 2017. http://www.qualityforum.org/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=86083.

4. Agency for Healthcare Research and Quality. Selecting Quality and Resource Use Measures: A Decision Guide for Community Quality Collaboratives. Content last reviewed October 2014. http://www.ahrq.gov/professionals/quality-patient-safety/quality-resources/tools/perfmeasguide/index.html

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6. Centers for Medicare and Medicaid Services. Blueprint for the CMS Measures Management System. Version 13.0. May 2017. https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/Downloads/Blueprint-130.pdf

7. Centers for Medicare and Medicaid Services. OCM Performance-Based Payment Methodology Version 2.1. December 2017. https://innovation.cms.gov/Files/x/ocm-cancercodelists.zip

8. Merit-Based Incentive Payment System (MIPS): Medicare Spending Per Beneficiary. Measure Information Form 2018 Performance Period. https://www.cms.gov/Medicare/Quality-Payment-Program/Resource-Library/2018-Cost-Measures.zip

APPENDIX D: RISK ADJUSTMENT

Risk, severity or case-mix adjustment refers to the statistical process used to adjust for differences among clinic patient populations. The goal of risk adjustment is to account for patient factors that are present before the period when the outcome is measured that may influence the outcome in ways unrelated to the quality of care provided by the clinic. Risk adjustment helps facilitate a "level playing field" when comparing the outcomes achieved by different clinics.[1]

Developing the Risk Adjustment Models

HICOR's process of developing risk adjustment models is guided by the CMS Measure Management System[1] and the NQF's Measure Developer Guidebook[2] but is tailored to our goal of community public reporting.

Our metrics fall into two types: 1) process metrics (e.g., Recommended Treatment), which capture whether the right care was given to the right patient at the right time and tend to be a narrower indicator of quality, and 2) outcome metrics (e.g., Hospitalization During Chemotherapy), which are aggregate markers of quality, combining numerous factors that may be difficult to measure individually.[3] All outcome metrics and costs are risk adjusted, and process measures are adjusted for cancer type only.

For each metric, we developed a list of potential patient-level clinical and demographic risk adjustors based on 1) literature review, 2) variables available in our data source (e.g., cancer registry variables), 3) expert clinical opinion, and 4) empirical analysis. A partial list is included on this page and the next. Given the small size of our community population, we developed parsimonious risk adjustment models by including a strictly limited number of risk adjustors to avoid the problem of overfitting (e.g., a risk adjustment model performs well in one population but poorly in another). Following current performance methodology best practices, we removed non-significant variables (excluding age and sex) from the risk adjustment model by combining stepwise purposeful selection, assessing the degree of multicollinearity between variables, and removing predictors that offered little improvement in overall model fit. Following recently amended NQF guidance on risk adjusting for sociodemographic factors, we also explored three proxies for socioeconomic status: census tract-level median income, dual eligibility for Medicare and Medicaid, and non-Hispanic White vs. Others for race. Given the demographics of our region, race was not significant and was removed from the final models.

List of Risk Adjustors

Below is a brief overview of the risk adjustors used in this report. The table at the end of this appendix lists the risk adjustors that are used in the models.

- Age: Age of the patient at the time of diagnosis, calculated using the cancer registry's dates of birth and diagnosis. All outcome and cost models include either this variable or age interacted with insurance status (e.g., Medicare × Age, Commercial × Age) when we need to control for differences in coverage policies and reimbursement rates among different insurers.
- Sex: Sex as reported by the cancer registry. All outcome and cost models with both sexes include this variable.
- Charlson Score (0, 1, 2+): A weighted score reporting non-cancer comorbidities. The Charlson Score uses claims data and was originally developed to predict the risk of death within one year of hospitalization by identifying specific comorbid conditions, such as heart disease or diabetes.[4] However, it has emerged as one of the most widely recognized predictors of health care outcomes and expenditures. We categorize the scores into three groups: 0, 1, and 2 or above.
- Area Deprivation Index (ADI) is a measure of a patient's neighborhood socioeconomic disadvantage or the material deprivation in a person's residence at the census tract level. It includes 17 factors such as income and income disparity, education, employment, and housing costs and quality. ADI ranges from

1 (least deprived) to 10 (most deprived).[5] Census tract information is reported by the cancer registry, and ADI is based on the 2011-2015 American Community Survey 5-Year Estimates.[5]

- Medicare Indicator: Measures whether a patient had Medicare insurance at any point during the period of interest. This variable is included to control for differences in coverage policies and reimbursement rates among different insurers.
- Medicare × Age: Due to the correlation between age and enrollment in Medicare, this variable allows for both Medicare and Age to be included in the model.
- Medicare × Dual Eligibility: Dual Eligibility indicates whether a Medicare patient is enrolled in both Medicaid and Medicare during the period of interest. All dual-eligible patients are Medicare enrollees, and so this variable allows for both Medicare and Dual Eligibility to be included in the model.
- Commercial Insurance: Measures whether a patient had only commercial insurance during the period of interest. This variable is included to control for differences in coverage policies and reimbursement among different insurers. This indicator is used in models where it is a better statistical fit than the Medicare indicator. In general, this indicator is a better fit for populations that are younger and have a larger proportion of commercial insurance enrollees.
- Commercial Insurance × Age: Due to the correlation between age and enrollment in a commercial plan, this variable allows for both the Commercial indicator and Age to be included in the model.
- AJCC Stage: The American Joint Committee on Cancer (AJCC) stage of the patient's tumor at the time of diagnosis, as reported by the cancer registry. AJCC stages range from in situ to stage I through IV to unknown stage.
- Cancer Site (Breast Cancer Indicator, Colorectal Cancer Indicator, Lung Cancer Indicator, Prostate Cancer Indicator, Liquid Tumor Indicator): These variables indicate the type of cancer a patient is diagnosed with, as reported by the cancer registry.
- # Days in the Period: The number of days the patient was in the period of interest.
- # Chemo Administrations: The number of days with a claim for chemotherapy administration or drug during the period of interest.
- Radiation Receipt Indicator: An indicator for patient receipt of any radiation treatment during the period of interest, as identified using claims data.
- Surgery Receipt Indicator: An indicator for patient receipt of cancer-directed surgeries during the period of interest, as identified using claims data. The list of surgeries is pulled from the OCM[7] and in-house clinical expertise.

Limitations of Risk Adjustment

Risk adjustment cannot account for all patient-level factors that influence outcomes but are outside of the cancer clinics' control. The Measure Limitations section for each measure describes limitations in risk adjustment for that particular measure.

1. Centers for Medicare and Medicaid Services. Blueprint for the CMS Measures Management System. Version 13.0. May 2017. https://www. cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/Downloads/Blueprint-130.pdf
2. National Quality Forum. Measure Developer Guidebook for Submitting Measures to NQF. Version 4.0. August 2017. http://www. qualityforum.org/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=86083.
3. Krumholz HM, Brindis RG, Brush JE, et al. Standards for Statistical Models Used for Public Reporting of Health Outcomes: An American Heart Association Scientific Statement from the Quality of Care and Outcomes Research Interdisciplinary Writing Group: cosponsored by the Council on Epidemiology and Prevention and the Stroke Council. Endorsed by the American College of Cardiology Foundation. Circulation. 2006;113(3):456-62. http://circ.ahajournals.org/content/113/3/456.long.
4. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A New Method of Classifying Prognostic Comorbidity in Longitudinal Studies: Development and Validation. Journal of Chronic Disease. 1987; 40 (5): 373-83.
5. University of Wisconsin School of Medicine and Public Health. Area Deprivation Index. Available at: https://www.neighborhoodatlas.medicine.wisc.edu/
6. U.S. Census Bureau. American Community Survey 2011-2015 ACS 5-year Estimates. 5 Year Summary File. https://www.census.gov/ programs-surveys/acs/data/summary-file.2015.html
7. Centers for Medicare and Medicaid Services. OCM Performance-Based Payment Methodology Version 2.1. December 2017. https:// innovation.cms.gov/Files/x/ocm-cancercodelists.zip

APPENDIX D: RISK ADJUSTMENT

	TREATMENT						
	Measure 1A: Recommended Treatment for Breast, Colorectal and Lung Cancer		**Measure 1B: Recommended Treatment for Breast Cancer**		**Measure 2: Hospitalization During Chemotherapy**		
Individual Metrics	Recommended Therapy & Anti-Nausea Meds	Cost	Recommended Therapy Based on ER/PR & HER2 Status and Anti-Nausea Meds	Cost	ED During Chemo	IP During Chemo	Cost
Risk Adjustors							
Age (continuous)					X	X	
Sex		X			X	X	X
Charlson Score (0, 1, +2)[1]		X			X	X	X
Area Deprivation Index (ADI)[2]					X		
Medicare Indicator		X					X
Medicare × Age		X					X
Medicare × Dual Eligibility		X			X	X	X
Commercial Insurance Indicator				X			
Commercial × Age				X			
AJCC Stage				X	X	X	X
Breast Cancer Indicator					X	X	X
Colorectal Cancer Indicator	X	X			X	X	
Lung Cancer Indicator	X	X			X		
Prostate Cancer Indicator						X	X
Gynecologic Cancer Indicator					X	X	X
Pancreas Cancer Indicator						X	X
Bladder Cancer Indicator							X
Liver Cancer Indicator							X
Melanoma Cancer Indicator							X
Oral Cancer Indicator							X
Liquid Tumor Indicator					X	X	X
# Days in Period		X		X		X	X
# Chemo Administrations					X	X	X
Radiation Receipt Indicator		X			X	X	X
Surgery Receipt Indicator		X		X	X	X	X

1. Reference Appendix D for Charlson Score
2. Reference Appendix D for Area Deprivation Index (ADI)

APPENDIX D: RISK ADJUSTMENT

	FOLLOW-UP		END OF LIFE			
	Measure 3: Breast Cancer Tumor Marker Testing Following Treatment		Measure 4: End of Life Care			
Individual Metrics	BC Tumor Marker	Cost	Chemo in Last 14 Days & Hospice	Multiple ED in Last 30 Days	ICU in Last 30 Days	Cost
Risk Adjustors						
Age (continuous)				X	X	
Sex				X	X	X
Charlson Score (0, 1, +2)[1]		X		X	X	X
Area Deprivation Index (ADI)[2]				X		
Medicare Indicator						X
Medicare × Age						X
Medicare × Dual Eligibility		X				X
Commercial Insurance Indicator		X				
Commercial × Age		X				
AJCC Stage						
Breast Cancer Indicator						
Colorectal Cancer Indicator						X
Lung Cancer Indicator					X	X
Prostate Cancer Indicator				X		X
Gynecologic Cancer Indicator						
Pancreas Cancer Indicator						
Bladder Cancer Indicator						
Liver Cancer Indicator						
Melanoma Cancer Indicator						
Oral Cancer Indicator						
Liquid Tumor Indicator						
# Days in Period		X				
# Chemo Administrations						
Radiation Receipt Indicator						
Surgery Receipt Indicator						

1. Reference Appendix D for Charlson Score
2. Reference Appendix D for Area Deprivation Index (ADI)

APPENDIX E: ACRONYMS

ABIM	American Board of Internal Medicine
ADI	Area Deprivation Index
AJCC	American Joint Committee on Cancer
ASCO	American Society of Clinical Oncology
CCN	CMS Certification Number
CMS	Centers for Medicare & Medicaid Services
CSS	Western Washington Cancer Surveillance System
CT	Computed Tomography
CPT	Current Procedural Terminology
E&M	Evaluation & Management
ED	Emergency Department
EOL	End of Life
HICOR	Hutchinson Institute for Cancer Outcomes Research
ICD	International Classification of Diseases
ICU	Intensive Care Unit
IP	Inpatient
MACRA	Medicare Access and CHIP Reauthorization Act of 2015
NCCN	National Comprehensive Cancer Network
NCI	National Cancer Institute
NCQA	National Committee for Quality Assurance
NQF	National Quality Forum
NSCLC	Non-Small Cell Lung Cancer
OCM	Oncology Care Model
PET	Positron Emission Tomography
PQRS	Physician Quality Reporting System
QOPI	Quality Oncology Practice Initiative
SEER	Surveillance, Epidemiology, and End Results
TIN	Tax Identification Number
WSCR	Washington State Cancer Registry

APPENDIX F: PUBLICATIONS

1. Fedorenko C, Kreizenbeck K, Schwartz JS, Cheteri MK, Janes T, Potts M, et al. Linking Cancer Registries with Claims Data to Enable Community Oncology Reporting. NAACCR Annual Conference; June 19-16, 2018; Pittsburgh, PA.

2. Fedorenko C, Walker JR, Panattoni L, Kreizenbeck K, Ramsey SD. Comparing Quality of Care for Medicaid and Commercially Insured Patients with Cancer in Washington State. ASCO Quality Care Symposium; September 28-29, 2018; Phoenix, AZ.

3. Panattoni L, Fedorenko C, Kreizenbeck K, Sun Q, Li L, Barger S, et al. Washington State Community Cancer Care Report: Implications for Value-based Purchasing. ASCO Quality Care Symposium; September 28-29, 2018; Phoenix, AZ.

4. Panattoni L, Fedorenko C, Kreizenbeck K, Sun Q, Li L, Conklin T, et al. Lessons From Reporting National Performance Measures in a Regional Setting: Washington State Community Cancer Care Report. J Oncol Pract. 14(12):e801-e14, 2018 Available from: https://ascopubs.org/doi/10.1200/JOP.18.00410.

5. Panattoni L, Fedorenko C, Kreizenbeck K, Sun Q, Li L, Lyman GH, et al. Lessons from Reporting National Performance Measures in a Regional Setting: Washington State Community Cancer Care Report. ASCO Quality Care Symposium; September 28-29, 2018; Phoenix, AZ.

6. Ramsey SD, Fedorenko C, Panattoni L, Kreizenbeck K, Sun Q, Li L, et al. The Washington State Community Cancer Care Report: A Multi-stakeholder Effort to Characterize Quality of Care and Costs for Washington State Oncology Practices. ASCO Quality Care Symposium; September 28-29, 2018; Phoenix, AZ.

7. Panattoni L, Fedorenko C, Sun Q, Li L, Kreizenbeck K, Ramsey S. Impact of Rurality Versus Neighborhood Deprivation on Stage at Diagnosis and Survival: A Regional Analysis. ASCO Quality Care Symposium; September 6-7, 2019; San Diego, CA.

8. Fedorenko C, Panattoni L, Sun Q, Li L, Kreizenbeck K, Ramsey S. Do Rural Cancer Patients Receive Lower Quality Cancer Care? Assessing the Impact of Rurality on Oncology Practice Performance Measures. ASCO Quality Care Symposium; September 6-7, 2019; San Diego, CA.

APPENDIX G: RESTATED 2014-2016 CLINIC RATES

We have restated last year's results (i.e. care delivered between 2014-2016) in Appendix G using this report's updated methodology. These results are designed to provide clinics with a comparable set of results to see year-over-year changes. Some individual clinic results are not available due to variability in the minimum population size requirements and updates to the methodology.

Measure 1A: Recommended Treatment for Breast, Colorectal and Lung Cancer

	Recommended therapy based on cancer type		Anti-nausea medication during chemotherapy	
CLINIC	**2014-2016**	**2015-2017**	**2014-2016**	**2015-2017**
Cancer Care Northwest	85.1%	85.1%	98.8%	98.4%
CHI Franciscan Health	80.2%	82.4%	96.7%	97.0%
Compass Oncology	85.9%	85.5%	97.9%	97.5%
Confluence Health	84.9%	85.8%	98.3%	98.4%
Kadlec	86.8%	85.5%	98.2%	98.4%
MultiCare Health System	82.0%	83.6%	98.8%	98.7%
Northwest Medical Specialties	86.1%	86.5%	97.6%	97.8%
Olympic Medical Center	84.4%	84.5%	98.9%	98.4%
Overlake Medical Center	84.6%	84.6%	97.5%	96.8%
PeaceHealth	84.1%	83.8%	93.4%	94.0%
Providence Health & Services	86.4%	85.5%	98.4%	98.5%
Rockwood Clinic	84.7%	85.0%	97.6%	97.9%
UW Medicine & Physicians (incl SCCA)	86.6%	85.3%	97.1%	94.9%
Skagit Regional Health	84.9%	84.2%	97.7%	98.1%
Summit Cancer Centers	85.8%	—	98.2%	—
Swedish	83.9%	84.2%	97.0%	97.6%
Providence Regional Cancer Partnership	85.0%	85.2%	97.4%	98.1%
The Polyclinic	85.6%	85.3%	97.7%	98.2%
Trios Health	—	—	97.8%	—
Vancouver Clinic	85.7%	—	98.0%	97.6%
Virginia Mason	83.8%	83.9%	91.0%	95.8%
Vista Oncology	85.1%	84.4%	98.2%	98.5%
Yakima Valley Memorial	86.6%	85.9%	98.9%	98.5%

APPENDIX G: RESTATED 2014-2016 CLINIC RATES

Measure 2: Hospitalization During Chemotherapy

	Emergency department (ED) visits during chemotherapy		Inpatient (IP) stays during chemotherapy	
CLINIC	**2014-2016**	**2015-2017**	**2014-2016**	**2015-2017**
Cancer Care Northwest	27.5%	29.7%	37.2%	35.9%
CHI Franciscan Health	29.7%	31.1%	40.1%	44.3%
Compass Oncology	30.4%	31.1%	36.7%	38.0%
Confluence Health	27.2%	28.8%	33.2%	32.8%
Island Hospital	28.8%	30.3%	37.8%	42.9%
Jefferson County	30.2%	32.9%	35.4%	31.4%
Kadlec	35.1%	36.5%	40.0%	40.9%
MultiCare Health System	29.6%	32.0%	36.2%	34.8%
Northwest Medical Specialties	27.3%	28.3%	38.5%	36.1%
Olympic Medical Center	29.7%	31.6%	34.3%	30.4%
Osborn Cancer Care	28.3%	29.1%	36.9%	37.0%
Overlake Medical Center	28.4%	28.7%	37.7%	39.1%
Pacific Gynecology	29.7%	—	36.3%	—
Pacific Medical Centers	28.5%	29.0%	34.9%	31.0%
Partner Oncology	30.1%	30.8%	37.5%	39.1%
PeaceHealth	30.7%	33.2%	36.8%	34.7%
Providence Health & Services	33.7%	33.6%	38.7%	39.7%
Rockwood Clinic	29.7%	30.5%	38.7%	42.5%
UW Medicine & Physicians (incl SCCA)	30.6%	32.5%	35.7%	37.5%
Skagit Regional Health	29.2%	29.8%	37.5%	40.2%
Summit Cancer Centers	28.9%	—	37.2%	—
Swedish	31.6%	33.3%	39.2%	39.6%
Providence Regional Cancer Partnership	30.9%	32.4%	33.8%	30.6%
The Polyclinic	25.1%	27.2%	35.6%	34.1%
Trios Health	33.5%	33.0%	38.8%	41.3%
Vancouver Clinic	27.6%	28.3%	33.8%	31.8%
Virginia Mason	30.6%	32.5%	36.6%	35.6%
Vista Oncology	28.9%	29.9%	39.0%	43.0%
Yakima Valley Memorial	32.0%	31.4%	35.5%	32.9%

APPENDIX G: RESTATED 2014-2016 CLINIC RATES

Measure 3: Breast Cancer Tumor Marker Testing Following Treatment

	Breast cancer tumor marker testing following treatment	
CLINIC	**2014-2016**	**2015-2017**
Cancer Care Northwest	13.1%	16.1%
CHI Franciscan Health	30.6%	25.0%
Confluence Health	2.7%	—
Kadlec	14.8%	—
MultiCare Health System	12.7%	7.2%
Northwest Medical Specialties	10.0%	5.6%
Overlake Medical Center	5.8%	5.6%
PeaceHealth	20.6%	11.8%
Providence Health & Services	30.5%	24.7%
UW Medicine & Physicians (incl SCCA)	36.0%	30.0%
Swedish	49.0%	46.2%
Providence Regional Cancer Partnership	10.0%	5.4%
Virginia Mason	4.7%	3.7%
Yakima Valley Hospital	14.9%	—

APPENDIX G: RESTATED 2014-2016 CLINIC RATES

Measure 4: End of Life

	Chemotherapy in last 14 days of life		Multiple emergency department (ED) visits in the last 30 days of life		Intensive Care Unit (ICU) stay in the last 30 days of life		Hospice care 3 or more days prior to death	
CLINIC	**2014-16**	**2015-17**	**2014-16**	**2015-17**	**2014-16**	**2015-17**	**2014-16**	**2015-17**
Cancer Care Northwest	7.7%	7.7%	12.9%	15.1%	12.2%	15.8%	64.5%	64.4%
CHI Franciscan Health	6.6%	6.5%	17.9%	18.7%	38.3%	40.4%	59.6%	60.2%
Compass Oncology	6.3%	5.1%	15.3%	15.0%	16.4%	17.1%	64.0%	62.7%
Confluence Health	4.3%	3.9%	11.7%	13.6%	17.9%	19.5%	62.9%	65.8%
Grays Harbor	5.5%	5.7%	17.0%	18.4%	22.6%	19.2%	59.5%	58.1%
Island Hospital	6.3%	4.9%	15.1%	16.4%	15.5%	20.3%	60.5%	63.7%
Jefferson County	4.2%	4.3%	14.9%	15.1%	15.0%	17.7%	64.3%	62.7%
Kadlec	5.8%	6.1%	19.0%	18.2%	21.1%	16.9%	59.2%	58.3%
MultiCare Health System	4.3%	4.9%	16.1%	16.8%	33.9%	33.4%	62.7%	60.6%
Northwest Medical Specialties	6.6%	6.9%	14.5%	14.2%	38.2%	38.3%	59.6%	58.8%
Olympic Medical Center	3.9%	4.4%	15.8%	16.9%	19.8%	20.9%	46.7%	50.4%
Osborn Cancer Care	7.6%	9.1%	16.0%	17.7%	30.8%	33.6%	57.8%	57.9%
Overlake Medical Center	3.6%	3.3%	12.6%	14.5%	27.8%	29.6%	70.9%	72.1%
Partner Oncology	7.4%	7.6%	14.2%	14.4%	39.2%	35.8%	58.4%	56.0%
PeaceHealth	4.7%	4.8%	12.9%	13.6%	13.4%	12.8%	68.3%	67.2%
Providence Health & Services	4.1%	4.1%	15.7%	16.2%	20.3%	22.4%	65.8%	63.9%
Rockwood Clinic	5.3%	5.7%	13.4%	17.2%	24.3%	29.8%	63.2%	60.8%
UW Medicine & Physicians (incl SCCA)	4.3%	4.3%	12.8%	14.2%	22.3%	23.6%	61.4%	60.4%
Skagit Regional Health	5.0%	5.1%	16.5%	19.1%	18.2%	19.6%	61.2%	63.6%
Southlake	5.4%	—	19.2%	—	35.7%	—	56.8%	—
Summit Cancer Centers	4.7%	4.5%	14.1%	15.5%	15.8%	15.4%	66.2%	67.6%
Swedish	4.7%	4.5%	17.3%	18.0%	32.2%	30.2%	60.3%	61.1%
Providence Regional Cancer Partnership	5.2%	5.1%	14.3%	16.6%	23.8%	22.6%	62.6%	62.3%
The Polyclinic	7.8%	6.5%	14.5%	15.1%	36.8%	38.4%	58.9%	62.0%
Trios Health	4.8%	5.4%	18.9%	18.8%	26.0%	20.6%	53.0%	55.5%
Vancouver Clinic	4.8%	4.6%	13.7%	15.2%	17.5%	19.8%	64.0%	62.6%
Virginia Mason	5.1%	5.5%	15.0%	15.7%	28.8%	30.8%	67.5%	66.8%
Vista Oncology	9.9%	11.1%	15.0%	15.0%	19.9%	22.4%	57.6%	57.8%
WhidbeyHealth	5.8%	6.0%	14.4%	15.0%	13.7%	13.9%	62.4%	64.7%
Yakima Valley Memorial	7.8%	8.2%	19.1%	18.5%	30.0%	29.7%	60.3%	60.6%

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