First Annual Report from the Evaluation of the Oncology Care Model: Baseline Period

Final

Contract #HHSM-500-2014-00026I T0003

February 1, 2018

Prepared for:
Susannah Cafardi
Centers for Medicare and Medicaid Services
7500 Security Boulevard
Baltimore, MD 21244

Submitted by:
Abt Associates
4550 Montgomery Avenue
Suite 800 North
Bethesda, MD 20814

In Partnership with:

The Lewin Group
Harvard Medical School
GDIT
Dartmouth College

Executive Summary

Introduction

In the summer of 2015, CMS invited oncology physician group practices to participate in the Oncology Care Model (OCM), an episode-based alternative payment model for cancer care. All types of cancer treated with outpatient chemotherapy, hormonal therapy and/or immunotherapy are included in the model. The model tests whether additional funding for enhanced services, and financial incentives to improve quality and efficiency, can reduce Medicare spending while maintaining or improving quality for a broad array of cancer types. CMS invited other payers to operate similar programs for their insured patients served by participating oncology practices. In April 2016, CMS informed practices and payers of their acceptance into OCM and the model launched with patient episodes starting July 1, 2016.

The OCM evaluation primarily employs a difference-in-differences (DID) evaluation framework, comparing changes before and after program implementation among the OCM participants, with changes in a matched comparison group. The matched comparison group represents the counterfactual of what would have happened in the absence of OCM. Change over time will be measured against a baseline period before OCM began.

The overarching goal of the evaluation is to examine the impact of the OCM model on outcomes such as episode utilization and expenditures. This report examines characteristics of participating practices and their matched comparators prior to implementation of the model, and describes cancer care before any changes induced by OCM. This report lays the foundation for evaluation results that will be presented in subsequent reports. This baseline report has the following main objectives:

- Describe how the Medicare OCM episodes, practices and markets differed at baseline from those of the nation, to understand representativeness of the group that volunteered and were accepted for OCM
- Describe the OCM practices and a matched comparison group, including their markets, practice characteristics and organizational structure, and beneficiary mix, as well as use of health care services and associated Medicare costs and quality outcomes, during the baseline period
- Evaluate the trends in key measures over the baseline period, which were quite similar (parallel) in OCM and comparison groups, validating the planned DID evaluation approach
- Inform the selection of covariates for evaluation analyses

Please note that this report includes information current as of February 2017; updated information about model participants, or methodology changes after that date are not included.

Data and Methods

The DID methodology underlying much of the evaluation requires identifying the OCM participating oncology physician practices (the intervention group) and a matched group of non-participating practices (the comparison group), to compare changes over time in the two groups. If the two groups had parallel trends in the baseline period, then the impacts estimated with econometric models are likely related to OCM. We used propensity score matching with three types of variables to select the comparison group including: (a) patient characteristics, (b) practice characteristics, and (c) market characteristics. Each of

these types of variables could influence the likelihood that a practice chose to participate in OCM, as well as its performance in the model.

Creation and Attribution of Episodes: We assembled Medicare claims for Parts A, B and D for the baseline period, and applied the OCM episode construction algorithm.[1] Each six-month episode was then attributed to the physician group practice responsible for care, using the same attribution logic that CMS will use for payment reconciliation.

Identification of Treatment and Comparison Physician Group Practices: A Tax ID Number (TIN) is a billing unit and may not perfectly map to an entire physician group practice, which can be comprised of multiple TINs. For the purposes of the model, OCM practices must unify their billing under a single TIN. Each participating practice gave CMS a list of all TINs that the practice used in the past, and we were therefore able to identify OCM practices (all relevant TINs for a practice) in the baseline period before OCM began. For comparisons, we have no comparable lists of TINs that were used by physician practices in the baseline period. Consequently, we used propensity score matching techniques to identify comparison TINs that closely match one or more OCM practices on a number of important characteristics (size, cancer mix, urbanicity, etc.).

Identification of Baseline Period: This report concerns the baseline period, before OCM implementation. Due to concern that participants could have begun making preparatory changes in the months leading up to the July 2016 program launch, we intentionally built in a "clean" period—January through June, 2016—which is in neither the baseline nor intervention period. The baseline period for this report, and for future impact measurement, encompasses six-month chemotherapy episodes that started or "triggered" between January 1, 2014 and June 30, 2015, the last of which ended December 31, 2015. We divided this into three six-month performance periods based on episode start and end dates. This period is useful for understanding episodes, practices, and markets just before OCM began. A longer time horizon would improve confidence that the OCM and comparison groups are truly similar, and had parallel trends in the years before OCM. We therefore conducted additional analyses for this baseline report, looking back two additional years (2012 and 2013), to understand the stability of trends between the intervention and comparison groups.

Findings

OCM Baseline Episodes

An understanding of episode utilization, cost, and quality during the baseline period will contribute to the design of future impact analyses. It is first important to validate the underlying assumption that the OCM practices and comparison TINs are well-matched, and were experiencing similar—parallel—trends in their attributes and performance during the baseline period. It is also important to understand the degree to which OCM participants (and their matched comparisons) are representative of oncology practices serving Medicare beneficiaries nationwide. Key findings about baseline episode characteristics and trend analyses include the following:

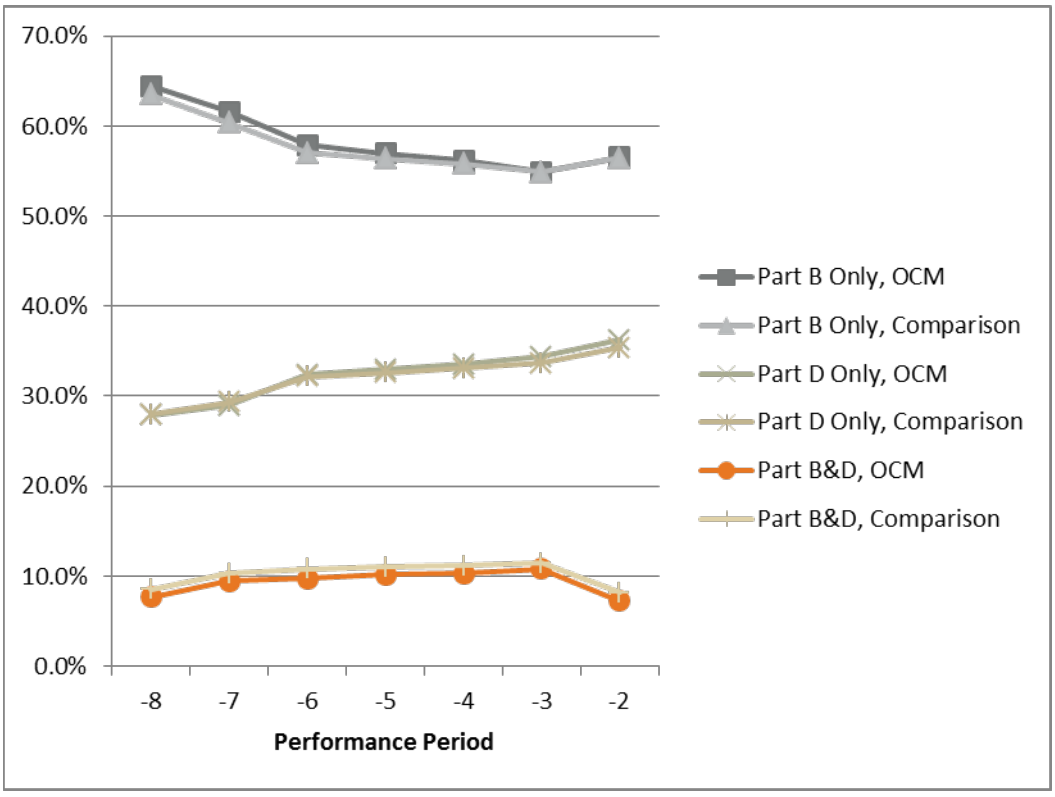
[1] OCM episode construction algorithm and other design features can be found at https://www.cms.gov/Newsroom/MediaReleaseDatabase/Fact-sheets/2016-Fact-sheets-items/2016-06-29.html.

- The OCM and comparison groups had many similar characteristics during a multi-year baseline period, and these patterns reflected national trends in most respects. Key attributes of the two groups include the following:
  - The OCM and comparison episodes included a wide representation of cancer types and services. Breast cancers, prostate cancers, and lung cancers represented nearly 60 percent of the episodes for OCM practices and comparison TINs, and the same was true nationwide. Breast cancer episodes were the most common (30 to 35 percent in each performance period) and increased as a proportion of total episodes during the expanded baseline period,[2] while lung cancer and colorectal cancer episodes declined as a proportion of total episodes.
  - Nearly half of all OCM episodes were for beneficiaries aged 65 – 74 years, as was true for the national sample of beneficiaries with chemotherapy episodes, and the age distribution across episodes was similar between OCM practices and comparison TINs.
  - Over 80 percent of OCM and comparison episodes were for non-Hispanic white beneficiaries, and the same was true nationwide.
  - Beneficiaries receiving care in OCM practices had a slightly higher number of comorbidities and cancer-relevant comorbidities, as well as slightly higher Hierarchical Condition Category (HCC) scores (an alternative indicator of severity and comorbidities), than did those in comparison TINs. These health status measures were stable over time for both groups.
  - More than 80 percent of OCM and comparison patients were enrolled in Medicare Part D drug plans. Despite high enrollment, there were undoubtedly episodes that did not "trigger" for model purposes because the prescribed drugs were not covered under Part D, and these episodes are not observed in our data.
  - While OCM and comparison episodes were similar on most characteristics and reflected national trends during the baseline period, one important exception regards dual eligibility. A smaller proportion of episodes in OCM practices were for beneficiaries who were dually eligible for Medicare and Medicaid than was true for the comparison group or nationwide. The proportion of episodes for dual eligible beneficiaries declined in OCM practices and comparisons throughout the expanded baseline period by approximately two percentage points.
- There were differences across a number of utilization and cost measures between OCM practices and comparison TINs, though these differences were stable over time. The stability of trends for OCM practices and comparison TINs is an important assumption for the evaluation of OCM. Key findings and trends in outcome measures include:
  - Episodes attributed to OCM practices averaged higher total cost of care (including standardized Parts A and B, and [non-standardized] Part D) with $27,400 at OCM practices and $26,200 for the comparison group. A few extreme (outlier) values skewed the averages; median total costs per episode were $22,300 for OCM practices and $20,900 for comparisons. Trends over the baseline period were quite similar for the OCM practices and comparison TINs.

[2] Breast cancer episodes include those with cytotoxic chemotherapy and/or hormonal therapy.

- There was significant variation in per episode utilization and cost of care by cancer bundle. Breast, prostate, and bladder cancers had the lowest average per episode total Medicare cost of care, while melanoma and leukemia had the highest episode cost. Cancer mix will be an important driver of cost and utilization outcomes in OCM, and the evaluation is designed and powered to detect differences between OCM and comparisons, for common types of cancer.
- Episodes with only Part D chemotherapy (without infused or injected [Part B] chemotherapy) increased as a percentage of the total during the baseline period and the same was true for Medicare Part D costs per episode. This may, in part, be due to the introduction of new oral therapies during the period, as well as expanded use of existing oral therapies. This pattern was true for both OCM practices and comparison TINs (see trend lines), emphasizing the importance of accounting for advances in cancer treatment in the OCM evaluation (Exhibit ES-1).

Exhibit ES-1: Trends in Share of Episodes by Source of Chemotherapy (Part B, Part D, Both) in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015.

- OCM practices' patients who died during the baseline period were more likely to elect hospice services in the last six months of life than were those served by comparison TINs, or in the nation as a whole. However, OCM practices' patients used more services, including more high acuity/high cost services at the end of life (emergency department [ED], hospital, and intensive care unit [ICU] care), than did patients in the comparison group. OCM practices' patients were also more likely to receive chemotherapy treatment in the last 14 days of life than patients in the comparison group, or nationwide. Despite these absolute differences, trends were parallel in the

two groups for most end-of-life (EOL) measures and provide a reasonable foundation for future impact analyses. In the future we will explore whether the few very large practices in OCM (see below) were contributing to the differences in EOL care.

- The trends in practice and episode characteristics, and episode outcomes, were visually very similar between OCM practices and comparison TINs. Statistical tests of parallel trends showed that for many outcomes (including cancer Evaluation and Management [E&M] services, chemotherapy services, ED visits, total episode costs, beneficiary cost sharing, and many EOL measures), the two groups were significantly different. Most differences were very small (less than one percent of the mean values), although statistically different from zero. It is important to note that due to the large number of episodes in these analyses, small differences are more likely to be statistically significant, even if the differences are not meaningful. We conclude that although unadjusted differences in linear trends were statistically different, the magnitude of the differences are not clinically or economically meaningful, and the parallel trend assumptions for DID are largely met.

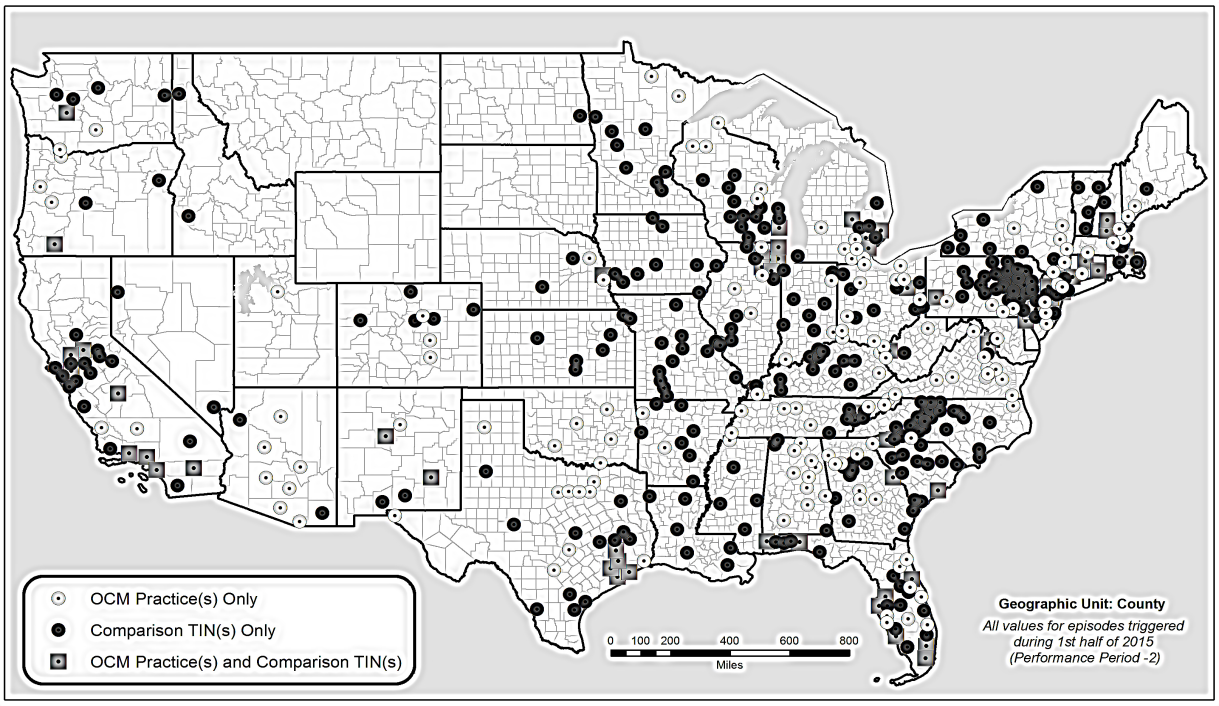
OCM Practices at Baseline

Practice characteristics, such as size, oncology specialties, and ownership/affiliations may be associated with the types of cancers treated, the severity of disease in the treated patient population, and important aspects of care delivery. Some practice characteristics will be important analytic control variables for evaluation analyses. Key baseline findings about practice characteristics and trends include the following:

- Despite careful propensity score matching it was not possible to select a comparison group that perfectly matched the OCM participants, especially on size-related practice characteristics. OCM practices were larger, on average, than comparison TINs, and had more providers (NPIs), and more oncology specialty providers. This is due in part to several very large OCM practices for which there are no similar comparison TINs in the nation. We will control for these size-related characteristics in future impact models to ensure they do not bias evaluation findings.
- The number of oncology specialty NPIs per practice/TIN increased over time for both OCM practices and comparison TINs, most likely due to ongoing industry consolidation.
- OCM practices, on average, had a significantly higher number of attributed cancer episodes than did comparisons TINs. Higher episode volume was related to the larger number of NPIs billing through the practice/TIN, and the averages were influenced by several large OCM practices that have no counterparts in the comparison group. Future analyses will explore whether episodes attributed to these very large practices are substantively different from episodes attributed to smaller practices, and whether additional adjustments are needed to address the influence of these large practices in the OCM sample.
- OCM practices and comparison TINs were more likely to be multi-specialty (defined as practices that include non-oncology specialties billing for cancer E&M or chemotherapy services) than was true for oncology practices nationally. Multi-specialty practices also had more NPIs, on average, which explains some of the difference in practice size and episode volume.
- OCM practices and their matched comparison TINs were also more likely to be affiliated with an academic medical center than was true for oncology practices nationwide. This is related to the greater proportion of multi-specialty practices in OCM, since academic physician groups are generally multi-specialty.

- OCM practices and comparison TINs were almost all urban, as was also true nationwide, and some parts of the country had very few OCM participants or matched comparisons (see map in Exhibit ES-2).

Exhibit ES-2: Geographic Distribution of OCM Practices and Comparison TINs



Source: Market characteristics file, 2015.

OCM Markets at Baseline

Market-level characteristics and dynamics may impact the decision to participate in OCM, the ability to transform care, and potentially cost and quality outcomes. Market supply characteristics, including number of physicians and number of oncology practices within a market, affect access to care and probably practice composition. Market-level demographics, such as population over the age of 65, gender, and income, may affect the demand for cancer care, types of cancers, and possibly outcomes. Key findings about market characteristic and trend analyses include:

- OCM practices differed from the broader national set of oncology TINs in the nation on several market characteristics. Despite the differences across practices and TINs nationally, the matched comparison TINs were well balanced with OCM practices on important market characteristics.
- Market characteristics and trends, including supply of physicians and population demographics, were similar for markets served by OCM practices and comparison TINs, and consistent with national trends (e.g., aging population, increasing Medicare enrollment).
- OCM practices and comparison TINs were located in markets with fewer, albeit larger practices compared to all markets nationwide. OCM practices and comparison TINs were also more likely to operate in multiple sites (office locations), draw patients from outside markets, and have higher market shares, than was true for the broader national set of oncology TINs.

Conclusions

OCM practices and comparison TINs were similar in the baseline period across many dimensions, as were the episodes of care they provided. The differences we identified, such as average practice size and average practice volume, were due to several very large OCM practices for which there are insufficient comparison TINs in the nation. Trends in the baseline were parallel between the two groups on most important measures, indicating a strong foundation for the impact analyses to come. The most consistent differences between the two groups were in the proportion of episodes for dually-eligible patients, which was lower in OCM practices than in comparisons, and in care provided at the end of life, where OCM practices' patients were receiving more hospital-based care at the end of their lives than was true for the comparison group. The markets served by OCM practices and comparison TINs were also similar in being almost entirely urban, which was also true for all oncology practices nationwide.

We conclude that the comparison group of TINs is an appropriate match for the OCM participants on most dimensions, and had parallel baseline trends. Despite this overall appropriateness, the volunteer OCM participants and the matched comparison group did not reflect the nation during the baseline period in terms of practice size and composition. These results highlight factors that will be taken into account in future analysis (e.g., for risk adjustment), and suggest some relevant subgroup analyses, especially by cancer bundle, and practice size and affiliation.

1. Introduction

1.1 OCM Background

The Centers for Medicare & Medicaid Services (CMS) is exploring methods to transform the fragmented health care delivery system and foster coordinated, high-quality, cost-effective care, including oncology care. Half of newly diagnosed cancer patients are over age 65,[3] making Medicare the single largest payer of oncology care. This is a medically complex population, many of whom have other chronic conditions that complicate—and are complicated by—their cancer treatment. There is evidence that patient-centered medical homes can reduce service utilization and cost of care for complex patients,[4] and specifically for those with cancer.[5] There is also emerging evidence that adherence to cancer-specific clinical guidelines can reduce variation in cost, pain management, and other patient outcomes.[6]

CMS launched the Oncology Care Model (OCM) for patients with all types of cancer who are undergoing chemotherapy treatment.[7] OCM combines attributes of medical homes (patient-centeredness, accessibility, efficiency, evidence-based guidelines, and continuous monitoring for improvement opportunities) with financial incentives for providing these services and quality outcomes. OCM features a two-pronged financial incentive strategy for its six month episodes. First, participating practices may bill Medicare a $160 monthly per patient care management fee that is intended to support care redesign and enhanced oncology services, including the following:

1. Provide 24/7 patient access to an appropriate clinician who has real-time access to patient's medical records
2. Provide core functions of patient navigation
3. Document a care plan for every OCM patient that contains the 13 components in the Institute of Medicine Care Management Plan[8]
4. Treat patients with therapies consistent with nationally recognized clinical guidelines (and explain deviations)

---

3 American Cancer Society website. Retrieved on October 29, 2015 from http://www.cancer.org/research/cancerfactsstatistics/cancerfactsfigures2015/.

4 Evidence: Benefits of the Patient Centered Medical Home, NCQA. Retrieved on October 15, 2015 from http://www.ncqa.org/Portals/0/Programs/Recognition/NCQA%20PCMH%20Evidence%20Report,%20June%202015.pdf.

5 Page RD, Newcomer LN, Sprandino JD, McAneny BL. The Patient-Centered Medical Home in Oncology: From Concept to Reality. 2015 ASCO Educational Book. Retrieved on June 7, 2016 from http://meetinglibrary.asco.org/content/11500082-156.

6 Demartino, JK and Larsen, JK. Equity in Cancer Care: Pathways, Protocols, and Guidelines. JNCCN, vol. 10, Supplement 1: S1-S9.

7 Chemotherapy is defined for OCM purposes as including cytotoxic chemotherapy, hormonal therapy, immunotherapy, and combinations of these therapies.

8 Delivering High Quality Cancer Care: Charting a New Course for a System in Crisis. Committee on Improving the Quality of Cancer Care: Addressing the Challenges of an Aging Population; Board on Health Care Services; Institute of Medicine. 2013. Available at: http://nap.edu/18359.

Second, although OCM physician group practices will continue to be paid under Medicare's Fee-For-Service (FFS) billing rules, all of the care their patients receive while undergoing chemotherapy, for cancer and for other medical conditions, will be "bundled" in six month episodes.[9] Participating practices are eligible to share in the savings from reductions in Medicare episode expenditures as compared with historic benchmarks (less a discount retained by CMS). These payments will be adjusted to reflect performance on several quality measures that participating practices will regularly report, other quality measures derived from Medicare claims, and patient satisfaction and care experiences as measured through a survey.

The combination of monthly per-patient payments for enhanced oncology services (the MEOS payment), and the potential for performance-based payments (PBPs) reflecting episode savings adjusted for quality, form the financial and quality incentives in OCM. The five year OCM program began with episodes starting on or after July 1, 2016 and will operate through nine consecutive six-month performance periods, with the last episodes ending on June 30, 2021.

Practices may voluntarily adopt two-sided risk (sharing losses as well as savings), beginning on or after January 2017. This qualifies as an Advanced Alternative Payment Model for the Quality Payment Program. Practices will be required to move to two-sided risk (or end their participation in OCM) if, as of the initial reconciliation of the fourth performance period (estimated summer 2019), they have not yet achieved a PBP at least once.

1.2 Evaluation Overview

The OCM evaluation will explore the characteristics of practices that volunteered to participate in OCM, using a carefully constructed comparison group to measure whether changes over the five-year demonstration period are greater in the OCM intervention group than in the comparison group—a difference-in-differences (DID) evaluation design. The evaluation focuses on how care delivery evolves under OCM, which OCM design elements contribute most to success, what contextual factors affect program success, and most importantly, the impact of OCM on quality of care, patient experiences, health outcomes, utilization, and Medicare spending.

The evaluation's mixed method design uses data from many sources including: Medicare administrative data systems, applications completed by volunteer practices and payers, case studies, and surveys completed by patients and family members, clinicians, and practice leaders. The evaluation takes advantage of inputs and data from other CMS contractors that are charged with implementing OCM and leverages information from additional sources such as the OCM Data Registry and Practice Transformation Plans. This baseline report provides a broad assessment of oncology care in the FFS Medicare program prior to the implementation of OCM, and tests a number of assumptions related to the DID evaluation design. Annual reports will contain analyses that require a year or more of data to reach the power to detect differences (e.g., mortality, medication management, unintended consequences), and will also synthesize information from multiple sources to answer key research questions.

[9] Six-month episodes are described in Section 2.1.

1.3 Report Objectives

This baseline report describes OCM participants and a carefully selected comparison group prior to the announcement and implementation of OCM. These analyses will inform the evaluation of OCM, and identify and characterize ongoing and emerging trends in care delivery that are important to the integrity of the baseline and the evaluation moving forward.

This baseline report contains information from analysis of Medicare claims. There was no qualitative or survey data collection in the baseline period, prior to OCM. The primary objectives of this baseline report include:

1. ***Describe how the OCM practices differ from the national universe of oncology practices, to understand the group that volunteered and were accepted for OCM.*** Since OCM practices volunteered for the model, attributes that influenced their decision to participate, such as size or patient mix, may differ systematically from the national patterns of all oncology group practices. We examine how OCM practices' characteristics compare to the national set of oncology TINs—this analysis also informs the criteria used for selecting the comparison group, described below. We also compare OCM practices and their matched comparison TINs to the remaining non-OCM, non-comparison (NONC) TINs in the nation. Since OCM practices and their selected comparisons have a larger volume of episodes relative to the rest of the nation, they drive the national episode-level patterns. To better understand variation, we examine episode-level characteristics between OCM practices and the NONC TINs.
2. ***Describe the OCM and comparison TIN markets, practice characteristics and organizational structure, and beneficiary mix, as well as cost and quality outcomes, during the baseline period.*** The characteristics we evaluate include market-level, practice-level, and episode-level variables, such as market population, practice size and specialty mix, and beneficiary demographics and cancer type. Understanding commonalities and differences among OCM practice and comparison TIN characteristics supports the evaluation of OCM by identifying the underlying variation in practice structure, patient and cancer mix, utilization and associated health costs, as well as inform the structure and design of the evaluation.
3. ***Evaluate the stability of these measures over time.*** A number of factors may influence trends in oncology care over the baseline period, including variation in cancer incidence, use of new therapies, or cost of treatment. Measuring these trends among OCM practices and comparison TINs, and confirming parallel trends, validates a primary assumption of the evaluation design.
4. ***Inform the selection of covariates for inclusion in the evaluation design***. It is important for the evaluation to identify and control for variation among subgroups within the sample of episodes for OCM practices and comparison TINs. The baseline analyses identify variables that may be appropriate for risk adjustment, and for potential subgroup analyses.

1.4 Organization of the Baseline Report

This report is organized in three sections. Following this introduction, Section 2 describes the file construction and methods used in the baseline analyses. We present baseline findings from claims analyses in Section 3. Throughout the report we refer to several appendices that are available in the accompanying volume.

2. Evaluation Data and Methods

In this section, we describe the data and methods used for this baseline report.

2.1 Defining and Constructing the Baseline Study Period

The baseline period for the impact evaluation includes six-month chemotherapy episodes that began between January 1, 2014 and June 30, 2015, which are divided into three performance periods based on episode start and end dates. The performance period definitions follow the same logic as the intervention performance periods of OCM, which began on July 1, 2016. For this report we also define an expanded baseline period that also includes episodes beginning in 2012 and 2013. By adding two additional years of data we are able to better identify and evaluate historic trends in costs, quality, cancer treatment and the organization of health care that could affect the evaluation.

The performance periods analyzed in this baseline report occurred prior to CMS's notification to practices of their acceptance into OCM, in the spring of 2016. The baseline performance periods are intended to provide an unbiased view of oncology practices, since CMS did not expect practices to make any changes in preparation for OCM prior to their acceptance into the program. Exhibit 2-1 displays the performance periods by episode trigger (start) and end date. The episodes used for this baseline report are denoted as performance periods -8 through -2. Baseline periods -4 through -2 will be used for impact analyses throughout the evaluation. These together represent a 24-month period during which interested oncology group practices and payers learned about OCM and applied, but did not yet know if they'd been be accepted. This period is useful for understanding attributes of episodes, practices, and markets before any changes due to OCM. Episodes that triggered in the latter half of 2015 and the first half of 2016 are omitted as part of the hold-out period, since those episodes either extend into the period after notification of acceptance into the program, or into the first OCM performance period. To ensure that the OCM and comparison groups are truly similar, and had parallel trends in the years before OCM, a longer time horizon is needed. We analyzed earlier years of data (performance periods -8 through -5) to better understand stability of trends between the two groups, and any potential threats to validity of the parallel trends assumption underlying the evaluation.

2.2 Episode Identification and Attribution to TINs

The OCM program centers on episodes of care triggered by chemotherapy, and thus much of the baseline data is built by identifying and attributing these episodes to TINs. We constructed OCM episodes using the same methodology as the OCM Implementation and Monitoring contractor. We identified the start of an episode as the first chemotherapy drug claim during a performance period (see Exhibit 2-1 for the timeline of performance periods). Episodes triggered by Part B chemotherapy events were identified as a Part B drug claim (outpatient, carrier, or durable medical equipment/DME) with a corresponding cancer diagnosis. Episodes triggered by Part D chemotherapy events were identified using Part D Prescription Drug Events (PDEs) with chemotherapy drug codes (as represented by National Drug Codes or NDCs), where we found a corresponding Part B carrier or outpatient claim with a cancer diagnosis, on either the Part D fill date or in the prior 59 days.

Exhibit 2-1: Performance Period Definition

OCM Performance Periods				
Performance Period	Episodes Triggering	Episodes Ending	Description	
-8	1/2/12 – 7/1/12	7/1/12 – 12/31/12		Expanded baseline analyses performance periods in this report
-7	7/2/12 – 1/1/13	1/1/13 – 6/30/13		
-6	1/2/13 – 7/1/13	7/1/13 – 12/31/13		
-5	7/2/13 – 1/1/14	1/1/14 – 6/30/14		
-4	1/2/14 – 7/1/14	7/1/14 – 12/31/14	Pooled baseline periods in this report and future Impact Analyses Baseline Periods	
-3	7/2/14 – 1/1/15	1/1/15 – 6/30/15		
-2	1/2/15 – 6/30/15	7/1/15 – 12/31/15		
-1	7/1/15 – 1/1/16	1/1/16 – 6/30/16	Hold-out Period	
0	1/2/16 – 6/30/16	7/1/16 – 12/30/16		
1	7/1/16 – 1/1/17	12/31/16 – 6/30/17	OCM Intervention Periods	
2	1/2/17 – 7/1/17	7/1/17 – 12/31/17		
3	7/2/17 – 1/1/18	1/1/18 – 6/30/18		
4	1/2/18 – 7/1/18	7/1/18 – 12/31/18		
5	7/2/18 – 1/1/19	1/1/19 – 6/30/19		
6	1/2/19 – 7/1/19	7/1/19 – 12/31/19		
7	7/2/19 – 1/1/20	1/1/20 – 6/30/20		
8	1/2/20 – 7/1/20	7/1/20 – 12/31/20		
9	7/2/20 – 1/1/21	1/1/21 – 6/30/21		

After a Part B or Part D trigger event, we then identified all cancer-related Evaluation and Management (E&M) services from the Part B carrier claims to determine episode eligibility and practice/TIN attribution. A beneficiary needed to have at least one cancer-related E&M service during the six-months after the trigger event, and further meet the eligibility criteria outlined below during the six month episode:

- Continuous Medicare Parts A and B enrollment
- Medicare FFS, no HMO or Medicare Advantage, not covered under the United Mine Workers of America program
- Medicare as the primary payer
- No End-Stage Renal Disease (ESRD)

We assigned all eligible episodes to the practice providing the majority of cancer-related E&M services for a beneficiary during the six month period. A practice was defined as the TIN listed on the E&M claim. The number of visits was equal to the count of unique dates for cancer-related E&M services for a beneficiary, at a TIN, during the six month period. The total number of visits for a beneficiary at a specific TIN was ranked for each beneficiary, and the beneficiary episode was attributed to the TIN with the most visits. In situations where there was a tie for the number of E&M visits, the episode was attributed to the TIN with the latest E&M visit during the episode period.

CMS identified OCM practices whose older "legacy" TINs had been replaced by a new TIN, likely due to practice mergers and acquisitions. Legacy TINs associated with participating OCM practices were identified as participating providers in baseline analyses, since current TINs may not have been available. In these cases, we followed the episode attribution plurality rule and treated OCM practices with one or more legacy TINs as a single unit.

2.3 Assignment of Cancer Bundles to Episodes

In the baseline report analyses, we present many episode-specific characteristics stratified by nine cancer bundles, along with a catch-all category that represents "all other" cancers. The cancer bundles of interest are derived from the cancer types assigned to each episode, per CMS's program methodology.[10] Using the cancer type assigned to an episode, we assigned the episode to a cancer bundle. For most cancers there is a one-to-one mapping from cancer type to cancer bundle, but two of the bundles contain more than one cancer type. Each episode is assigned to one unique cancer bundle.

The cancer bundles of interest were selected in consultation with our clinical experts, based on episode prevalence and clinical relevance. The table below (Exhibit 2-2) shows how the OCM-designated cancer types are mapped into the broader cancer bundles, reflected throughout this report. The OCM program does not group the individual cancer types into broader bundles, but we have done so for these baseline analyses to yield groups large enough to support comparisons.

Exhibit 2-2: Mapping of Cancer Types to Cancer Bundles

OCM-Assigned Cancer Type(s)	Mapped Evaluation Cancer Bundle
• Lung Cancer	Lung Cancer
• Breast Cancer • Carcinoma in situ of breast	Breast Cancer
• Prostate Cancer	Prostate Cancer
• Lymphoma	Lymphoma
• Intestinal Cancer	Colorectal Cancer
• Head and Neck Cancer	Head and Neck Cancer
• Bladder Cancer	Bladder Cancer
• Acute Leukemia • Chronic Leukemia	Leukemia
• Malignant Melanoma	Melanoma
• All Other Cancer Types	Other

[10] Per the program methodology, each episode is assigned a cancer type using the plurality of diagnoses on E&M visits in the carrier file that occurred during the episode. The diagnosis code corresponding to each E&M visit is mapped to a cancer type.

2.4 Relationship of NPIs to TINs

Oncology physician practices voluntarily applied to participate in OCM. Practices are represented in secondary data by their tax identification number (TIN). For each TIN and performance period, we identified relevant providers, as defined by their National Provider Identifier (NPI), based on the following criteria: during the performance period, the NPI billed at least one cancer-related E&M or Part B chemotherapy service through the TIN, for a beneficiary whose episode was ultimately attributed to the TIN using the OCM attribution algorithm. We applied the criteria that the NPI must serve at least one of the TIN's attributed beneficiaries, so as to focus on NPIs that were providing care to beneficiaries whose chemotherapy episode was the TIN's responsibility.

To identify the locations associated with the TINs, we relied on the billing locations of the relevant NPIs, as defined above. We used only the locations of NPIs who were billing at least one cancer-related E&M visit to the TIN, to try to capture a TIN's actual practice site(s) where physicians see their patients, and not a hospital outpatient or other setting where only chemotherapy is administered. We used billing locations reported as zip codes and mapped them to other market definitions, including county and Core-Based Statistical Area (CBSA).

2.5 Selection of OCM Practices and Comparison TINs

2.5.1 Identification of Practices

As of January 2017, there were 190 practices participating in OCM. Some of these practices specialize in oncology care and others are multi-specialty practices that provide other primary and specialty care in addition to cancer treatment. Some practices are community-based practices and others are hospital-based. The participating practices vary considerably in size, ranging from a single oncologist practicing in one location, to several hundred practicing in multiple office sites. The majority of practices treat a broad range of cancer diagnoses and offer infusion and hormonal chemotherapy; some also offer other therapies, such as radiation therapy and immunotherapy.

OCM practices self-selected to participate in the model and may differ from non-OCM TINs in both observable and unobservable characteristics. The goal of comparison group selection was to identify non-OCM TINs that were similar to the OCM practices prior to the OCM program announcement.

It is important to note that when selecting the comparison group we identified potential comparisons based on their TIN. A TIN is a billing unit and may not perfectly map to an entire physician group practice, which can be comprised of multiple TINs or parts of TINs. We used TINs since they are the basis of OCM episode attribution, and because we lack information to conclusively link TINs to their broader practice group. This is not a concern for the OCM practices since we can account for their legacy TINs in the baseline period, and during the program each OCM practice must bill under a single TIN or pool. As a result, throughout this report, we refer to OCM organizations as practices, comparison organizations as TINs, and we use practice/TIN when referring to both OCM and comparison organizations.

We used three types of variables for comparison group selection, including: (a) patient case mix characteristics, (b) practice characteristics, and (c) market characteristics. Each of these types of variables could influence the likelihood that a practice would participate in OCM, as well as its performance in the model.

We selected the baseline comparison group using propensity score matching. Prior to running the propensity score model, we identified a pool of non-OCM TINs that would be eligible for OCM and were broadly similar to the OCM participants, based upon: (a) patterns of billing cancer-related E&Ms for chemotherapy patients in 2014, (b) eligibility to participate in OCM based on program rules, and (c) similarity to OCM practices in terms of key characteristics. The exclusion criteria we applied to construct the baseline comparison pool are described below.

We began by identifying all non-OCM TINs that had at least one attributed beneficiary in 2014.[11] A beneficiary's episode was attributed to a TIN if the beneficiary received Part B or Part D chemotherapy in 2014 and the plurality of the beneficiary's cancer E&M services were billed through that TIN. We first selected TINs for the potential comparison pool that had at least one NPI billing under that TIN who had a designated oncology specialty (i.e., hematology/medical oncology, gynecologic oncology, radiation oncology, or surgical oncology). This reduced the comparison pool to a likely set of oncology (and urology)[12] TINs that provided oncology care to patients receiving Part B or Part D chemotherapy.

Second, we excluded TINs for the potential comparison group that were not eligible for the OCM, based on program participation rules. Third, we eliminated non-OCM TINs that were substantially dissimilar from the OCM practices based on market socio-demographics, practice size, beneficiary volume, provider specialty, patient demographics, or cancer mix. For each of these variables, we identified the range of values observed among OCM practices, and excluded from the comparison pool all non-OCM TINs that had characteristic values substantially outside the range for OCM practices. We applied exclusions based on distributions of the following variables:

- The minimum number of attributed episodes in the baseline period among OCM practices was one. Thus, we excluded any non-OCM TINs with fewer than two attributed episodes in 2014.
- The minimum average HCC score of patients attributed to an OCM practice was 0.37. We believed this to be an outlier practice and instead based the average HCC score exclusion on the second lowest average HCC score among OCM practices, 0.77. Non-OCM TINs with average HCC scores less than 0.77 were excluded from the comparison pool.
- There were no OCM practices where 100 percent of episodes were for breast cancer. For this reason, we excluded non-OCM TINs where 100 percent of episodes were assigned to the breast cancer bundle.
- The maximum proportion of Medicaid dual eligible patients at an OCM practice was 66.9 percent. We excluded non-OCM TINs where greater than 90 percent of their patients were Medicaid dually eligible.
- The maximum average Part B and D chemotherapy cost per attributed episode (including costs of care provided elsewhere during the episode) was $12,660 among OCM practices. We increased this value by 25 percent and excluded all non-OCM TINs with an average chemotherapy cost per attributed episode greater than $15,825.

---

[11] At the time the initial comparison group was selected, we did not have access to episode-level data. As a result, we used preliminary calendar year data defined at the patient-level.

[12] The two OCM urology practices each also had at least one oncologist, and therefore, we imposed a minimum of one oncologist NPI to also capture urology TINs.

Fourth, we analyzed characteristics of OCM markets and removed TINs located in states and territories that were substantively different from those of OCM participants. For example, we excluded non-OCM TINs practicing in more than three states because there were no OCM practices extending across more than three states during the baseline period. Additionally, TINs located in CBSAs where more than 50 percent of cancer-related E&Ms were billed by OCM practices were excluded, due to concerns about market spillover effects.

Finally, we applied a set of exclusions related to data availability. A practice's TIN can change over time (e.g., a practice goes out of business, merges with other practices, or is bought by a hospital or health system), and CMS identified OCM practices whose older "legacy" TINs had been replaced by a new TIN. Similar information was not available for non-OCM TINs. This is problematic for the baseline and impact analyses of the evaluation because we wish to keep the comparison group as stable as possible over the course of the evaluation. Changing and disappearing TINs threaten the longevity of the comparison group because it may indicate instability in the TIN or that the TIN no longer exists. In particular, we wished to exclude any TINs from the comparison group where we had some signal that ownership or existence of the practice could be changing. Therefore, TINs that did not have attributed beneficiaries in both 2014 and 2015 were excluded.

After applying all exclusions described above, the pool of potential comparison TINs was reduced from 72,187 non-OCM TINs in the nation who were billing cancer E&Ms and serving beneficiaries treated with chemotherapy, to 1,958 potential comparison TINs.

2.5.2 Propensity Score Matching

The comparison group was constructed using propensity score matching (PSM) techniques. The objective of PSM is to identify a comparison group that is statistically similar to the treatment group based on observable factors. The propensity score is defined as the probability of receiving the treatment (i.e., participating in OCM), conditional on a set of observed characteristics. PSM aims to balance the distributions of important characteristics across the two groups (i.e., participating practices and the comparison group), improving the quality of inferences that can be made about the impact of the intervention. The key advantage of PSM over other methods is that by using a combination of covariates to compute a single score, it balances the treatment and comparison groups on a large number of covariates without eliminating TINs that may be good matches (i.e., similar), on average, to OCM practices.

To estimate the propensity score for each TIN, a logistic regression model was fitted to account for market-level, practice-level, and episode-level factors that are conceptually and empirically related to the likelihood that a practice volunteered for OCM. We used nearest neighbor (NN) matching, where each OCM practice was matched to non-OCM TINs with the nearest propensity score values, and constrained matches to be within a certain caliper in terms of their propensity score from the OCM practice. We used matching "with replacement" where a comparison TIN could be used as a match for more than one OCM practice.

After fitting the model and estimating propensity scores, there were several OCM practices with extremely high propensity scores, driven by episode counts (three very large OCM practices), for which there was no NN match within the allowed caliper. Several approaches were tested to try to match these OCM practice to at least one comparison TIN using the PSM methods described above. These included alternative functional forms for key variables, propensity score weighting, breaking the large practices

into smaller sub-practices based on geographic clusters, and censoring episode counts. These approaches were tested before the PSM model was run. Ultimately, we censored episode count to the 99th percentile of the distribution (2,041 episodes) to limit the effect very high episode count had on the PSM model, while keeping all other characteristics the same. The comparison group sample used in this report includes 319 unique TINs.

In order to ensure similarity between the selected comparison group and the OCM practices, we calculated standardized differences for each variable included in the PSM model, as well as the average standardized difference across all variables. This process provided evidence that the selected comparison group is statistically similar to the OCM practices overall, and on most key characteristics. A detailed summary of the comparison group selection and propensity score matching methodology can be found in Appendix 1.

2.6 Baseline Episodes and Analytic File Creation

The data sources necessary to construct the baseline episode file and subsequent analytic files used in our analyses are summarized below in Exhibit 2-3.

2.6.1 Baseline Episode File

The foundational file from which we derived subsequent outcome measures and beneficiary, practice and market characteristics was the baseline episode file. That file contained episodes with start dates from 1/2/2012 through 6/30/2015, representing the expanded baseline period. We identified all potential chemotherapy episode-initiating events in Part B institutional, Part B non-institutional, and Part D records. Additional criteria included having at least one non-denied cancer E&M visit, and beneficiary eligibility during the episode.

Identification of Chemotherapy

We identified chemotherapy from four types of records using the chemotherapy HCPCS or NDC9 codes, and other selection criteria. We defined the episode start date as the date on the claim for each chemotherapy record that initiated an episode. The duration of each chemotherapy episode was six calendar months (which could vary from 181 to 184 days). We created flags to distinguish selected hormonal therapy for breast cancer and prostate cancer that can be used either as adjuvant therapy for early stage cancer or as treatment for advanced cancer:

Identification of Potential Eligible Episodes

We applied the episode inclusion criteria per OCM program rules, which specified that each episode must meet the following criteria:

- Presence of a non-denied E&M visit on a Carrier line with a cancer diagnosis on the same line
- The beneficiary meets all relevant eligibility criteria (e.g., Medicare Part A and B enrollment, no ESRD, Medicare primary payer, etc.) from episode start date through the end date, if the beneficiary was alive at the end of six months, or through the date of death (DOD) if the beneficiary died before the end of the episode

Exhibit 2-3: Data Sources Used in Analytic File Construction

Data Source	Purpose
2012 – 2015 Part B Claims	• Identify Part B chemotherapy episode triggers for episode identification and cancer E&M services for episode attribution • Assign episode-level utilization and costs for Part B services
2012 – 2015 PDE Tap Files	• Identify Part D chemotherapy triggers for episode identification • Assign episode-level Part D chemotherapy and overall drug utilization and costs
2012 – 2015 Part A Claims	• Assign episode-level utilization and costs for Part A services
2012 – 2015 Beneficiary Summary Files	• Beneficiary eligibility criteria for episode identification (Part A and B enrollment, etc.)
2012 – 2015 Geographic Variation Database (GVDB) Beneficiary Files	• Beneficiary characteristics including age, race, and gender • Beneficiary zip code of residence • Beneficiary Hierarchical Condition Category (HCC) score • Monthly Part D enrollment
2012 – 2015 Chronic Condition Warehouse (CCW) Flags	• Presence of beneficiary comorbidities • Assignment of TIN's affiliation with an entity participating in the 340B drug program
2012 – 2015 National Plan and Provider Enumeration System (NPPES)	• Supplement provider specialty using primary specialty taxonomy
2012 – 2015 Master Data Management (MDM) Provider and Beneficiary Extracts	• TIN's participation in CMS initiatives: Pioneer ACO and Medicare Shared Savings Program (MSSP) • Participation of beneficiaries in CMS initiatives: Pioneer ACO and MSSP
August 2016 SK&A Office – Based Physician File	• TIN's affiliation with health system and hospital ownership
2010 – 2015 Area Health Resource Files (AHRF)	• County-level sociodemographic and market supply characteristics
Welch, P., Town and Gown Differences Among the Largest Medical Groups in the US, 2016	• TIN's assignment to a medical school's academic medical group

Identification of Final Baseline Episodes

If we identified more than one chemotherapy episode on the same day, we applied the following rules to select one:

- Sort based on the hierarchy assigned to each record type
- Select the one with the first claim ID
- Utilize the first line record when there are multiple line records with the same claim ID

We determined the start and end dates of the first episode within the baseline period for a beneficiary. All subsequent episodes could only begin after the end date of the previous episode (i.e., consecutive but not overlapping episodes).

Cancer Type Assignment

We used the CMS-provided mapping between diagnosis codes and cancer type to assign the cancer type associated with the plurality of carrier E&M visits that had a cancer diagnosis during the episode. In the case of a tie, we followed the OCM program logic and selected the cancer type from the latest E&M service during the episode. In situations where there was a tie for the latest E&M service, we selected the cancer type associated with the Tax ID Number (TIN) having the lowest last digit (approximating random selection) to assign the cancer type for the episode. In situations where a beneficiary had a cancer type associated with only hormonal therapy and only utilized drugs identified as hormonal therapy during the episode, we created flags to note hormonal therapy only during the episode.

Attribution of Episodes to TINs

We used non-denied cancer-related E&M visits during an episode to attribute the episode to a TIN. We ranked the total number of visits for a beneficiary at a specific TIN, and attributed the episode to the TIN with the most visits. In a situation where a beneficiary had an equal number of visits to two TINs, the most recent E&M visit determined attribution; if necessary, we then used the lowest last digit of the TIN to break the tie for episode attribution. As noted above (see Section 2.2), we treated OCM practices with one or more legacy TINs as a single unit.

Since practices may be pooled together for reconciliation purposes, and our evaluation defines practices at the TIN-level, we made no special consideration for OCM practices that are part of a mandatory or voluntary pooling arrangement when selecting comparison TINs, or in episode attribution. Episodes were attributed at the TIN-level, and we treated each OCM practice as a single unit, even if it was part of a pool, for the purposes of matching to comparison TINs in the PSM model. Moreover, in these baseline analyses of practice and market characteristics, we treated OCM practices as individual units, and their characteristics were not aggregated to the level of the pool.

2.6.2 Analytic Files

Using the episodes identified in the baseline episode file, we then constructed the set of outcome measures analyzed in this report, along with episode-level, provider-level, and market characteristics.

Cost and Utilization Measures

Exhibit 2-4 summarizes the main categories of cost and utilization episode-level outcomes analyzed for this report.

Exhibit 2-4: Episode-Level Cost and Utilization Outcomes

Outcome Category	Measures
Utilization of services	• Cancer-related (cancer E&Ms, chemotherapy) • Inpatient (stays, readmissions, ICU admits) • ED, SNF, home health • Imaging, outpatient therapy, radiation therapy • Part B drug services and Part D utilization
Cost measures	• Total Part A, B, and D cost of care (TCOC)[13] • Components of cost – Part A & B, – Part D – Cancer E&M, chemotherapy – Inpatient and readmission, inpatient ED – Imaging – Part B and D drug costs • Part A, B, and D beneficiary cost sharing
Mortality	• All-cause mortality

End-of-Life Care Measures

The Core Quality Measure Collaborative reached consensus on core quality measures for medical oncology care,[14] and we followed these to construct ten claims-based end-of-life (EOL) care process measures focused on patient-level outcomes. In addition to various measures specific to cancer treatment, the measures also include several hospice and EOL concepts from the National Quality Forum measures portfolio.[15]

See also Appendix Exhibit A2-18.

Episode Characteristics

Each episode's characteristics include beneficiary demographics, comorbidities, and cancer type, and are summarized below:

---

[13] TCOC measures total Medicare payment, not allowed costs. Part A and B costs are standardized, while Part D costs are not. Part D Medicare payment is calculated as the sum of Low Income Cost Sharing amount and reinsurance.

[14] The Core Quality Measure Collaborative is led by the America's Health Insurance Plans (AHIP) and their chief medical officers, and includes leaders from CMS, the National Quality Forum, with additional input from national physician organizations, employers, and consumers. The seven core sets of measures include a set for medical oncology, which can be found here: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/QualityMeasures/Downloads/Medical-Oncology-Measures.pdf.

[15] Technically, several Consensus Core Set of Medical Oncology Measures are calculated as clinician-level rates. For our purposes, we calculate and report these measures as practice-level rates among OCM and comparison group TINs.

- Primary cancer bundle (Exhibit 2-2, above, describes how the cancer types were grouped into the broader cancer bundles used in the baseline analyses)
- Age cohort (under 65, 65 – 69, 70 – 74, 75 – 79, 80 – 84, 85 and older)
- Gender
- Race (non-Hispanic white, Non-Hispanic Black, Hispanic, Other)
- Medicaid dual eligibility
- Health/clinical status
  - Hierarchical Condition Category (HCC) risk score
  - Number of "oncology relevant" chronic conditions[16]
- Number of months of Part D enrollment

Practice Characteristics

Practice-level characteristics such as size, the specialty mix of providers, and affiliations with health systems may affect care delivery and the types of patients treated. We created a practice characteristics file that contains the attributes of the providers (NPIs) billing through the practices/TINs, as well as the organizational and structural characteristics of the practices/TINs, for each performance period.

Provider Specialty Mix: Using the resulting file, we identified the relevant NPIs for each TIN, as described in the section above on identification of TINs' providers (Section 2.4). We then constructed the following attributes for each practice/TIN:

- Number of NPIs billing cancer E&Ms or chemotherapy to the practice/TIN
- Number of Urologist NPIs
- Proportion of Urologist NPIs
- Number of Nurse Practitioner (NP)/Physician Assistant (NP) NPIs
- Proportion of NPIs that are NP/PA
- NPIs with Oncology Specialty[17]
- Proportion of NPIs with Oncology Specialty
- Indicator for whether the practice is oncology only[18]
- Number of Part B chemotherapy services billed by NPIs with a pharmacy specialty
- Total Part B chemotherapy payment billed by NPIs with a pharmacy specialty

---

[16] The following conditions were identified by clinical experts as ones that could influence physicians to recommend against chemotherapy treatment: Acute Myocardial Infarction, Alzheimer's Disease and Related Disorders or Senile Dementia, Chronic Kidney Disease, Chronic Obstructive Pulmonary Disease, Heart Failure, Stroke/Transient Ischemic Attack.

[17] An oncology specialty included any of the following specialties: hematology/oncology, medical oncology, surgical oncology, radiation oncology, or gynecologic oncology.

[18] A practice is considered oncology only if all of its NPIs have an oncology specialty designation. There are several limitations to this indicator as defined in the baseline analyses. First, oncology nurse practitioners are not classified as oncology NPIs. Second, as part of the total NPI count, we do not include NPIs that are part of a practice but are not delivering any cancer-related care to an attributed beneficiary. This could potentially misclassify a practice as oncology only if it has other non-oncologists that are providing non-cancer-related services.

Volume of Beneficiaries and Cancer Services: We constructed a number of variables to characterize each practice's patient volume:

- Number of cancer patients receiving oncology services at each practice/TIN
- Number of attributed beneficiaries[19]
- Proportion of chemotherapy patients that are attributed to the practice/TIN
- Number of attributed beneficiaries per oncologist NPI
- Number of Part B chemotherapy services delivered at the practice/TIN

The number of cancer patients included all patients receiving chemotherapy or cancer-related E&M services at the practice/TIN, even if the episode was not attributed to the TIN, to gain a sense of the practice's overall patient volume. We also created a variable for the volume of Part B chemotherapy services delivered at each practice/TIN, regardless of whether the patient's episode was attributed to the TIN. This variable helps characterize whether the practice/TIN routinely outsources chemotherapy administration to a hospital outpatient department or other clinical setting.

Participation in Other CMS ACO Initiatives: For purposes of the baseline file, we identified practice/TIN participation in the Pioneer ACO and Medicare Shared Savings Program (MSSP) CMS ACO initiatives using the provider extracts from the Master Data Management (MDM) database.

Affiliation with Other Organizations and Systems: We used several data sources to characterize each practice's association and affiliation with other health care systems and entities. These affiliations may influence referral patterns and access to clinical trials and other novel therapies, and may be associated with certain types or severity of cancer. In particular, we constructed the following attributes:

- Indicator for whether the practice/TIN was a medical school academic group practice
- Indicator for whether the practice was managed by or affiliated with a health system
- Indicator for whether the practice was owned by a hospital
- Indicator for whether the practice was affiliated with an entity participating in the 340B drug discount program

Market Characteristics

The characteristics of a practice's market may affect access to care, the organizational structure and physician specialty mix of the practice, and patterns in the practice's episode demographics and outcomes. We created a file that contains market-level beneficiary demographics, physician supply, and utilization factors for the markets associated with each practice, in each performance period.

Market Penetration of Practices and CMS ACO Program Participation: We constructed variables to characterize the composition of each practice's market area, defined as the modified CBSA[20]:

- Number of practice/TINs located in each CBSA
- Proportion of Medicare beneficiaries residing in a practice/TIN's CBSA, aligned to the Pioneer ACO and/or MSSP programs

---

[19] This is equivalent to the number of attributed episodes in a single performance period.

[20] We employed a modified version of the CBSA to include rural counties that would otherwise not be assigned to a CBSA.

Practice Market Presence: We also constructed variables to evaluate each practice's geographic spread and market presence.

- Multi-market (number of CBSAs a practice/TIN is billing in)
- Number of unique sites for the practice/TIN (defined by provider zip codes)
- Market share (defined as proportion of all cancer E&Ms billed in the CBSA by the practice/TIN)

Market Demographics and Supply: CBSA is an appropriate designation for measuring competition (market share, etc.). However, when assigning healthcare supply and demographic characteristics of the Medicare population, we used county as the market designation because CBSAs are much larger geographic areas and a single CBSA can contain significant variation in demographics and supply factors. We used county-level characteristics from the AHRF data to assign the following market demographics, supply, and utilization characteristics:

- Market demographics (population, median household income; percent of population living in poverty, with less than a high school education, aged 65 and older, Medicare and MA population, urbanicity)
- Market supply (number of specialists, number of primary care physicians)
- Market healthcare utilization (Number of hospital beds, number of ED visits)

Some practices and TINs were associated with multiple CBSAs and/or counties. In these cases, we assigned each characteristic using an average of the characteristic, weighted by the volume of cancer-related E&M visits associated with each practice/TIN's market area.[21]

[21] For example, consider a practice with two counties, A and B, each representing 75 percent and 25 percent of the practice's cancer E&Ms, respectively. If county A had a population of 100,000 and county B had a population of 10,000, the practice would be assigned a weighted average population of 77,500 (0.75*100,000 + 0.25*10,000).

3. Claims-Based Findings

The baseline claims-based analyses focus on three core dimensions of OCM practices and comparison TINs:

- ***Episode-level characteristics*** describe utilization and outcomes in the baseline period as well as beneficiary demographic characteristics, cancer mix, and severity/comorbidities. Underlying differences in episode mix may have influenced the decision to participate in OCM and these characteristics may impact OCM's effect on cost and quality outcomes.
- ***Practice characteristics*** such as size, number and mix of oncology specialists, and affiliations with other providers, academic centers, or health systems may affect the types of cancers treated, the severity of the patient population, and care delivery.
- ***Market-level characteristics*** include dimensions of healthcare supply (i.e., number of physicians and number of oncology practices within a market), urbanicity, market population, and market demographics. These characteristics may affect access to care, practice composition and patterns in episode characteristics.

OCM practices and comparison TINs make up approximately one-quarter of all oncology practices/TINs nationally[22] that were eligible to participate in OCM, and nearly two-thirds of all relevant Medicare FFS cancer episodes. While the propensity score matching (PSM) approach improves the validity of the evaluation by selecting comparisons that resemble OCM participants along multiple dimensions, practices were not randomly assigned to participate in OCM, which may impact generalizability of results. This report therefore assesses the similarities and differences among the voluntary participants, their matched comparisons, and other oncology practices/TINs in the US.

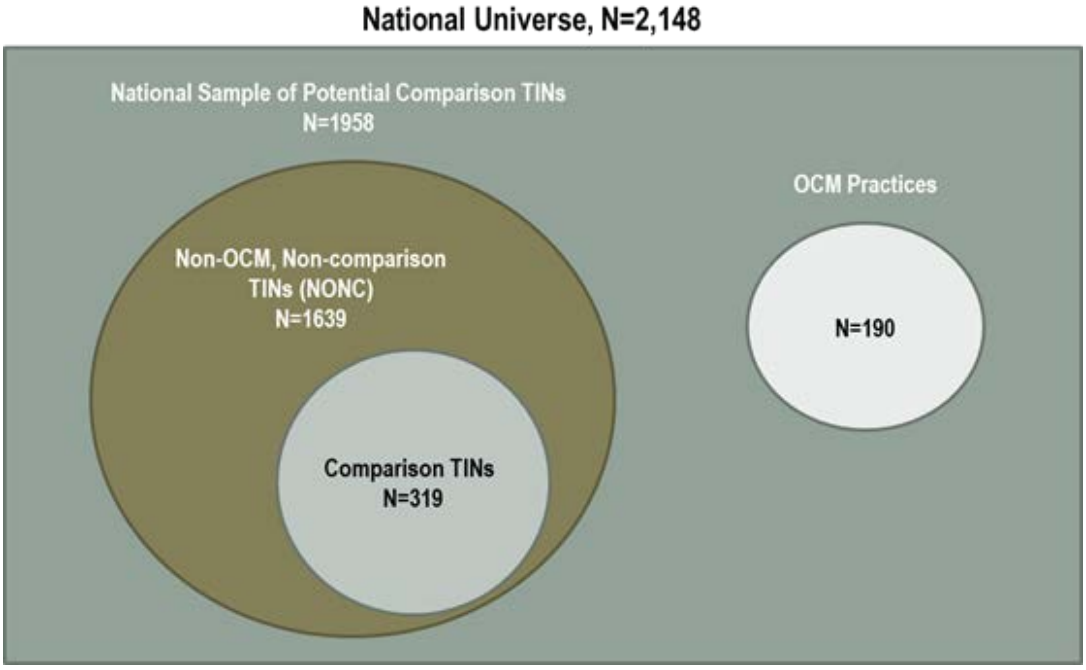
We present patterns in the data for key outcomes, broken down by the following groups:

1. OCM practices.
2. Comparison TINs.
3. Non OCM-non comparison TINs (NONC). These TINs would have been eligible for OCM, and were in the potential pool of comparison TINs, but were not selected in the propensity score matching. The episode-level findings include results for the NONC group since the large episode volume of the OCM practices and comparison TINs drive the national results, which may mask important differences between OCM practices, comparison TINs, and the rest of the nation.
4. All practices and TINs (national universe).

Exhibit 3-1 shows the number of associated practices/TIN in each of the groups comprising the national universe.

[22] The national universe was determined after applying a series of exclusions to eliminate non-OCM TINs that were not eligible for OCM based on program participation rules or were substantially dissimilar from the OCM practices. These exclusions were described in detail in Section 2.5.

Exhibit 3-1: Practice/TIN Groups Comprising the National Universe



We examined data from seven historic performance periods (-8 through -2, referred to as the "expanded baseline period") to assess trends over time in oncology care. The impact evaluation, however, will employ a shorter "baseline period": episodes beginning in 2014 and the first half of 2015, or performance periods -4 through -2 (the summarized findings for the baseline period are referred to as the "pooled baseline period"). We therefore focus on this pooled baseline period in the analyses that follow, and also report any divergence in trends over the longer expanded baseline period.

This report includes summary statistics, subgroup analyses, and an evaluation of the stability of outcomes over time. For episode-level cost, utilization, and quality outcomes, we conducted statistical tests to assess whether trends in the outcomes for OCM practices and comparison TINs were parallel across the expanded baseline period. Specifically, we tested whether deviations in the linear time trend between OCM practices and comparison TINs were statistically significant. Outcomes reported have not been risk-adjusted, but will be adjusted in future impact analyses.

This baseline report analyzes 190 OCM practices and 319 comparison TINs (Exhibit 3-2), representing approximately one-quarter of the relevant oncology TINs in the nation. Nationwide, approximately 300,000 episodes were triggered in each performance period from 2012 to 2015, and just over 60 percent of these episodes were attributed to OCM practices or the selected comparison TINs.

The number of practices and TINs fluctuated across performance periods, reflecting new practices/TINs forming, consolidation of practices/TINs, ownership changes, and practices/TINs closing their businesses. We anticipate that changes over time will continue in the practice/TIN structure and presence within markets.

Exhibit 3-2: Summary of Attributed Episodes in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)

Performance Period	Number of Practices/TINs			Attributed Episode Count		
	National	OCM Practices	Selected Comparison TINs	National	OCM Practices	Selected Comparison TINs
-8	1,986	184	304	298,752	101,192	80,345
-7	2,026	187	313	259,926	88,489	70,523
-6	2,071	188	316	287,531	97,611	79,677
-5	2,098	189	318	278,171	95,027	77,374
-4	2,135	189	319	303,016	102,988	85,643
-3	2,141	190	319	294,303	99,600	83,828
-2	2,126	190	319	312,437	106,978	89,961

Source: Episode characteristics file.

The baseline findings are organized in five subsections. First, we summarize episode characteristics, including beneficiary characteristics, and episode utilization and costs, and evaluate episode-level trends throughout the baseline period (Section 3.1). Next, we evaluate practice-level characteristics, which include practice size, provider specialty mix, and practice affiliation, and trends in these characteristics (Section 3.2). In Section 3.3, we assess the market structure and characteristics in which OCM practices and comparison TINs are located, and evaluate the patterns of beneficiaries traveling for oncology care. In Section 3.4 we evaluate episode-level measures and practice characteristics for a number of episode, practice and market subgroups, to identify underlying variation in outcomes and important covariates to include in the evaluation design. We summarize all claims-based findings in Section 3.5.

3.1 Episode Characteristics

Summary of Episode Characteristics Findings

An understanding of episode utilization and outcomes in the baseline period is essential for measuring the effectiveness of OCM. Key findings of baseline episode characteristic and trend analyses include:

- OCM practice and comparison TINs were larger than the average oncology practice, as measured by episode volume in each performance period. OCM practices had more than seven-fold and comparison TINs had more than three-fold greater episode volume than NONC TINs in the pooled baseline period.
- On a per episode basis, utilization (including cancer E&M services, Part B and D chemotherapy services, acute and non-acute care) and related costs were higher, on average, for OCM episodes relative to comparison episodes.
- In terms of episodes for patients who died, OCM episodes had higher rates of chemotherapy near death, hospital admissions near death, ICU and ED use near death, deaths in the hospital associated with ICU use, and being on hospice less than three days, relative to comparison episodes. Patients served by OCM practices were more likely to elect hospice services in the last six months of life than were those served by comparison TINs, or in the nation as a whole.
- Trends in outcomes across the expanded baseline period were similar for OCM and comparison episodes. Even for trend differences that were statistically significant, the magnitude of the differences was almost always less than one percent of the OCM average, and thus likely not meaningful from an economic or clinical perspective.

The results in this section focus on statistically significant differences in episode-level cost, utilization, and quality outcomes between OCM and comparison TINs during the pooled baseline period.[23] As described in Section 2.2, an episode represents a six-month period of care triggered by Part B or Part D chemotherapy treatment. Since OCM practice and comparison TIN episodes collectively represent about 60 percent of the episodes in the nation, patterns in outcomes among OCM and comparisons are reflected in national averages. As a result, we also provide findings for NONC episodes to clearly show where OCM practice and comparison TIN patterns deviate from those TINs not included in either group.

For episode-level outcome measures, statistical tests were conducted to determine whether the trends across OCM practices and comparison TINs were parallel throughout the expanded baseline; we specifically tested whether deviations in the linear time trend between OCM practices and comparison TINs were statistically different from zero. Within this report, statistically significant differences in trends between OCM practices and comparison TINs are described as "differences in the trends were statistically significant." If the trend in outcomes were parallel (i.e., no statistically significant difference in trends), we described this as "trends were statistically parallel." A statistically significant difference in trends between the two groups may indicate potential threats to the validity of assumptions for the DID models used in future impact analyses, alerting us to outcomes that we need to monitor and for which we may need to apply econometric techniques in our future models. However, it is important to note that due to the large number of episodes in these analyses, small differences may be statistically significant, even if

[23] For select analyses, we note findings with no statistically significant differences, however, we do not include corresponding tables for these findings.

the differences are not actually clinically or econometrically meaningful. Further, the tests reported here do not factor in episode-level risk adjustments, or adjust for practice or market covariates, which will be used in the impact evaluation to reduce unexplained variation and clarify differences in trends.

3.1.1 Episode Volume

There were significant differences in average episode counts per practice/TIN between OCM practices, comparison TINs, and the broader national universe during the pooled baseline period (episodes initiating January 1, 2014 through June 30, 2015). Nationally, the average episode volume was 424 episodes per practice/TIN, OCM practices had an average of 1,629 attributed episodes, while comparison TINs averaged 813 episodes. In contrast, the NONC TINs had an average of 208 episodes (Exhibit 3-E1). In part, the difference in episode volume between the comparisons and the NONC TINs was a result of our comparison group methodology and matching criteria. Because practices that selected to participate in OCM tended to be larger in size and patient volume, our propensity score model selected comparison TINs that were also large.

Episode Volume by Cancer Bundle

The volume of episodes varied by cancer bundle among both OCM practices and comparison TINs (Exhibit 3-E1).

- Breast cancers, prostate cancers, and lung cancers together represented over 55% of the episodes for OCM practices and comparison TINs.
- The share of total episodes by cancer bundle was, with few exceptions, similar among OCM practices and comparison TINs. The OCM and comparison groups differed with respect to the proportion of breast and prostate cancer episodes. For example, OCM practices had a higher proportion of breast cancer episodes (35.1 percent) than did comparison TINs (33 percent), and comparison TINs had a higher proportion of prostate cancer episodes (15.9 percent) compared to OCM practices (12 percent).
- There were also changes in the distributions of episodes by cancer bundle over time, throughout the expanded baseline period (Appendix Exhibit A2-1):
  - Breast cancer episodes increased as a proportion of total episodes during the expanded baseline period among OCM practices and comparison TINs. The proportion of breast cancer episodes increased from 32.1 percent to 35.1 percent in OCM practices and from 30.4 percent to 32.9 percent in comparison TINs during the expanded baseline period.
  - Meanwhile, lung cancer and colorectal cancer episodes declined as a proportion of total episodes. The proportion of lung cancer episodes decreased from 11.6 percent to 9.6 percent for OCM practices and from 10.8 percent to 9.3 percent for comparison TINs. The proportion of colorectal cancer episodes decreased by one percentage point during the expanded baseline period, from 7.5 percent to 6.4 percent for OCM practices and from 7 percent to 6 percent for comparison TINs.

Exhibit 3-E1: Episodes by Cancer Bundle in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	Number of Episodes	Mean Episode Count per Practice	Percent of Episodes by Cancer Bundles									
			Lung Cancer	Colorectal Cancer	Breast Cancer	Prostate Cancer	Lymphoma	Head and Neck Cancer	Leukemia	Melanoma	Bladder Cancer	Other Cancer
National	909,756	424*	9.2%	6.2%	34.3%	15.5%	6.2%	1.4%	4.1%	0.6%	2.7%	19.8%
OCM	309,566	1,629	9.8%	6.5%	35.1%	12.0%	7.1%	1.5%	4.3%	0.7%	2.1%	20.8%
Comparison	259,432	813*	9.4%	6.1%	33.0%	15.9%	6.1%	1.5%	4.1%	0.7%	2.7%	20.4%
NONC	340,758	208*	8.6%	5.9%	34.5%	18.4%	5.6%	1.2%	3.8%	0.4%	3.1%	18.4%

Source: Episode characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05.
Note: Proportions represent the percent of total episodes, not an average proportion per practice or TIN.

Part D Episode Enrollment

Beneficiaries were considered to be enrolled in Part D if they were enrolled for at least one month during their six-month chemotherapy episode.[24] Part D coverage may impact the total costs of the episode and also beneficiary cost sharing.

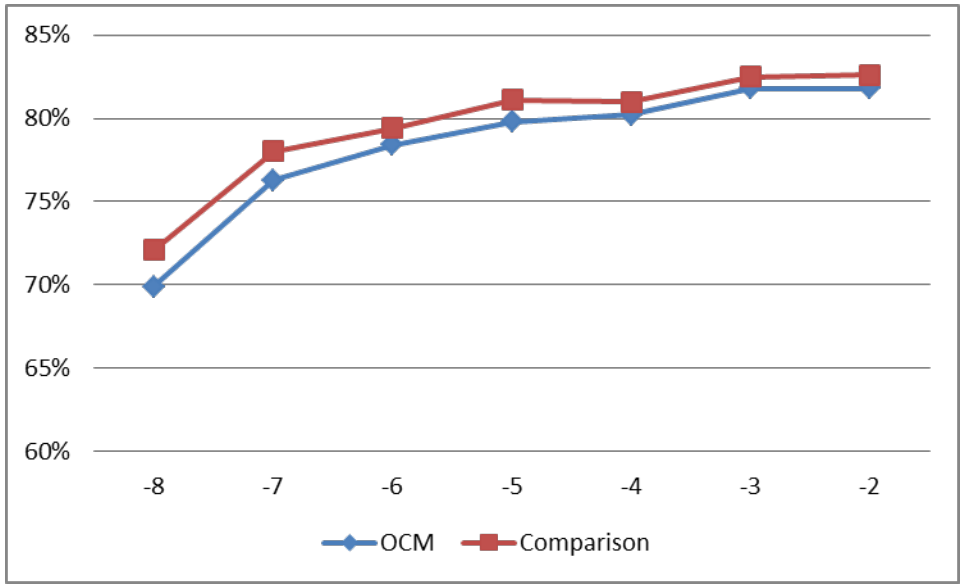
- The proportion of episodes with beneficiaries enrolled in Part D increased over the expanded baseline period (Exhibit 3-E2). This trend was consistent with the national trend of more Medicare beneficiaries enrolling in Part D in recent years.[25] The differential between OCM practice and comparison TIN episodes where the beneficiaries were enrolled in Part D was larger in earlier performance periods, but narrowed over time.
- The majority of episodes were for beneficiaries who were enrolled in Part D during the pooled baseline period. About 81 percent of the episodes attributed to OCM practices and 82 percent of episodes attributed to comparison TINs were for beneficiaries enrolled in Part D (Exhibit 3-E3). There may, however, have been beneficiaries enrolled in Part D and prescribed chemotherapy that we do not observe in our sample of episodes, because the drug is not covered under Part D, or because no claims were submitted for their prescription chemotherapy drugs.
- There was notable variation in Part D enrollment across cancer bundles (Exhibit 3-E3).
  - Breast cancer episodes had a high percentage of Part D enrollment (over 90 percent), which may be because beneficiaries needed Part D to cover the costs of their oral hormonal therapy.[26]
  - Comparison TINs had a higher proportion of episodes with Part D enrollment than did OCM practices. The difference was more than two percentage points for each of lung cancer, colorectal cancer, lymphoma, head and neck cancer, and other cancers relative to OCM practices.

[24] Episodes for oral/prescription medications will not trigger – and be present in claims data – unless the beneficiary is enrolled in Part D and a claim for the drug was submitted as a covered drug under Part D.

[25] Center for Medicare and Medicaid Services. Statistics found in the Medicare Enrollment Dashboard: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Dashboard/Medicare-Enrollment/Enrollment%20Dashboard.html.

[26] See section 3.4.2 for an assessment of breast cancer episodes using only hormonal therapy.

Exhibit 3-E2: Trends in Share of Episodes with Part D Enrollment in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note:** Y-axis does not start at zero.

Exhibit 3-E3: Percent of Episodes with Part D Enrollment by Cancer Bundle in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

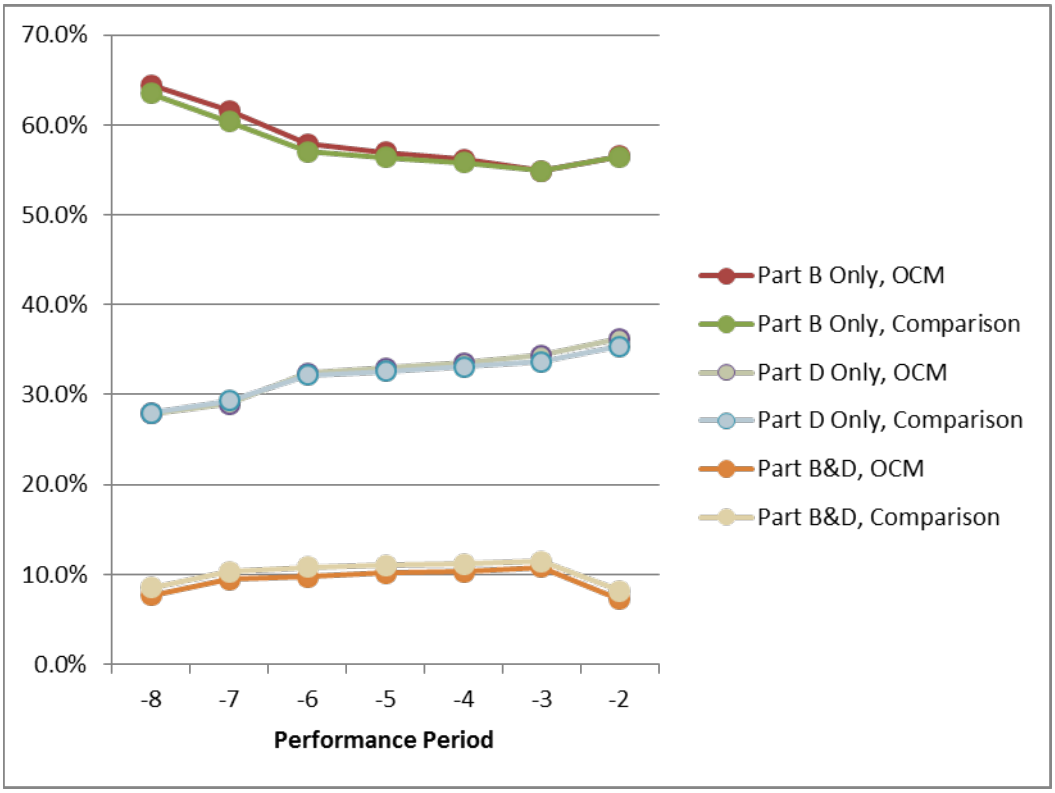
Practice/ TIN Type	N	Percent of Episodes with Part D Enrollment										
		All Episodes	Lung Cancer	Colorectal Cancer	Breast Cancer	Prostate Cancer	Lymphoma	Head and Neck Cancer	Leukemia	Melanoma	Bladder Cancer	Other Cancer
National	909,756	82.0%	75.7%	75.2%	94.0%	70.8%	73.0%	73.0%	86.3%	77.8%	68.6%	79.8%
OCM	309,566	81.3%	73.6%	73.2%	93.0%	70.5%	71.5%	70.9%	85.4%	78.7%	68.3%	78.5%
Comparison	259,432	82.0%	76.1%	75.6%	93.9%	71.1%	73.9%	73.6%	86.5%	78.0%	69.1%	80.2%
NONC	340,758	82.6%	77.4%	76.8%	95.0%	70.7%	73.9%	74.9%	87.0%	76.2%	68.5%	80.8%

Source: Episode characteristics file, 2014 – 2015.

Part B and Part D Chemotherapy Episode Volume

In the baseline analyses we identified the service setting of all chemotherapy drugs utilized during the episode (whether from Part B only, Part D only, or both Part B and D) to understand underlying trends in utilization and costs. The OCM practices, comparison TINs, and the broader national universe had similar distributions of episode volume by chemotherapy source during the pooled baseline period: 54 to 56 percent of episodes had Part B chemotherapy only, 34 to 36 percent had Part D chemotherapy only, and Part B and D chemotherapy were both present in the remaining nine to 10 percent of episodes. As a proportion of total episodes, those with only Part B chemotherapy decreased over the expanded baseline period, while those with only Part D chemotherapy had a corresponding increase, and the trends for the OCM and comparison groups were virtually identical (Exhibit 3-E4). The proportion of episodes with both Part B and Part D chemotherapy remained relatively constant over the expanded baseline period. In Section 3.4.1, we examine how the source of chemotherapy drugs within the episode varied by cancer bundle.

Exhibit 3-E4: Trends in Share of Episodes by Source of Chemotherapy in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015.

Episode Volume by Beneficiary Characteristics

Beneficiary Age

Nearly half of all OCM and comparison episodes were for beneficiaries aged 65 to 74 years (Appendix Exhibit A2-2). A small share of episodes (10 percent – 12 percent) involved beneficiaries less than 65 years old. Nineteen percent of episodes were for beneficiaries aged 75 to 79 years, 13 percent were for beneficiaries aged 80 to 84 years, and nine to 10 percent of episodes involved beneficiaries older than 85 years. The proportion of episodes by age group was consistent throughout the expanded baseline period.

Beneficiary Race and Ethnicity

The distribution of episodes by beneficiary race/ethnicity was similar for OCM practices and comparison TINs (Appendix Exhibit A2-2). White, non-Hispanic beneficiaries made up more than 80 percent of the episode volume, Black, non-Hispanic beneficiaries accounted for approximately 10 percent of episodes, Hispanic beneficiaries accounted for approximately five percent of episodes, and approximately three percent of episodes were for all other ethnicities and races combined.

Beneficiary Gender

Female beneficiaries represented the majority of episodes for OCM practices and comparison TINs, although OCM practices had a slightly higher proportion (60.6 percent) relative to comparison TINs (57.6 percent) in the pooled baseline period (Exhibit 3-E5). The proportion of episodes for female beneficiaries was higher than the female representation in the broader Medicare FFS population, which was 53% in 2015.[27] The proportion of female episodes increased slightly over the expanded baseline period (one percentage point), which was consistent with a parallel increase in breast cancer episodes (Appendix Exhibit A2-2).

Exhibit 3-E5: Episode Volume Share by Beneficiary Characteristics in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	N	Percent of Episodes Among Females	Percent of Episodes Among Dual Eligibles
National	909,756	58.5%	14.1%
OCM	309,566	60.6%	11.8%
Comparison	259,432	57.6%	14.3%
NONC	340,758	57.2%	16.4%

Source: Episode characteristics file, 2014 – 2015.

Dual Eligibility

A small proportion of episodes were for beneficiaries eligible for both Medicare and Medicaid during the pooled baseline period. Twelve percent of OCM practice episodes and 14 percent of comparison TIN episodes were for Medicaid dual eligible beneficiaries (Exhibit 3-E5), which was lower than the proportion of dual eligible episodes among the NONC TINs (16 percent). The proportion of dual eligible

[27] Data provided by the Center for Medicare and Medicaid Services, CMS Program Statistics. Retrieved October 13, 2017 from https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/CMSProgramStatistics/.

beneficiary within our sample of episodes is also lower than the proportion observed in the broader Medicare FFS population (20 percent).[28] The proportion of episodes for dual eligible beneficiaries declined throughout the expanded baseline period by approximately two percentage points for both OCM and comparison groups (Appendix Exhibit A2-2).

Episode Volume by Health Status and Severity

We examined patterns in beneficiary health status for OCM practice episodes relative to comparison TIN episodes, using three measures of health status and severity: count of all chronic conditions, count of chronic conditions relevant for cancer care, and HCC score.

Chronic Conditions

The number of non-cancer chronic conditions was tallied for each beneficiary in each episode and averaged separately for the two groups (OCM practices and comparison TINs). On average, approximately four out of a maximum of 22 non-cancer chronic conditions were present for OCM practice and comparison TIN episodes during the pooled performance period (Exhibit 3-E6). There was no meaningful change in the average number of non-cancer chronic conditions over the expanded baseline period.

Relevant Chronic Conditions for Oncology Care

Clinical experts advised our evaluation team as to which specific chronic conditions are cancer-relevant. We counted the number of cancer-relevant chronic conditions, out of a maximum of seven, for each episode. On average, an episode had 0.7 of these cancer-relevant chronic conditions (Exhibit 3-E6). This cancer-relevant metric did not differ between OCM practice and comparison TIN episodes and was stable throughout the expanded baseline period.

HCC Score

A third way to quantify beneficiary comorbidity burden is the HCC risk score, which is used to predict plan payments for Medicare Advantage risk adjustment. HCC scores are based on beneficiary demographics and diagnostic history. HCC scores averaged just below 2 for OCM practices and comparison TINs and fluctuated slightly during the expanded baseline period (Exhibit 3-E6 and Exhibit 3-E7).[29]

---

[28] Data provided by the Center for Medicare and Medicaid Services press release, 2015 and Data Analysis Brief prepared by CMS Medicare-Medicaid Coordination Office. Retrieved September 5, 2017 from https://www.cms.gov/Newsroom/MediaReleaseDatabase/Press-releases/2015-Press-releases-items/2015-07-28.html and https://www.cms.gov/Medicare-Medicaid-Coordination/Medicare-and-Medicaid-Coordination/Medicare-Medicaid-Coordination-Office/Downloads/DualEnrollment_2006-2015.pdf.

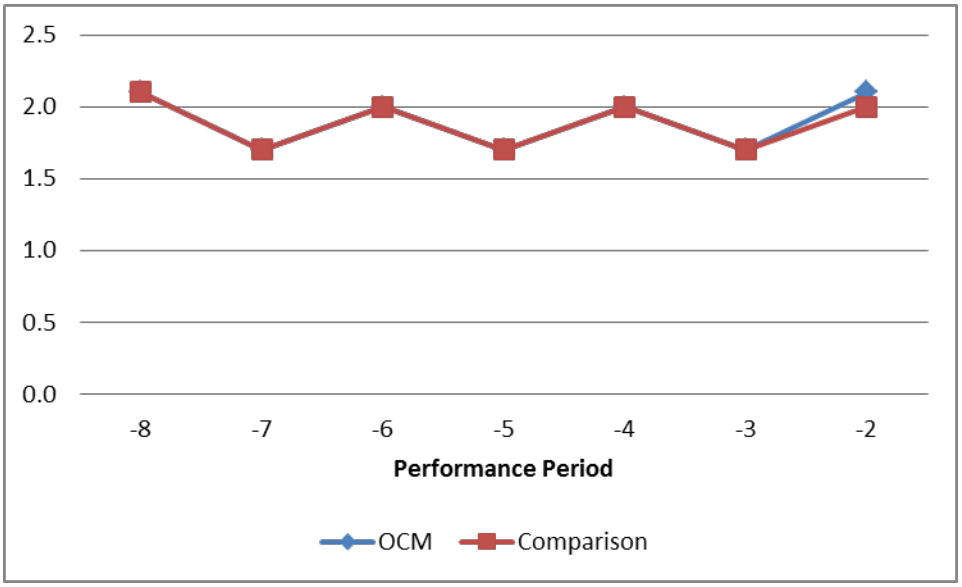
[29] The fluctuation in HCC scores in even and odd performance periods was due to the timing of the episode's start and end dates and the fact that episodes in the odd performance periods span two calendar years. Since the HCC score was assigned to the episode as of the start date, the episodes in the odd performance periods likely have an understated score because there was an additional lag in the diagnoses represented when the episode continued over to the following year.

Exhibit 3-E6: Measures of Beneficiary Health Status in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	Number of Non Cancer Chronic Conditions			Number of Chronic Conditions, as Specified by Evaluation Clinical Experts			HCC Score		
	N	Mean	Std Dev	N	Mean	Std Dev	N	Mean	Std Dev
National	909,756	4.16*	2.84	909,756	0.68	0.95	909,724	1.94*	1.53
OCM	309,566	4.14	2.86	309,566	0.68	0.95	309,554	1.96	1.54
Comparison	259,432	4.10*	2.81	259,432	0.66*	0.93	259,424	1.95*	1.53
NONC	340,758	4.22*	2.84	340,758	0.69*	0.96	340,746	1.91*	1.51

Source: Episode characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05.

Exhibit 3-E7: Trends in Average HCC Score in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note:** Parallel trends tests showed that these trends were statistically different.

3.1.2 Utilization, Cost and Quality Measures

It is important to understand trends in utilization, cost, and quality outcomes prior to the start of OCM, because practices will be rewarded based on ability to achieve cost savings while maintaining (or improving) quality of care, relative to baseline benchmarks. This report section explores episode-level outcomes for standardized costs of care by service setting, components of those costs, utilization, and quality during the baseline period.

Standardized Total Cost of Care

Medicare total payments per episode, referred to here as standardized total cost of care, are comprised of standardized Part A and Part B Medicare payments and Part D (non-standardized) Medicare payments. The non-standardized Part D payments include Low Income Cost Sharing (LICS), plus 80 percent of Gross Drug costs above the OOP threshold. The values reported have not been adjusted for inflation.

- In the pooled baseline period, average total episode cost of care (standardized Parts A and B, Part D) was approximately $27,400 for OCM practice episodes and $26,200 for comparison TIN episodes (Exhibit 3-E8). NONC episodes averaged slightly lower total costs of $24,300 per episode. Large extreme (outlier) values skewed the average total costs per episode, and median total costs per episode were $21,800 for OCM practices and $20,200 for comparison TINs (Appendix Exhibit A2-3).
- The primary drivers of total cost of care were chemotherapy costs, Part A costs, and other Part D costs. Part B and Part D chemotherapy costs made up 39 percent of total episode costs, other Part D drugs made up three percent, and inpatient costs made up 14 percent, during the pooled baseline period (Exhibit 3-E9).
- There were statistically significant differences in the average standardized Parts A and B costs per episode between OCM practices and comparison TINs across the expanded baseline period, although the magnitude of the differences was less than 0.5 percent of the OCM mean (Exhibit 3-E10). When including Part D expenditures in the total cost of care, there were similar patterns in the means between OCM, comparison, and NONC episodes. The deviations in trends in the average total cost of care (Parts A, B, and D) are statistically significant, but again, the magnitude of the differences is less than 0.5 percent of the OCM mean (Exhibit 3-E11).
- Although there was an increase in total cost of care (Parts A, B and D) for OCM practices and comparison TINs during the expanded baseline period, which may reflect inflation and an increase in episode costs, average standardized Part A and Part B costs were nearly flat. The increase in total cost of care was the result of an increase in Part D costs over the expanded baseline period (Exhibit 3-E12).

Exhibit 3-E8: Total Cost of Care per Episode in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	Standardized Part A & B Costs			Total Standardized Part A & B Costs, and Part D Costs		
	N	Mean	Std Dev	N	Mean	Std Dev
National	909,756	$21,635*	$23,998	909,756	$25,897*	$26,170
OCM	309,566	$23,138	$24,638	309,566	$27,386	$26,540
Comparison	259,432	$21,712*	$24,362	259,432	$26,234*	$26,578
NONC	340,758	$20,212*	$23,026	340,758	$24,289*	$25,418

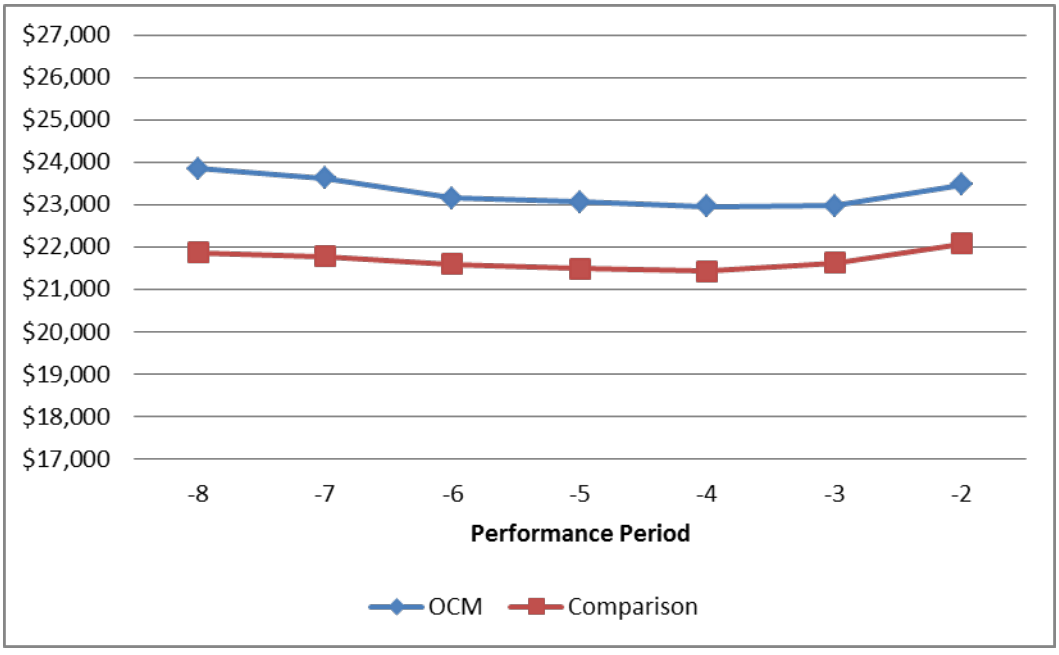
Source: Episode characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05. Part D costs include Low Income Cost Sharing (LICS), plus 80 percent of Gross Drug costs above the OOP threshold.

Exhibit 3-E9: Components of Total Cost of Care in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Cost Component	OCM Practices		Comparison TINs	
	n = 309,566		n = 259,432	
	Mean Costs	Proportion of TCOC	Mean Costs	Proportion of TCOC
Inpatient Costs	$3,850	14.1%	$3,568	13.6%
Part B Chemo Costs	$7,257	26.5%	$6,631	25.3%
Part D Chemo Costs	$3,441	12.6%	$3,631	13.8%
Cancer E&M Costs	$418	1.5%	$339	1.3%
All Other Part D Costs (non-chemo)	$807	2.9%	$892	3.4%
Non-inst. Part B Imaging	$600	2.2%	$442	1.7%
ED Discharges	$74	0.3%	$79	0.3%
All Other Part A and B	$10,938	39.9%	$10,652	40.6%
TCOC	$27,386	100%	$26,234	100%

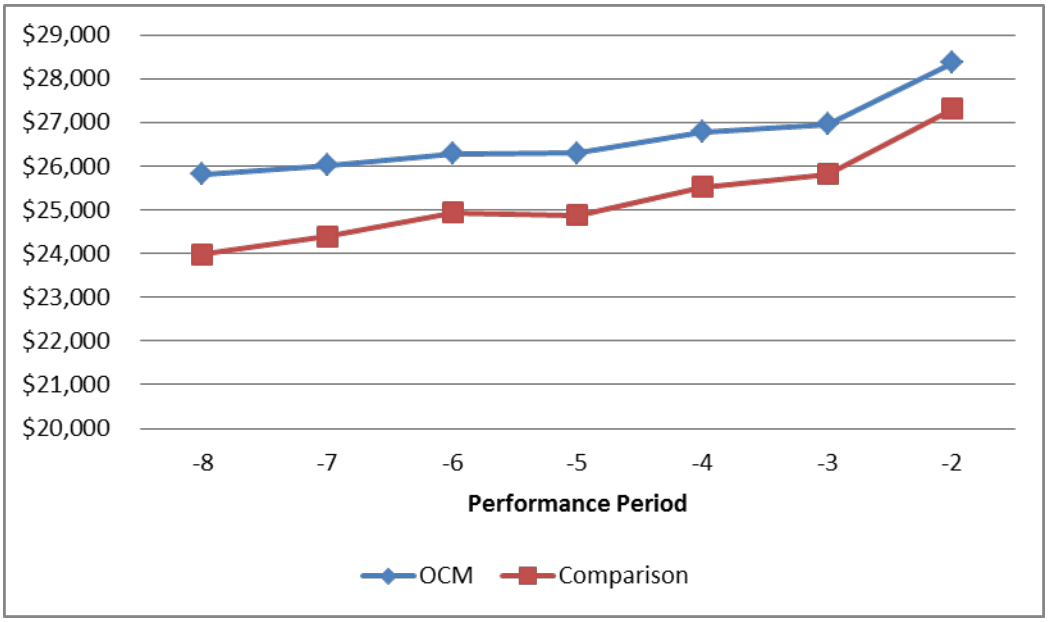
Source: Episode characteristics file, 2014 – 2015. Inpatient costs have not been restricted to episodes with at least one inpatient stay, thus will not match other estimates of inpatient costs within the report.

Exhibit 3-E10: Trends in Average Part A and B Cost of Care per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



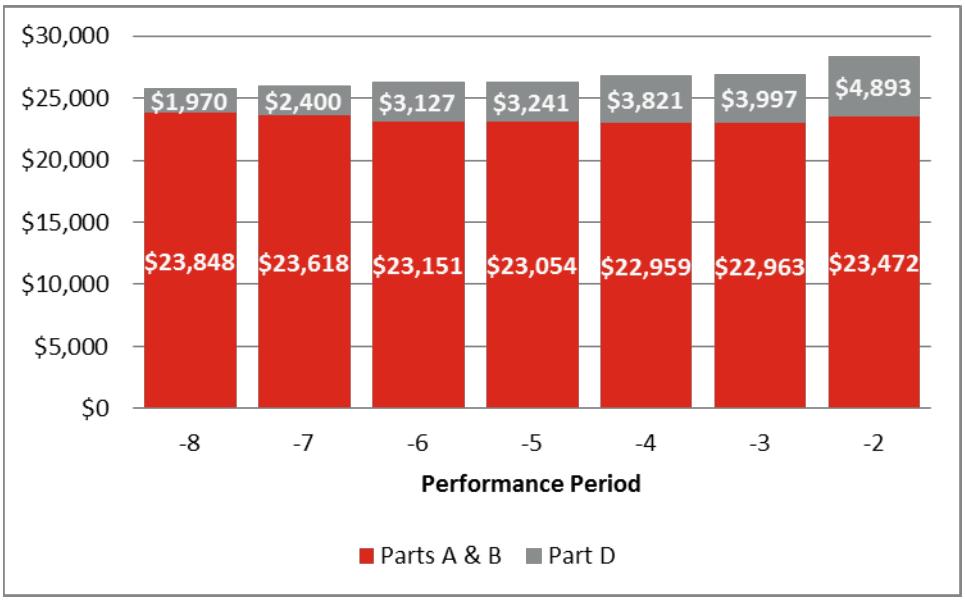
Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Exhibit 3-E11: Trends in Average Part A, B, and D Total Cost of Care per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Exhibit 3-E12: Distribution of Average Part A, B, and D Total Cost of Care per OCM Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015, sample limited to episodes attributed to OCM practices.

Beneficiary Cost Sharing[30]

- Average per episode beneficiary cost sharing (total standardized Part A and B, non-standardized Part D) was higher for OCM practices than for comparison TINs. Beneficiary cost sharing averaged $5,700 per episode for OCM practices and $5,400 per episode for comparison TINs in the pooled baseline period. The average beneficiary cost sharing for both OCM practices and comparison TINs was higher than that of NONC TINs, which averaged $5,100 (Exhibit 3-E13).
- Standardized Part B beneficiary costs made up the majority of beneficiary cost sharing and also the growth in average cost sharing. Standardized Part A beneficiary costs averaged $540 per episode, standardized Part B cost sharing averaged $4,500 per episode, and Part D cost sharing[31] averaged $550 per episode.
- There were statistically significant differences between OCM practices and comparison TINs in the trends for average overall beneficiary cost sharing and standardized Part B beneficiary cost sharing (Exhibits 3-E14 and 3-E15), however the magnitude of the deviations was less than one percent of the OCM mean.

Differences between OCM practices and comparison TINs in average beneficiary cost sharing may be due to cancer mix or severity of the episodes, and are examined in the subgroup analyses in Section 3.4.

Exhibit 3-E13: Beneficiary Cost Sharing per Episode in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

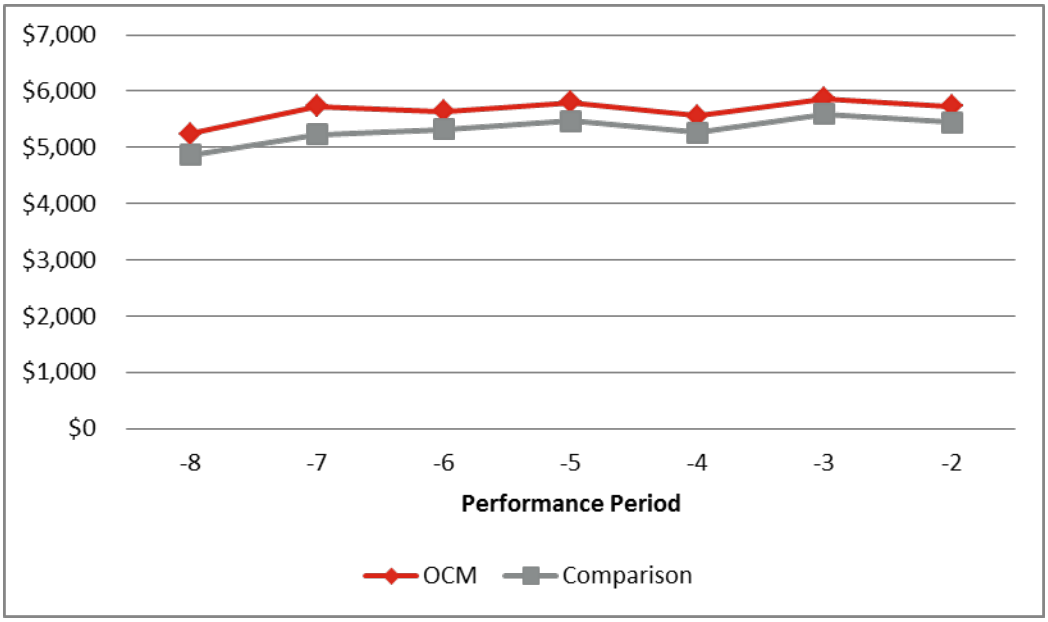
Practice/ TIN Type	Standardized Part A & B and Part D Beneficiary Cost Sharing			Standardized Part A Beneficiary Cost Sharing			Standardized Part B Beneficiary Cost Sharing			Part D Beneficiary Cost Sharing (for episodes with Part D coverage)		
	N	Mean	Std Dev	N	Mean	Std Dev	N	Mean	Std Dev	N[a]	Mean	Std Dev
National	909,756	$5,419*	$5,594	909,756	$541*	$1,468	909,756	$4,426*	$5,171	746,114	$550*	$1,072
OCM	309,566	$5,718	$5,636	309,566	$550	$1,461	309,566	$4,697	$5,237	251,584	$580	$1,095
Comparison	259,432	$5,435*	$5,598	259,432	$533*	$1,445	259,432	$4,431*	$5,185	212,876	$574	$1,106
NONC	340,758	$5,134*	$5,539	340,758	$539*	$1,492	340,758	$4,177*	$5,086	281,654	$506*	$1,022

Source: Episode characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05. [a] Denominator represents the number of episodes for beneficiaries with Part D coverage.

[30] Part D beneficiary cost sharing was calculated as the sum of patient pay amount and other True Out-of-Pocket (TrOOP) amount (amounts paid that count toward the drug plan's out-of-pocket threshold).

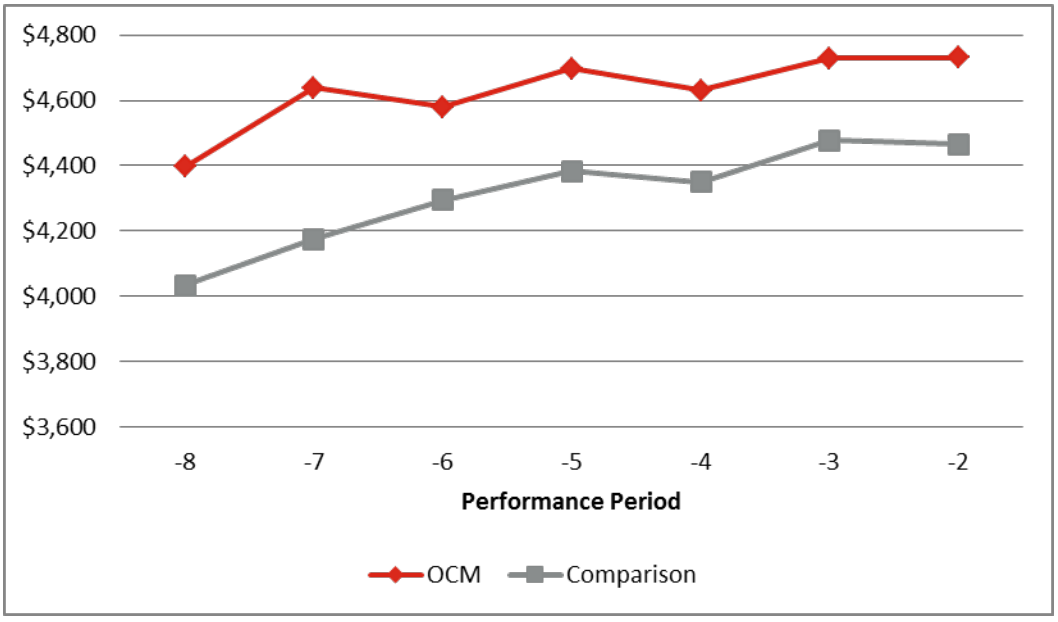
[31] Part D cost sharing averages are based on episodes for beneficiaries enrolled in Part D for at least one month during the episode.

Exhibit 3-E14: Trends in Average Beneficiary Cost Sharing per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Exhibit 3-E15: Trends in Average Part B Beneficiary Cost Sharing per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Chemotherapy Services and Costs per Episode

Part B and Part D Chemotherapy Services per Episode

Chemotherapy intensity was measured as the number of Part B and Part D chemotherapy services per episode. We report services instead of visits because a beneficiary can have multiple chemotherapy treatments during the same visit, on the same day and same claim. A Part D service is defined as a prescription drug event (PDE) and reflects a prescription filled by a beneficiary at a pharmacy, covered under the Part D benefit.

- In the pooled baseline period, OCM practices had an average of 7.9 Part B and Part D chemotherapy services per episode compared to 7.5 services for comparison TINs (Exhibit 3-E16). The differences between OCM practices and comparison TINs in the average number of chemotherapy services per episode were driven by outliers among the OCM practices, and median values were the same for the two groups. Trends for OCM practices and comparison TINs were statistically different across the expanded baseline period, although deviations in the trend represented less than one percent of the OCM mean (Exhibit 3-E17).
- Most chemotherapy services observed in claims were Part B (i.e., administered in physician practice settings). OCM practice episodes averaged 6.6 Part B chemotherapy services relative to 6.2 services for comparison TINs (Exhibit 3-E16), which additional analysis indicates was again due to outliers among the OCM practices. The differences in trends in Part B chemotherapy services between OCM practices and comparison TINs were statistically significant, but again, the magnitude of difference was only about one percent of the OCM mean (Exhibit 3-E18). Potential drivers of the differences in the number of Part B chemotherapy services between OCM practices and comparison TINs, including beneficiary demographics and cancer bundle mix, are explored in the subgroup analyses in Section 3.4.
- Among episodes for beneficiaries enrolled in Part D, the average number of Part D chemotherapy services[32] per episode was similar for OCM practices and comparison TINs (Exhibit 3-E16).

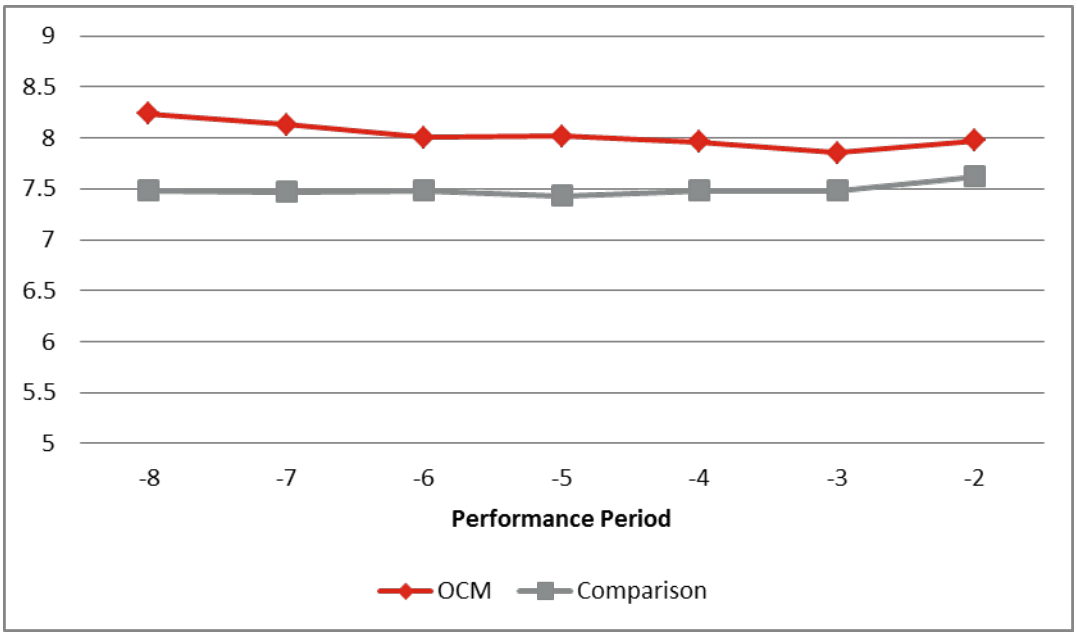
Exhibit 3-E16: Part B and D Chemotherapy Utilization per Episode in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	Number of Part B and D Chemo Services			Number of Part B Chemo Services			Number of Part D Chemo Services (among episodes with Part D coverage)[a]		
	N	Mean	Std Dev	N	Mean	Std Dev	N	Mean	Std Dev
National	909,756	7.54*	8.73	909,756	6.19*	9.15	746,114	1.65*	2.21
OCM	309,566	7.93	8.98	309,566	6.62	9.44	251,584	1.61	2.16
Comparison	259,432	7.53*	8.61	259,432	6.16*	9.05	212,876	1.67*	2.21
NONC	340,758	7.19*	8.58	340,758	5.81*	8.95	281,654	1.68*	2.25

Source: Episode characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05. [a] Denominator represents the number of episodes for beneficiaries with Part D coverage.

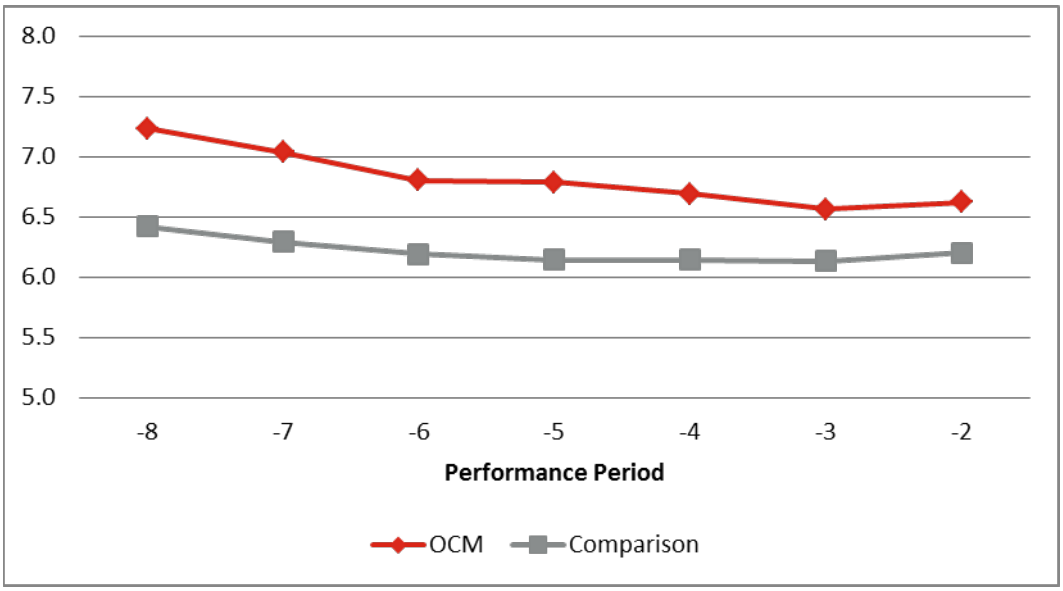
[32] Part D chemotherapy services were adjusted for days' supply (30 day equivalents).

Exhibit 3-E17: Trends in Average Part B & Part D Chemotherapy Utilization per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Exhibit 3-E18: Trends in Average Part B Chemotherapy Utilization per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Part B and Part D Chemotherapy Costs per Episode

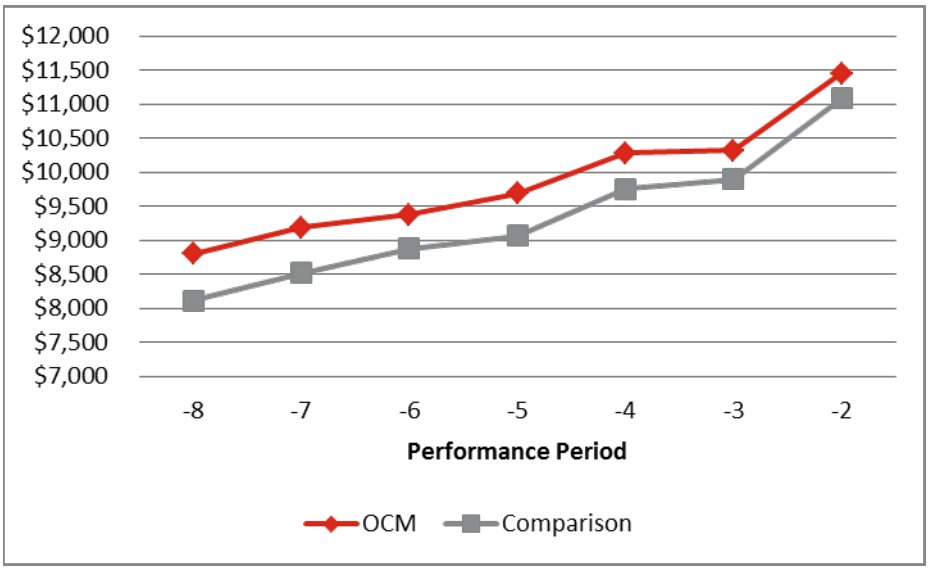
- Part B and Part D chemotherapy costs per episode had high variance and were heavily skewed. This was a result of a broad distribution in chemotherapy costs, due to differences in treatment patterns by cancer bundle, which is discussed further in Section 3.4.1. The average chemotherapy cost (Part B and Part D combined) for OCM practice episodes was $10,700, while the average for comparison TIN episodes was $10,300 (Exhibit 3-E19). Median values were about $1,240 for OCM practices and about $1,070 for comparison TINs in the pooled baseline period.
- Examining Part B and Part D average and median expenditures over the expanded baseline period reveals divergent trends. Average per episode Part B and Part D costs increased over the expanded baseline period (Exhibit 3-E20), while median values decreased (Appendix Exhibit A2-4). Differences between OCM practices and comparison TINs in average per episode Part B and Part D chemotherapy costs were statistically significant over the expanded baseline period, although the magnitude of the difference was less than 0.5 percent of the OCM mean.

Exhibit 3-E19: Part B and Part D Chemotherapy Costs per Episode in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	Part B and D Chemotherapy Costs			
	N	Mean	Median	Std Dev
National	909,756	$9,931*	$1,049	$16,492
OCM	309,566	$10,698	$1,235	$16,864
Comparison	259,432	$10,262*	$1,068	$16,867
NONC	340,758	$8,981*	$943	$15,802

Source: Episode characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05.

Exhibit 3-E20: Trends in Average Part B and Part D Chemotherapy Costs per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Cancer-Related Evaluation & Management (Cancer E&M) Services and Associated Costs

Cancer E&M Utilization per Episode

Throughout the expanded baseline period, OCM practice episodes averaged a slightly higher number of cancer E&M services than episodes for comparison TINs:

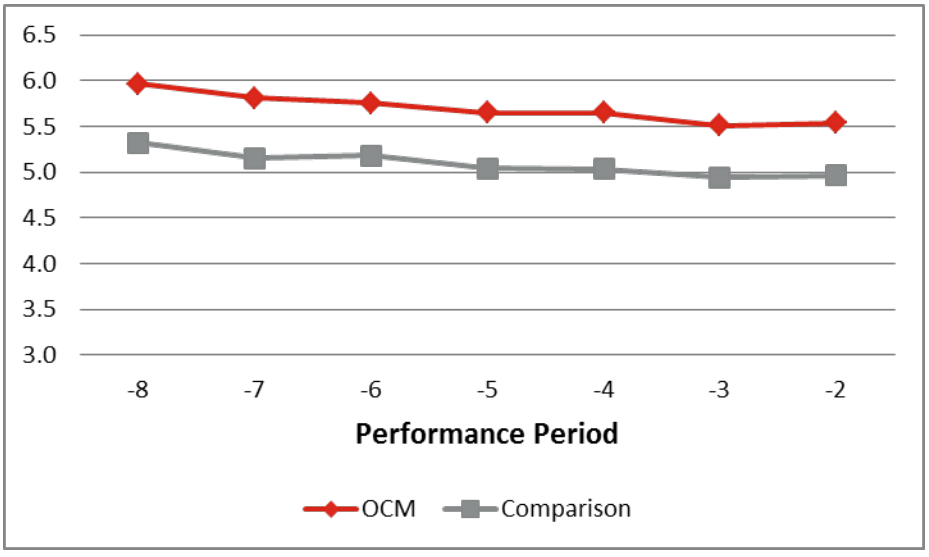
- The average number of cancer E&M services was 5.6 for OCM practice episodes, and 5.0 for comparison TIN episodes (Exhibit 3-E21). This difference, although statistically significant, was driven primarily by outliers in the OCM group; the median number of E&M visits was four for episodes in both OCM practices and comparison TINs.
- OCM practices and comparison TINs differed significantly over the expanded baseline period, in the average number of cancer E&M services per episode (Exhibit 3-E22), however, the magnitude of these deviations represents less than 0.25 percent of the OCM mean and we judge that the difference is not meaningful.

Exhibit 3-E21: Cancer-Related E&M Services per Episode in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	Number of Cancer-Related E&M Services			Cancer-Related E&M Costs		
	N	Mean	Std Dev	N	Mean	Std Dev
National	909,756	5.14*	4.74	909,756	$366*	$365
OCM	309,566	5.56	4.89	309,566	$418	$394
Comparison	259,432	4.98*	4.40	259,432	$339*	$327
NONC	340,758	4.87*	4.82	340,758	$340*	$359

Source: Episode characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05.

Exhibit 3-E22: Trends in Average Cancer-Related E&M Services per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)

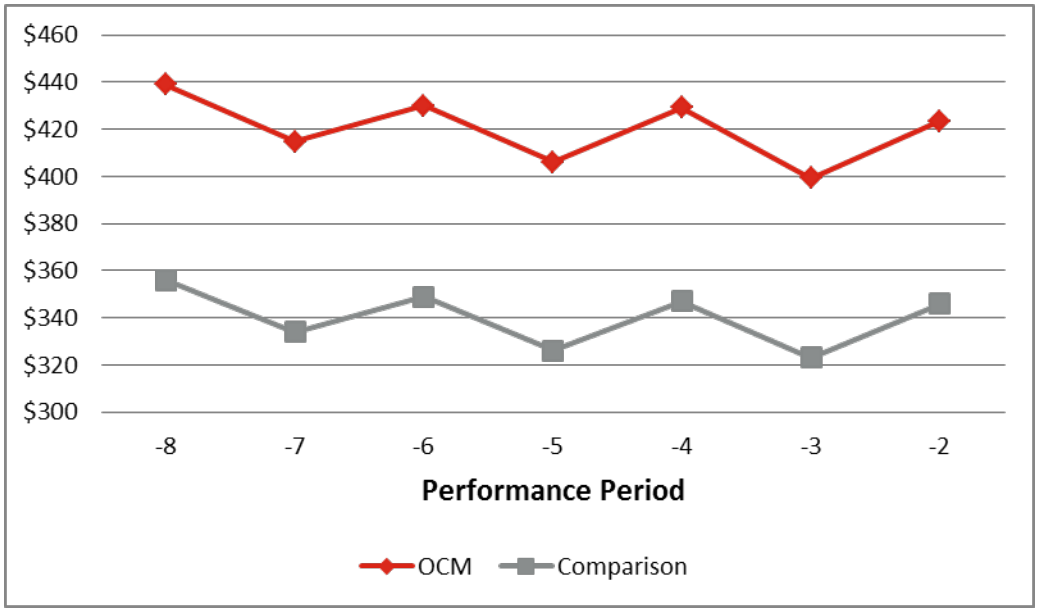


Source: Episode characteristics file, 2012 – 2015. **Notes**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Cancer E&M Service Costs per Episode

- The average per episode Medicare cost for cancer E&M services was higher for OCM practices than for comparison TINs, which is consistent with the higher average number of services per episode among OCM practices. Episodes at OCM practices had an average cancer E&M service cost of $418 compared to $339 for episodes at comparison TINs (Exhibit 3-E21).
- Although differences in the trends of average cancer E&M service costs per episode between OCM practices and comparison TINs were statistically significant (Exhibit 3-E23), the differences are not meaningful as the magnitude of the differences is less than 0.25 percent of the OCM mean.
- There was some variation in cancer E&M costs by cancer bundle, reflecting different numbers of services for various cancer bundles. This is explored further in the subgroup analyses in Section 3.4.1.

Exhibit 3-E23: Trends in Average Cancer E&M Costs per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Hospital, Outpatient and Post-Acute Care Utilization and Costs

In addition to chemotherapy treatments and cancer E&M services, there were a number of other major components of care contributing to episode utilization and cost. The following section explores hospital inpatient and ED utilization, use of skilled nursing facilities and home health services, and use of ancillary services such as imaging. Variation in utilization patterns may be related to cancer care management and coordination, and may also be drivers of episode outcomes.

Inpatient Utilization

Although inpatient admissions were relatively infrequent, OCM practice episodes had higher rates of inpatient admissions than did comparison TIN episodes during the pooled baseline period, and inpatient utilization varied by cancer bundle (Appendix Exhibits A2-5 through A2-8).

- OCM practice episodes had a slightly higher average number of inpatient admissions (0.41 per episode) compared to comparison TIN episodes (0.38 per episode) in the pooled baseline period (Exhibit 3-E24). The distribution of inpatient admissions was skewed. For example, only 26 percent of OCM practice episodes and 25 percent of comparison TIN episodes had at least one inpatient stay during an episode.[33]
- The average number of inpatient admissions per episode decreased over the expanded baseline period among both OCM practices and comparison TINs. Differences in trends for inpatient admissions were not statistically significant between OCM practices and comparison TINs.
- The average length of stay for inpatient admissions was approximately eight days (Exhibit 3-E24). Over the expanded baseline period, the differences in trends in length of stay between OCM practices and comparison TINs were statistically significant (Exhibit 3-E25), but were not meaningful as they represented less than 0.5 percent of the OCM mean.

OCM practices also had a slightly higher rate of readmissions per episode[34] and ICU admissions per episode, than did comparison TINs (Exhibit 3-E24). Both readmissions and ICU use are conditional on first having an inpatient admission.

- Among episodes with at least one inpatient admission, the average number of 30-day readmissions per episode was 0.41 for OCM practices and 0.39 readmissions for comparison TINs (Exhibit 3-E24). There were statistically significant differences in the trends of readmissions between OCM practices and comparison TINs, although the differences are not meaningful as the magnitude of the deviation was less than one percent of the OCM mean (Exhibit 3-E26).
- Among episodes with at least one inpatient admission, there were an average of 0.23 ICU admissions per episode for OCM practices and 0.21 ICU admissions per episode for comparison TINs (Exhibit 3-E24). ICU use was stable throughout the expanded baseline period and trends for the two groups were statistically parallel.

[33] Distribution of values are not shown, but the values mentioned can be calculated from the sample sized provided in Exhibit 3-E24.

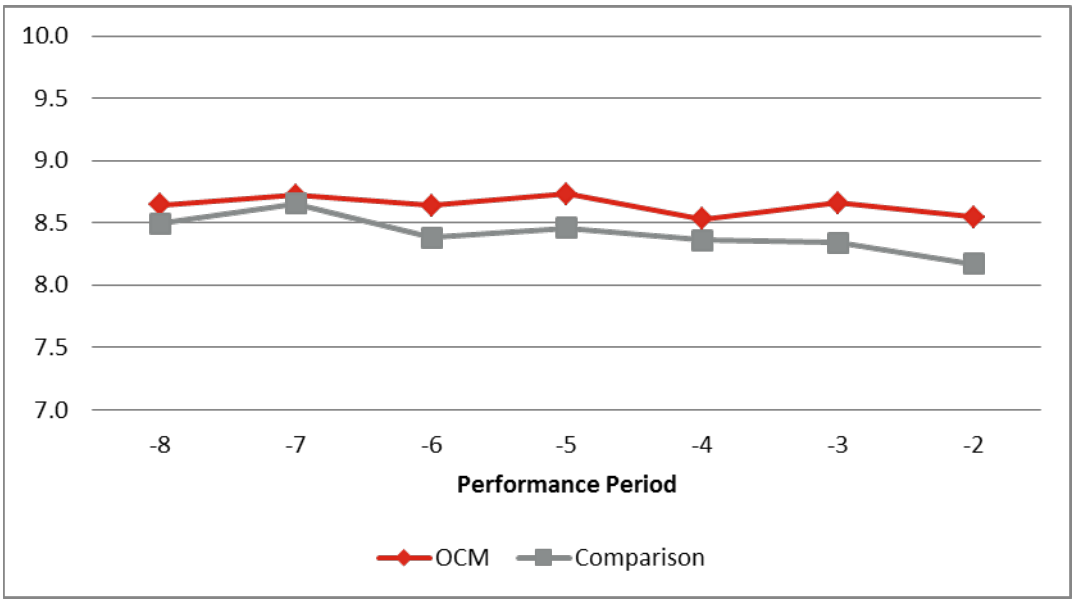
[34] The readmissions measure includes all readmissions, not just unplanned readmissions.

Exhibit 3-E24: Inpatient Admissions, Length of Stay, 30-Day Hospital Readmissions, and Intensive Care Unit Admissions per Episode in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	Number Inpatient Admissions			Number of Inpatient Days (among episodes with 1+ admission)			Number of 30-Day Hospital Readmissions (among episodes with 1+ admission)			Number of Intensive Care Unit Admissions (among episodes with 1+ admission)		
	N	Mean	Std Dev	N[a]	Mean	Std Dev	N[a]	Mean	Std Dev	N[a]	Mean	Std Dev
National	909,756	0.39*	0.82	229,859	8.40*	8.63	229,859	0.40*	0.82	229,859	0.22*	0.49
OCM	309,566	0.41	0.84	81,974	8.58	8.76	81,974	0.41	0.84	81,974	0.23	0.50
Comparison	259,432	0.38*	0.81	64,532	8.29*	8.59	64,532	0.39*	0.82	64,532	0.21*	0.47
NONC	340,758	0.37*	0.80	83,353	8.30*	8.54	83,353	0.39*	0.81	83,353	0.21*	0.48

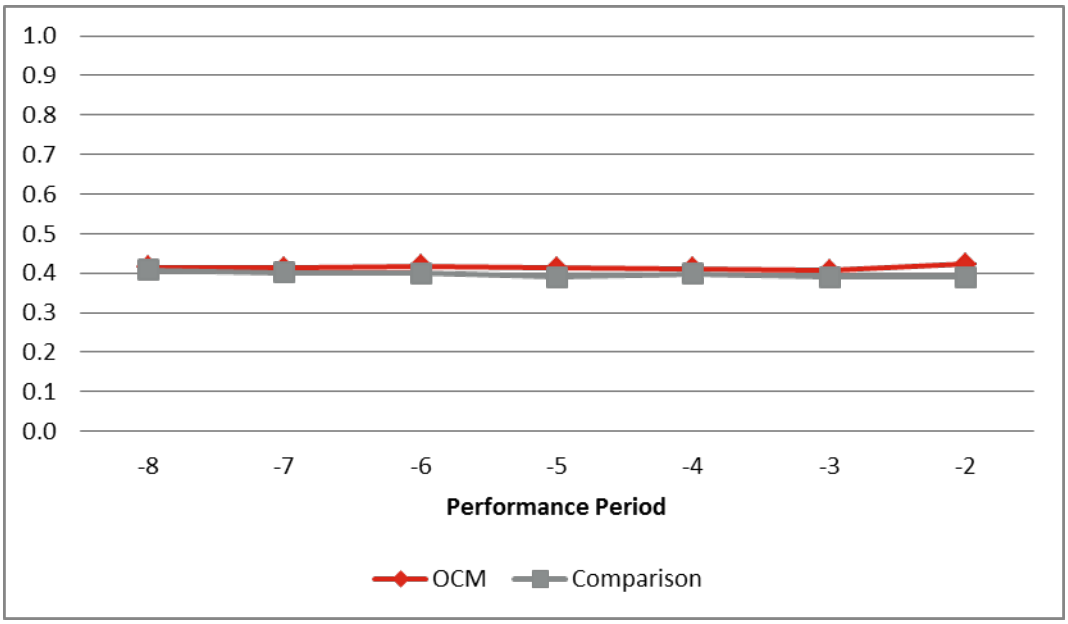
Source: Episode characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05. [a] Denominator represents the number of episodes with at least one inpatient admission.

Exhibit 3-E25: Trends in Average Number of Inpatient Days for Episodes with 1+ Inpatient Stay, in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. Sample based on episodes with at least one inpatient admission.
Note: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Exhibit 3-E26: Trends in Average Number of 30-Day Hospital Readmissions for Episodes with 1+ Inpatient Stay, in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. Sample based on episodes with at least one inpatient admission.
Note: Parallel trends tests showed that these trends were statistically different.

Inpatient Costs

Utilization patterns contributed to differences in average cost per episode for inpatient hospital utilization among OCM practices and comparison TINs.

- Average Part A costs per episode were slightly higher for OCM practices ($13,700) than for comparison TINs ($13,400; Exhibit 3-E27), which is consistent with the slightly higher number of inpatient admissions per episode among OCM practices (Exhibit 3-E24). Trends in Part A inpatient costs were parallel, with no statistically significant differences in trends between OCM practices and comparison TINs.
- Costs related to 30-day readmissions[35] were similar between OCM practices and comparison TINs in the pooled baseline period (Exhibit 3-E27). Trends in readmission costs between OCM practices and comparison TINs were also statistically parallel during the expanded baseline period.
- Average per episode costs for Part A inpatient admissions and for 30-day readmissions varied by cancer bundle. Lymphoma and leukemia episodes had higher than average Part A admission and readmission costs, while breast and prostate cancer episodes had lower admission costs, during the pooled baseline period (Appendix Exhibits A2-9 and A2-10).

Exhibit 3-E27: Part A Inpatient Costs per Episode in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	Part A Inpatient Costs (among episodes with 1+ admission)			Part A Costs for 30-Day Readmissions (among episodes with 1+ readmission)[a]		
	N[b]	Mean	Std Dev	N[c]	Mean	Std Dev
National	229,859	$13,419*	$14,499	62,181	$15,593	$17,095
OCM	81,974	$13,656	$14,778	22,730	$15,714	$17,598
Comparison	64,532	$13,439*	$14,778	17,204	$15,613	$17,249
NONC	83,353	$13,171*	$13,991	22,247	$15,452	$16,441

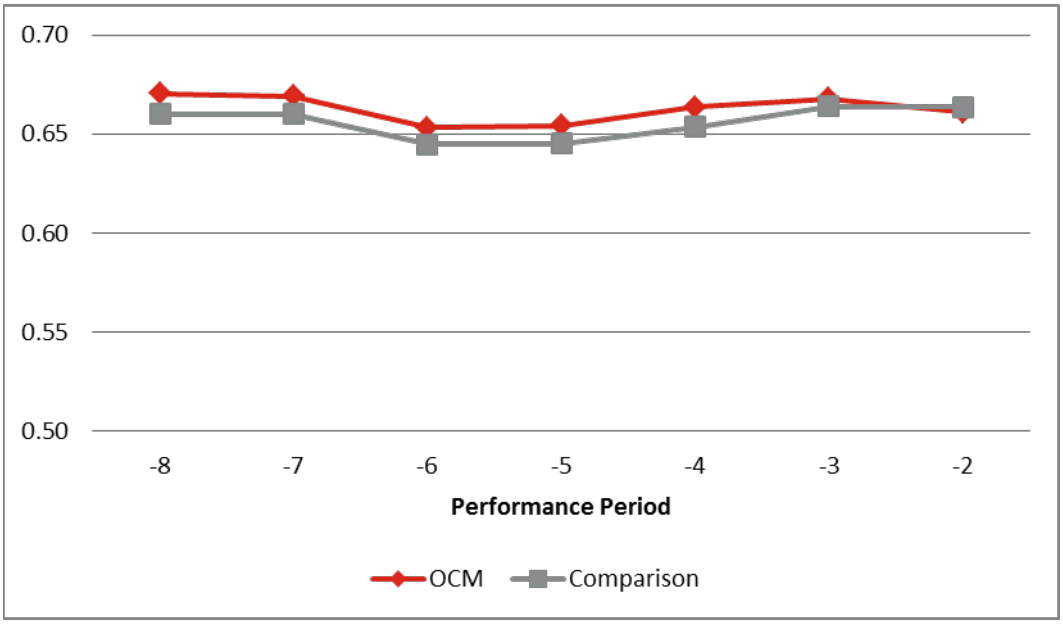
Source: Episode characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05. [a] 2015 readmission costs were not standardized. [b] Denominator represents the number of episodes with at least one inpatient admission. [c] Denominator represents the number of episodes with at least one 30-day readmission.

[35] As with the mean count of readmissions, costs for readmissions include all readmission, not just unplanned readmissions.

Emergency Department Utilization and Related Costs

- Thirty-six percent of episodes had at least one ED visit in the pooled baseline period and the average number of ED visits per episode was 0.66. The rate was the same for OCM practices and comparison TINs. The differences between OCM practice and comparison TIN trends in the average number of ED visits per episode were statistically significant during the expanded baseline period, although the differences do not appear to be meaningful (Exhibit 3-E28).
- The average number of ED visits resulting in an inpatient admission ranged from 0.28 to 0.31 visits per episode, and the average number of ED visits not resulting in an inpatient admission ranged from 0.35 to 0.38.
- Average Medicare episode cost for ED visits that did not result in an admission (among episodes with at least one ED visit not resulting in an inpatient admission) was $310 for both OCM practices and comparison TINs during the pooled baseline period.[36] The average episode cost of ED visits increased throughout the expanded baseline period, but the differences in trends between OCM practices and comparison TINs were not statistically different.

Exhibit 3-E28: Trends in Average Number of ED Visits per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Notes**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

[36] Average costs were calculated based on episodes with at least one ED visit not resulting in an inpatient stay.

Skilled Nursing Facility (SNF) Utilization

Medicare reimburses SNFs for care following a hospital inpatient stay of at least three days within the prior 60 days, and the use of the Medicare SNF benefit is therefore conditional on first having a three-day hospital admission.

- A small proportion of OCM practice and comparison TIN episodes, five percent, had at least one skilled nursing facility (SNF) stay.[37] The average number of SNF stays ranged from 0.6 to 0.7 stays per episode (Exhibit 3-E29). Among episodes with at least one SNF stay, the average number of Medicare-covered SNF days (LOS) was 29 days for both the OCM practices and comparison TINs.
- There were statistically significant differences in trends in the number of SNF stays per episode between OCM practices and comparison TINs, although the magnitude of the deviations was less than one percent and the trends were stable throughout the expanded baseline period (Exhibit 3-E30).
- There was variation in the average number of SNF stays and average LOS per episode, by cancer bundle, discussed in Section 3.4.1.

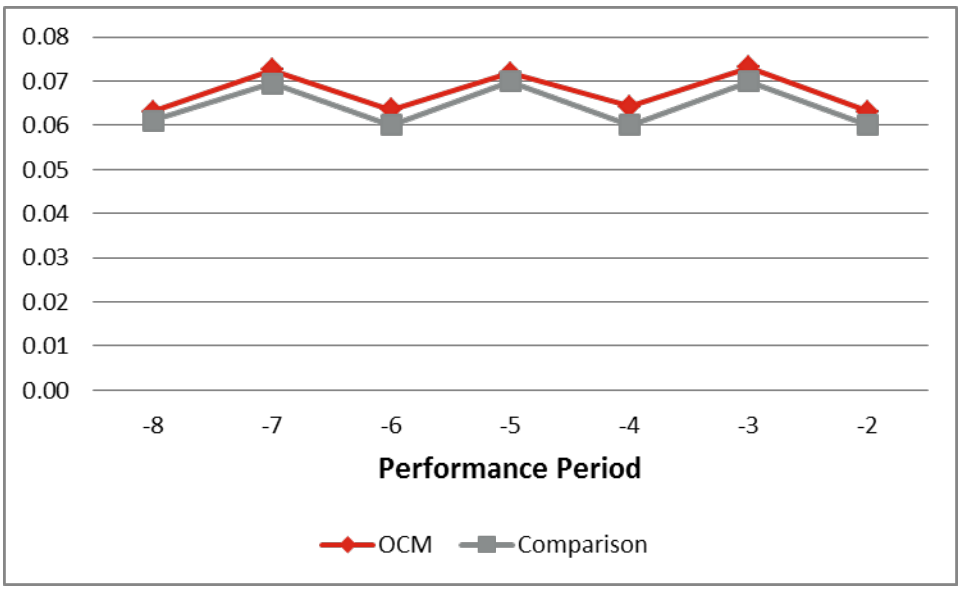
Exhibit 3-E29: Skilled Nursing Facility Utilization per Episode in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	Number of Skilled Nursing Facility Stays			Number of Skilled Nursing Facility Days (among episodes with 1+ SNF stay)[a]		
	N	Mean	Std Dev	N	Mean	Std Dev
National	909,756	0.07	0.32	46,565	29.79*	31.81
OCM	309,566	0.07	0.32	15,943	28.91	29.25
Comparison	259,432	0.06*	0.30	12,395	29.54	33.23
NONC	340,758	0.07*	0.33	18,227	30.73*	32.92

Source: Episode characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05. [a] Denominator represents the number of episodes with at least one Medicare-covered SNF day.

[37] Data is not shown, but values can be calculated from the sample sizes noted in Exhibit 3-E29.

Exhibit 3-E30: Trends in Average Number of SNF Stays per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note:** Parallel trends tests showed that these trends were statistically different.

Home Health Agency (HHA) Services

HHAs provide or arrange for services including skilled nursing, medical social work, physical therapy, occupational therapy, and home health aides. Seventeen percent to 18 percent of OCM and comparison episodes included Medicare-covered HHA services (Appendix Exhibit A2-11) during the pooled baseline period. Use of HHA services varied by cancer type and was much higher for certain cancer bundles. For example, over 35 percent of head and neck cancer episodes included the use of HHA services. There were no significant trends in use of HHA services throughout the expanded baseline period and no differences between OCM practices and comparison TINs.

Other Therapies and Services

Radiation Therapy

Radiation therapy was used in approximately 16 percent of episodes in the pooled baseline period. Among episodes with at least one radiation visit, OCM practices and comparison TINs averaged 19 radiation therapy visits per episode. Like home health services, use of radiation therapy was much higher for certain cancer bundles than for others, discussed further in Section 3.4. There were no substantial changes in use of radiation therapy or intensity of use during the expanded baseline period, and no meaningful differences in trends between OCM practices and comparison TINs.

Standard and Advanced Imaging

- The majority of episodes (over 85 percent) involved at least one imaging visit, in both OCM practices and comparison TINs (Exhibit 3-E31). There were 2.8 to 2.9 standard imaging visits and 3.9 to 4.2 advanced imaging visits per episode. Use of imaging services was stable throughout the baseline period.

- Average Part B non-institutional[38] costs for imaging were $690 per episode among OCM practices and $510 per episode among comparison TINs (Exhibit 3-E31). Trends in the average cost of standard and advanced imaging per episode for OCM practices and comparison TINs were statistically parallel across the expanded baseline period.
- There was some variation in use of imaging, and type of imaging, by cancer bundle, likely due to cancer treatment regimens. Detailed findings regarding imaging use by cancer bundle can be found in Appendix Exhibits A2-12, A2-13 and A2-14.

Outpatient Therapy

Outpatient therapy includes physical therapy, occupational therapy, and nutritional therapy. Only one percent of episodes used outpatient therapy services in the pooled baseline period (Appendix Exhibit A2-15). The proportion of episodes that included outpatient therapy services was consistently low across cancer bundles (one percent of episodes). Among the few episodes that did include outpatient therapy, the average number of visits ranged from nine to 11 visits in the baseline period. There were no significant changes in utilization of outpatient services or intensity of services throughout the expanded baseline period, and no differences between OCM practices and comparison TINs.

Part B and Part D Drug Utilization

We examined monthly patterns in the use of both Part B and Part D drugs during an episode.

- OCM practice episodes had a higher average monthly combined number of Part B and D drug services[39] (4.88) relative to comparison TINs (4.20) and the difference was statistically significant. OCM practices' episodes averaged 2.17 Part B drug services each month, and comparison TIN episodes had 1.31 Part B drug services each month (Exhibit 3-E32). The majority of the drug services were under Part D, and OCM practice episodes averaged 4.17 Part D drug services [40] while comparison TIN episodes averaged 4.23 Part D drug services.[41]
- For all three measures (monthly Part B and D drug services, Part B drug services, and Part D drug services), differences in the trends for OCM practices and comparison TINs were statistically significant (Exhibits 3-E33, -E34 and -E35). However, the magnitude of the differences in the trends for Part B and D drug services, and for Part D drug services, was less than one percent of the OCM mean and not meaningful. For Part B drug services, the magnitude of the deviation was about 1.6 percent of the OCM mean.

---

[38] Imaging payments include average non-institutional payments for standard and advanced imaging. Institutional imaging payments were not available for the baseline analyses.

[39] For Part B, we computed the number of claim lines for drugs, and for Part D the number of prescription drug events (PDEs); for Part D, we also computed the total 30-day equivalents, calculated as the number of days supplied, divided by 30.

[40] Note, we cannot observe prescriptions for oral medications that were filled by patients without Part D coverage.

[41] Unique Part D prescriptions were identified and standardized using 30-day equivalents. In future reports we will address 30 day equivalent supplies of drugs, in addition to the number of prescriptions filled.

Exhibit 3-E31: Use of Standard and Advanced Imaging per Episode in the Pooled Baseline Period (Jan. 2014 – Jun. 2015)

Practice/ TIN Type	Proportion of Episodes with at Least One Imaging Visit		Number of Standard Imaging Visits (among episodes with 1+ imaging visit)			Number of Advanced Imaging Visits (among episodes with 1+ imaging visit)			Costs for All Imaging Visits (among episodes with 1+ imaging visit)		
	N	%	N	Mean	Std Dev	N	Mean	Std Dev	N[a]	Mean	Std Dev
National	909,756	85.1%	773,846	2.83*	3.62	773,846	3.96*	6.45	773,846	$585*	$1,278
OCM	309,566	86.4%	267,568	2.86	3.66	267,568	4.17	6.44	267,568	$689	$1,408
Comparison	259,432	85.3%	221,304	2.81*	3.63	221,304	3.90*	6.05	221,304	$512*	$1,191
NONC	340,758	83.6%	284,974	2.83*	3.57	284,974	3.81*	6.75	284,974	$544*	$1,208

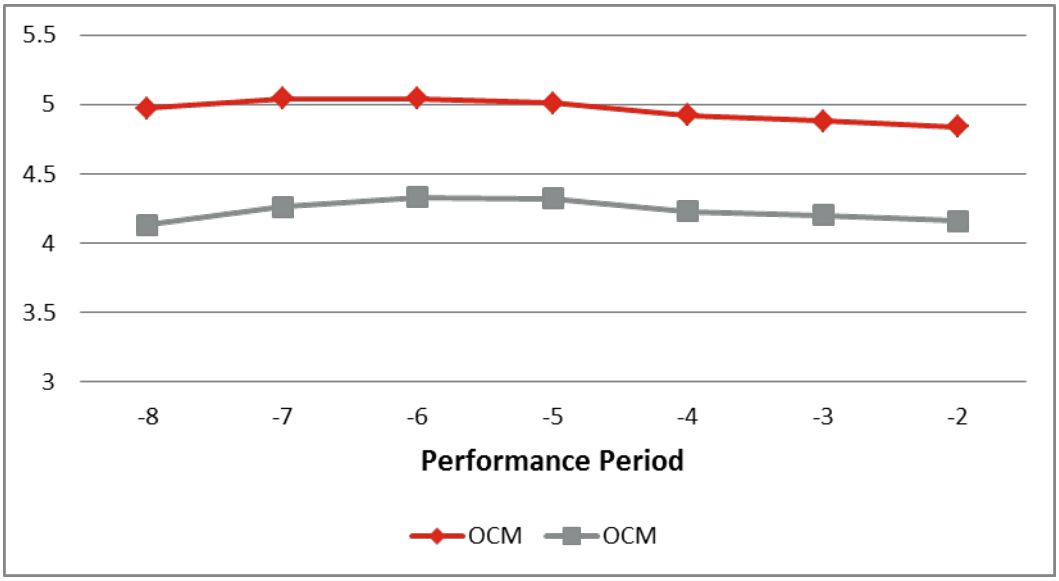
Source: Episode characteristics file. * Denotes a statistically significant difference from OCM practice point estimates at 0.05. [a] Denominator represents the number of episodes with at least one imaging visit.

Exhibit 3-E32: Part B and D Drug Services Each Month per Episode in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	Number of Part B and D Drug Services per Month			Number of Part B Drug Services per Month			Number of Part D Drug Services per Month (among episodes enrolled in Part D)		
	N	Mean	Std Dev	N	Mean	Std Dev	N	Mean	Std Dev
National	909,756	4.49*	4.22	909,756	1.66*	3.32	746,114	4.24*	2.72
OCM	309,566	4.88	4.32	309,566	2.17	3.57	251,584	4.17	2.67
Comparison	259,432	4.20*	3.98	259,432	1.31*	2.96	212,876	4.23*	2.72
NONC	340,758	4.35*	4.29	340,758	1.47*	3.30	281,654	4.30*	2.77

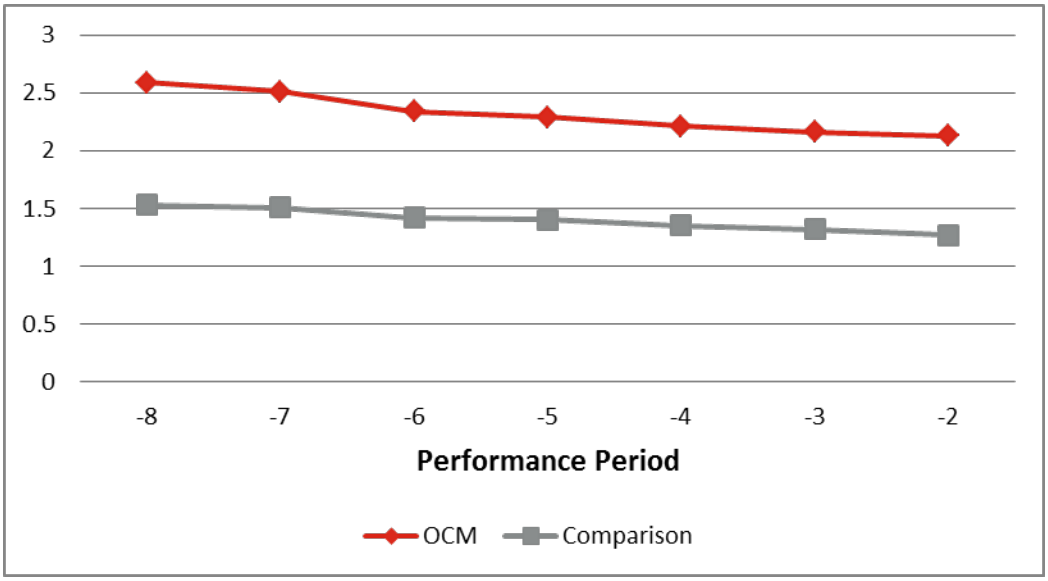
Source: Episode characteristics file. * Denotes a statistically significant difference from OCM practice point estimates at 0.05.

Exhibit 3-E33: Average Part B and D Drug Services Each Month per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



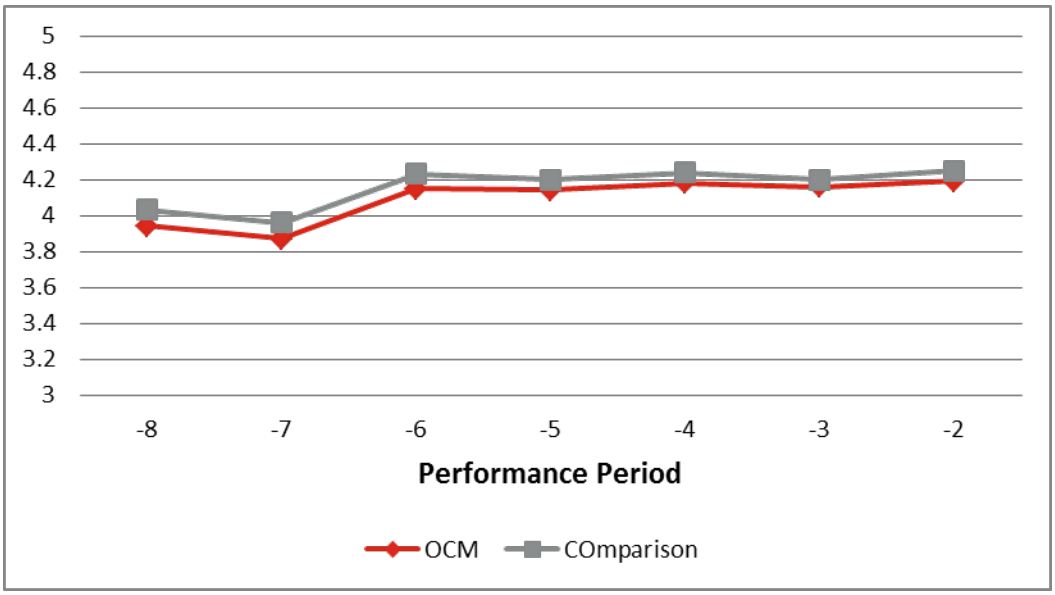
Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Exhibit 3-E34: Average Part B Drug Services Each Month per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Exhibit 3-E35: Average Part D Drug Services Each Month per Episode Enrolled in Part D in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

We also examined patterns in average monthly Part B and D drug costs during the episode. Monthly Part B and D drug costs were different between OCM and comparison TINs and also varied by the setting in which the drug was dispensed. Given the importance of drug spending as a proportion of total episode costs of care, these differences will be carefully monitored in future evaluation impact analyses.

- OCM practice episodes averaged $1,040 in Part B drug costs per month, while comparison TIN episodes averaged only $550 in Part B drug costs per month (Exhibit 3-E36). Differences in the trends of Part B drug costs for OCM practices and comparison TINs were statistically significant, although the magnitude of the difference was only 0.6 percent of the OCM mean (Exhibit 3-E37).
- Monthly Part D drug costs averaged $770 and $810 among OCM practices and comparison TINs, respectively (Exhibit 3-E36). Average monthly Part D drug costs doubled over the expanded baseline period (monthly costs averaged $420 in performance period -8 and $900 in performance period -2) for OCM practices and comparison TINs (Exhibit 3-E38). Like Part B drug costs, differences in the trends for Part D drug costs between OCM practices and comparison TINs were statistically significant but the magnitude of the deviations was small, representing only 0.6 percent of the OCM mean.

Fluctuations in the Part D costs by performance period were likely due to seasonality in Part D Medicare payments. One feature of the Part D benefit structure is that reinsurance, which comprises most of the Part D Medicare cost observed on Part D claims, is incurred in the catastrophic phase of the benefit. On average, Part D beneficiaries enter the catastrophic phase later in the calendar year, after they have accumulated sufficient out-of-pocket costs. Episodes that begin later in the year, with more months taking place during the catastrophic benefit phase, will have higher Part D costs on average (more of the costs

covered under Part D) than episodes occurring earlier in the calendar year. This is important to consider when assessing trends in Part D costs over time.

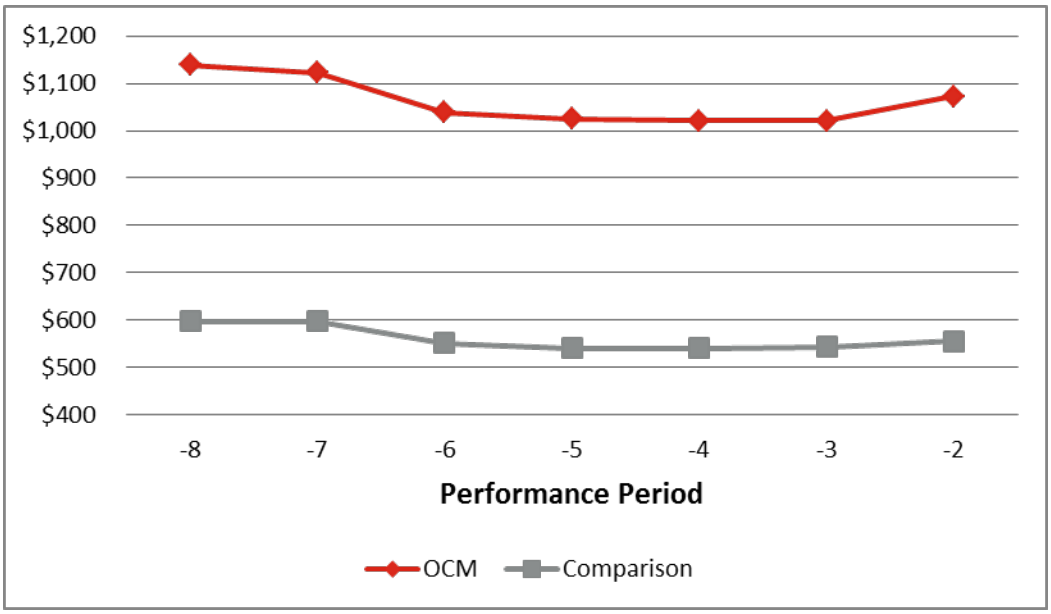
Part B and Part D prescription drug counts and monthly costs by cancer bundle can be found in Appendix Exhibits A2-16 and A2-17.

Exhibit 3-E36: Monthly Drug Costs per Episode in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	Monthly Part B Drug Costs			Monthly Part D Drug Costs (among episodes enrolled in Part D)		
	N	Mean	Std Dev	N	Mean	Std Dev
National	909,756	$720*	$1,737	746,114	$765	$1,960
OCM	309,566	$1,039	$2,042	251,584	$768	$1,958
Comparison	259,432	$547*	$1,541	212,876	$811*	$2,009
NONC	340,758	$562*	$1,521	281,654	$727*	$1,924

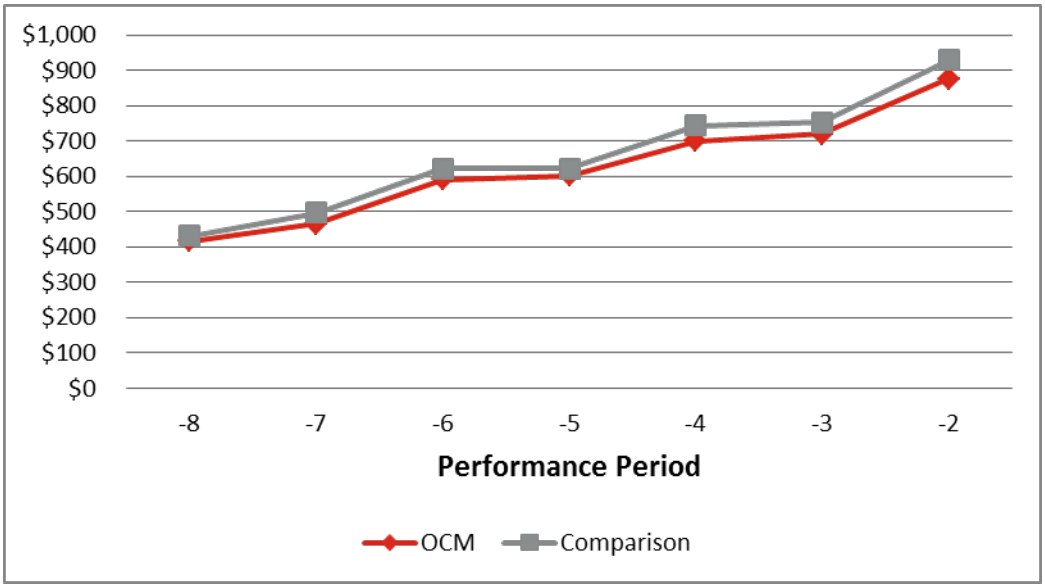
Source: Episode characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05.

Exhibit 3-E37: Average Monthly Part B Drug Costs per Episode in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Exhibit 3-E38: Average Monthly Part D Drug Costs per Episode Enrolled in Part D in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Mortality

- The overall episode-level all-cause mortality[42] rate was 10 and 11 percent among OCM practice and comparison TIN episodes, respectively. In Section 3.4, we examine how mortality rates vary by cancer bundle mix between OCM practices and comparison TINs.
- Mortality in both groups declined over the baseline period from 11.8 percent to 10.3 percent for OCM practices, and from 10.9 percent to 9.7 percent for comparison TINs. Trends in mortality rates among OCM practices and comparison TINs were statistically parallel across the expanded baseline period.
- Variation in mortality rates by cancer bundle are discussed in the subgroup analyses in Section 3.4.

3.1.3 End-of-Life (EOL) Care Measures

When patients are terminally ill, and further curative treatment is futile and may reduce quality of life, holistic care shifts to prioritizing pain management and symptom palliation. EOL care can be overseen by oncologists, but often also involves other care providers such as hospices, and the careful management of patient symptoms during transitions to palliative care or hospice is important. Improved care coordination and more deliberate attention to advanced care planning are stated goals of OCM. Outcomes related to these objectives could include less aggressive treatment and greater use of hospice at the end of cancer patients' lives. A careful evaluation of OCM patients' EOL process quality measures is highly relevant

[42] Mortality was calculated as the proportion of episodes, overall and within a cancer bundle, for beneficiaries who died during the six month episode. Mortality was identified if the beneficiary has a date of death that falls within the episode start and end date. This metric for mortality does not factor deaths that occur outside the episode of care.

and integral to understanding the full impact of OCM on patients' experiences. In this section, we present findings from baseline analysis of EOL care measures.

Exhibit 3-E39 (below) presents results for six EOL measures with statistical significance, based on the analytic cohort of all cancer decedents in the baseline period. Exhibit 3-E40 presents results for two EOL measures with statistical significance, calculated using the analytic sub-cohort of decedent cancer patients who used hospice. (Not shown are two measures – deaths occurring in the hospital and rates of discharge from hospice followed by hospitalization and return to hospice – where differences were not statistically significant). The appendix displays rates in the measures across the expanded baseline period (Appendix Exhibits A2-19 and A2-20).

Exhibit 3-E39: End-of-Life Measures for Decedent Cancer Patients as Assigned by the Most Recent Episode in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	N	Chemotherapy during the Last 14 Days of Life	Hospital Use in the Last 30 Days of Life	Intensive Care Unit (ICU) Use in the Last 30 Days of Life	Emergency Department (ED) Use in the Last 30 Days of Life	Deaths that Occur in Hospitals with ICU Care during the Terminal Admission	Never Admitted to Hospice
		Mean	Mean	Mean	Mean	Mean	Mean
National	122,012	13.0%	54.9%	24.8%	57.5%	11.6%	35.7%
OCM	33,374	13.5%	55.8%	27.0%	57.7%	12.2%	32.8%
Comparison	26,387	12.8%	54.5%	22.6%	56.6%	10.8%	34.8%
NONC	62,251	12.8%	54.6%	24.5%	57.8%	11.7%	37.6%

Source: Decedents file, 2012 – 2015. For all listed measures there is a statistically significant difference between OCM and comparison estimates at 0.05.

Exhibit 3-E40: End-of-Life Measures for Decedent Hospice-Using Cancer Patients as Assigned by the Most Recent Episode in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

Practice/ TIN Type	N	The Number of Days between Hospice Entry and Death		Being on Hospice Less than 3 Days before Death
		Mean	Std Dev	Mean
National	76,592	19.4	23.5	11.7%
OCM	21,952	18.7	22.8	12.3%
Comparison	16,749	19.5	23.3	11.3%
NONC	37,891	19.8	24.0	11.6%

Source: Decedents file, 2012 – 2015. For all listed measures there is a statistically significant difference between OCM and comparison estimates at 0.05.

Exhibit 3-E39 displays, for the 122,012 deceased individuals in the baseline period, the EOL outcome measures with statistical differences between OCM practices and comparison TINs. Among the measures with significant differences, OCM practices' episodes had greater use of aggressive treatment at the end of life than did comparison TIN episodes, during the pooled baseline period.

- ***Chemotherapy in the Last 14 Days of Life.*** OCM episodes had a higher rate of cancer patients receiving chemotherapy in the last 14 days of life than did comparison TINs. In the pooled baseline period, the national per episode rate of chemotherapy for cancer patients in the last 14 days of life was 13.0 percent, and the rate for the comparison and NONC TINs was 12.8 percent; the rate for OCM practices was 13.5 percent.
- ***Inpatient Hospitalizations in the Last 30 Days of Life.*** Episodes for deceased cancer patients served by OCM practices had a slightly higher rate of hospital admissions in the last 30 days of life (55.8 percent) than did episodes for deceased cancer patients served by comparison TINs (54.5 percent) or the nation overall (54.9 percent).
- ***ICU Use in the Last 30 Days of Life.*** Episodes for deceased cancer patients served by OCM practices had more ICU use in the last 30 days of life (27.0 percent) than did episodes for deceased patients served by comparison TINs (22.6 percent), or in the nation (24.8 percent), during the pooled baseline period. As described above, ICU use is conditional on first being admitted to the hospital. The rate of hospitalizations in the last month of life was slightly different between OCM episodes and TINs', but the difference in rate of ICU use in the last month of life was much greater. This suggests some discrepancy in the reasons for hospitalization between the two groups, or perhaps differences in the tendency of hospital staff (at hospitals affiliated with OCM practices particularly) to place hospitalized, dying cancer patients in the ICU. Clinical experts advise that this difference may be clinically meaningful and in the future, if numbers permit, we will conduct subgroup analyses to explore it in more detail.
- ***ED Visits in the Last 30 Days of Life.*** Rates of ED visits in the last 30 days of life were nearly the same for OCM practice episodes and in the nation as a whole (57.7 percent OCM and 57.5 percent nation), and the rate was slightly lower for comparison TINs' episodes (56.6 percent). On this measure, the OCM practice rate was closer to the national average than was the comparison TIN rate.
- ***Deaths that Occur in Hospitals with ICU Care during the Hospitalization.*** Deceased cancer patients served by OCM practices were slightly less likely to die in the hospital than were those served by comparison TINs, although the difference was not statistically significant. However, deaths during hospitalizations that involved ICU use were higher among decedents served by OCM practices (12.2 percent) vs. comparison TINs (10.8 percent), during the pooled baseline period. The national rate of deaths occurring during hospital stays that included ICU care was 11.7 percent among NONC TINs. This difference is consistent with the use of ICUs in the last month of life (described above), and suggests some discrepancy in the reasons for hospitalization between the two groups, or differences in the rate at which hospitalized, dying cancer patients were placed in the ICU.
- ***Never Admitted to Hospice.*** A high rate of never using hospice suggests a missed opportunity to support patient comfort at the end of life. Cancer patients who died during their episode had a lower rate lower rate of never utilizing hospice in OCM practices (32.8 percent) than comparison TINs (34.8 percent), implying higher quality of EOL care in OCM practices. However, both of these rates were below the national rate of never being admitted to hospice (35.7 percent), and also below the NONC rate (37.6 percent).

Exhibit 3-E40 shows results for the cohort of cancer patients (76,592) who died during their episode and used hospice, including:

- ***The Number of Days between Hospice Entry and Death.*** More days between hospice entry and death reflects better care quality than fewer days. In the baseline period, for those who did use hospice, the national mean number of days between hospice entry and death was 19.4 days; among comparison TINs the mean number of days between hospice entry and death was 19.5 days, while among OCM practices the average was almost a day shorter, 18.7 days.
- ***Being on Hospice Less than Three Days before Death.*** A higher rate of being in hospice for less than three days reflects worse care than does a lower rate, because patients who enter hospice while actively dying may not experience the full benefits of hospice (e.g., symptom management, family member support). For patients who did elect hospice, the national duration of hospice enrollment less than three days before death was 11.7 percent during the pooled baseline period. The rate of hospice enrollment less than three days before death was slightly higher for deceased patients served by OCM practices (12.3 percent) during the baseline period than among comparison TINs (11.3 percent).

Overall, there were statistically significant differences between OCM practices and comparison TINs in almost all claims-based EOL measures, and in almost every instance the OCM practices had more room to improve their EOL care processes than did comparison TINs. For only one measure, the rate of those never admitted to hospice, did OCM practices have a better rate than comparison TINs. Although statistically significant, most differences were small in absolute terms, and likely not of clinical importance, with the possible exception of ICU use in the last 30 days of life.

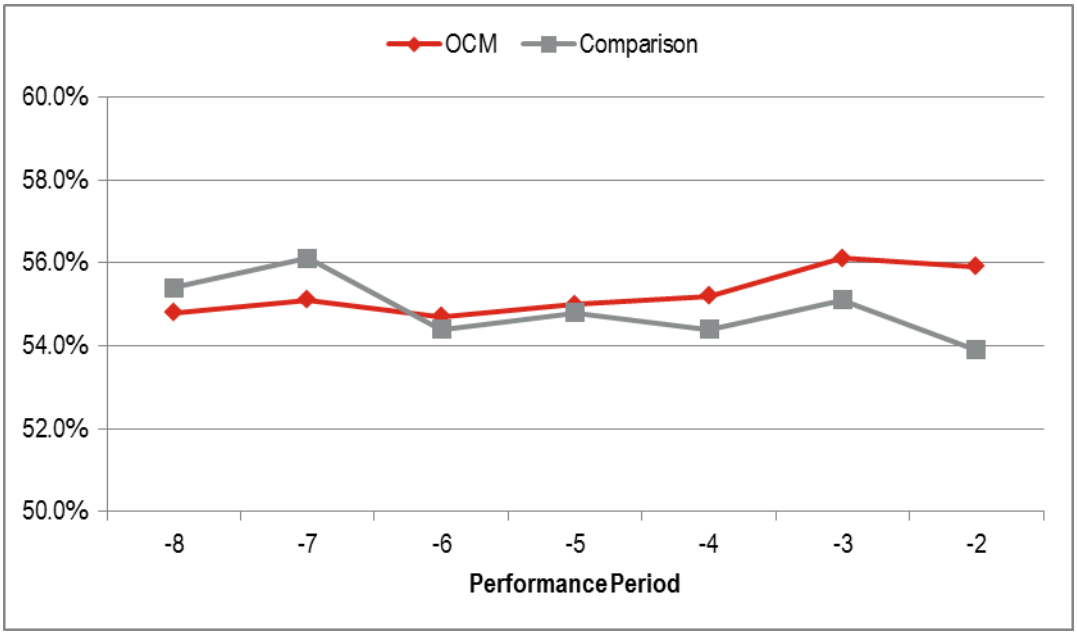
In statistical tests of the equality of trends between OCM practice and comparison TINs over the expanded baseline period, trends were statistically parallel in seven of the ten EOL measures, but differences in the trends were statistically significant for the following three measures:

- ***Inpatient Hospitalizations in the Last 30 Days of Life***. Episodes for OCM practices averaged 54.8 percent in 2012 and rose slightly to 55.9 percent during the expanded baseline period. Episodes for comparison TINs fell from 55.4 percent to 53.9 percent over the same period. This difference was less than one percent (0.8) of the OCM mean rate of acute care hospitalizations in the last 30 days of life (Exhibit 3-E41).
- ***ED Visits in the Last 30 Days of Life***. ED visits in the last 30 days of life rose from an average of 54.5 percent to 58.0 percent for OCM practice episodes during the expanded baseline period, whereas the rate for comparison TINs rose more modestly from 54.5 percent to 56.5 percent over the same period. Deviations in the trend represented only 0.5 percent of the OCM mean (Exhibit 3-E42).
- ***Number of Days between Hospice Entry and Death***. The amount of time between hospice entry and death was shorter for OCM practice episodes than for those at comparison TINs, for every baseline performance period after the first. For OCM practice episodes, the number of days between hospice entry and death declined from 20.4 days to 18.8 days over the expanded baseline period. Over the same period, the number of days dropped from 20.3 to 19.5 days for comparison TINs. Again the magnitude of deviation between OCM and comparison trends for this measure was less than one percent of the OCM mean (Exhibit 3-E43).

Although there was statistical difference for these three measures, the divergence for each measure was less than one percentage point of the OCM mean, and our clinical advisors do not regard these small differences as being clinically meaningful.

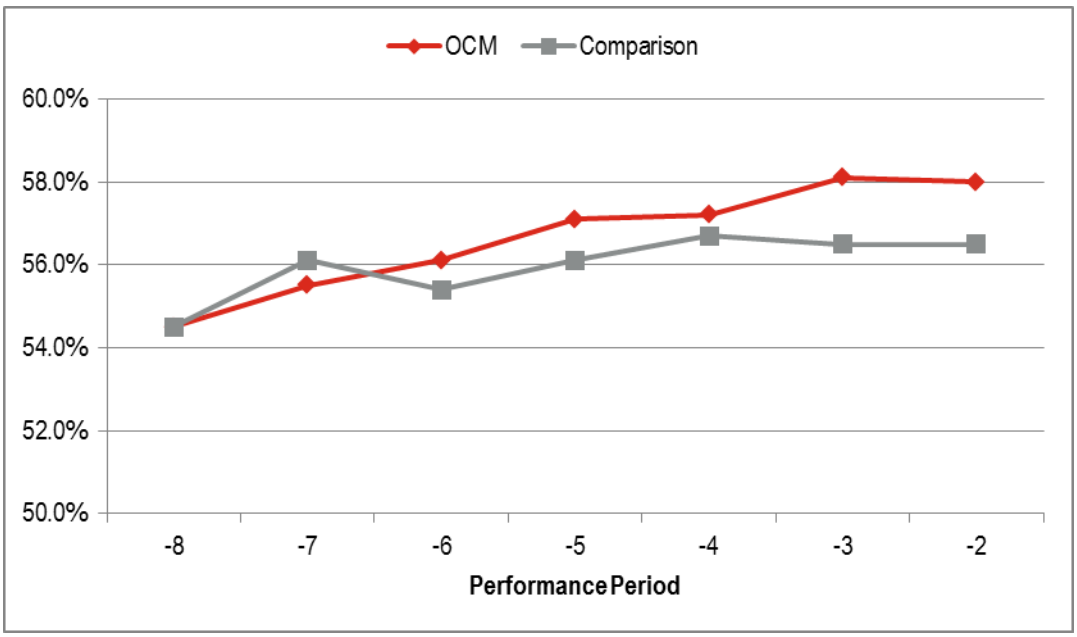
The purpose of testing for divergent trends is to ensure the validity of a stable baseline period for the DID methodology. The baseline EOL results suggest that our DID approach is appropriate, given underlying trends in these claims-based measures during the baseline period. For most measures, OCM practices' outcomes suggest more intense care at the end of life than was true for comparison TINs. There is some evidence of diverging (non-parallel) trends for three of ten EOL measures during the baseline period, however the absolute magnitude of the divergence was modest. We will give special attention to the DID results for these three measures that had non-parallel baseline trends, to identify whether divergence between the two groups increases as OCM continues, which could potentially indicate OCM exacerbation of a pre-existing trend. Overall, we judge that these baseline findings support our DID approach for evaluating the impact of OCM on EOL care.

Exhibit 3-E41: Rate of Hospital Use in the Last 30 Days of Life in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



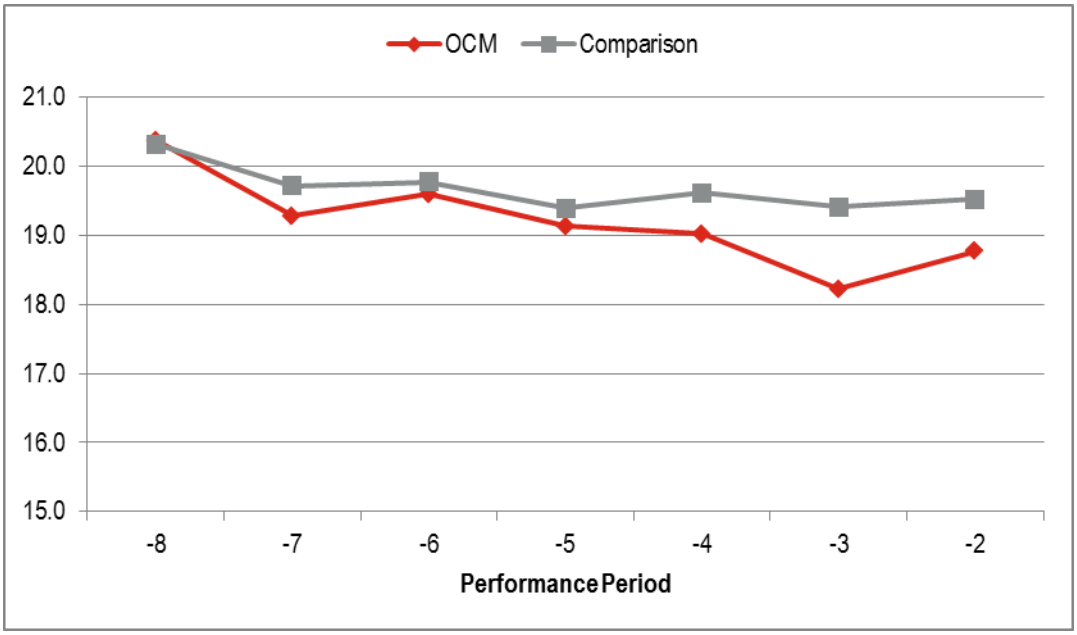
Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Exhibit 3-E42: Rate of Emergency Department (ED) Use in the Last 30 Days of Life in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

Exhibit 3-E43: Average Number of Days between Hospice Entry and Death in the Expanded Baseline Period (Episodes initiating Jan. 2012 – Jun. 2015)



Source: Episode characteristics file, 2012 – 2015. **Note**: Y-axis does not start at zero. Parallel trends tests showed that these trends were statistically different.

3.2 Practice Characteristics

Summary of Practice Characteristics Findings

Practice characteristics such as size, oncology specialty, or ownership/affiliation may be associated with the types of cancer treated, the severity of illness in the patient population, and care delivery. It is also important to understand trends in the years leading up to OCM, to ensure that the parallel trends assumption of our evaluation strategy is valid.

Key baseline findings about practice characteristic and trends include:

- OCM practices were larger, on average, than comparison TINs. OCM practices had more providers of any specialty (NPIs), and more oncology NPIs, in the pooled baseline period. This was in part due to a few very large OCM practices for which there are no comparisons in the nation.
- The number of NPIs per practice/TIN increased over the expanded baseline period, likely due to consolidation of practices, which may continue during the OCM program period.
- The number of attributed cancer episodes was significantly higher among OCM practices, relative to comparison TINs. This difference was driven largely by the number of NPIs billing through the practice/TIN.
- Patient load, or the episode volume per oncology NPI, shows that patient loads were higher among comparison TINs than in OCM practices. There are multiple explanations of this difference, including cancer mix, practice affiliations, and practice specialization.
- OCM practices were more likely to be multi-specialty (defined as practices that include non-oncology specialties billing cancer E&Ms or chemotherapy). Multi-specialty practices had more NPIs, on average, which explains some of the difference in practice size and episodes volume.

3.2.1 Number of Practices/TINs

The baseline analysis of practice characteristics was based on 190 OCM practices, 319 comparison TINs, and the full national universe of 2,148 practices and TINs.[43] These practices and TINs were selected using 2014 data and 2014 practice characteristics (described previously in Section 2.5). We ensured that selected TINs remained eligible over 2014 – 2015, but some practices and TINs did not exist in earlier performance periods (i.e., the practice was established partway through the expanded baseline period). As a result, sample sizes differed across the performance periods. The results in this section focus on the pooled baseline period. When historic data were not available, the analysis uses data from performance period -2: (i.e., episodes initiated between January and June 2015.) Select results, by performance period, for the expanded baseline period are available in Appendix 3.

[43] The list of comparison TINs for inclusion in the baseline report was finalized October 11th. Subsequent changes to the comparison TIN sample have not been incorporated here, but will be reflected in future analyses. The national sample includes 1,639 TINs that were identified in the potential comparison TIN pool, but not selected as a comparison TIN in the PSM.

3.2.2 Practice Composition

Practice Size: The number of NPIs (total and oncology NPIs) varied across oncology practices. There were practices and TINs with just one oncology NPI billing cancer E&M services or chemotherapy through the TIN, as well as very large, multi-market practices with more than 100 oncology NPIs. There were a number of significant differences in practice size and composition between OCM practices, comparison TINs, and the broader national universe of oncology practices.

- OCM practices were larger, on average, than comparison TINs or the broader national set of TINs. This was true when size was measured as the total number of NPIs or the number of oncology NPIs (Exhibit 3-P1). The average number of NPIs (all specialties) per practice was 14.1 in the national sample of practices and TINs, two-thirds of which were likely focusing on oncology care.[44] OCM practices and comparison TINs had an average of 41.9 and 27.4 NPIs (all specialties), respectively, though NPIs likely focusing on oncology care accounted were a smaller proportion of NPIs (approximately 61 percent).
- OCM practices were less likely to be oncology-only practices[45] than comparison TINs or the national profile of oncology TINs (Exhibit 3-P1). Thirty-one percent of OCM practices, and 40.5 percent of comparison TINs had only oncology NPIs billing cancer E&M services and/or Part B chemotherapy, while 52.6 percent of the national TINs were oncology-dedicated practices.
- Practices grew in terms of the number of NPIs during the expanded baseline period (Appendix Exhibit A3-1). The total NPI counts and oncology NPI counts steadily increased over time, while the proportion of oncology NPIs, and proportion of practices comprised of only oncology NPIs, remained steady.

Exhibit 3-P1: Provider Characteristics of Practices in the Pooled Baseline Period (Jan. 2014 – Jun. 2015)

Practice/ TIN Type	N	Number of NPIs per Practice TIN		Number of Oncologist NPIs per Practice/TIN		% Oncology NPIs within Practice/TIN	% of Practices with Only Oncology Specialty[a]
		Mean	Std Dev	Mean	Std Dev	Mean	Mean
National	2,148	14.12*	29.35	5.94*	13.28	67.7% *	52.6% *
OCM	190	41.85	61.25	20.32	33.44	61.2%	30.9%
Comparison	319	27.44*	39.99	10.47*	15.12	60.1%	40.5% *

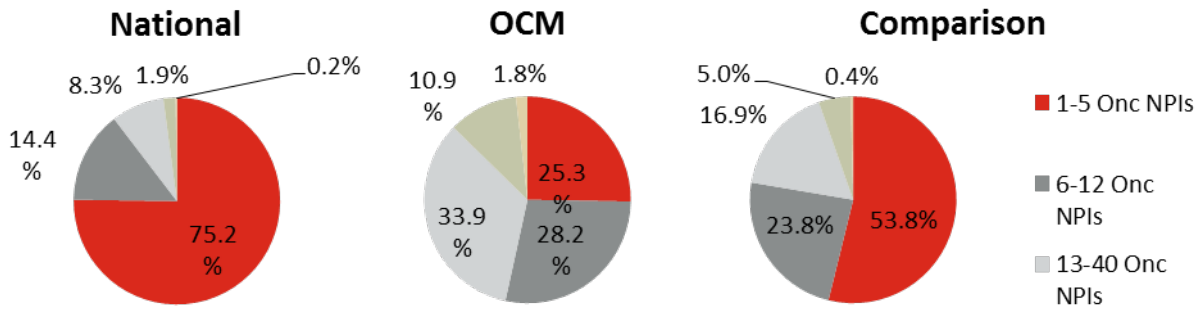
Source: Practice characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05. [a] NPs and PAs are included in the calculation as an oncology specialty.

[44] NPIs that likely focus on oncology care include hematology/oncology, medical oncology, surgical oncology, radiation oncology, gynecologic oncology, urologists, and nurse practitioners/physician assistant NPIs within an oncology practice or TIN.

[45] We define oncology-only vs. multi-specialty among the set of NPIs that are billing cancer E&Ms and/or Part B chemotherapy during the episode. Nurse practitioners (NPs) and Physicians Assistants (PAs) are included as oncology NPIs in the calculation.

OCM practices and comparison TINs were larger, on average, than the broader set of national oncology TINs. Forty-seven percent of OCM practices and 22 percent of comparison TINs had 13 or more oncology NPIs. Conversely, 75 percent of the national sample of oncology practices and TINs had fewer than six oncology specialty NPIs, and nearly 90 percent had fewer than 13 oncologist NPIs (Exhibit 3-P2).

Exhibit 3-P2: Distribution of Practice Size (Number of Oncology NPIs) in the Pooled Baseline Period (Jan. 2014 – Jun. 2015)



Source: Practice characteristics file, 2014 – 2015.

NPI Specialty: An NPI was categorized as an oncology specialty if they specialized in hematology/oncology or medical oncology, surgical oncology, radiation oncology, gynecologic oncology, or urology. Specialty distributions within oncology NPI subspecialties were similar among OCM practices and comparison TINs (Exhibit 3-P3). The majority (81 to 82 percent) of oncology specialists were hematology/medical oncologists. Radiation oncologists made up about 12 percent of oncology NPIs, gynecologic oncologists made up four to five percent, and surgical oncologists made up just over two percent of oncology specialists. On average, OCM practices and comparison TINs were comparable in terms of the average number and proportion of urology NPIs (2.8 and 2.4).

The national TIN averages showed a smaller proportion of hematology/oncology and medical oncology NPIs (67 percent) and a larger proportion of radiation oncology NPIs (24 percent) than OCM practices or comparison TINs. These differences were due in part to our matching of comparison TINs by practice specialty, and removal of TINs from the sample that were made up entirely of radiation oncologists.

Non-physicians, such as NPs and PAs, can contribute to cost-effective care delivery and support quality improvement initiatives in payment models such as OCM. OCM practices employed more NPs and PAs than comparison TINs (Exhibit 3-P3). NPs/PAs per practice averaged 5.5 NPs/PAs for OCM practices and 3.8 NPs/PAs for comparison TINs. The average number of NPs/PAs for OCM practices and comparison TINs were higher than the national average of 1.8 NPs/PAs. The same patterns were true for the proportion of NPs/PAs as a percent of total NPIs.

The greater number of NPs/PAs in OCM practices than in comparison TINs was consistent with the finding that OCM practices were larger and more likely to be multi-specialty, relative to comparison TINs. There was an upward trend in the numbers of NPs and PAs nationally and in both OCM and comparison TINs in the expanded baseline period (Appendix Exhibit A3-2).

Exhibit 3-P3: Provider Oncology Specialties among Practices in the Pooled Baseline Period (Jan. 2014 – Jun. 2015)

Practice/ TIN Type	N	NP/PA NPIs		Urologist NPIs		Hematology/Oncology, Medical Oncology NPIs		Surgical Oncology NPIs		Radiation Oncology NPIs		Gynecologic Oncology NPIs	
		Mean	%[a]	Mean	%[a]	Mean	%[b]	Mean	%[b]	Mean	%[b]	Mean	%[b]
National	2,148	1.75*	7.2%*	1.31*	5.5%	4.18*	67.3%*	0.24*	3.5%	1.22*	24.2%*	0.33*	5.0%
OCM	190	5.54	11.6%	2.81	4.4%	15.61	81.7%	0.71	2.5%	2.94	11.5%	1.09	4.4%
Comparison	319	3.75*	10.4%	2.35	5.8%	8.02*	81.1%	0.44	2.1%	1.42*	11.7%	0.60*	5.1%

Source: Practice Characteristics File, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05. [a] The percentage of NP/PA NPIs and Urology NPIs was based off the full NPI count. [b] The proportion for each oncology specialty was based on the total number of oncology NPIs.

3.2.3 Practice Episode Volume

Attributed Episode Volume

Episodes were attributed to a practice/TIN based on the plurality of cancer E&M services. This implies that the majority of cancer care was provided by the practice or TIN to which the episode was attributed, and the OCM practice could bill for the MEOS payment for the episode. Higher episode volume was associated with an increased likelihood to participate in OCM and this may reflects a practice's ability to achieve economies of scale to implement many of the OCM requirements.

- The number of episodes for chemotherapy and the number of attributed episodes[46] in oncology practices nationally were significantly smaller, on average, than for OCM practice and comparison TINs (Exhibit 3-P4)
  - OCM practices provided care during approximately 3.5 times the number of episodes as did TINs nationally (on average 625 episodes, of which 85 percent were attributed to the practice) in the pooled baseline period
  - The share of episodes during which care was provided, that were attributed to OCM practices and comparison TINs, was larger than the attributed share nationally, suggesting that OCM practices and comparison TINs were more often responsible for the majority of care during episodes
- The differences in attributed episode volume was largely due to the difference in the number of oncology NPIs billing to a practice or TIN

[46] Since our analysis was conducted by performance period, a beneficiary could have a maximum of one attributed episode per period. As a result, the number of attributed episodes in a given performance period was equivalent to the number of attributed beneficiaries. The practice may be delivering care to other beneficiaries as well, who were ultimately attributed to a different practice, based on the plurality of visits. For example, academic practices that provide second opinions may not be responsible for the majority of treatment and management during the episode, which are the responsibility of a different practice/TIN. We report both figures since the total volume of cancer care may provide additional information about the scale and scope of oncology activities at the practice.

Exhibit 3-P4: Episode Characteristics of Practices in the Pooled Baseline Period (Jan. 2014 – Jun. 2015)

Practice/ TIN Type	Number of Cancer Episodes Receiving Chemotherapy			Number of Attributed Episodes			Percent Attributed Episodes[a]			Number of Attributed Episodes per Oncologist NPI		
	N	Mean	Std Dev	N	Mean	Std Dev	N	Mean	Std Dev	N	Mean	Std Dev
National	2,148	178.04*	431.24	2,148	141.31*	379.05	2,148	70.6%*	26.8%	2,141	26.54*	28.38
OCM	190	624.44	1202.70	190	543.17	1077.82	190	85.3%	11.7%	190	32.19	21.28
Comparison	319	323.33*	377.82	319	271.09*	307.32	319	84.7%	11.7%	319	37.13	40.51

Source: Practice characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05. [a] The percent attributed episodes represents the percent of total episodes the practice/TIN bills cancer E&M or chemotherapy that were attributed to the practice/TIN.

3.2.4 Practice Affiliation

We constructed indicators to explore practice affiliation and ownership using several data sources. We first focused on constructing affiliation information for OCM practices and comparison TINs using SK&A data current as of August 2016. We did not include the national universe of practices, nor did we have historic data with which to evaluate trends. In the SK&A data, 38 percent of OCM practices and 45 percent of comparison TINs self-reported affiliation with a health system. A smaller proportion, 25 percent of OCM practices and 33 percent of comparison TINs, self-reported hospital ownership.

We used another data source, created and used by researchers and the Office of the Assistant Secretary for Planning and Evaluation (ASPE), to identify which practices were affiliated with an academic medical center.[47] Only information for performance period -2 was available to measure academic medical center affiliation. OCM practices and comparison TINs were more likely to be affiliated with an academic medical center in that period than was true for the national universe of TINs. For example, 16 percent of OCM practices and 11 percent of comparison TINs were affiliated with an academic medical center in performance period -2; only six percent of national TINs were affiliated with an academic medical center (Exhibit 3-P5). In addition, seven percent of OCM practices and 14 percent of comparison TINs were affiliated with a facility that participate in the 340B drug discount program, in performance period -2.

Exhibit 3-P5: Affiliation of Practices in Performance Period -2 (Jan. – Jun. 2015)[48]

Performance Period	Practice/ TIN Type	N	% Affil. with 340B Entity	% Affil. with Academic Med Center
-2	National	2,147	10.8%	5.9%*
	OCM	190	7.4%	15.8%
	Comparison	319	13.8%*	10.7%

Source: Practice characteristics file, 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05.

Variation in Practice Characteristics based on Affiliation: Affiliation with a health system or an academic medical center was associated with variation in practice size and average patient population size, but the nature of the association varied for OCM practices and comparison TINs (Exhibit 3-P6).

- Larger OCM practices tended to be affiliated with a health system. This may reflect larger referral networks, higher inflow of patients from surrounding areas, or access to technologies (e.g., clinical trials) needed to treat more complex cancer cases.
- TINs and practices that were affiliated with an Academic Medical Center were even larger than those affiliated with a health system, in terms of numbers of NPIs and oncology NPIs per practice.

[47] W. Pete Welch, Bindman, A. "Town and Gown Differences among the 100 Largest Medical Groups in the US," 2016; Academic Medicine. *Forthcoming*.

[48] Note, these categories are not mutually exclusive. A TIN/practice can have all types of affiliations.

Exhibit 3-P6: Practice Size by Affiliation in Performance Period -2 (Jan. – Jun. 2015)

Performance Period	Practice/ TIN Type	Practice Size, Conditional on SK&A Health System Affiliation, PP-2					Practice Size, Conditional on Academic Medical Center Affiliation				
		N	Number of NPIs	Number of Onc NPIs	Number of Attributed Episodes	Number of Attributed Episodes per Onc NPI	N	Number of NPIs	Number of Onc NPIs	Number of Attributed Episodes	Number of Attributed Episodes per Onc NPI
-2	OCM	73	70.63	25.08	462.32	24.6	30	118.97	42.1	650.9	16.23
	Comparison	142	49.69*	16.87*	370.01	27.67	34	91.29	33.15	510.94	16.24

Source: Practice characteristics file, 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05.

3.2.5 Participation in Other CMS Initiatives

Participation in CMS ACO initiatives, specifically MSSP and Pioneer ACOs, increased throughout the baseline period, driven mainly by increasing participation in MSSP. Twelve percent of OCM practices were involved in the MSSP program, as were nine percent of comparison TINs. OCM practices had a slightly higher participation in the Pioneer ACO program (2.3 percent) relative to comparison TINs (1.6 percent). Higher participation by OCM practices may reflect larger size, affiliations with hospitals, willingness to try APMs, and willingness to build on their APM experience by volunteering for OCM. For the baseline analyses, only these two CMS ACO models were evaluated. The impact of these and additional models will be included in future analyses, as warranted.

3.3 Market Characteristics

Summary of Market Characteristics Findings

Key findings of market characteristic and trend analyses include:

- Nearly all of the oncology practices participating in OCM are located in urban markets, though there was variation during the baseline period in the market structure for cancer care among OCM practices and comparison TINs, as compared with the broader national universe.
- OCM practices and comparison TINs are located in markets with fewer, albeit larger, practices compared to all TINs nationwide. In the baseline period they were more likely to operate multiple practice sites, draw patients from outside markets, and had higher market share.
- The market characteristics and trends, including supply of physicians and population demographics, were similar among OCM practices and comparison TINs, and consistent with national patterns. All markets experienced a growing Medicare-aged population and increased enrollment in Medicare Advantage.

3.3.1 Geographic Representation of OCM Practices and Comparison TINs

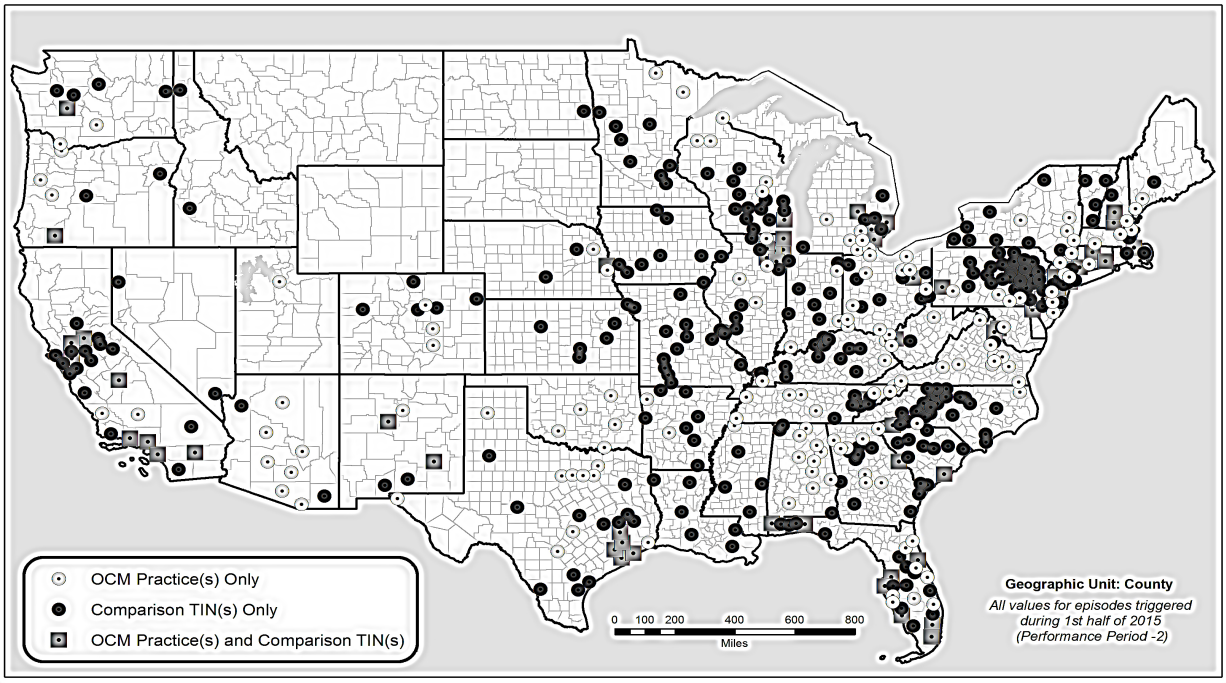
Nearly all OCM and matched comparison TINs are located in urban markets. Certain geographic regions are underrepresented in the sample of practices and TINs, and OCM practices are clustered in certain regions of the U.S. A map of the plotted site locations[49] (Exhibit 3-M1) shows that OCM practices are underrepresented in the mountain and plains states. While some of this clustering mirrors the population distribution across the country, generalizability of OCM to market areas that are not represented in the sample of OCM practices and comparison TINs may be limited.

Propensity score matching yielded considerable geographic overlap, such that market areas contained both OCM practices and comparison TINs, based on proportion of practice locations. Two-thirds of OCM practice sites overlapped with a comparison TIN (based on a 25 mile radius from center point of practice or TIN County).[50]

[49] Based on the midpoint of the county the site is located.

[50] Practice area overlap was calculated based on defining 25 mile radiuses around practice and TIN county center points and measuring the proportion of these practice areas overlapping. Analysis was conducted in ArcGIS.

Exhibit 3-M1: Geographic Location of Practices and TINs



Source: Market characteristics file, 2015.

3.3.2 Practice/TIN-Level Market Penetration and Structure

Practice Structure: There were few differences between OCM practices and comparison TINs based on market composition and geographic reach (Exhibit 3-M2).

- The majority of oncology practices and TINs operated within a single market. On average, OCM practices and comparison TINs operated within 1.3 markets (defined as the CBSA where the practice or TIN is located), though these averages were skewed by a few very large OCM practices (0.5 percent) and comparison TINs (0.3 percent) operating in more than five markets.
- It was more common for OCM practices to operate in multiple sites (office locations) than was true for comparison TINs.[51] Fifty-four percent of OCM practices and 42 percent of comparison TINs operated in multiple sites (average number of sites was 2.1 and 2.0 for OCM practices and comparison TINs, respectively). There were a few practices and TINs with more than 10 practice sites (two percent), which skewed the distribution.
- The proportion of OCM practices and comparison TINs operating in multiple markets or across multiple sites was significantly larger than was true nationally. Only 10 percent of TINs nationally operated in multiple markets (compared to 16 and 18 percent for comparison TINs and OCM practices, respectively), and only 26 percent of TINs nationally operated in multiple sites (compared to 42 and 54 percent for comparison TINs and OCM practices, respectively).
- The majority (97 percent or more) of cancer E&M services came from within a practices' or TINs' primary market, defined as the market with the most cancer E&M services billed.

[51] Defined as the number of provider billing zip codes.

It is important to note that the OCM requirement for participating NPIs to bill through a single TIN during the model may be contributing to these observed differences. In creating the comparison group, we attempted to match comparison TINs to OCM practices that had the same size, site and market features, to mitigate differences created by program rules. Nonetheless we cannot match on potentially unobserved characteristics that could make it easier for certain organizations to bill under a single TIN, and this factor may be important in understanding OCM performance. We are sensitive to the potential effect of program billing rules on our results and, as part of our case studies, we will be exploring the effects of these factors in qualitative analyses. We also point out where OCM practices and comparison TINs differ with respect to organization and market structure below, since these are important features which may be due in part to program rules.[52]

Exhibit 3-M2: Market-Level Penetration and Structure in the Pooled Baseline Period (Jan. 2014 – Jun. 2015)

Practice/ TIN Type	N	Number of Market Areas		Percent of Cancer E&Ms in Primary Market		Percent in Multiple Markets		Percent in Multiple Sites	
		Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
National	2,148	1.14*	0.50	98.7%*	6.0%	9.7%*	28.2%	26.3%*	40.9%
OCM	190	1.27	0.74	97.4%	8.8%	18.4%	37.5%	53.5%	47.0%
Comparison	319	1.25	0.69	98.0%	7.1%	15.5%	34.9%	41.7%*	46.5%

Source: Market characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05.

Market Share and Penetration: OCM practices operated within markets with fewer oncology practices (less competition), and they had a larger share of the cancer E&M services within their markets, compared to the broader national sample of TINs (Exhibit 3-M3). OCM practices averaged 39 percent market share,[53] while comparison TINs averaged 35 percent (not statistically different) and nationally the average TIN market share was 24 percent. Market share may reflect a number of practice characteristics, including practice size (number of NPIs), or affiliation with hospitals, health systems or academic medical centers.

OCM practices and comparison TINs were located in markets with fewer oncology TINs than was true nationally, on average, though differences were not statistically different. Nationally, markets included approximately 50 oncology TINs, on average, as compared with 40 or fewer in the OCM and comparison markets. This difference may not imply greater market competition nationally, because, as seen in Section 3.2.2 above, the average number of practicing oncologists was smaller nationally (six Oncology NPIs) than for OCM practice or comparison TINs (20 and 11 Oncology NPIs, respectively).

[52] OCM practices participating pools were not evaluated in the baseline report as a pooled entity; instead each practice ID was evaluated individually.

[53] Market share is based on the total proportion of cancer E&Ms the practice or TIN billed within the market.

Exhibit 3-M3: Practice/TIN Market Landscape in the Pooled Baseline Period (Jan. 2014 – Jun. 2015)

Practice/ TIN Type	N	Practice/TIN Market Share		Number of Oncology Practices/TINs per Market		Number of OCM Practices per Market		Number of Comparison TINs per Market	
		Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
National	2,148	23.6%*	34.0%	50.48	81.21	3.73*	5.67	5.03*	6.17
OCM	190	39.2%	37.7%	40.04	70.61	4.59	4.97	3.96	5.94
Comparison	319	35.1%	34.4%	33.50	60.41	2.46*	4.58	4.68	5.16

Source: Market characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05.

3.3.3 Market Supply & Demand Patterns

Healthcare Supply: Supply of physicians, both primary care and specialty care physicians, may influence oncology care in a number of important ways. Primary care physicians may provide important cancer screenings and serve as a referral source for oncologists. The supply of specialty physicians within a market (defined here as the county where the practice/TIN is located) may indicate the healthcare infrastructure available and the level of competition within a market, and may also impact the total costs of care.

OCM practices and comparison TINs operated in similar markets in terms of healthcare supply measures, and there were no significant changes in supply over the expanded baseline period (Appendix Exhibit A4-1). The number of primary care physicians (PCPs) per 10,000 population, specialty physicians per 10,000 population, and trends in provider supply, were similar for OCM practice and comparison TIN markets. OCM practice markets averaged 8.8 PCPs, 13.3 specialists and 36.6 hospital beds per 10,000 population, while comparison TIN markets averaged 8.7 PCPs, 12.6 specialists and 39.2 hospital beds per 10,000 population, in the baseline period. These differences were not statistically significant.

The number of PCPs per 10,000 population and the number of specialists per 10,000 population increased slightly over the expanded baseline period. Consistent with national trends in number of hospital beds per 10,000 population,[54] the supply of beds declined within markets served by OCM practices and comparison TINs during the expanded baseline period.

ED Utilization: ED utilization within a market may reflect local barriers in access to timely primary or acute care. ED visits per 10,000 population were similar among OCM practice markets and comparison TIN markets in the pooled baseline period. There was also no significant difference between OCM practice and comparison TIN markets and the national sample of oncology TIN markets.

Medicare-Eligible Population Patterns and Medicare Advantage Penetration: The number of Medicare beneficiaries and the Medicare Advantage penetration within a market is important for the OCM evaluation for a number of reasons. Younger, healthier Medicare beneficiaries are more likely to

[54] Trendwatch Chartbook (2016). Trends Affecting Hospitals and Health Systems—Supplementary Data Tables, Organizational Trends, Table 2.2. Chicago, IL: American Hospital Association.

enroll in Medicare Advantage,[55] which affects the risk profile of beneficiaries remaining in Medicare FFS. Further, value-based initiatives by Medicare Advantage plans that affect payment, cost, and quality may have spillover effects on the treatment and costs of Medicare FFS beneficiaries, which could amplify OCM effects or make it easier for practices who are familiar with value-based care to participate and succeed in OCM.

- The number of Medicare beneficiaries per 10,000 was similar for OCM practice and comparison TIN markets. The number of Medicare beneficiaries per 10,000 population increased over the expanded baseline period (Appendix Exhibit A4-2). These trends from 2012 through 2015 are consistent with an aging population.[56]
- Medicare Advantage penetration was also similar for OCM practice and comparison TIN markets. Medicare Advantage penetration increased during the expanded baseline period. From performance periods -8 to -2, Medicare Advantage penetration increased from 27.7 percent to 32.1 percent in OCM practice markets, and from 26.5 percent to 31.7 percent in comparison TIN markets (Appendix Exhibit A4-2). This trend was consistent with penetration of Medicare Advantage plans nationally.[57]

3.3.4 Market Demographics

OCM practice markets and those of comparison TINs were similar across a number of beneficiary demographic characteristics. The patterns in market-level demographics over the expanded baseline period were consistent with national population trends.

- OCM practices and comparison TINs were located within urban, more densely populated markets. Average market population was 1.1 million for comparison TINs and 1.3 million for OCM practices. More than 98 percent of practices and TINs were located in urban markets.
- The average proportion of population aged 65 and older in the market averaged 15 percent among both OCM practices and comparison TINs, the same as that for the national universe of oncology practices, and close to that reported by the American Community Survey (ACS) of 14.1 percent.[58]

---

55 Byhoff E, Harris JA, Ayanian JZ. Characteristics of Decedents in Medicare Advantage and Traditional Medicare. *JAMA Intern Med*. 2016;176(7):1020 – 1023.

56 US Census Bureau, (2013). American FactFinder ACS Demographic and Housing Estimates: Allegany County, N.Y. Retrieved December 15, 2016, from https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_5YR_DP05&prodType=table.

57 CMS/Office of Enterprise Data & Analytics (OEDA). Retrieved January 3, 2017 from https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Dashboard/Medicare-Enrollment/Enrollment%20Dashboard.html.

58 US Census Bureau, (2013). American FactFinder ACS Demographic and Housing Estimates: Allegany County, N.Y. Retrieved December 15, 2016, from https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_5YR_DP05&prodType=table.

- The average median household income was about $55,600 in markets where OCM practices were located and $54,100 for comparison TIN markets, which was consistent with the ACS reported national median of $55,775 in 2015.[59]
- The percent of a market's population living in poverty was 16 percent and the percent of the population with less than a high school education was 13 percent for both OCM practices and comparison TINs.

3.3.5 Beneficiary Travel Patterns for Oncology Care

We examined patterns of beneficiaries traveling for oncology care, including the distance beneficiaries traveled and whether they traveled outside their home market for care. Beneficiary travel patterns may be influenced by a number of factors, such as specialty of physicians in the market; the outcomes and reputation of oncology practices in the market; affiliations with hospitals, health systems and academic medical centers; and geographic distance. The ability to draw beneficiaries from outside markets may indicate stronger market presence or another competitive advantage. It is possible that participation in OCM may improve patient outcomes and satisfaction, and this, in turn, could enhance a practice's market reputation and attract more patients, both from within the practice's market and from outside markets. Measuring baseline beneficiary travel patterns will enable the measurement of changes over time in market share, and the ability of a practice to draw patients from other markets.

For the purposes of this baseline report, beneficiary travel patterns describe the geographic distance traveled by beneficiaries between the center point of their county of residence and that of the county for the oncology practice or TIN to which they were attributed. These metrics categorize episodes that were attributed to a practice or TIN within the beneficiary's county of residence,[60] or that are attributed to a practice or TIN outside of the beneficiary's county of residence.

Beneficiary travel patterns for oncology care were similar among OCM practices and comparison TINs, but differed somewhat from national patterns (Exhibit 3-M4).

- The majority of beneficiaries lived in the same market where their OCM practice or comparison TIN was located. Seventy-two percent of episodes attributed to OCM practices and 73 percent of comparison TIN episodes were attributed to practices with the beneficiary market of residence. Nationally, 76 percent of beneficiaries sought care within their own markets.
- OCM practice and comparison TIN markets had a larger percentage of beneficiaries traveling from other markets for oncology care, compared to national patterns. Approximately 27 to 28 percent of beneficiaries served by OCM practices and comparison TINs came from outside the defined markets, but nationally, this proportion was slightly lower (24 percent). A high percentage of beneficiaries

---

[59] Noss, A. (2016). Household Income: 2015. American Community Survey Briefs, 13(02). doi: September 2016.

[60] The defined market area includes the practice or TIN's own county, nearby counties with no oncology practices (based on the distance between the center points of provider and beneficiary counties, the beneficiary is traveling to their closest provider), proximate counties located within geographically dense areas (where counties may be smaller and distance between the center point of provider and beneficiary counties is less than 15 miles), and nearby counties where the distance between the provider county and beneficiary county center points is not more than 1.5 times the distance between the beneficiary county and nearest oncology provider county center point.

traveling from outside markets may indicate a stronger market reputation, greater specialization in oncology care, or a shortage of cancer care services in surrounding counties (requiring patients to travel to an urban hub for care).

- A smaller proportion of beneficiaries residing in the OCM practice and comparison TIN markets left their home market for cancer care. This proportion of beneficiaries traveling outside their market of residence was 26 and 28 percent in OCM practice and comparison TIN markets, respectively, and 34 percent nationally. This difference implies that OCM practices and comparison TINs were better able to retain cancer patients who resided within their markets, and attracted patients from outside markets, at a greater rate than the national norm.

Exhibit 3-M4: Average Beneficiary Travel Patterns of Practices in the Pooled Baseline Period (Jan. 2014 – Jun. 2015)

Practice/ TIN Type	N	Proportion of Episodes Traveling from Outside Markets for Care		Proportion of Episodes Seeking Care within Home Markets		Proportion of Episodes Traveling to Outside Markets Care	
		Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
National	2,148	24.1%*	22.9%	75.9%*	22.9%	33.8%*	24.9%
OCM	190	28.2%	21.1%	71.8%	21.1%	25.8%	21.3%
Comparison	319	26.7%	22.4	73.3%	22.4%	27.6%	22.5%

Source: Market characteristics file, 2014 – 2015. * Denotes a statistically significant difference from OCM practice point estimates at 0.05.

3.3.6 Market-Level Penetration of MSSP and Pioneer ACOs

Two CMS initiatives, the MSSP and Pioneer ACO, were evaluated for overlap in participation over the expanded baseline period (episodes initiating January 2012 through June 2015). A minority of the Medicare beneficiaries residing in OCM practice and comparison TIN markets were aligned with other CMS initiatives in the pooled baseline period.[61] The average proportion of all Medicare beneficiaries within the market aligned to Pioneer ACO was 1.5 percent within OCM practice markets, and 1.2 percent within comparison TIN markets. Alignment with MSSP, which began in 2012, was 14.7 percent for OCM practice markets and 14 percent for comparison TIN markets. In future analyses of participation in other CMS initiatives, we will evaluate alignment at the beneficiary (episode) level, rather than alignment within the market.

3.4 Subgroup Analyses

In this section, we examine how episode, practice, and market attributes were related to episode-level utilization and Medicare costs in the baseline period. These findings will inform the market, practice, and beneficiary-level factors (covariates) that we will control for in future evaluation impact analyses. Significant differences in outcomes by subgroup also informs whether and how to generalize results to Medicare subgroup populations.

[61] This is a market-level variable capturing the proportion of Medicare beneficiaries aligned to these CMMI initiatives, and is not specific to beneficiaries with attributed chemotherapy episodes.

Subgroup analyses are informed by a basic ecological model: episodes are nested within cancer bundles, bundles are nested in practices (or TINs), which in turn are nested in communities or markets. Each of these layers in the hierarchy may influence outcomes, and our baseline subgroup analyses focus on each "layer" of the hierarchical model for costs, utilization, and patient-level outcomes such as mortality.

We begin by evaluating episode-level cost and utilization outcomes by cancer bundle (Section 3.4.1), and how episode characteristics and utilization vary according to the use of only hormonal therapies (without infusion chemotherapy) among breast and prostate cancer episodes (Section 3.4.2). Section 3.4.3 describes patterns in utilization and cost outcomes according to subgroups of beneficiaries defined by demographics, health risk, and Medicaid dual eligibility. Section 3.4.4 describes patterns in episode-level characteristics and outcomes, stratified by practice-level factors such as practice size, patient load, specialty mix, and affiliation with academic and health systems. Finally, in Section 3.4.5 we turn to the relationship between market factors (income, supply, and size) and episode-level demographics, as well as episode-level utilization and Medicare costs.

3.4.1 Episode Attributes by Cancer Bundle

Summary of Findings Regarding Episode Attributes by Cancer Bundle

Health service utilization, Medicare costs, and mortality vary across episodes in different cancer bundles.

- There was significant variation in utilization of chemotherapy services and acute care services for different cancer bundles. This variation reflects differences in treatment regimens and modality, and severity, by cancer bundle.
- Episode costs also varied greatly by cancer bundle. Chemotherapy costs were a significant contributor to the variation in total costs, due to differences in the availability and use of hormonal treatments and novel therapies, by cancer bundle. Some of the variation in costs was also associated with the intensity of service use (e.g., number of cancer E&M services and total cancer E&M costs per episode).
- All-cause mortality ranged from three percent to 26 percent within a six-month episode, depending on the cancer bundle. Cancer bundles with low mortality (breast and prostate) were often for patients undergoing long term hormonal therapy regimens with stable health outcomes over a longer time period.

There was considerable variation in episode cost and utilization by cancer bundle.[62] Variation is related to the epidemiology of the cancer and the standard treatment approaches, and severity patterns for difference cancers. Examining the variation in key outcomes among cancer bundles is important for identifying and understanding underlying patterns of care for the OCM evaluation. In the following analyses we segment episodes by primary cancer bundle to examine variation in cancer treatment patterns and costs.

[62] We assigned each episode to a cancer bundle, which was determined according to the single cancer type assigned to the episode per the OCM program rules on cancer type assignment. Section 2.3 describes how the cancer types were grouped into the broader cancer bundles used in this report.

Exhibit 3-S1 summarizes findings by cancer bundle, where "high" indicates higher than average outcomes and "low" indicates lower than average outcomes, relative to other cancer bundles. Overall, episodes for beneficiaries with breast cancer, prostate cancer, and bladder cancer had lower than average utilization and costs per episode, and lower mortality, relative to other cancer bundles.

Exhibit 3-S1: Summary of Average Costs and Utilization per Episode by Cancer Bundle in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)

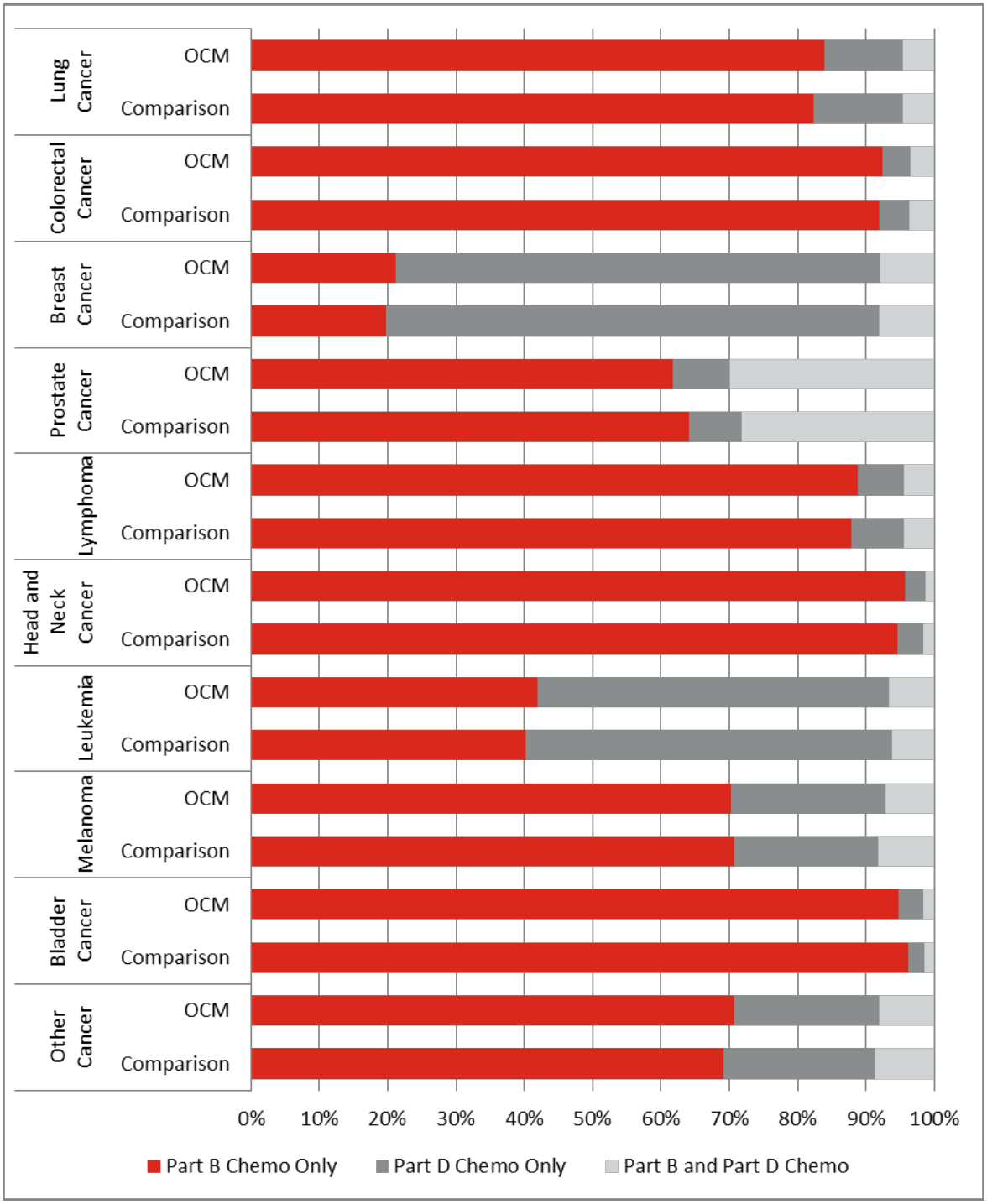
Outcome	Lung Cancer	Colorectal Cancer	Breast Cancer	Prostate Cancer	Lymphoma	Head & Neck Cancer	Leukemia	Melanoma	Bladder Cancer	Other Cancer
# Cancer E&M Services	High	High	Low	Low		High				High
# Chemotherapy Services	High	High	Low	Low				Low		High
# Inpatient Admissions	High		Low	Low		High				
# ED Visits not resulting in an inpatient stay	High		Low	Low		High				
Total E&M Costs	High	High	Low	Low		High				
Total Chemotherapy Costs			Low	Low	High	Low		High	Low	
Total Episode Cost of Care			Low	Low			High	High	Low	
Total Beneficiary Cost Sharing			Low	Low	High	High		High	Low	
All-Cause Mortality	High		Low	Low	Low	High	Low	High		

Source: Episode characteristics file, 2014 – 2015. This exhibit presents a qualitative assessment of trends of episode outcomes by cancer bundle, based on the distribution of cost and utilization outcomes by cancer bundle in the pooled baseline period. "High" represents higher than average episode costs or utilization, and "Low" represents lower than average episode costs or utilization, within a cancer bundle, relative to all other cancer bundles. This summary does not indicate statistical differences.

Part B and D Chemotherapy, by Cancer Bundle

Chemotherapy can be covered under Medicare Part B (physician administered) or Part D (oral, topical, patient administered). The mix of Part B and Part D chemotherapy used in an episode varied across cancer bundles (Exhibit 3-S2). More than 80 percent of episodes for bladder, head and neck, lymphoma, colorectal, and lung cancers included Part B chemotherapy only, no Part D chemotherapy. The share of episodes with Part D chemotherapy only was highest for leukemia and breast cancers. In the tables below we refer to the mix of Part B and Part D as chemotherapy "source."

Exhibit 3-S2: Episode Volume by Source of Chemotherapy and Cancer Bundle in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristics file, 2014 – 2015. Proportions are based the full sample of episodes in the pooled baseline period.

Episode Utilization by Primary Cancer Bundle

Many utilization and cost measures varied significantly by cancer bundle due to differences in treatment regimens, disease severity, and beneficiary characteristics (e.g., age, comorbidities). Due to the variation in outcomes by cancer bundle, OCM impact analyses will be conducted at the cancer bundle level, when a sufficient sample size is available for analysis.

Cancer E&M Services

There was variation in the number of cancer E&M services by cancer bundle.

- The number of cancer E&M services was lowest for breast and prostate cancer episodes, averaging three to four cancer E&M services per episode (Exhibit 3-S3). Fewer cancer E&M services reflect the use of hormonal therapy for stable patients with breast and prostate cancer, which requires fewer services (further analysis of utilization based on hormonal therapy can be found in Section 3.4.2).
- The number of cancer E&M services per episode was highest, on average, for lung, colorectal, and head and neck cancers. Beneficiaries with lung cancer averaged seven to eight E&M services per six-month episode, while colorectal and head & neck cancer episodes averaged eight to nine cancer E&M services. Average cancer E&M services by cancer bundle were systematically higher among OCM practice episodes than among comparison TIN episodes, although differences were small (differences of 0.3 to 1.1 cancer E&M services per episode).
- Across cancer bundles there was a small decline in the average number of cancer E&M services per episode over the expanded baseline period, although not all cancer bundles had equal declines. Melanoma episodes, for example, had no change in the average number of cancer E&M services, while leukemia episodes had an average decline of 0.6 cancer E&M services. A change in the number of E&M services over the expanded baseline period may be due to shifts in treatment modality (e.g., fewer infusion therapies and more oral therapies) or changes in clinical guidelines (e.g., fewer lines of treatment recommended for non-responsive cancers).
- Detailed findings of cancer E&M services by cancer bundle and performance period are shown in Appendix Exhibit A5-1.

Part B and D Chemotherapy Services

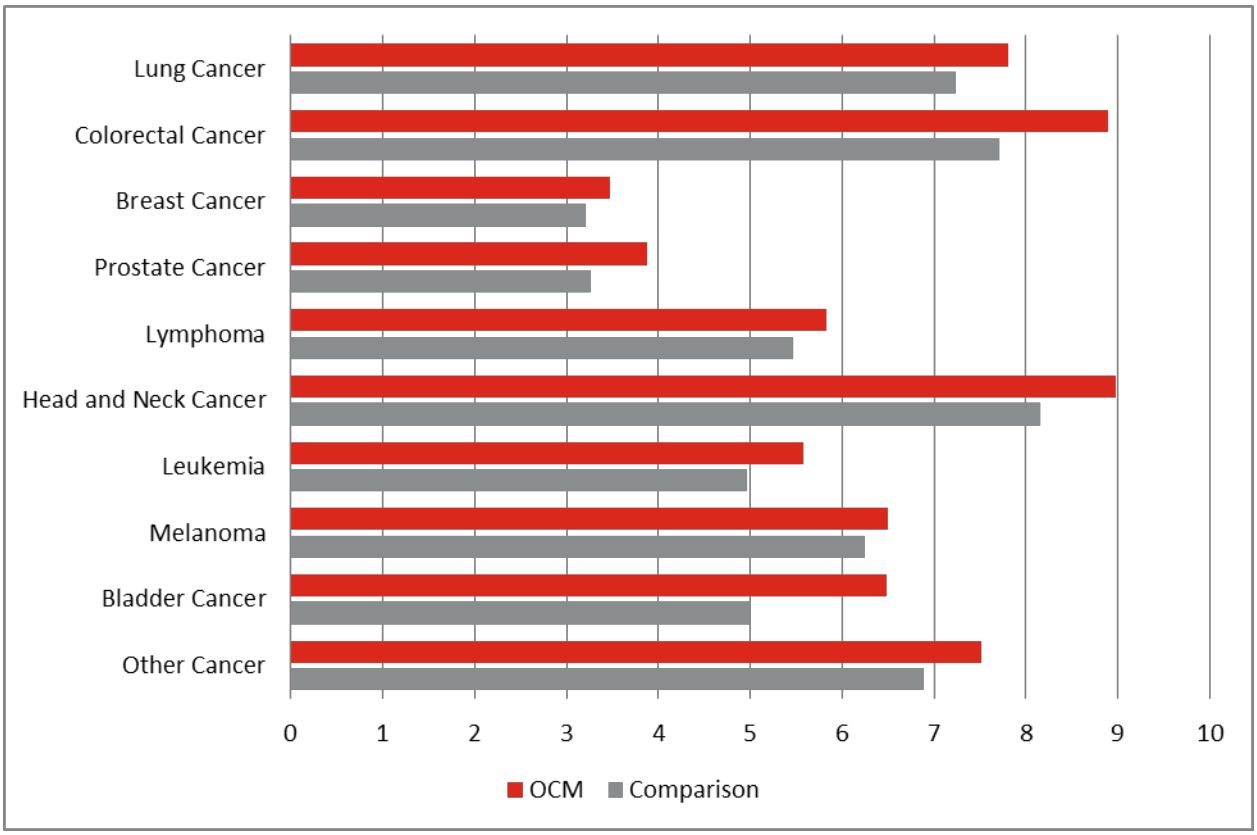
The number of chemotherapy services per episode varied across cancer bundle. While Part B and Part D chemotherapy for all cancer bundles averaged seven to eight services per episode,[63] this ranged from three to sixteen services per episode for the different cancer bundles (Exhibit 3-S4).

- Cancer bundles with fewer chemotherapy services included breast and prostate cancer, again because many of these episodes were for stable patients on long-term hormonal therapy. In the pooled baseline period, OCM practice and comparison TIN breast cancer episodes averaged five chemotherapy services, and prostate cancer episodes averaged three to four chemotherapy services per episode. Hormonal therapies may require as few as one to two chemotherapy services per episode (e.g., two 90-day prescriptions for oral hormonal therapy for breast cancer patients per six-month

[63] We use the terminology services instead of records or visits to report the count of chemotherapy services since a beneficiary can have multiple chemotherapy treatments on the same visit/day.

episode). Further analysis about differences in episodes using only hormonal therapy is in Section 3.4.2.

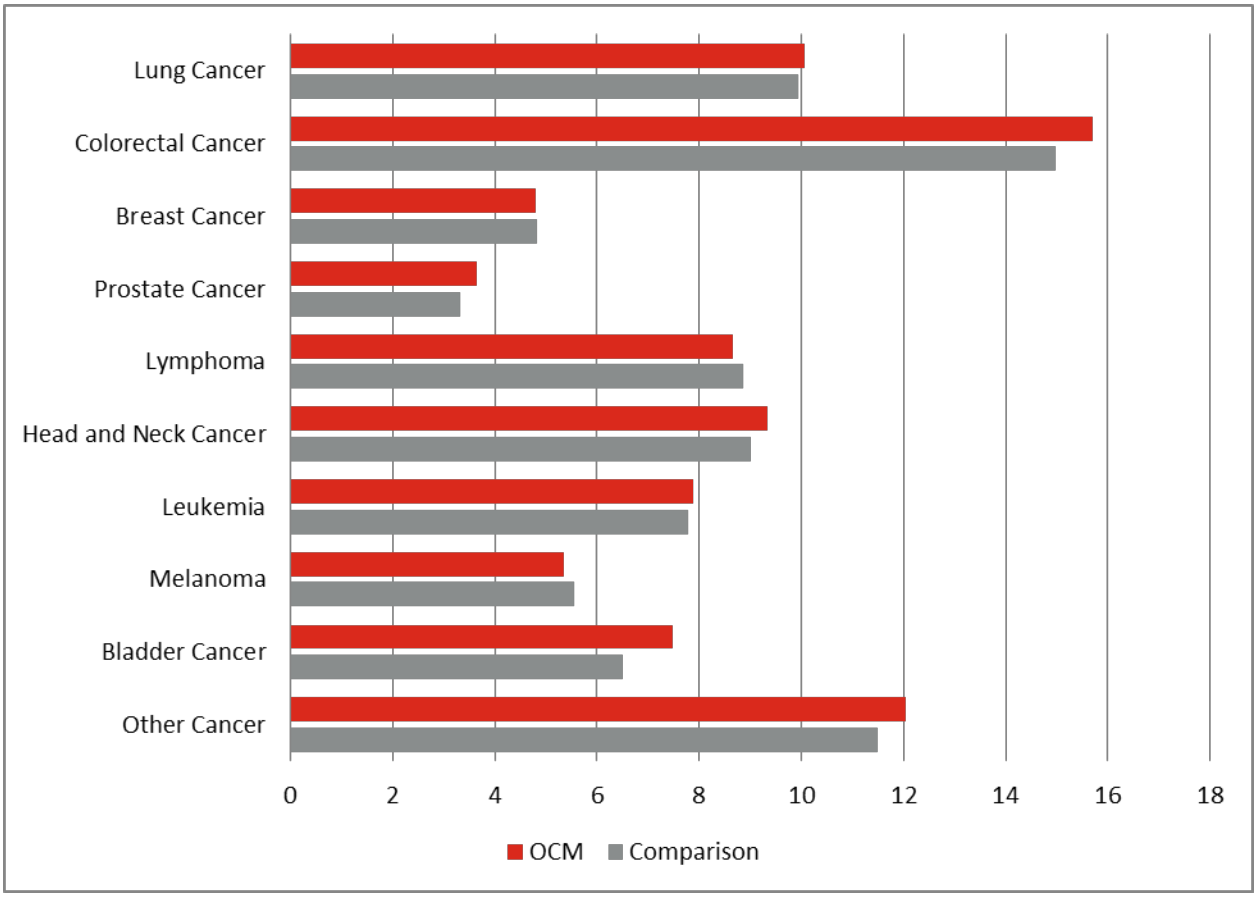
Exhibit 3-S3: Cancer-Related E&M Services per Episode by Cancer Bundle in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristics file, 2014 – 2015.

- Cancer bundles with a higher number of Part B and Part D chemotherapy services per episode included colorectal, lung, and "other cancer" bundles. Lung cancer episodes averaged 10 chemotherapy services per episode, other cancer episodes averaged 11 to 12 chemotherapy services per episode, and colorectal cancer episodes averaged 15 to 16 chemotherapy services per episode.
- Detailed findings of how chemotherapy intensity—as measured by the number of chemotherapy services—varies by cancer bundle and performance period are shown in Appendix Exhibit A5-2.

Exhibit 3-S4: Part B and D Chemotherapy Services per Episode by Cancer Bundle in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristics file, 2014 – 2015.

Other Services

Hospital and Emergency Department Utilization

- Rates of inpatient admissions varied by cancer bundle which is likely due to cancer type, disease stage and severity, and treatments (e.g., surgery, cytotoxic chemotherapy). Breast and prostate cancer episodes had the lowest average number of inpatient admissions (0.17 to 0.30 admissions per episode in the baseline period),[64] and lower average length of stay for those that were admitted. Lung cancer and head and neck cancer had the highest average number of inpatient admissions per episode, ranging from 0.61 to 0.70 admissions per episode in the baseline period. Detailed inpatient utilization by cancer bundle and performance period is shown in Appendix Exhibit A2-5 and A2-6.
- There was variation in average number of ED visits per episode not resulting in an inpatient stay, by cancer bundle. Episodes for head and neck cancers and lung cancers had higher rates of ED visits not resulting in an inpatient stay (1.05 to 1.21 visits per episode among OCM practices and comparison TINs in the baseline period), while breast and prostate cancer bundles had lower average ED visits not resulting in an inpatient stay (0.37 to 0.40 and 0.49 to 0.59 visits per episode, respectively, in the baseline period) (Appendix Exhibit A5-3). These differences were likely related to hormonal treatments for many breast and prostate cancer episodes, relative to the more toxic treatments for other cancers.

Skilled Nursing Facility Utilization

- Similar to other utilization outcomes, the use of SNF was lowest among breast and prostate cancer episodes (ranging from 0.3 to 0.7 stays per episode in the baseline period), and highest among head and neck cancer, lung cancer, and melanoma (ranging from 0.8 to 0.17 stays per episode in the baseline period) (Appendix Exhibit A5-4). Again, breast cancer and prostate cancer patients treated with hormonal therapy, who were less likely to need inpatient hospital care during their episode, were also less likely to need SNF care following a hospitalization.
- Among episodes with at least one SNF stay, the mean length of stay, measured as the number of Medicare-covered SNF days, was similar across cancer bundles (approximately one month), with the exception of head and neck cancer episodes, which had higher than average SNF length of stay (32 to 44 Medicare-covered days in the baseline period) (Appendix Exhibit A5-5). These differences in length of SNF stay by cancer bundle likely reflect the need for more extensive rehabilitation (e.g., following head and neck surgery).

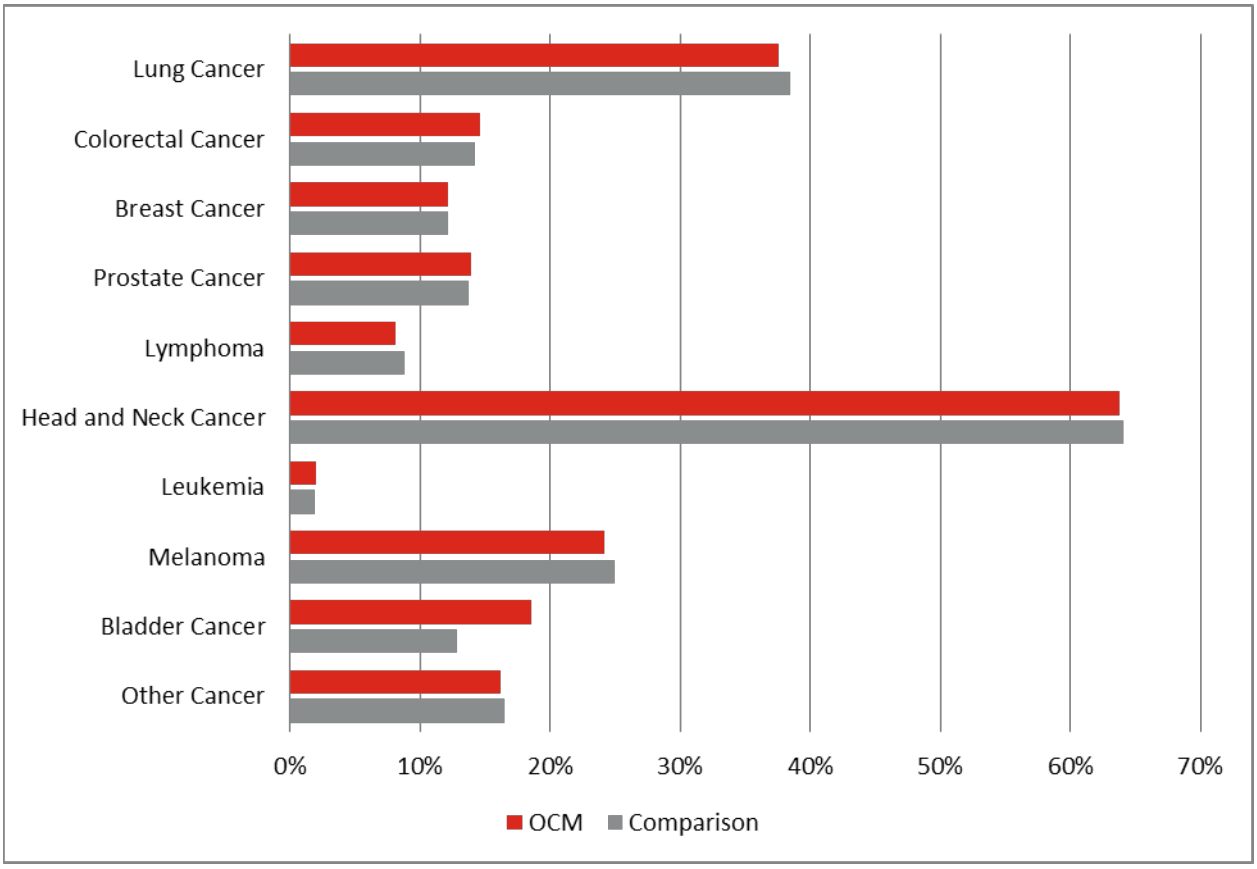
Radiation Therapy

Utilization of radiation therapy was much higher for certain cancer bundles than for others, due to differing treatment regimens (Exhibits 3-S5 and 3-S6). Within the head and neck cancer bundle, for example, approximately two-thirds of episodes included radiation therapy, while radiation therapy was uncommon for leukemia episodes. Radiation therapy use by cancer bundle and performance period is shown in Appendix Exhibits A5-6 and A5-7.

---

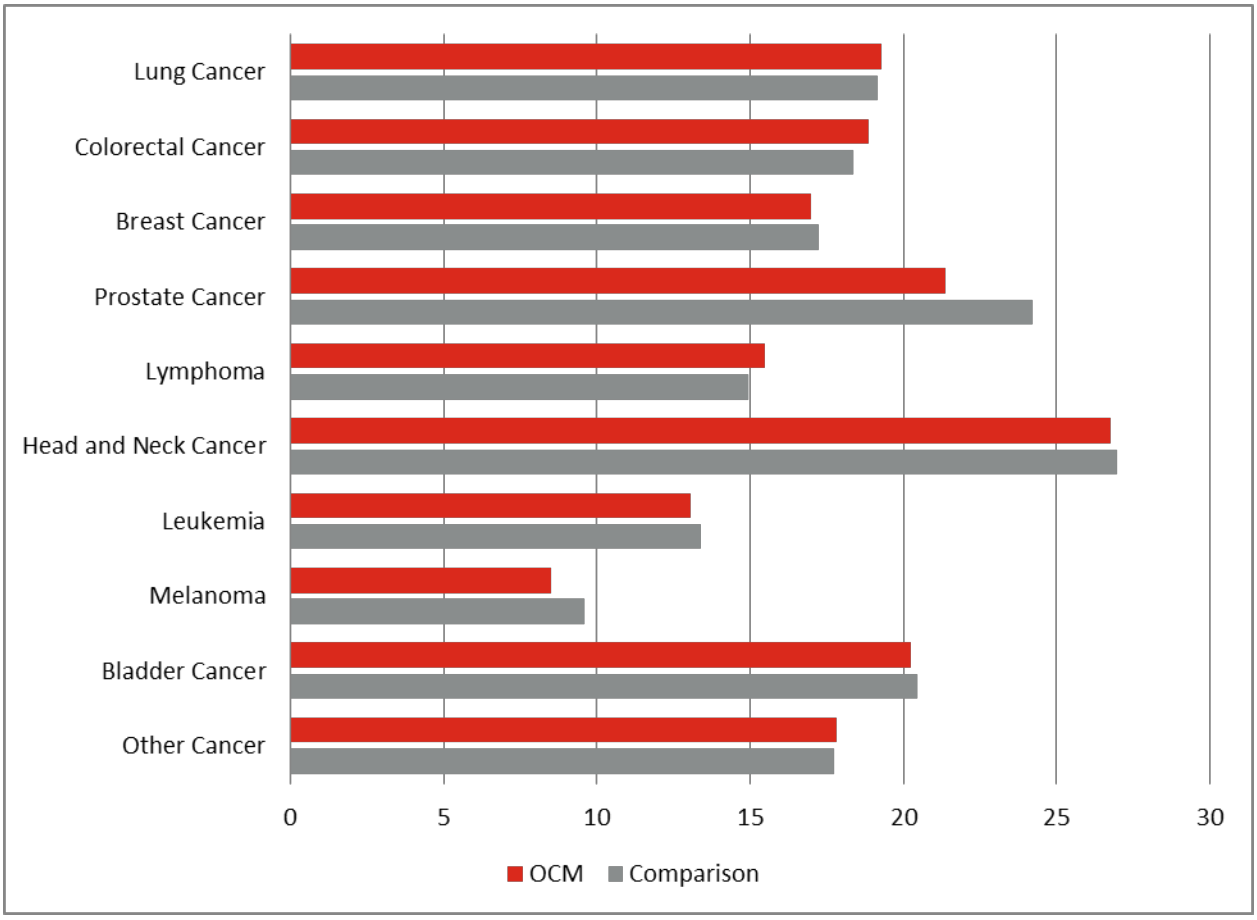
[64] The "baseline period" represents performance periods -4, -3 and -2.

Exhibit 3-S5: Proportion of Episodes Utilizing Radiation Therapy by Cancer Bundle in the Pooled Baseline Period (Episodes Initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristics file, 2014 – 2015.

Exhibit 3-S6: Number of Radiation Therapy Visits per Episode by Cancer Bundle in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



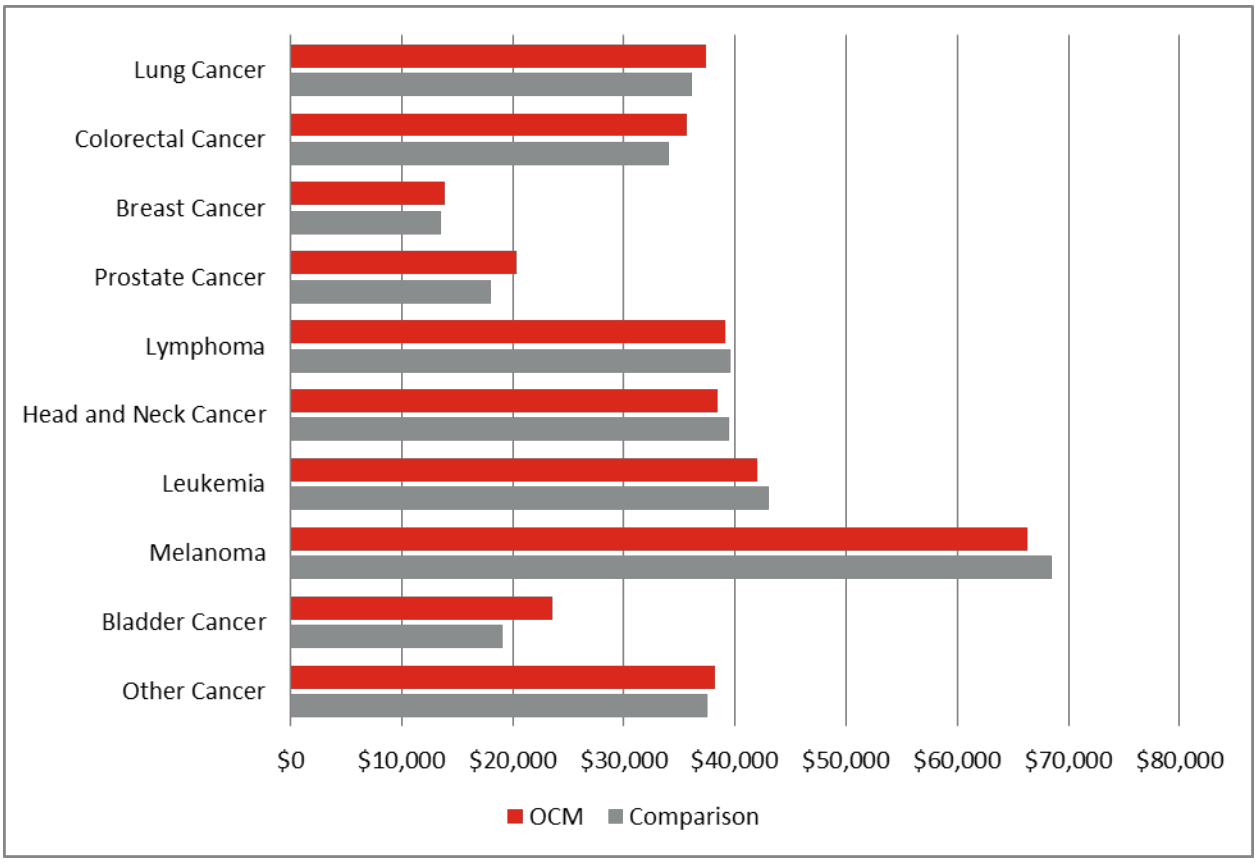
Source: Episode characteristics file, 2014 – 2015.

Episode Costs by Primary Cancer Bundle

Total Medicare Episode Cost of Care

- Total cost of care per episode varied by cancer bundle during the baseline period, as some cancer bundles were much more resource intensive or required more costly drugs or procedures than others.
  - Breast, prostate, and bladder cancer bundles had the lowest average cost per episode. Total cost of care averaged $13,500 to $13,900 per breast cancer episode, $18,000 to $20,400 per prostate cancer episode, and $19,100 to $23,600 per bladder cancer episode, in the pooled baseline period (Exhibit 3-S7).
  - Melanoma and leukemia episodes had the highest average episode cost of care. Melanoma total episode costs ranged from $66,400 to $68,500 and leukemia total episode costs ranged from $42,000 to $43,100 in the pooled baseline period.
- Total Medicare cost per episode, by cancer bundle and performance period, is presented in Appendix Exhibits A5-8.

Exhibit 3-S7: Standardized Part A and B and Part D Total Cost of Care per Episode by Cancer Bundle in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristics file, 2014 – 2015.

Cancer E&M Service Costs

Total cancer E&M service costs were lowest for beneficiaries with breast and prostate cancer ($200 – $300 per episode in the baseline period), and highest for beneficiaries with lung, colorectal and head and neck cancer ($500 – $700 per episode in the baseline period). These cost differences reflect the underlying differences in numbers of cancer E&M services per episode by cancer bundle. Cancer E&M costs per episode by cancer bundle and performance period is shown in Appendix Exhibit A5-9.

Part B and D Chemotherapy Costs

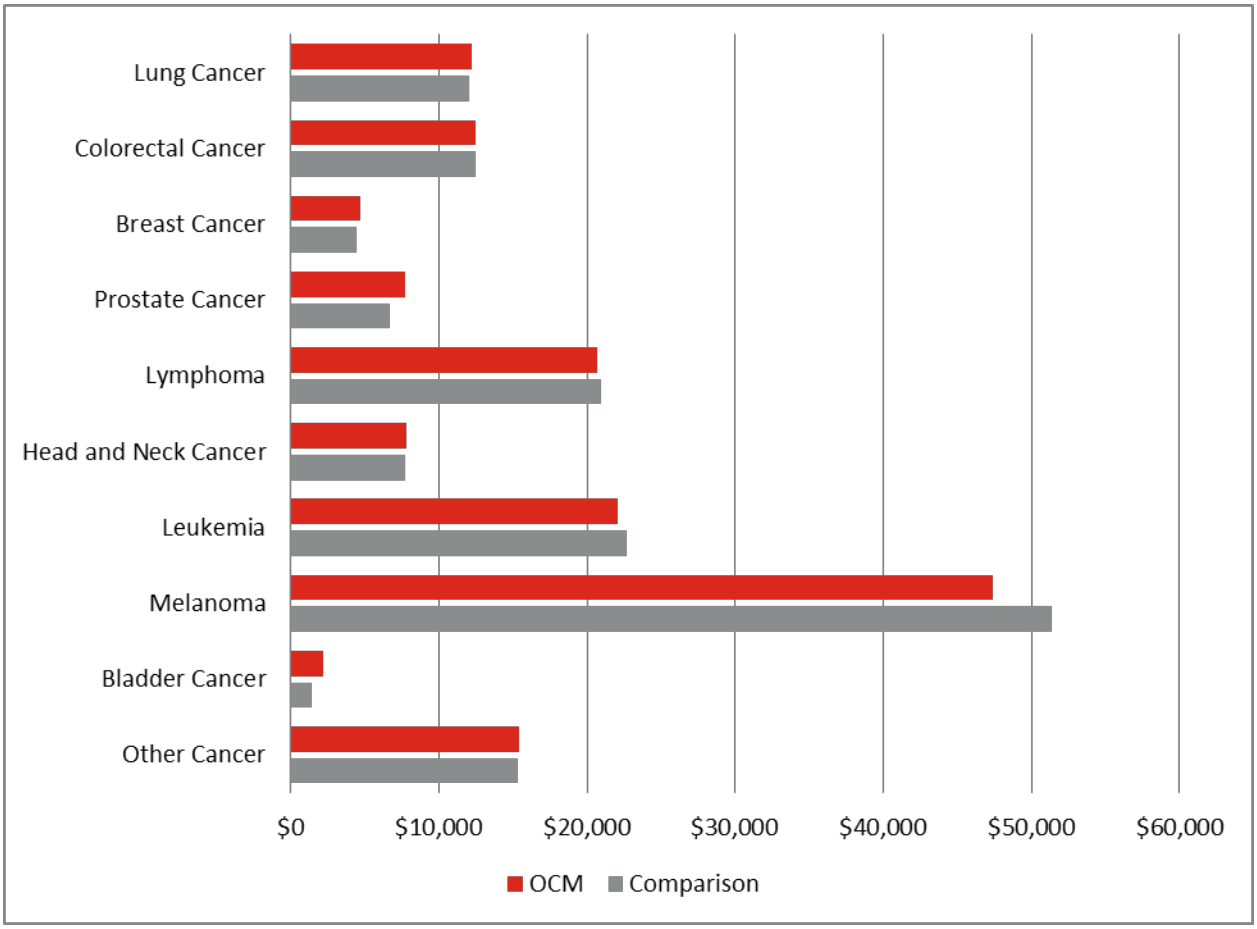
Part B and Part D chemotherapy costs varied considerably by cancer bundle.

- Average total Part B and Part D chemotherapy costs per episode were lowest for beneficiaries with bladder cancer ($1,400 to $2,200 per episode), breast cancer ($4,400 to $4,700 per episode), and prostate cancer ($6,700 to $7,700 per episode), and highest for beneficiaries with lymphoma ($20,700 to $20,900 per episode), leukemia ($22,100 to $22,700 per episode), and melanoma ($47,400 to $51,400 per episode) in the pooled baseline period (Exhibit 3-S8).
- Factors contributing to the variation in chemotherapy costs by cancer bundle include the chemotherapy regimen (i.e., types and numbers of drugs) and associated drug costs, and availability

of more costly new drug therapies. Novel therapies and alternatives to cytotoxic chemotherapy (e.g., immunotherapy) will continue to become available throughout the evaluation of OCM. It will be important to factor in these therapeutic advances overall, and by cancer bundle.

- Total Part B and Part D chemotherapy costs per episode by cancer bundle and performance period is shown in Appendix Exhibit A5-10.

Exhibit 3-S8: Part B and Part D Chemotherapy Costs per Episode by Cancer Bundle in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristics file, 2014 – 2015.

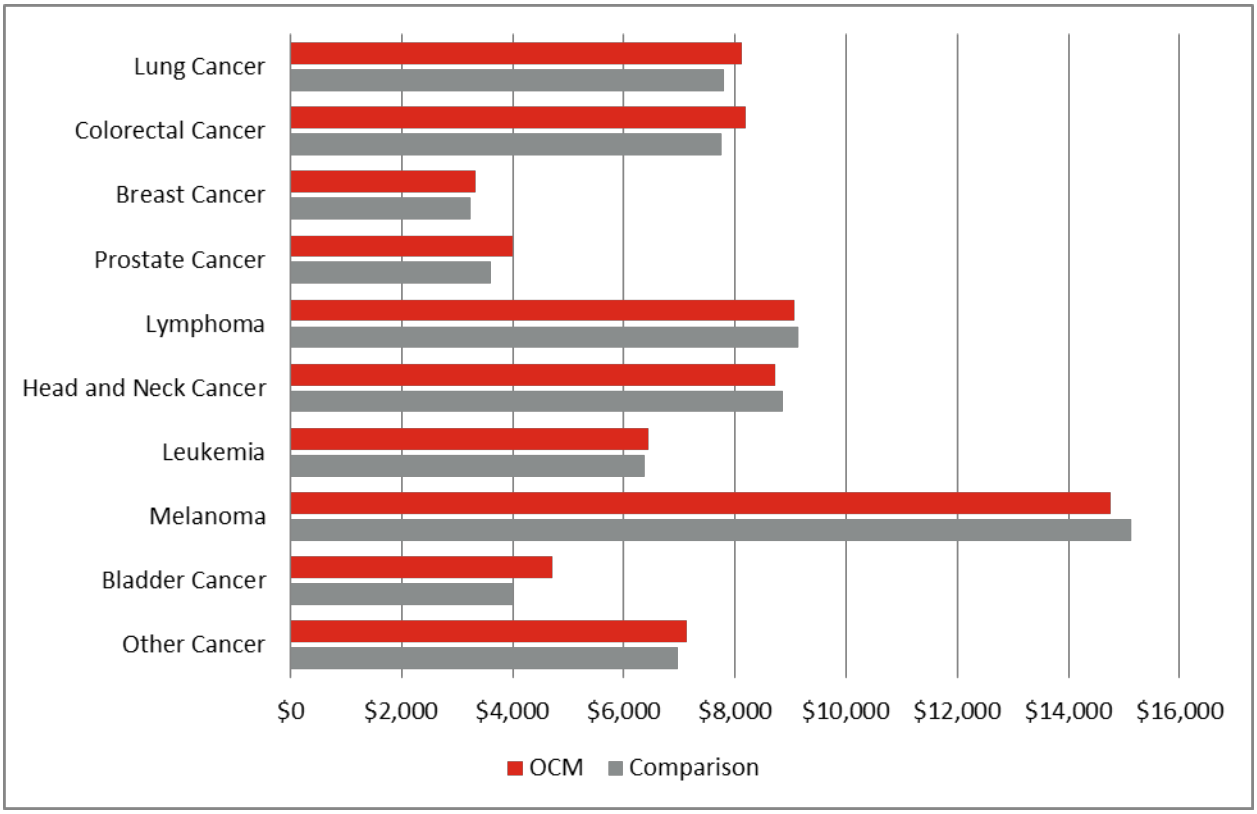
Beneficiary Cost Sharing

There was significant variation in the average beneficiary cost sharing by cancer bundle, and this was related to the variation in total episode cost.

- Beneficiaries with breast and prostate cancer had lower than average cost sharing per episode, $3,200 to $4,000 per episode in the pooled baseline period (Exhibit 3-S9). This was likely the result of hormonal therapies for many patients with these types of cancer, which may be less costly than cytotoxic chemotherapy, and may also lead to fewer chemotherapy services and fewer E&M services per episode, than is true for other cancer bundles (see Section 3.4.2 for a more thorough analysis of hormonal therapy use).

- In contrast, melanoma, lymphoma, and head and neck cancer bundles had higher than average beneficiary cost sharing per episode. Standardized Part A and Part B and Part D beneficiary cost sharing was $14,800 to $15,100 per episode, on average, for beneficiaries with melanoma, $9,100 for patients with lymphoma, and $8,700 to $8,900 for patients with head and neck cancers, in the pooled baseline period.
- Beneficiary cost sharing per episode, cancer bundle, and performance period is shown in Appendix Exhibit A5-11.

Exhibit 3-S9: Standardized Part A and B and Part D Beneficiary Cost Sharing per Episode by Cancer Bundle in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristics file, 2014 – 2015.

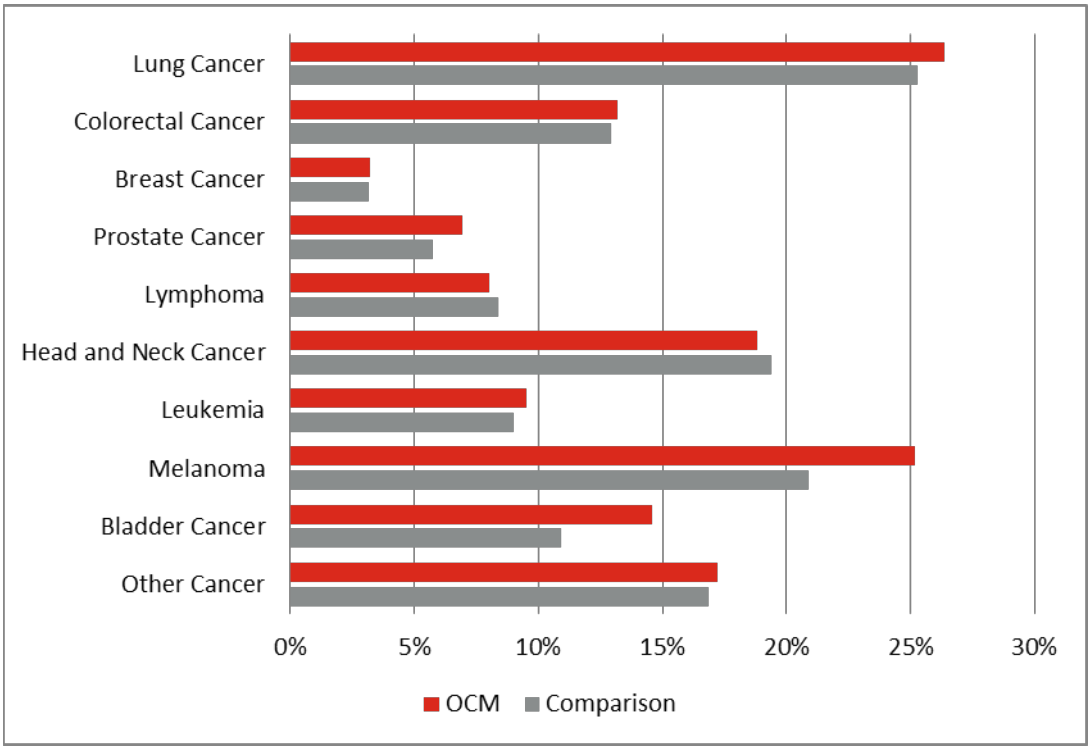
Mortality by Primary Cancer Bundle

Death during an episode indicates that the patient underwent chemotherapy (to trigger the episode) and died during the following six months. Mortality rates varied widely by cancer bundle (Exhibit 3-S10).

- Breast and prostate cancers had lower than average per episode mortality rates. All-cause mortality was three percent in breast cancer episodes and six (comparison TINs) to seven percent (OCM practices) for prostate cancer episodes, in the pooled baseline period. As with many other measures, this is likely due to the long periods of hormonal therapy (often years) during which patients are stable and not at high risk of dying from their cancer.

- All-cause mortality rates for lung cancer episodes was 25 percent for comparison TINs and 26 percent for OCM practices, head and neck cancer mortality was 19 percent for both OCM practices and comparison TINs, and melanoma mortality rates was 21 percent for comparison TINs and 25 percent for OCM practices, in the pooled baseline period.
- All-cause mortality by cancer bundle and performance period is shown in Appendix Exhibit A5-12.

Exhibit 3-S10: All-Cause Mortality by Cancer Bundle in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristics file, 2014 – 2015.

3.4.2 Episode Attributes by Use of Hormonal Therapy

Summary of Hormonal Therapy Subgroup Findings

Among breast cancer and prostate cancer episodes, there are subgroups treated exclusively by hormonal therapy, without any other type of chemotherapy. The majority of breast and prostate cancer episodes used only hormonal therapies.

- Among breast cancer episodes, hormonal therapy-only was associated with older, White beneficiaries with lower HCC scores, on average.
- Hormonal therapy-only prostate cancer episodes were less likely to be for dual eligible beneficiaries and more likely to be for older beneficiaries with lower HCC scores.
- Per episode service utilization was significantly lower among hormonal therapy-only episodes, as were episode costs.

Chemotherapy regimens can dramatically affect other service utilization and cost per episode. In Section 3.1 we described how breast cancer and prostate cancer episodes had fewer cancer E&M services, chemotherapy services, inpatient admissions, and ED visits not resulting in an inpatient stay, on average, compared to other cancer bundles. We investigated differences in treatment regimens, specifically use of hormonal therapies for a majority of breast and prostate cancer episodes, by segmenting the breast and prostate cancer episodes as follows:

- Hormonal Therapy-Only Subgroup.[65]
  - Breast cancer episodes were considered hormonal therapy-only if only hormonal therapy for breast cancer [66] and no other chemotherapies [67] were used during the episode.
  - Prostate cancer episodes were considered hormonal therapy-only if only hormonal therapy for prostate cancer[68] and no other chemotherapies were used during the episode.
- Other Therapies Subgroup.
  - Breast cancer and prostate cancer episodes were considered part of the other therapies subgroup if hormonal therapy for breast or prostate cancer was not the only type of therapy used during the episode. These episodes included hormonal therapy in combination with other chemotherapies, or no hormonal therapy at all.

We analyzed these subgroups separately for the breast and prostate cancer bundles and evaluated the same episode attributes as in previous sections. All utilization and cost measures were lower for episodes utilizing hormonal-only therapy, compared to episodes using other therapies which had higher than average utilization and cost.

Episode Characteristics by Hormonal Therapy Subgroups

The majority of breast and prostate cancer episodes used only hormonal therapy, without other chemotherapy. Beneficiaries with episodes using only hormonal therapy had lower HCC scores, for both breast and prostate cancer, than did breast cancer and prostate cancer patients with episodes for other therapy.

Breast Cancer Episodes

- Throughout the expanded baseline period, 69 percent of breast cancer episodes attributed to OCM practices and 71 percent of breast cancer episodes attributed to comparison TINs included only hormonal therapy.

---

65 These include breast or prostate cancer episodes receiving palliative hormonal therapy for advanced or metastatic disease, or adjuvant endocrine therapy for early-stage disease.

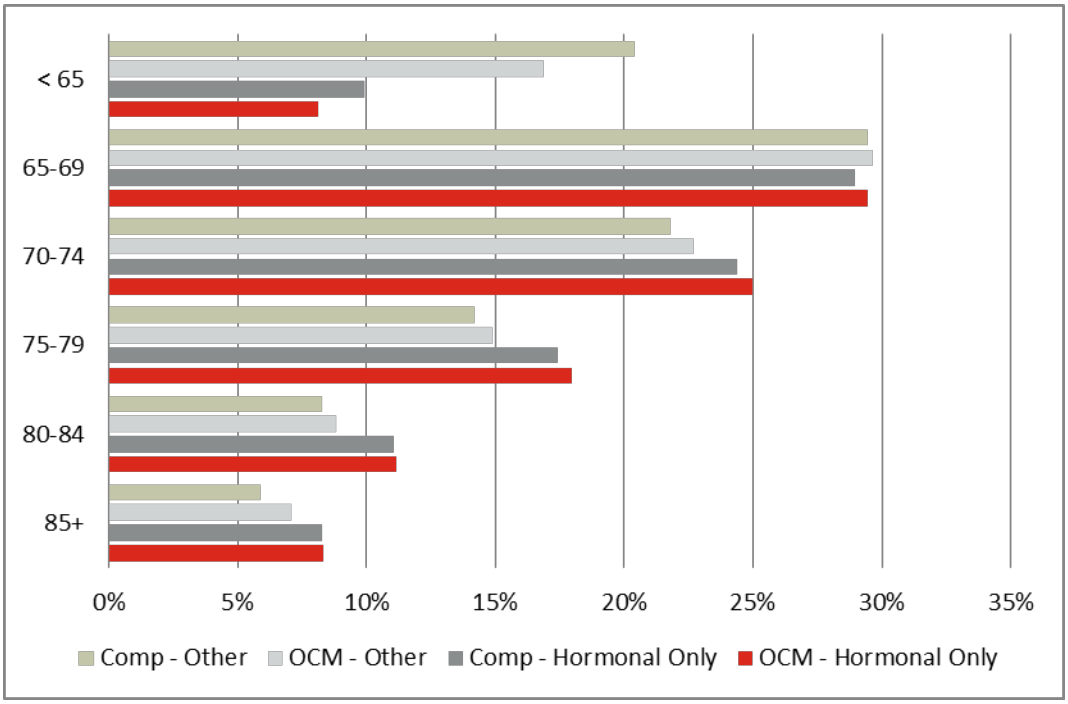
66 The set of drugs considered to be hormonal therapies for breast cancer were Tamoxifen, Anastrozole, Exemestane, and Letrozole.

67 Other chemotherapies were identified using the list of chemotherapy drugs that trigger an episode, per OCM program specifications.

68 The set of drugs considered to be hormonal therapies for prostate cancer were Degarelix, Goserelin, Leuprolide, Triptorelin, Bicalutamide, Flutamide, and Nilutamide.

- Hormonal therapy-only breast cancer episodes tended to be for older beneficiaries, on average, compared to breast cancer episodes with other or combination therapies. Sixty-two percent of OCM practice and 61 percent of comparison TIN hormonal therapy-only breast cancer episodes were for beneficiaries over the age of 70, while 50 percent (comparison TINs) and 53 percent (OCM practices) of other therapy breast cancer episodes were for beneficiaries over the age of 70 (Exhibit 3-S11).
- Hormonal therapy-only breast cancer episodes were more likely to be for white beneficiaries, though the magnitude of the difference was small.
- Beneficiaries with breast cancer episodes treated by hormonal therapy-only had lower HCC scores relative to those treated with other therapies; 15 to 21 percent of hormonal therapy-only episodes had HCC scores greater than or equal to two, while 42 to 57 percent of other therapy breast cancer episodes were for beneficiaries with HCC scores of two or above in the baseline period.
- Episode characteristics by performance period and hormonal therapy use among beneficiaries with breast cancer can be found in Appendix Exhibit A5-13.

Exhibit 3-S11: Age Breakdown of Breast Cancer Episodes, Hormonal Only vs. Other Therapies, in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristic file, 2014 – 2015.

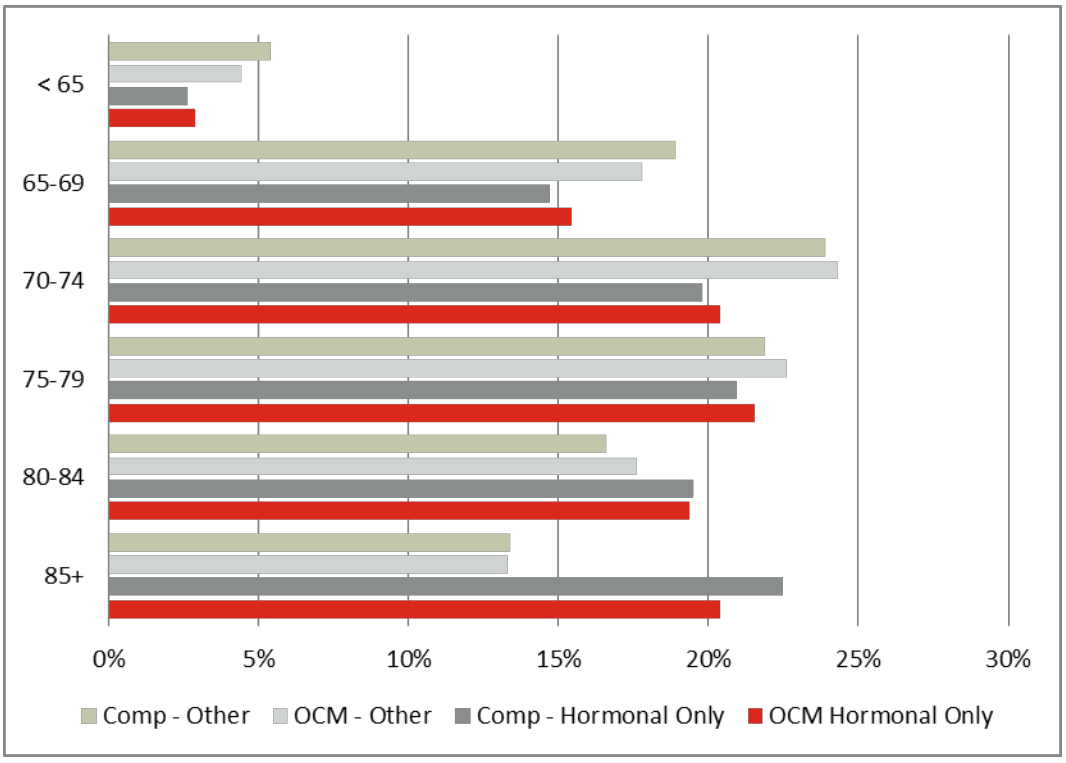
Prostate Cancer Episodes

- During the expanded baseline period, 70 to 75 percent of prostate cancer episodes attributed to OCM practices and comparison TINs were treated with hormonal therapy only.
- Among episodes with only hormonal therapy, 37 percent (comparison TINs) and 39 percent (OCM practices) of episodes were for beneficiaries under the age of 75, compared to 48 percent (comparison

TINs) and 47 percent (OCM practices) of prostate cancer episodes treated with other chemotherapies, during the pooled baseline period (Exhibit 3-S12).

- Prostate cancer episodes treated with hormonal therapy only were less likely to be for dual eligible beneficiaries, compared to prostate cancer episodes treated with other therapies. Eight percent of hormonal therapy-only prostate cancer episodes were for dual eligible beneficiaries in the baseline period, and 10 to 11 percent of prostate cancer episodes treated with other therapies were for dual eligible beneficiaries (Appendix Exhibit A5-14).
- On average, 33 percent (comparison TINs) to 36 percent (OCM practices) of hormonal therapy-only prostate cancer episodes had HCC scores greater than or equal to two, while 67 percent (comparison TINs) to 69 percent (OCM practices) of other therapy prostate cancer episodes had HCC scores greater than or equal to two in the baseline period.
- Episode characteristics by performance period and hormonal therapy use among beneficiaries with prostate cancer are shown in Appendix Exhibit A5-14.

Exhibit 3-S12: Age Breakdown of Prostate Cancer Episodes, Hormonal Only vs. Other Therapies, in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristic file, 2014 – 2015.

Episode Utilization by Hormonal Therapy Subgroups

The average number of cancer E&M services per episode for episodes treated with hormonal therapy-only was significantly lower than for episodes treated with other therapies, for both breast cancer and prostate cancer. Differences in the number of chemotherapy services per episode were lower as well. These

findings are not surprising as hormonal therapy regimens typically require less frequent visits than do other treatments. For example, stable prostate cancer patients typically receive a hormonal therapy injection every three months, and stable breast cancer patients may see their oncologists just once or twice each year.

Inpatient admissions and ED visits not resulting in an inpatient stay per episode were much lower for episodes with hormonal therapy-only treatment regimens than for episodes treated with other therapies. This is consistent with the finding that patients treated with hormonal therapy-only had substantially lower HCC scores and comorbidity burden.

Breast Cancer Episodes

- The average number of cancer E&M services per episode in the baseline period was 1.9 visits for breast cancer episodes with hormonal therapy-only, and 6.5 (comparison TINs) to 7.0 (OCM practices) for episodes treated with other therapies.
- Hormonal therapy-only breast cancer episodes averaged 2.3 to 2.5 chemotherapy services per episode, while episodes with other therapies averaged 11 chemotherapy services per episode in the baseline, probably reflecting greater use of infusion chemotherapy.
- Among episodes for breast cancer treated with hormonal therapy only, the mean number of inpatient admissions was 0.11 per episode, and the average number of ED visits not resulting in an inpatient stay was 0.19 (OCM practices) to 0.21 (comparison TINs) per episode during the baseline period. Breast cancer episodes where other therapies were used averaged 0.35 inpatient admissions per episode, and 0.33 (OCM practices) to 0.38 (comparison TINs) ED visits not resulting in an inpatient stay per episode in the baseline period.
- Episode utilization by performance period and hormonal therapy use among beneficiaries with breast cancer can be found in Appendix Exhibit A5-15.

Prostate Cancer Episodes

- For prostate cancer episodes, beneficiaries receiving hormonal therapy averaged 2.5 (comparison TINs) to 2.9 (OCM practices) cancer E&M services per episode, compared to 5.6 (comparison TINs) to 6.1 (OCM practices) cancer E&M services for episodes where other therapies were used in the baseline period.
- The average number of Part B and D chemotherapy services per episode in the baseline period, where hormonal therapy was the only treatment, was 2.2 to 2.3, but for episodes with other therapies there were 6.8 chemotherapy services per episode.
- Hormonal therapy-only prostate cancer episodes averaged 0.20 (comparison TINs) to 0.23 (OCM practices) inpatient admissions per episode, while episodes with other therapies averaged 0.37 (comparison TINs) to 0.43 (OCM practices) inpatient admissions in the baseline period. Similarly, prostate cancer episodes with hormonal therapy-only averaged 0.28 to 0.29 ED visits not resulting in an inpatient stay per episode in the baseline period, and those with other therapies averaged 0.43 to 0.44 visits per episode.
- Episode utilization by performance period and hormonal therapy use among beneficiaries with prostate cancer can be found in Appendix Exhibit A5-16.

Episode Costs by Hormonal Therapy Subgroups

Average total Medicare episode cost and beneficiary cost sharing were also significantly lower for episodes with hormonal therapy only.

Breast Cancer Episodes

Breast cancer episodes with hormonal therapy only averaged $5,600 in total episode cost, and $1,400 in beneficiary cost sharing, in the pooled baseline period. Breast cancer episodes treated with other therapies averaged $33,000 in total episode cost and $7,700 to $7,800 in beneficiary cost sharing in the pooled baseline period. Episode costs by performance period and hormonal therapy use among beneficiaries with breast cancer can be found in Appendix Exhibit A5-17.

Prostate Cancer Episodes

Average total Medicare episode cost in the pooled baseline period was $10,500 to $11,300 for prostate cancer episodes with hormonal therapy only, and $41,000 for episodes with other therapies. Hormonal therapy-only prostate cancer episodes averaged $2,500 to $2,600 in beneficiary cost sharing, while episodes with other therapies averaged $7,000 to $7,300 in beneficiary cost sharing, in the baseline period. Episode costs by performance period and hormonal therapy use among beneficiaries with prostate cancer can be found in Appendix Exhibit A5-18.

3.4.3 Episode Attributes by Beneficiary Subgroups

Summary of Episode Attributes by Beneficiary Subgroup Findings

- Episodes for dual eligible beneficiaries had more inpatient admissions and ED visits, but fewer cancer E&M services and chemotherapy services, on average, than episodes for beneficiaries who were not dually-eligible. Average total Medicare episode costs for dual eligible beneficiaries were significantly higher than for those without dual eligibility.
- Episodes for non-white beneficiaries had more chemotherapy services, inpatient admissions, and ED visits not resulting in an inpatient stay, as well as higher total Medicare cost, than did episodes for white beneficiaries. Beneficiary cost sharing was lower, on average, for episodes for non-white beneficiaries.
- Episodes for beneficiaries with at least one cancer-relevant chronic condition had higher utilization, on average, than those for beneficiaries without cancer-relevant chronic conditions. Total episode cost of care and beneficiary cost sharing per episode were both significantly higher for beneficiaries with at least one cancer-relevant chronic condition relevant, reflecting greater use of costly services.

Certain episode characteristics may differentially affect cancer treatment efficacy, and the impact of OCM. Previous research has documented differential outcomes based on race or ethnicity, income, and patient comorbidities.[69] Further, analyses presented in sections above note variation in utilization, costs, and mortality.

We considered several key beneficiary attributes that may impact episode patterns in treatment and utilization. For example, several factors contribute to beneficiaries being dually eligible for Medicare and Medicaid, including income, disabilities, and age, all of which may impact cancer detection and

[69] American Cancer Society. Cancer Facts & Figures 2017. Atlanta: American Cancer Society; 2017.

treatment, and possibly the effectiveness of OCM. In addition, beneficiary health status (as measured by HCC score or comorbidities) can affect treatment decisions and the total cost of an episode. Examining variation within potentially risky and costly subgroups of episodes is important for identifying and understanding patterns of care for the OCM evaluation.

Abundant previous research demonstrated differences in cancer detection and treatment outcomes based on race or ethnicity, including diagnosis rates and stage at diagnosis,[70] beneficiary survival curves,[71] and overall mortality rates.[72] These differences may reflect uneven access to care, ability to afford cancer care, or the quality of the cancer care received.[73] Understanding baseline beneficiary characteristics, patterns in utilization and costs, and outcomes of treatment based on beneficiary race or ethnicity is important for developing analytical approaches that properly account for this variation. Race and ethnicity are not independent of other beneficiary characteristics that influence access and outcomes, including health status and eligibility for Medicaid (dual status). While we analyze each factor independently, it is important to note that some of the outcome patterns we see in racial/ethnic subgroups mirror patterns for dual-eligible and high-risk beneficiaries. Multivariate techniques will help us disentangle the contribution of race/ethnicity and other beneficiary characteristics in future impact analyses.

Below we segment OCM practice and comparison TIN episodes by a number of key beneficiary-level characteristics to examine variation in cancer treatment and cost (Exhibit 3-S13). These analyses will support the design of evaluation models and covariate selection, and allow for more thorough evaluation and understanding of underlying drivers of outcomes.

Exhibit 3-S13: Beneficiary Subgroups and Attributes Analyzed

Beneficiary Subgroup Type	Subgroup	Description
Medicaid Dual Eligible Status	Dual	Beneficiary with Medicaid dual eligible status (either full dual or partial dual) as of the episode trigger start month
	Non-Dual	Beneficiary without Medicaid dual eligible as of the episode trigger start month
Race	White	Beneficiary with non-Hispanic White race/ethnicity
	Non-White	Beneficiary with a race other than non-Hispanic White (include Black, Hispanic, etc.)
Health Risk	High Risk	Beneficiary with at least one chronic condition relevant for oncology care (see Section 2.6.2)
	Low Risk	Beneficiary with no chronic conditions that are relevant for oncology care

In this initial evaluation of baseline patterns, we grouped together non-White groups because sample sizes for specific racial and ethnic minorities were small and identifying significant effects could be difficult. In the future we will explore whether there are differential impacts among the various minority populations

[70] SEER Cancer Stat Facts: Cancer of Any Site. National Cancer Institute. Bethesda, MD.

[71] American Cancer Society. Cancer Facts & Figures for African Americans 2016 – 2018. Atlanta: American Cancer Society, 2016. American Cancer Society. Cancer Facts & Figures for Hispanics/Latinos 2015 – 2017. Atlanta: American Cancer Society; 2015.

[72] SEER Cancer Stat Facts: Cancer of Any Site. National Cancer Institute. Bethesda, MD.

[73] Atlanta: American Cancer Society, 2016, American Cancer Society. Cancer Facts & Figures for Hispanics/Latinos 2015 – 2017. Atlanta: American Cancer Society; 2015.

to determine if additional segmentation is necessary and feasible. To examine variation by health risk, we stratified by whether a beneficiary had any cancer-relevant chronic conditions.[74] We also used HCC score as an alternative indicator of health risk (scores greater than or equal to 2 were considered high risk).[75] We focus here on the findings based on chronic condition subgroups and provide corresponding findings for subgroups defined by HCC score in Appendix Exhibits A5-26 through A5-28.

A summary of findings by beneficiary subgroup is summarized in Exhibit 3-S14.

Exhibit 3-S14: Summary of Differences in Selected Utilization and Cost Measures by Beneficiary Characteristic Subgroup

Outcome	Dual Eligible Status		Race/Ethnicity		Health Risk	
	Dual Eligible	Non-Dual Eligible	White	Non-White	High Risk	Low Risk
# Cancer E&M Services	Low	High	High	Low	High	Low
# Chemotherapy Services	Low[1]	High[1]	Low	High	High	Low
# Inpatient Admissions	High	Low	Low	High	High	Low
# ED Visits	High	Low	Low	High	High	Low
Total Episode Cost of Care	High	Low	Low	High	High	Low
Beneficiary Cost Sharing	High	Low	High	Low	High	Low

Source: Episode characteristic file, 2014 – 2015.
Note: "Low" corresponds to lower utilization and "high" corresponds to higher rates of utilization.
[1] Difference existed for OCM practices only, no significant difference was observed for comparison TINs.

Variation in Episode Volume by Cancer Mix and Beneficiary Subgroup

There was variation in cancer mix across the beneficiary subgroups during the expanded baseline period.

Dual-Eligibility

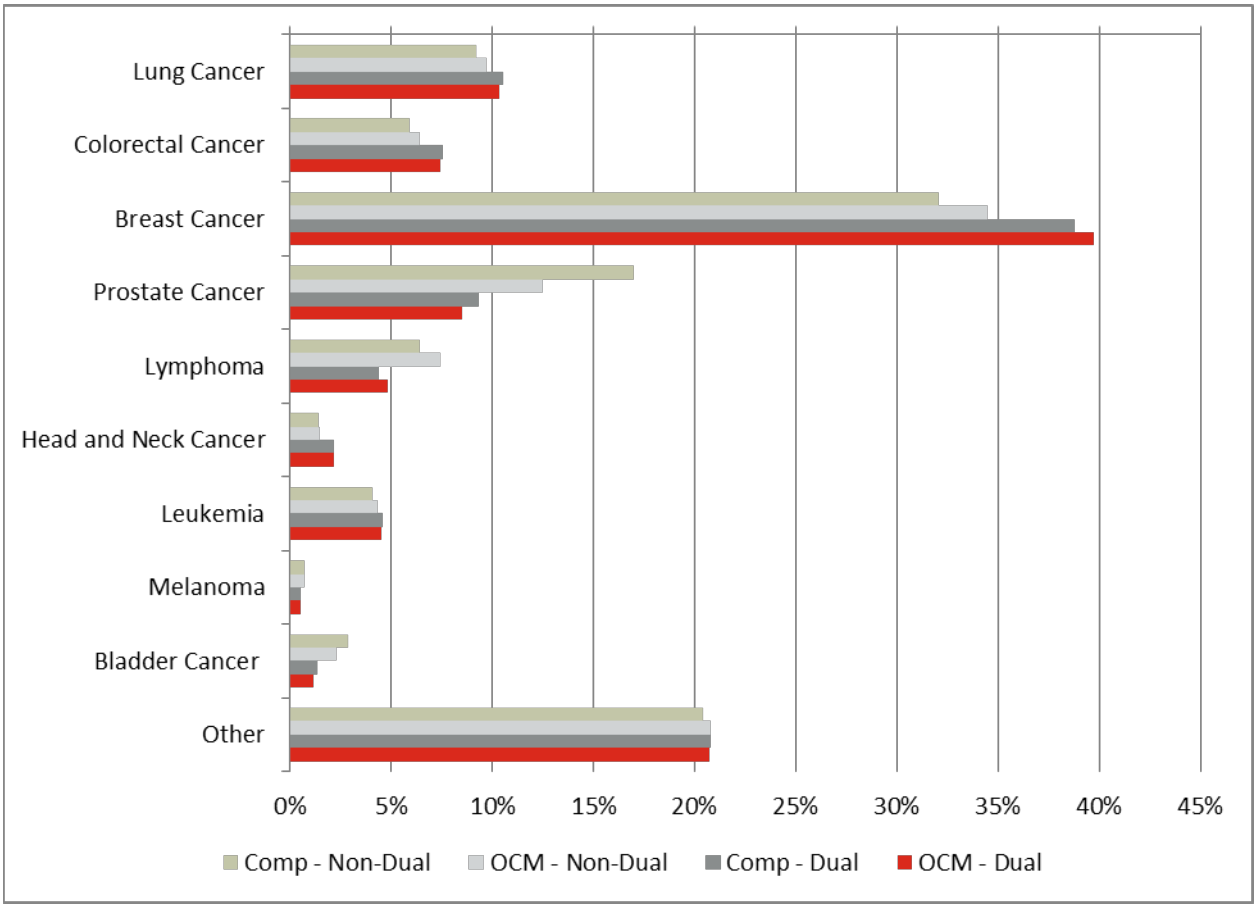
There were minor differences in the breakdown of episodes by cancer bundle between beneficiaries who were dual eligible and those who were not.

- A higher proportion of dual eligible beneficiaries had breast cancer or head and neck cancer, and a lower proportion had prostate cancer, lymphoma, and bladder cancer, compared with those not eligible for Medicaid. For example, in the pooled baseline period, 39 to 40 percent of OCM practice and comparison TIN dual-eligible episodes had breast cancer, compared to 35 percent and 32 percent of OCM practice and comparison TIN episodes, respectively, for those that were not eligible for Medicaid (Exhibit 3-S15).
- The difference in the proportion of dually eligible beneficiaries was much smaller for episodes with head and neck cancer, where two percent of episodes for dual eligible beneficiaries were for head and neck cancer, compared with one percent for those without dual eligibility.
- Share of episodes by cancer bundle, performance period, and dual eligibility can be found in Appendix Exhibit A5-19.

[74] The methods section describes how we identified cancer-relevant comorbidities.

[75] This threshold was defined based on the distribution of HCC scores throughout the expanded baseline period.

Exhibit 3-S15: Share of Episodes by Cancer Bundle, Dual vs. Non-Dual Beneficiaries, in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



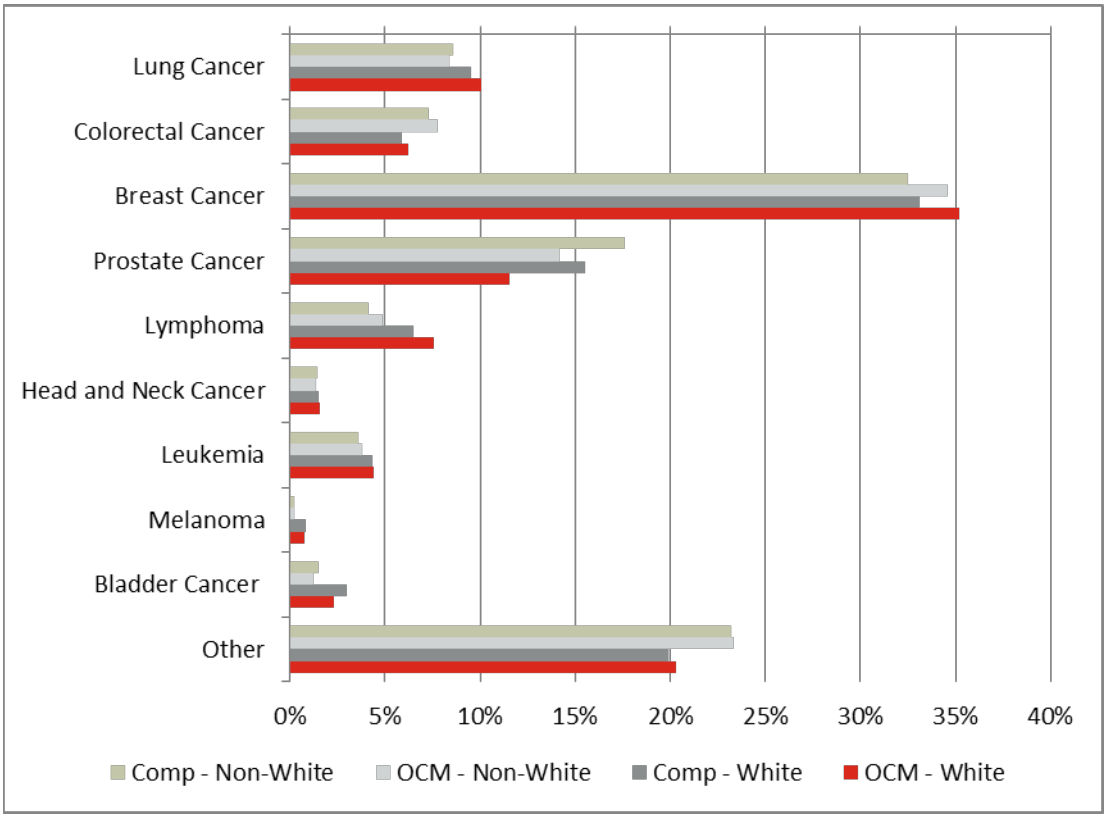
Source: Episode characteristic file, 2014 – 2015.

White vs. Non-White Beneficiaries

There was variation in cancer mix between White and non-White beneficiaries.

- Among White beneficiaries, there was a higher proportion of breast, lymphoma, leukemia, melanoma, and bladder cancer episodes than was true for non-White beneficiaries during the baseline period (Exhibit 3-S16).
- Conversely, among non-White beneficiaries there was a higher proportion of prostate, colorectal cancer and "other" cancer episodes than was true for White beneficiaries during the baseline period. Share of episodes by cancer bundle, performance period, and race/ethnicity can be found in Appendix Exhibit A5-20.

Exhibit 3-S16: Share of Episodes by Cancer Bundle, White vs. Non-White Beneficiaries, in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristic file, 2014 – 2015.

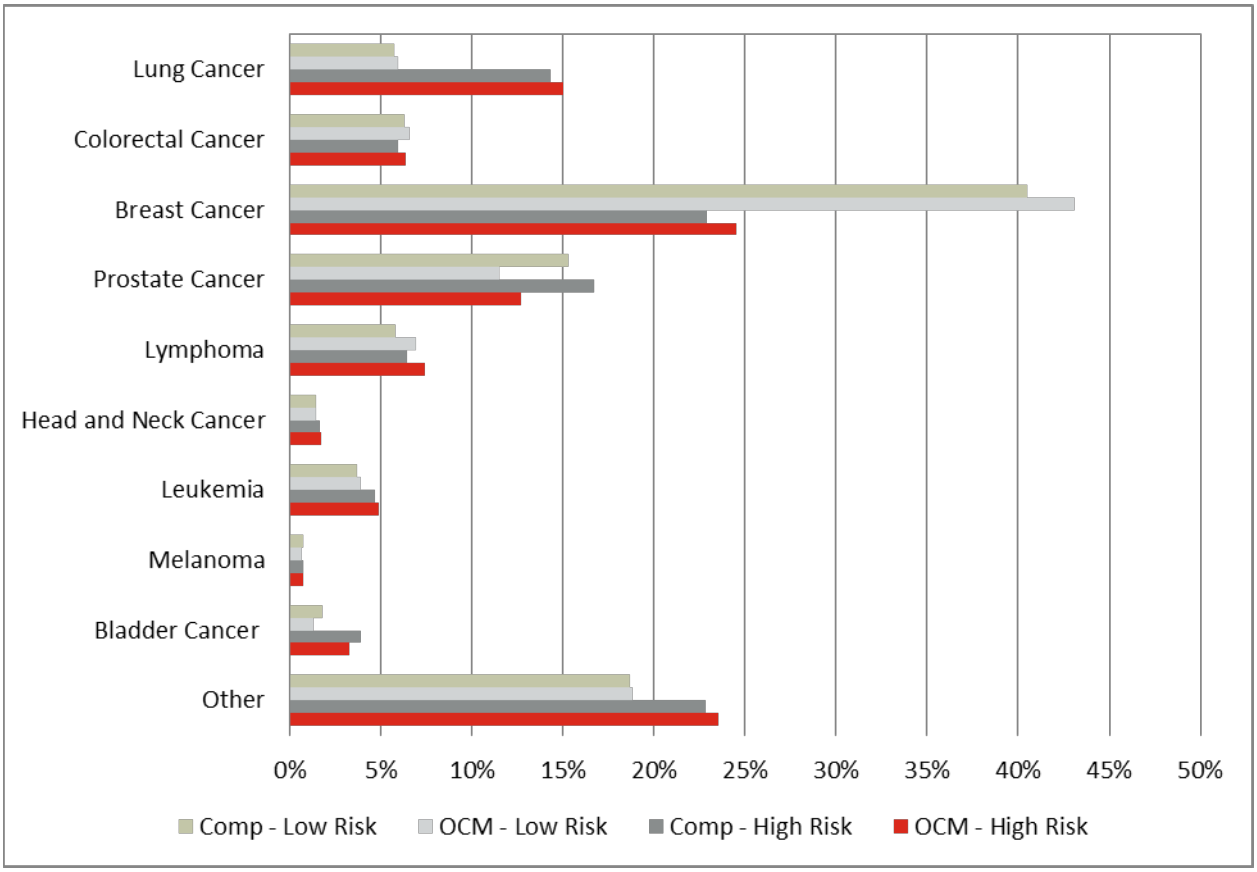
High Risk vs. Low Risk Beneficiaries

Cancer-relevant chronic conditions were more likely to be present within certain cancer bundles because factors related to the cancer were also associated with risk for comorbidities. Tobacco use, for example, is a cause of lung and bladder cancers and also leads to a number of other chronic conditions such as pulmonary and heart disease.

High-risk beneficiaries had a higher proportion of lung cancer, leukemia, lymphoma, bladder cancer, and "other" cancer episodes, and a lower proportion of breast cancer episodes, than did those at lower risk (Exhibit 3-S17).

- In the pooled baseline period, 14 to 15 percent of episodes for high-risk beneficiaries were for lung cancer treatment, while only six percent of episodes with no chronic conditions were for lung cancer treatment.
- The proportion of episodes with one or more relevant chronic conditions was five percent for leukemia, three to four percent for bladder cancer, and 23 to 24 percent for "other" cancers, while for those without chronic conditions, the comparable rates were four percent for leukemia, one to two percent for bladder cancer, and 19 percent for "other" cancers.
- Share of episodes by cancer bundle, performance period, and risk level can be found in Appendix Exhibit A5-21.

Exhibit 3-S17: Share of Episodes by Cancer Bundle, High Risk vs. Low Risk, in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristic file, 2014 – 2015.

Episode Utilization by Beneficiary Subgroups

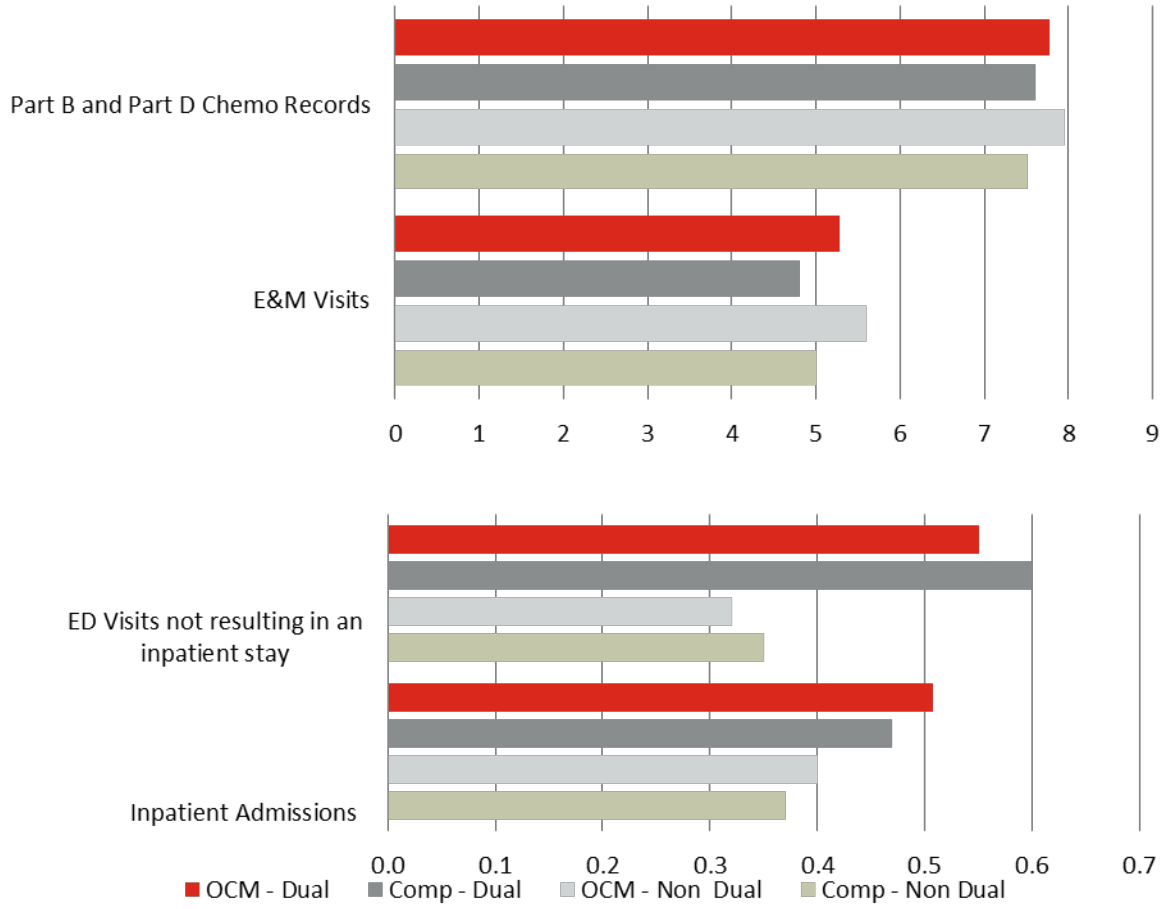
There were differences in episode utilization patterns between beneficiary subgroups. Dual-eligible beneficiaries had fewer cancer E&M services per episode, but more inpatient admissions and ED visits not resulting in an inpatient stay, than did those not eligible for both Medicare and Medicaid. White beneficiaries had lower utilization of chemotherapy and fewer inpatient admissions and ED visits not resulting in an inpatient stay per episode relative to non-White beneficiaries. High-risk beneficiaries had more cancer E&M services and more chemotherapy services per episode, and substantially more inpatient admissions and ED visits not resulting in an inpatient stay per episode, than did than lower risk beneficiaries.

Dual vs. Non-Dual Beneficiaries

- Dual-eligible beneficiaries had fewer cancer E&M services per episode, on average, compared to episodes for those not dual-eligible. In the pooled baseline period, dual-eligible beneficiaries in OCM practices had 5.3 cancer E&M services per episode and those attributed to comparison TINs had 4.8 cancer E&M services per episode, compared to 5.6 and 5.0 cancer E&M services, respectively, among episodes for beneficiaries who were not dual-eligible (Exhibit 3-S18). This pattern in E&M services among episodes for dual-eligible and non-dual beneficiaries was consistent across most cancer bundles.

- Episodes for dual eligible beneficiaries had a higher average number of inpatient admissions than was true of episodes for those not dual-eligible (0.47 to 0.51 compared to 0.37 to 0.40) and ED visits not resulting in an inpatient stay (0.55 to 0.60 compared to 0.32 to 0.35).
- Episode services by performance period and dual-eligible status can be found in Appendix Exhibit A5-22.

Exhibit 3-S18: Average Utilization of Cancer-Related and Hospital Services, Dual vs. Non-Dual Beneficiaries, in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristic file, 2014 – 2015.

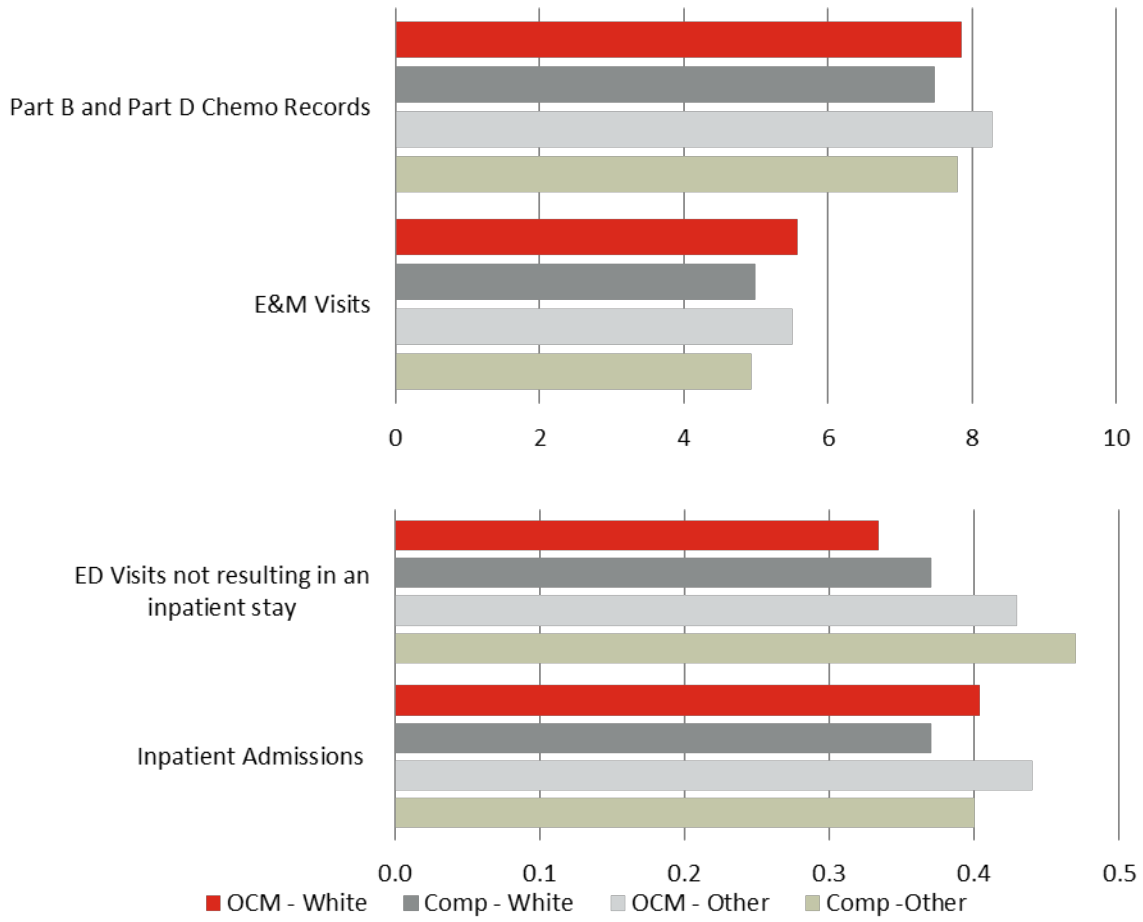
White vs. Non-White Beneficiaries

- Non-White beneficiaries had a higher number of chemotherapy services per episode, on average, than did White beneficiaries. These differences were small in magnitude (approximately 0.3 to 0.4 services among OCM practices and comparison TINs) and were likely correlated with socioeconomic status.
- Non-White beneficiaries also had a higher number of inpatient admissions and ED visits per episode, on average, throughout the expanded baseline period (Exhibit 3-S19). In the pooled baseline period, White beneficiaries averaged 0.37 (comparison TINs) to 0.40 (OCM practices) inpatient admissions

per episode while non-White beneficiaries averaged 0.40 (comparison TINs) to 0.44 (OCM practices) inpatient admissions per episode.

- The average number of ED visits not resulting in an inpatient stay was 0.33 (OCM practices) to 0.37 (Comparison TINs) among White beneficiaries and 0.43 (OCM practices) to 0.47 (comparison TINs) among non-White beneficiaries per episode in the pooled baseline period.
- Episode services by performance period and race/ethnicity can be found in Appendix Exhibit A5-23.

Exhibit 3-S19: Average Utilization of Cancer-Related and Hospital Services, White vs. Non-White Beneficiaries, in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristic file, 2014 – 2015.

High Risk vs. Low Risk Beneficiaries

High risk beneficiaries had higher utilization, on average, compared to low risk beneficiaries.

- The number of cancer E&M services was 5.3 and 6.0 among comparison TIN and OCM practice episodes, respectively, with one or more relevant chronic conditions. Among beneficiaries with no chronic conditions, OCM episodes averaged 5.2 services and comparison episodes averaged 4.7 services per episode in the pooled baseline period (Exhibit 3-S20).
- High risk beneficiaries averaged 7.8 (comparison TIN) to 8.3 (OCM practice) chemotherapy services per episode, compared to 7.4 (comparison TIN) to 7.7 (OCM practice) chemotherapy services per episode among low risk beneficiaries.
- Patterns in cancer E&M services and beneficiary risk were not consistent by cancer bundle (Appendix Exhibit A5-24).
- The average number of inpatient visits per episode was significantly higher for high risk beneficiaries, which may have been due to an underlying comorbidity rather than directly due to cancer. The number of inpatient admissions per episode was 0.61 admissions among OCM episodes and 0.56 admissions among comparison TIN episodes for high risk beneficiaries, compared to 0.24 (comparison TIN episodes) and 0.26 (OCM practice episodes) inpatient admissions for low risk beneficiaries in the pooled baseline period (Exhibit 3-S20).
- The differences in the number of ED visits not resulting in an inpatient stay per episode between high risk and low risk beneficiaries were similar to the pattern for inpatient admissions.
- Episode utilization of services by performance period and beneficiary risk can be found in Appendix Exhibit A5-25.

Episode Costs by Beneficiary Subgroup

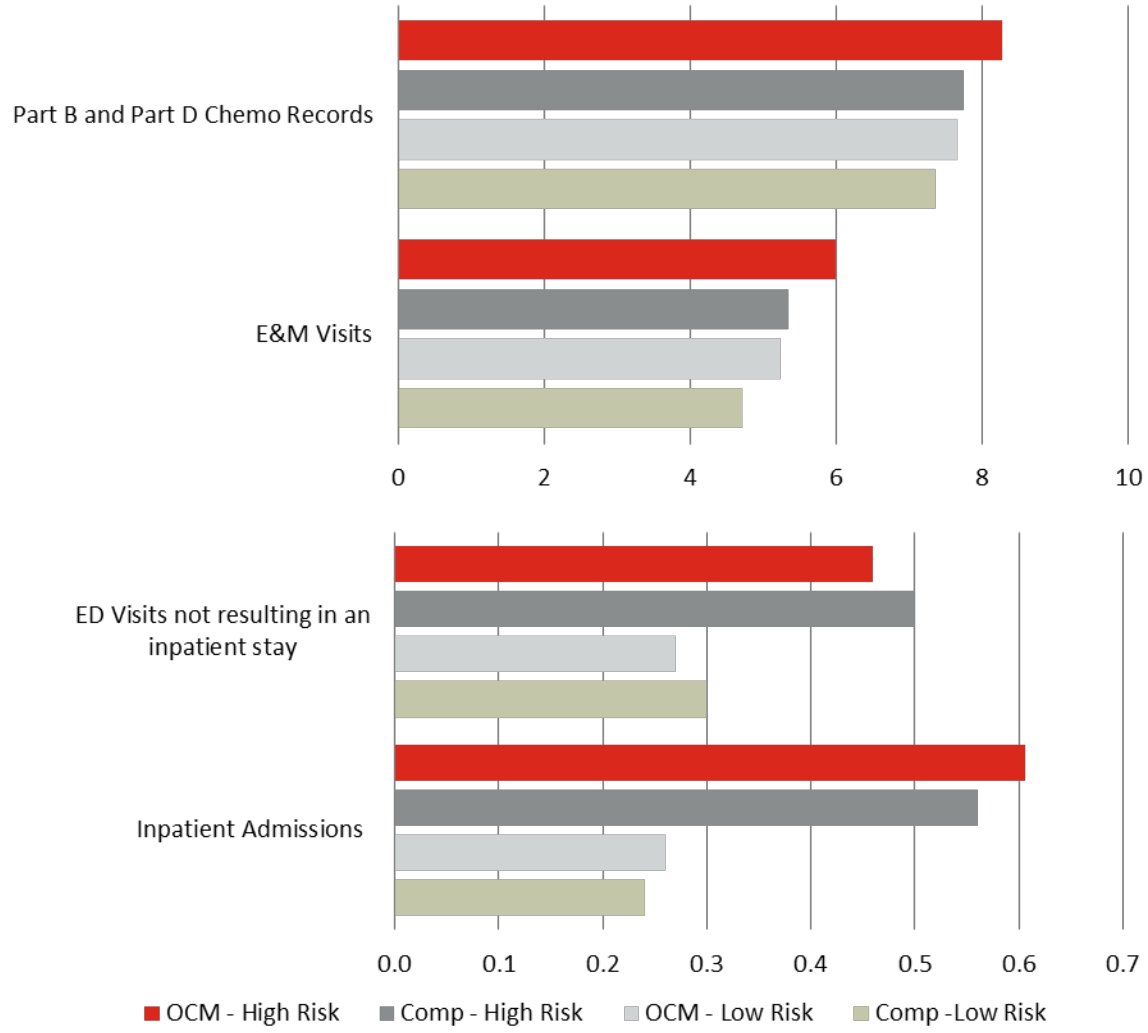
There were substantial differences in episode costs for different beneficiary subgroups. Both dual eligible beneficiaries and high-risk beneficiaries had substantially higher total Medicare episode costs than did their counterparts. High-risk beneficiaries also had higher beneficiary cost sharing than did low risk beneficiaries. Dual eligible beneficiaries had lower cost sharing relative to others, because they receive cost sharing subsidies. White beneficiaries had lower total episode costs, but higher cost sharing, compared to minority beneficiaries, because fewer White Medicare beneficiaries were eligible for Medicaid and the associated cost sharing subsidies.

Dual vs. Non-Dual Beneficiaries

Average total Medicare episode cost for dual eligible beneficiaries was significantly higher than for those who were not dual eligible. This is consistent with the patterns described above for higher risk scores and more utilization per episode among dual-eligible beneficiaries.

- In the pooled baseline period, dual eligible beneficiaries averaged $31,000 in total Medicare cost per episode, compared to $25,500 to $26,900 per episode for those not dually eligible. Higher costs among dual eligible beneficiaries were observed across cancer bundles.
- Mean beneficiary cost sharing per episode was lower for dual eligible beneficiaries (approximately $5,000 per episode) than for non-dual eligible beneficiaries (approximately $5,500 to $5,800 per episode).

Exhibit 3-S20: Average Utilization of Cancer-Related and Hospital Services, High vs. Low Risk Beneficiaries, in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Episode characteristic file, 2014 – 2015.

White vs. Non-White Beneficiaries

Average total episode cost was higher for non-White beneficiaries in the baseline period, but total beneficiary cost sharing per episode was lower, on average, compared to White beneficiaries.

- Total Medicare costs averaged $28,000 to $29,000 per episode for non-White beneficiaries and $26,000 to $27,000 per episode for White beneficiaries in the pooled baseline period.
- Beneficiary cost sharing ranged from $5,100 to $5,400 per episode for non-White beneficiaries and $5,500 to $5,800 per episode for White beneficiaries.

High Risk vs. Low Risk Beneficiaries

Total episode cost and beneficiary cost sharing per episode were both significantly higher for high risk beneficiaries.

- Total cost of care per episode averaged $31,000 (comparison TINs) to $32,000 (OCM practices) in the pooled baseline period for high risk beneficiaries and $23,000 (comparison TINs) to $24,000 (OCM practices) among low risk beneficiaries.
- Beneficiary cost sharing averaged $6,100 (comparison TIN) to $6,400 (OCM practice) per episode for high risk beneficiaries and $5,000 (comparison TIN) to $5,200 (OCM practice) per episode among low risk beneficiaries. Higher costs and cost sharing per episode were likely associated with higher utilization, high cost chemotherapy utilization, and cancer mix.

3.4.4 Episode Attributes by Practice Subgroups

Practice size and structure, such as number of physicians and physician specialty mix, may affect the care provided to beneficiaries treated within a practice (e.g., cancer types, patient comorbidities). Size and specialization may also impact practices' ability to implement many of the quality initiatives encouraged by OCM. There may also be implications for the OCM evaluation if high costs are a reflection of different treatment patterns, or if treatment patterns differ among high cost vs. low cost practices and TINs. Identifying differences in patterns between OCM practices and comparison TINs, segmented by high/low cost of the practice, is important for validating the evaluation approach.

Practice-level affiliation with hospitals, health systems or academic medical centers may influence referral networks, and availability of more specialized care, and this in turn may impact a practice's or TIN's patient mix, practice structure, and/or treatment patterns. Specific types of affiliations may affect the structure of practices, patient mix, and patient volume differently. For example, oncologists in a practice affiliated with an academic medical center may have other professional commitments such as teaching or research, and thus lower patient loads. Patients seeking clinical trials or novel therapies, and those with rare cancers, may be referred to practices affiliated with academic medical centers. Hospital ownership and/or health system affiliation may impact a practice or TIN's access to technology and treatments, influence whether they administer chemotherapy on-site, and provide a source of referrals (from colleagues in the health system) not available to independent practices. For these reasons, understanding variation by practice level subgroups is important for identifying drivers of cost and quality outcomes, and covariates for inclusion in the evaluation of OCM. We focus on seven practice-level subgroups to assess variation in episode-level characteristics and outcomes, summarized in the table below (Exhibit 3-S21).

Exhibit 3-S21: Practice Subgroups and Episode-Level Attributes Analyzed

Practice Subgroup Type	Subgroup	Description
Number of Oncologists	Large	Practice had greater than or equal to 12 oncology NPIs[76]
	Small	Practice had fewer than 12 oncology NPIs
Patient Load	High Load	Practice had greater than or equal to 50 attributed beneficiaries per oncologist NPI[77]
	Low Load	Practice had fewer than 50 attributed beneficiaries per oncologist NPI
Oncology Specialization	Oncology Only	Practice had only oncologist NPIs delivering cancer-related care
	Multi-Specialty	Practice had non-oncologist NPIs delivering cancer-related care
High Cost Practice in Market	High Cost	Practice was high cost, per methodology in Section 2.6.2
	Non-High Cost	Practice was not designated a high cost provider
Academic Medical Group	Academic	Practice was affiliated with an academic medical center
	Non-Academic	Practice was not affiliated with an academic medical center
Affiliation with Health System	Health System Affiliated	Practice was managed by or affiliated with a health system
	Non-Affiliated	Practice was not managed or affiliated with a health system
Owned by a Hospital	Hospital Owned	All or some subset of the practice's sites were owned by a hospital
	Not Hospital Owned	None of the practice's sites were owned by a hospital

Episode Volume by Cancer Mix and Practice Subgroup

The volume of episodes by cancer bundle mix varied according to several practice characteristics (subgroups). In particular, we observed notable variation due to oncology specialization, high cost, and practice affiliation subgroups, discussed below.

High vs. Low Patient Load Practices

The proportion of episodes for "other" cancers (not grouped into a more specific cancer bundle) was higher, and the proportion of episodes for prostate cancer was lower, among practices with low patient loads (Appendix Exhibit A5-29). Some of the more common cancers comprising the "other" cancer bundle included ovarian cancer, pancreatic cancer, and multiple myeloma.[78] We found a limited number of significant differences in the proportion of episodes for the specifically-defined cancer bundles. That is, most practices treated a similar proportion of the various cancer bundles, regardless of whether the practice/TIN had high or low patient loads. While certain cancer bundles are less resource intensive and might contribute to patient load, cancer bundle alone doesn't explain differences in patient load among practices and TINs.

---

[76] This threshold was determined by the distribution of oncology NPI counts, which differs for OCM practices and comparison TINs, and selected to ensure an adequate sample of practices within each subgroup.

[77] The threshold of 50 is based on the median value of the distribution.

[78] Together, these three cancer types comprised 48 percent of the episodes within the "Other" bundle for both OCM and comparisons with low patient loads.

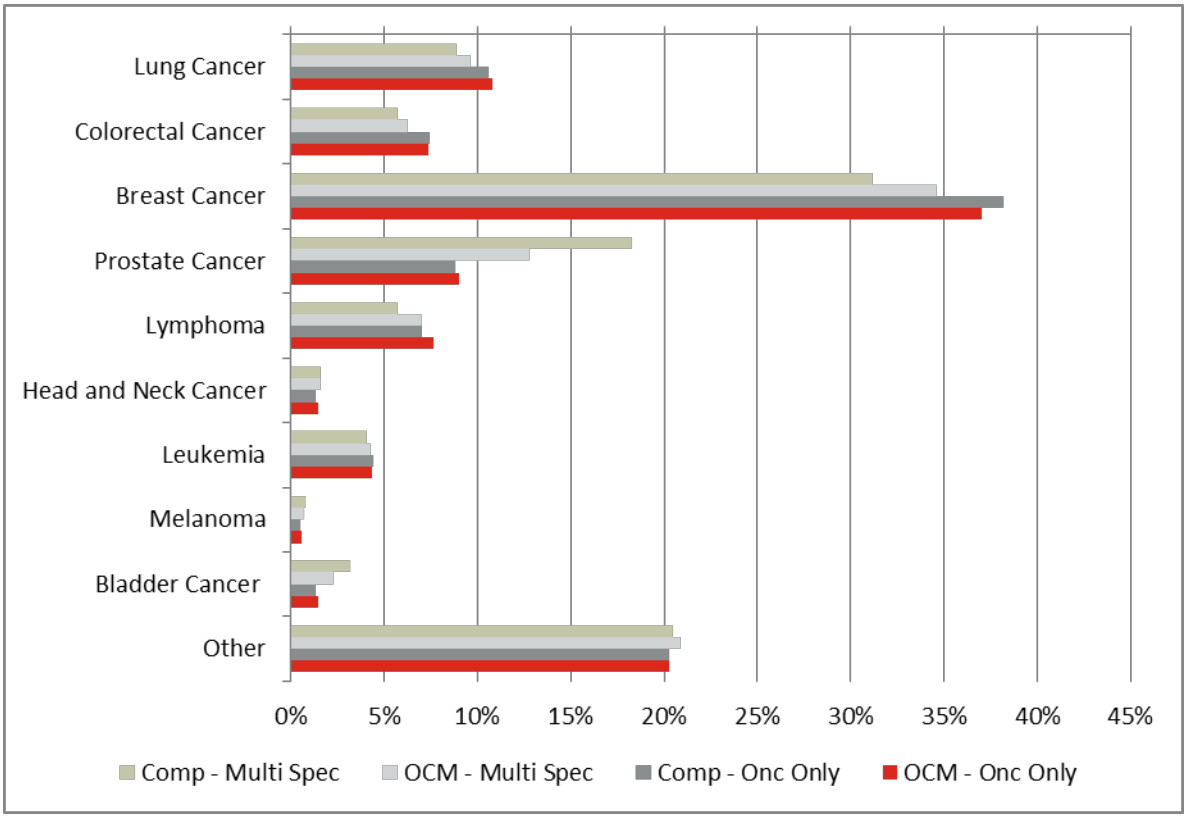
Oncology Only vs. Multi-Specialty Practices

The mix of cancer episodes differed between oncology-only and multi-specialty practices (Exhibit 3-S22).

- Across the baseline period, oncology-only OCM practices and comparison TINs had a larger proportion of lung cancer, breast cancer, and colorectal cancer episodes than did multi-specialty practices/TINs
- Multi-specialty practices and TINs had a higher proportion of prostate and bladder cancer episodes than did oncology-only practices and TINs, which may be due to the presence of urologists in these multi-specialty practices

These patterns were consistent throughout the expanded baseline period.

Exhibit 3-S22: Share of Episodes by Cancer Bundle, Oncology Only vs. Multi-Specialty Practices, in the Pooled Baseline Period (Episodes initiating Jan. 2014 – Jun. 2015)



Source: Practice and Episode characteristic files, 2014 – 2015.

High Cost vs. Non-High Cost Practices

Cancer bundle mix differed for high cost versus low cost practices and TINs. High cost OCM practices and comparison TINs had a higher proportion of lung cancer, colorectal cancer, and lymphoma episodes; high cost practices and TINs also had a lower proportion of prostate cancer episodes (Appendix Exhibit A5-30), perhaps because most early-stage prostate cancer is treated by urologists, not oncologists.

Affiliated vs. Non-Affiliated (Academic Medical Group, Health System, Hospital)

Information about academic medical center and health system affiliation, and hospital ownership, was available for 2015.

- Practices affiliated with an academic medical center had a lower proportion of lung cancer, colorectal cancer, and breast cancer episodes, and a higher proportion of melanoma, head and neck cancer (comparison TINs only), and other cancers (Exhibit 3-S23)
- OCM practices and comparison TINs affiliated with a health system had a lower proportion of episodes for lung cancer (OCM practices only), colorectal cancer, and lymphoma (OCM only), and a higher proportion of episodes for melanoma, bladder cancer, and other cancers
- Practices owned by hospitals had a lower proportion of episodes for lung cancer, colorectal cancer (OCM practices only), and breast cancer, and a higher proportion of episodes for melanoma, head and neck cancer, and other cancers

Practices/TINs owned by hospital or affiliated with health systems may have access to more advanced or resource intensive cancer treatment, and may attract patients with more complex cancers or needing more intensive and costly treatment, compared to independent OCM practices and comparison TINs. Across all affiliation and ownership types, practices and TINs had a higher proportion of episodes for beneficiaries with melanoma and "other" cancers and a lower proportion of lung cancer episodes (Appendix Exhibit A5-31).

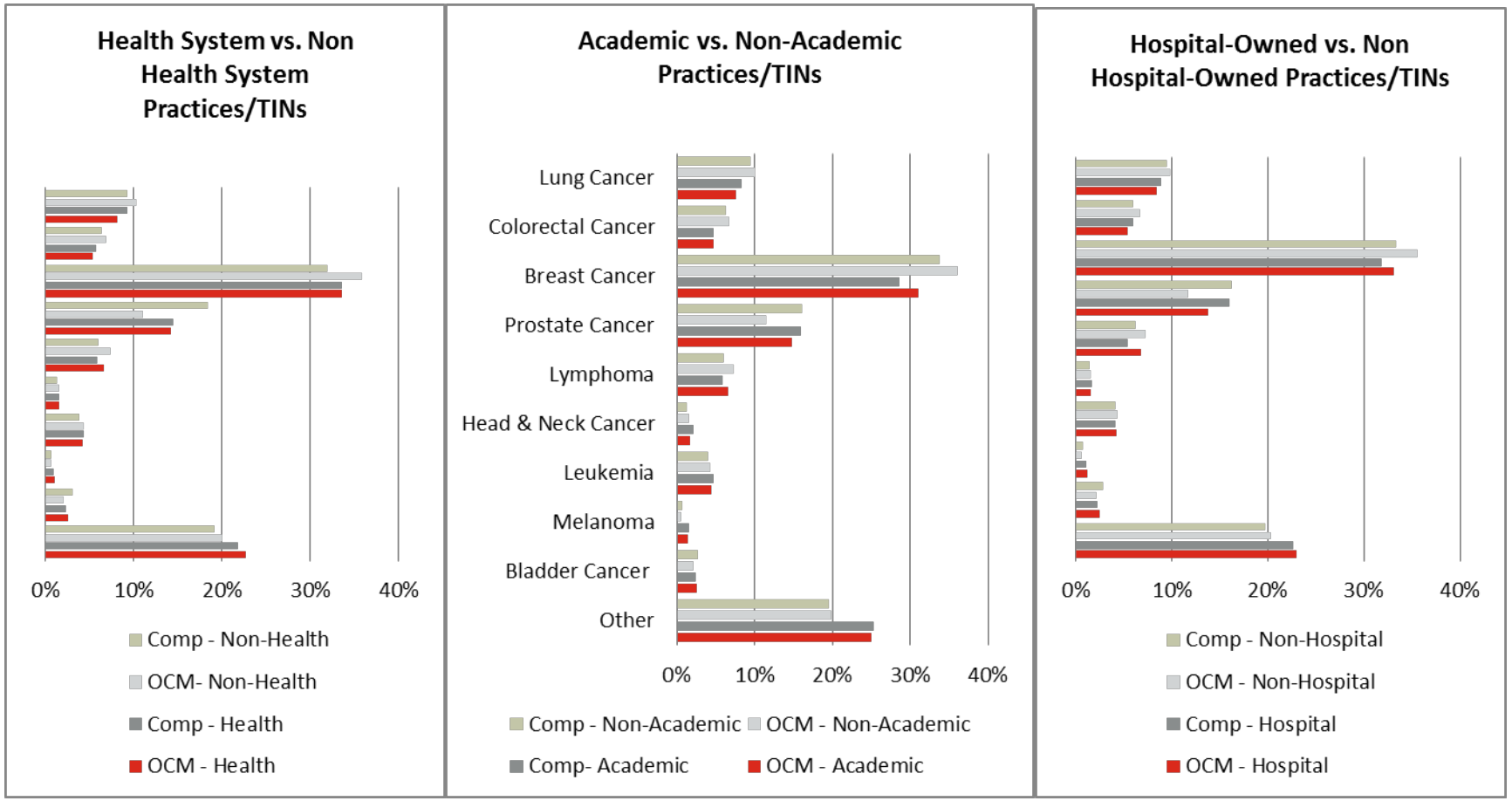
Episode Demographics by Practice Subgroups

Beneficiary demographics and health characteristics varied across practice subgroups.

- Large practices, those with low patient loads per oncology NPI, and those affiliated with a health system, tended to have younger Medicare beneficiary populations (under 70 years)
- Practices with high patient loads per oncology NPI, and those not affiliated with an academic medical center or a health system, tended to have a greater proportion of White beneficiaries
- High cost practices, large practices, and practices affiliated with an academic medical center, tended to have a larger share of high-risk beneficiaries (higher HCC scores)

Detailed findings of episode characteristics by performance period and practice subgroup can be found in Appendix Exhibits A5-32 through A5-36. Considering the patterns in beneficiary characteristics associated with specific practice subgroups, it will be necessary to control for demographic and practice characteristics in the OCM evaluation.

Exhibit 3-S23: Share of Episodes by Cancer Bundle and Affiliation Type in Performance Period -2 (Episodes initiating Jan. – Jun. 2015)



Source: Practice and Episode characteristic files, 2015.

Episode Utilization by Practice Subgroups

There were several patterns in episode-level utilization across the various practice subgroups, during the expanded baseline period.

- The number of cancer E&M services per episode was higher for episodes attributed to oncology-dedicated, high cost, and independent (non-affiliated) practices. The number of chemotherapy services per episode followed similar patterns.
- Episodes attributed to large practices, practices with low patient loads, high cost practices, and practices affiliated with an academic medical center had more inpatient admissions per episode than was true for episodes attributed to other kinds of practices.
- Episodes attributed to practices with low patient loads and practices affiliated with a health system or owned by a hospital had a higher number of ED visits not resulting in an inpatient admission.

Detailed findings of episode utilization outcomes by performance period and practice subgroup can be found in Appendix Exhibits A5-37 through A5-41.

Episode Costs by Practice Subgroups

Practice characteristics and subgroups were associated with a number of distinct trends in episode-level costs and beneficiary cost sharing.

- On average, larger practices, high cost practices, oncology-dedicated practices, and practices affiliated with an academic medical center, had higher episode costs of care
- Larger practices, high cost practices, and oncology-dedicated practices also had higher beneficiary cost sharing per episode, on average

Practice characteristics and structure may directly contribute to these differences, but there may also be underlying differences in the patients that seek care from different types of practices. Affiliation with an academic medical center, for example, may attract beneficiaries with more complex conditions, or those seeking advanced treatments. Simultaneously controlling for both practice and episode characteristics in the evaluation of OCM will address these potential associations.

Detailed findings of episode costs by performance period and practice subgroup can be found in Appendix Exhibits A5-42 through A5-46.

3.4.5 Episode Attributes by Market Subgroups

Variation in market characteristics may influence patterns of care and outcomes for Medicare beneficiaries with cancer. Market demographics such as median household income or the size of the market may impact access to cancer care or utilization. For example, less densely populated or rural markets may have limited access to cancer treatment, which may impact cost and quality outcomes in oncology care. Moreover, the supply of specialty physicians within a market may influence the intensity or types of services utilized, which may affect cost and quality. Understanding variation by market-level subgroup is important for identifying drivers of cost and quality outcomes and identifying covariates for inclusion in the OCM evaluation.

We use the same three market-level subgroups defined in the previous section to assess patterns in episode mix and outcomes (Exhibit 3-S24):

Exhibit 3-S24: Market Subgroups and Episode-Level Attributes Analyzed

Market Subgroup Type	Subgroup	Description
Practices in High vs. Low Income Markets	High Income	A county with a median household income greater than or equal to $53,000[79]
	Low Income	A county with a median household income less than $53,000
Practices in High vs. Low Supply Markets	High Supply	A county with at least 11 specialists per 10,000 population[80]
	Low Supply	A market with less than 11 specialists per 10,000 population
Practices in Large vs. Small Markets	Large	A county with a population greater than or equal to 250,000
	Small	A county with a population less than 250,000

Episode Volume and Demographics by Market Subgroups

There were few relevant differences across beneficiary demographics and market subgroups.

- Throughout the expanded baseline period, the volume of episodes increased among OCM practices and comparison TINs in high income and high specialty supply markets, relative to practices and TINs in low income and low oncology supply markets
- Practices in high income (OCM only), high supply, and large population markets also had a higher proportion of episodes for non-White beneficiaries

Controlling for episode-level characteristics in the evaluation of OCM should be sufficient to capture variation by market subgroup. Detailed findings of episode characteristics by performance period and market subgroup can be found in Appendix Exhibits A5-47 through A5-49.

Episode Services by Market Subgroups

There was variation in use of services across market subgroups:

- The number of chemotherapy services per episode, and number of cancer E&M services per episode, were both greater in high income markets for OCM practices, but greater in low income markets for comparison TINs. OCM practices and comparison TINs had more chemotherapy services and more cancer E&M services per episode in low supply markets, than in high supply markets. Practices and TINs averaged fewer chemotherapy services in large population markets.
- The average number of inpatient admissions per episode was higher in high income and high specialty supply markets for OCM practices, although admissions per episode were higher in low income markets for comparison TINs.

---

[79] This cut point is slightly lower than the national value of median household income in 2015 ($55,775), but similar to the 2014 value ($53,731) and provides greater balance in subgroup sample size throughout the expanded baseline period. U.S. Census Bureau, 2014 and 2015 American Community Surveys. Retrieved January 3, 2017 from https://www.census.gov/content/dam/Census/library/publications/2016/demo/acsbr15-02.pdf.

[80] This threshold represents a common median, or near median value among OCM practices and comparison TINs throughout the expanded baseline period, and ensures adequate sample within subgroups of interest.

- The number of ED visits not resulting in an inpatient admission per episode was higher for practices and TINs in low income, low specialty supply, and small markets.

Detailed findings of episode utilization by performance period and market subgroup can be found in Appendix Exhibits A5-50 through A5-52. While the differences in utilization noted may also be associated with other market, practice, or episode characteristics, they imply that testing for market-level covariates will be important in the development of the evaluation models.

Costs by Market Subgroups

- Total Medicare cost of care per episode was higher among OCM practices located in high income, low specialty supply, and large population markets. For comparison TINs, total cost of care was also higher in low specialty supply and large population markets, but slightly lower in high income markets.
- Beneficiary cost sharing was higher in low income and low supply markets.

Detailed findings of episode costs by performance period and market subgroup can be found in Appendix Exhibits A5-53 through A5-55. As with utilization by market subgroup, the differences in total episode cost of care may be associated with other market, practice, or episode characteristics, and testing for market-level covariates will be important in the development of the evaluation models. Further, understanding baseline differences by market subgroup will be important for determining the impact of OCM across markets.

3.5 Summary of Claims-Based Findings and Implications

Summary of Findings by Practice Type and Subgroup

Understanding commonalities and differences among OCM practices and comparison TINs will support the evaluation of OCM by identifying how the underlying variation in practice structure can influence patient and cancer mix, utilization and associated health costs. Despite overall similarities, there were a number of differences between OCM practices and comparison TINs within select market, practice, and episode characteristics and across subgroups identified.

Market characteristics did not appear to be a significant driver of differences between OCM practices and comparison TINs. Market characteristics, including market demographics, supply of physicians, and urbanicity, were similar among OCM practice and comparison TIN markets. Further, trends in market characteristics over the expanded baseline period were consistent with national population and healthcare supply trends.

There were a number of differences in the size and provider specialty mix between OCM practices and comparison TINs during the baseline period. OCM practices were larger, on average, than comparison TINs. OCM practices had more providers (NPIs) in total, and more oncology NPIs in particular, than did comparison TINs. OCM practices were more likely to be multi-specialty than were comparison TINs. Due to the number of NPIs billing through the practice/TIN, the number of attributed cancer episodes was also significantly higher among OCM practices than for comparison TINs.

Differences in practice characteristics contributed to underlying differences in episode characteristics and episode outcomes. Episodes attributed to larger OCM practices averaged more chemotherapy and cancer E&M services, than did episodes attributed to smaller OCM practices. The opposite was true for larger comparison TINs. Episodes in larger OCM practices and comparison TINs also averaged more inpatient

admissions, and had higher total costs of care (Medicare payments) and beneficiary cost sharing per episode.

OCM practices comprised only of oncology NPIs were more likely to have attributed episodes with high HCC scores, indicating a more severe episode case mix (more patients with comorbidities) compared with episodes attributed to OCM multi-specialty practices. Consistent with a more severe case mix, episodes attributed to oncology-only (specialty) practices had higher healthcare utilization, and total costs per episode.

Practices affiliated with academic medical centers or with health systems, or owned by hospitals, had distinctly different episode characteristics and outcomes. Affiliation with an academic medical center was associated with a larger proportion of non-white beneficiary episodes overall, and a higher proportion of episodes in select cancer bundles. Cancer E&M services were lower among practices and TINs owned by or affiliated with hospitals, academic medical centers, or health systems. Chemotherapy utilization was lower for OCM practices owned by hospitals, or affiliated with academic medical centers or health systems. Affiliation with an academic medical center was also associated with greater hospital and ED use, and higher total Medicare cost per episode.

On a per episode basis, utilization (including cancer E&M services, chemotherapy services, acute and non-acute care) and related costs were higher, on average, for OCM practices than for comparison TINs. Beneficiary characteristics and differences in the distribution of cancer bundles contributed to differences in utilization and costs. Medicaid dual eligibility, race/ethnicity, and indicators of episode severity (HCC score, chronic conditions) also contributed to variation in episode utilization and cost patterns. These beneficiary attributes were correlated, so the factor-by-factor analyses likely overstate the degree to which any single factor was driving patterns in the data. Further, these characteristics were associated with differences in chemotherapy utilization, inpatient admissions, ED discharges, total costs and beneficiary cost sharing. In addition, use of chemotherapy and hospital services (ED, inpatient, ICU) were greater in the last weeks of life for dying patients served by OCM practices than for those served by comparison TINs.

There was significant variation in utilization and cost by cancer bundle. For example, colorectal cancer had higher chemotherapy utilization per episode, on average, while lymphoma and melanoma had higher average total costs per episode. Although the baseline analyses did not simultaneously control for cancer mix when identifying differences based on practice and episode characteristics, underlying variation in cancer mix was likely an important contributor to differences in utilization and cost outcomes between OCM practices and comparison TINs.

Differences in cancer epidemiology and treatment standards were important contributors to differences between OCM practices and comparison TINs, and within cancer bundles. Use of hormonal therapies for breast and prostate cancer episodes, without other chemotherapy, was associated with lower utilization, lower total costs of care, and lower beneficiary cost sharing per episode. Drug costs were an important and growing component of total episode costs and use of high cost therapies will be an important factor going forward.

Parallel Trends Assumptions Required for the DID Impact Models

A DID approach relies on the standard assumptions of an ordinary least squares (OLS) model, as well as parallel baseline trends in the outcome of interest for the treatment and comparison group. Parallel trends in the treatment and comparison groups prior to treatment (in this case the implementation of OCM) allow

for the estimation of the treatment effect using a DID design. The analysis of market, practice, and episode characteristics over the expanded baseline period prior to the announcement of OCM, is useful for understanding any future differences in trends between OCM practices and comparison TINs.

The trends in practice and episode characteristics, and episode outcomes, appeared quite similar between OCM practices and comparison TINs (see Exhibits 3-E7, 3-E11, 3-E14, 3-E20, 3-E23). We conducted statistical tests to determine whether key variables exhibited parallel trends for subgroups of OCM practices and comparison TINs throughout the expanded baseline period. For many outcomes (including cancer E&M services, chemotherapy services, ED visits, total episode costs, and beneficiary cost sharing), the tests of parallel trends showed significant differences between OCM practices and comparison TINs. The same was true for most EOL measures. Most differences were very small, although statistically different from zero. It is important to note that due to the large number of episodes in these analyses, small differences are more likely to be statistically significant, even if the differences are not meaningful and the trends appear parallel visually. For example, the test for total episode costs found significant differences in trends between OCM practices and comparison TINs of $121 (or 0.4 percent of average OCM episode costs), across performance periods in the baseline. For most key episode outcomes (except some EOL care process measures), the differences detected were less than one percent of the mean OCM outcome value. We conclude that although several unadjusted differences in linear trends were statistically different, the magnitude of the differences are not clinically or economically meaningful and the parallel trend assumptions for DID are largely met.

There were select measures where trends between OCM practices and comparison TINs differed for specific subgroups, but these differences were likely due to underlying differences in cancer bundle mix by subgroup and practice type. For example, segmenting the sample by gender revealed some differences in the trends for average number of chemotherapy services per episode for male beneficiaries in OCM practices versus comparison TINs. These differences were likely due to differences in the proportion of prostate cancer episodes between the two groups over the expanded baseline period. Simultaneously controlling for multiple practice- and episode-level characteristics in the evaluation of OCM will address these differences in trends by subgroup.

Generalizability

The baseline analyses show that OCM practices reflect the national array of practices serving Medicare FFS beneficiaries, along many dimensions. The analyses also revealed a few ways in which the practices that volunteered for OCM are not representative of all practices serving Medicare FFS beneficiaries nationwide. The most important difference identified was that the OCM practices are larger (NPI counts and episode volume), on average, than the national pattern. While there are smaller-sized practices participating in OCM and we will conduct subgroup analyses by practice size, there is a significant difference between the average size of OCM practices and their matched comparison TINs, and an even greater difference between the size of OCM practices and those in the nation as a whole. Additionally, nearly all OCM practices, and their matched comparison TINs, are located in urban markets, as are most oncology TINs nationwide. While we developed a proxy for smaller, more rural markets based on small county populations, care must be taken when assessing generalizability of OCM, especially to small practices and rural areas, given the mix of practices participating in the program.

More than 80 percent of the episodes for OCM practices during the expanded baseline period were for non-Hispanic white beneficiaries, reflecting national Medicare FFS enrollment. We will conduct

subgroup analyses by race and ethnicity, but for less frequent outcomes it is possible that the results of the OCM evaluation will not apply to all racial or ethnic subgroups.

Conclusion

The baseline analyses presented here provide a strong foundation for the future DID evaluation of OCM impact. Additionally, we identified a number of important differences in the characteristics of OCM practices and comparison TINs that we will monitor closely throughout the evaluation. Tests for parallel trends throughout the expanded baseline period, a key assumption in the DID evaluation approach, are met. Future impact analyses will include robust covariate adjustment to control for the observable differences in characteristics between OCM practices and comparison TINs, and reduce the unexplained variation in outcomes between the two groups. The baseline analyses also identified a number of important subgroups to consider in the OCM evaluation, including therapy types (e.g., hormonal therapy only), cancer bundle, and beneficiary characteristics (e.g., dual eligible, race). Subgroup analyses will provide insight into why impacts may vary across participating practices and populations, and will be important for assessing generalizability of OCM for specific populations.