eAppendix A. Oncology Care Model’s Payment Design

The Centers for Medicare and Medicaid Innovation launched the Oncology Care Model (OCM) on July 1, 2016, with an objective to improve (1) care coordination, (2) appropriateness of care, and (3) access for beneficiaries undergoing chemotherapy. It consists of a flat per-beneficiary per-month payment, and a performance-based payment, whose level is set based on a practice’s performance in the specific quality measures relative to a matched comparison group. OCM is set to run from July 2016 to June 2021. It applies to both Medicare fee-for-service beneficiaries and patients covered by other payers.

The flat monthly payment aims to cover “care management services for Medicare beneficiaries in a 6-month OCM Episode of Care triggered by the administration of chemotherapy,” totaling $160 per beneficiary per month. In contrast, the performance-based payment is an episode-based, risk-adjusted payment calculated based on the participant’s achievement on a range of quality measures, such as a reduction in all-cause hospital admissions or improved adherence to clinical guidelines in some cancer types. OCM draws on both process and outcome-based quality measures, with the former relatively more represented. Outcome-based measures used in OCM range from all-cause hospital admissions to emergency department visits, mortality after more than 3 days in hospice, and patient-reported experience of care.
In our paper, we organize a new COS in oncology by 5 quality domains based on the APM Design Toolkit published by CMS’s Center for Medicare and Medicaid Innovation (CMMI):¹

- Clinical care
- Safety
- Care coordination
- Patient and caregiver experience
- Population health and prevention

Acknowledging the overlap between clinical care and care coordination domains, we treat “clinical care” as direct clinical outcomes (such as mortality and readmissions) and “care coordination” as outcomes linked to institutional or system-level health care delivery (such as timeliness of hospice care).

Measures we recommend for inclusion in an oncology COS are consistent with principles proposed by CMS, aiming to improve quality in four different ways in different APMs:¹

- make the care experience better reflect the patients’ goals and preferences,
- produce better health outcomes,
- reduce in better-coordinated care, and
- reduce health disparities.

Here, we discuss the rationale and utility of all measure categories as well as individual measures identified in our targeted search.

**Clinical Care**

Clinical care for cancer patient in different stages of their disease is complex, resulting in several challenges in the measurement of its quality. Most notably, each patient’s prognosis is related not just to the disease and its stage, but also to other factors, ranging from lifestyle choices and genetics to socioeconomic status and proximity of high-quality care. Given these underlying differences between patients and patient pools, it is important to risk-adjust clinical care metrics.²,³

Based on reported clinical practice experience and data availability, at least three key categories of clinical care quality metrics should be included in a future COS in oncology: hospital visits and admissions, treatment effectiveness, and mortality-related metrics.

First, *hospital visits and admissions* are among the most easily measurable proxies for the quality of care provided to cancer patients. Given their high costs and, sometimes, preventable nature, hospital (including emergency department) visits and unscheduled readmissions (typically within 30 days of previous release) are also of special interest to public and private payers, and have been thought to result from “poor quality of care or inadequate transitional care”.⁴ And while readmissions, for instance, cannot be avoided fully, variation in specific metrics observed between providers (even after risk-adjustment) is typically indicative of poor quality of cancer care.⁵
Measuring treatment effectiveness is customarily specific to the therapy received and the disease (including the stage) at hand. The most common measures for treatment effectiveness are 1) response rate, 2) progression-free survival and 3) overall survival. Several working groups convened by the ASCO Cancer Research Committee have concluded that overall survival is a preferable outcome measure for a treatment’s effectiveness, but have also underscored that it poses measurement challenges due to a longer time-frame required and multiple confounding variables present. Similarly, progression-free survival is often linked with quality of life improvements (such as in painful bone metastatic cancers) and thus is a useful metric, if implemented prudently, but is not validated as surrogate for survival in all settings and suffers from imprecise measurement and potential bias. Finally, a therapy response rate may be indicative of the appropriateness of care and while not possible to definitively ascertain ex ante, it is likely to be correlated with the adherence to clinical guidelines and best practices in oncology care. In sum, measuring a treatment’s effectiveness accompanied by risk-adjustment should be considered in future COS in oncology.

Finally, avoiding patient death is among the key objectives of medical professionals, including oncology specialists. Different measures of mortality are used, including those related to the setting in which a patient dies (with the assumption that dying in hospice or with palliative care is a better outcome than dying in an acute care setting – for both the patient and their caregivers) and how much time a patient has spent in a specific setting before death (longer stays in hospice facilities are thought to improve the quality of life of the patient and their caregiver(s) while reducing unnecessary spending). We summarize the three categories presented above in Figure 1.

### Appendix Figure 1. Core Outcome Measures in Clinical Care

<table>
<thead>
<tr>
<th>Hospital and ED visits</th>
<th>Treatment Effectiveness</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-cause ED visits</td>
<td>Response rate</td>
<td>Deaths in acute care setting</td>
</tr>
<tr>
<td>All-cause hospital admissions</td>
<td>Progression-free survival</td>
<td>Death outside of a hospice</td>
</tr>
<tr>
<td>Unscheduled readmissions within 30 days</td>
<td>Overall survival</td>
<td>Died after 3+ days in hospice</td>
</tr>
<tr>
<td>Hospice enrollment</td>
<td></td>
<td>Died in extended care facility (with hospice/palliative care)</td>
</tr>
<tr>
<td>Hospice enrollment or palliative services</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Safety

We distinguish between two types of safety outcome measures: infection-related and other adverse events-related. Collecting data on events such as hospital-onset clostridium difficile infections and central line-associated bloodstream infections is important regardless of the payment model in place, given the need to mitigate their occurrence, and their reporting allows
for a relatively straightforward implementation in future outcome sets. Data on infections listed in Figure 2 are collected from CDC’s National Healthcare Safety Network (NHSN), for example.15

The selection of other adverse events monitored in cancer care may draw on patient safety indicators (PSIs) developed by the AHRQ, which includes outcomes such as the number of Stage III or IV pressure ulcers per 1,000 discharges, postoperative sepsis rate, or the number of medical and surgical discharges with a secondary diagnosis of transfusion reaction.16 In Figure 2, we report PSIs that are relevant to oncology care. The inclusion of hospital adverse events is especially crucial given a steady increase in their frequency following major cancer surgeries, despite being potentially avoidable.17

**eAppendix Figure 2. Core Outcome Measures in Safety**

<table>
<thead>
<tr>
<th>Infections</th>
<th>Hospital Adverse Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient hospital-onset clostridium difficile infections</td>
<td>Patient Safety Indicators</td>
</tr>
<tr>
<td>Inpatient hospital-onset methicillin-resistant staphylococcus aureus (MRSA) bacteremia</td>
<td>o Pressure Ulcer Rate</td>
</tr>
<tr>
<td>Healthcare-associated, catheter-associated urinary tract infections</td>
<td>o Retained Surgical Item or Unretrieved Device Fragment Count</td>
</tr>
<tr>
<td>Surgical site infection</td>
<td>o Iatrogenic Pneumothorax Rate</td>
</tr>
<tr>
<td>Central line-associated bloodstream infections</td>
<td>o In Hospital Fall with Hip Fracture Rate</td>
</tr>
<tr>
<td></td>
<td>o Perioperative Hemorrhage or Hematoma Rate</td>
</tr>
<tr>
<td></td>
<td>o Postoperative Acute Kidney Injury Requiring Dialysis</td>
</tr>
<tr>
<td></td>
<td>o Postoperative Respiratory Failure Rate</td>
</tr>
<tr>
<td></td>
<td>o Perioperative Pulmonary Embolism or Deep Vein Thrombosis Rate</td>
</tr>
<tr>
<td></td>
<td>o Postoperative Sepsis Rate</td>
</tr>
<tr>
<td></td>
<td>o Postoperative Wound Dehiscence Rate</td>
</tr>
<tr>
<td></td>
<td>o Unrecognized Abdominopelvic Accidental Puncture/Laceration Rate</td>
</tr>
<tr>
<td></td>
<td>o Transfusion Reaction Count</td>
</tr>
</tbody>
</table>

**Care Coordination**

Care coordination is especially challenging in cancer patients due to the complex nature of the disease and its management, often involving multiple specialties and clinical settings.18 Given that over 40 different definitions of care coordination exist, AHRQ has developed the following definition based on a comprehensive review of them:

> Care coordination is the deliberate organization of patient care activities between two or more participants (including the patient) involved in a patient’s care to facilitate the appropriate delivery of health care services. Organizing care involves the marshalling of personnel and other resources
needed to carry out all required patient care activities, and is often managed by the exchange of information among participants responsible for different aspects of care.

With respect to oncology care, the key objective is to ensure appropriate and timely care is delivered in the most suitable setting, including end-of-life care. In 2013, the Committee on Improving the Quality of Cancer Care recommended that “CMS and other payers design, implement, and evaluate innovative payment models that incentivize the cancer care team to provide cancer patients with timely referral to hospice care for end-of-life care.” This is particularly important given the evidence that end-of-life hospice care is associated with “improved quality of life, reductions in symptom distress, better outcomes for family caregivers, and patient and family satisfaction with care.”

Multiple studies and outcome sets for care coordination exist, including those related to patient and cost outcomes measures as well as those related to care delivery processes. With respect to specific outcome measures in oncology care, we differentiate broadly between hospital and hospice care. Among hospital-related metrics we recommend for consideration are hospitalizations, emergency department visits and admissions to ICU in the last 30 days of life. While in some cases, these are not avoidable, there is evidence that higher event rates do not correspond with high-quality, patient-centered care. For hospice-related metrics, we include admissions under/over 3 days in length (hospice enrollment in the last three days of life is considered poor quality of care because that limits the benefit patients may gain from hospice services), hospice mortality (terminally-ill hospice patients live on average longer than non-hospice patients), the ratio of deaths at home/in hospice relative to in hospital, and the length of hospice care (if clinically appropriate, this provides benefits to the patient and their caregivers alike). Proposed measures are summarized in Figure 3.

**eAppendix Figure 3. Core Outcome Measures in Care Coordination**

<table>
<thead>
<tr>
<th>Hospital Care</th>
<th>Hospice Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED visits in last 30 days of life</td>
<td>Hospice admission for over 3 days</td>
</tr>
<tr>
<td>Hospitalization in last 30 days of life</td>
<td>Hospice admission for under 3 days</td>
</tr>
<tr>
<td>Admission to ICU in last 30 days of life</td>
<td>Mortality after more than 3 days in hospice</td>
</tr>
<tr>
<td>Percentage of deaths at home or in hospice, versus in hospital</td>
<td>Length of hospice care</td>
</tr>
</tbody>
</table>

**Patient and Caregiver Experience**

It has been argued that patient-reported experience offers “important additional information to assess the benefits and risks of cancer therapies,” including in cases where longer survival may be traded off for a lower quality of life. Patient-reported outcomes (PROs) can be categorized in several ways, such as 1) symptomatic adverse events, 2) physical function, and 3) disease-related symptoms, all of which contribute to the health-related quality of life (HRQOL). The assessment of symptomatic adverse events (sometimes termed “treatment side effects”) may be based on the National Cancer Institute’s Patient-Reported Outcomes version of
the Common Terminology Criteria for Adverse Events (PRO-CTCAE) – an item library of symptomatic toxicities, ranging from difficulty in swallowing to pain and swelling at injection side. Physical function refers to the ability to perform activities of daily living and as such is included in most patient-reported HRQOL measures. For instance, the Patient-Reported Outcomes Measurement Information System (PROMIS) Physical Function measures have been validated in cancer patients and shown to be “valid and reliable in multiple race-ethnicity and age groups”. Finally, disease-related symptoms include patient-reported outcomes such as pain, fatigue, dyspnea and cough, with some of these measures overlapping with symptomatic adverse events (in measures such as anorexia). Given the lack of symptoms in early cancer stages, some of the disease-related symptoms can be measured on a time-to-event basis while others, where relevant, could be assessed using a symptom palliation endpoint.

What distinguishes PROs from clinical metrics is a lack of interpretation of the former by a physician and their breadth – ranging from pain intensity to a broader quality of life assessment – and PROs are increasingly used in clinical practice, where they sometimes are “of better quality than clinician-reported data”. However, PROs should not replace data “gathered by clinicians directly or indirectly using medical tests,” but rather complement existing data with information not readily available from laboratory tests or physician’s examination, including lifestyle choices. A successful example of the use of PROs is PRO-CTCAE (Common Terminology Criteria for Adverse Events) which “enables patients to self-report toxicities and adverse events at least as reliably as clinician-based reporting.” Of special importance in the area of PROs are mental health-related metrics, including measures of anxiety and depression, mood and spiritual well-being.

Similarly to patient-reported outcomes, outcomes reported by informal caregivers or family members are of importance in the assessment of cancer care quality. In clinical practice, however, caregiver-reported outcomes are more nascent in literature and their validation has been more limited, with some exceptions. For example, the Consumer Assessment of Healthcare Providers and Systems (CAHPS) Hospice Survey includes measures related to communication, timeliness of care, treatment with respect, emotional and religious support and training, and data from this survey have been reported to the CMS by eligible hospices monthly since 2015.

Different types of measures have been proposed for caregiver-reported outcomes, mainly falling into one of these three categories: caregiver burden, caregiver need, and quality of life. For example, the Caregiver Quality of Life Index–Cancer (CQOLC) focuses on the latter, consisting of 35 items which are evaluated on a five-point Likert-type scale, ranging from alteration in daily routine to spirituality, and has been shown to possess “adequate validity, test-retest reliability and internal consistency” in a study of cancer caregivers. However, there appears to be no comprehensive instrument measuring a full breadth of cancer caregiver-related outcomes. Aside from measuring the direct impact of a cancer diagnosis on a caregiver (who may or may not be related to the patient), there is a close relationship between the well-being of the patient and the caregiver. As such, it is important to support future research that would lead to the development of reliable metrics for caregiver-reported outcomes. Proposed measures in this category are shown in Figure 4.
**Population Health and Prevention**

The domain of *population health and prevention* is less commonly included in oncology payment deliberations. Given the role of providers in reducing the burden of cancer in the population, we pay special attention to their role in early detection, although prevention and population health remains an important priority (such as in preventing cancers caused by tobacco use, viruses, or sun exposure).\(^{38}\)

Prompt and effective screening for malignancies in cases such as cervical, colorectal, breast, prostate and skin cancers improves patients’ survival prospects and quality of life, and its use has been linked to the reductions of cancer incidence and mortality in the United States.\(^{38}\) The use of proper and early screening often falls under process-based quality metrics – here, we identify key outcome-based measures that could be considered in future COS in oncology.\(^{38}\)

The first one, stage of cancer diagnosis, is used by a study that has shown minority patients face challenges in accessing screening and prevention programs, leading to, on average, higher disease stage at presentation, while the availability of affordable cancer screening may lead to improvements in early-stage cancer detection and result in better clinical outcomes.\(^{39}\) Similarly, ensuring the shortest-possible time between screening and diagnosis, and between diagnosis and the initiation of treatment is another challenge which could be overcome by including relevant measures in financial incentives, also given that vulnerable patient populations often face longer wait times and worse clinical outcomes due to suboptimal timeliness of care.\(^{40}\) Large variation in both metrics has been reported in breast and cervical cancers, among others.\(^{41}\)

An overview of the suggested outcome measures related to population health and prevention is presented in Figure 5.

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**eAppendix Figure 5. Core Outcome Measures in Population Health and Prevention**

<table>
<thead>
<tr>
<th>Suggested Metrics</th>
<th>Population Health and Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage of cancer diagnosis</td>
<td></td>
</tr>
<tr>
<td>Median time to diagnosis resolution</td>
<td></td>
</tr>
<tr>
<td>Time from diagnosis to the initiation of treatment</td>
<td></td>
</tr>
</tbody>
</table>
References

1. CMMI. *Alternative Payment Model Design Toolkit*. Department of Health & Human Services.


