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Innovative Oncology Care Models Improve End-Of-Life Quality, Reduce Utilization And Spending

ABSTRACT Three models that received Health Care Innovation Awards from the Centers for Medicare and Medicaid Services (CMS) aimed to reduce the cost and use of health care services and improve the quality of care for Medicare beneficiaries with cancer. Each emphasized a different principle: the oncology medical home, patient navigation, or palliative care. Comparing participants in each model who died during the study period to matched comparators, we found that the oncology medical home and patient navigation models were associated with decreased costs in the last ninety days of life (\$3,346 and \$5,824 per person, respectively) and fewer hospitalizations in the last thirty days of life (fifty-seven and forty per 1,000 people, respectively). The patient navigation model was also associated with fewer emergency department visits in the last thirty days of life and increased hospice enrollment in the last two weeks of life. These promising results can inform new initiatives for cancer patients, such as the CMS Oncology Care Model.

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Medicare expenditures in the last year of life for beneficiaries with cancer range from \$56,784 for those with melanoma to \$140,891 for those with brain cancer. These far exceed the average \$38,975 per beneficiary Medicare spending in the last year of life.^{1,2} There were approximately 901,000 Medicare beneficiaries with cancer in the last year of life in 2010, and that number is expected to increase to 1.2 million in 2020.¹ Total costs of cancer care in the last year of life amounted to \$37 billion in 2010 and will approach \$50 billion in 2020.³ Much end-of-life spending results from high rates of hospitalizations, emergency department (ED) visits, and stays in the intensive care unit in patients' last months.^{4,5} A substantial proportion of hospitalizations and ED visits at the end of life are avoidable and thus represent an area for improved quality of care and patient satisfaction and for reduced utilization.^{6–9}

High utilization of cancer treatment at the end of life not only poses a burden to the health care system, but it also may represent poor outcomes from the perspective of patients. Previous studies suggest that patients with advanced cancer prefer to have less aggressive treatment and more spiritual support and palliative care, and to avoid intensive inpatient settings at the end of life.^{10,11} In fact, the National Quality Forum has recognized the need to emphasize the importance of palliative options for cancer care at the end of life. It has endorsed the use of several measures as indicators of poor quality of care at the end of life, such as the use of chemotherapy in the last fourteen days of life, multiple ED visits and stays in the intensive care unit in the last thirty days of life, and enrollment in hospice for fewer than three days.¹²

Though hospice is designed to facilitate patients' end-of-life preferences, keeping patients at home or in a nonclinical environment while reducing pain and psychological stress and pro-

viding spiritual support, many patients are reluctant to choose hospice.¹³ Some may be hesitant to stop life-prolonging care and believe that doing so to meet hospice enrollment requirements amounts to giving up.^{13,14} Health care providers may also prefer to continue life-prolonging care, even when death is imminent.¹⁵ Though initiatives such as the Medicare Care Choices Model are testing the option of life-prolonging care in combination with hospice,¹⁶ such models are not universally available. Thus, while hospice care may offer much of what patients say they want at the end of life, it may be beneficial to have palliative care options outside of hospice, to improve patients' experiences and use of the health care system.

Innovative Models For Cancer Care

Three models received round 1 Health Care Innovation Awards from the Centers for Medicare and Medicaid Services (CMS), with the goal of reducing cost and utilization and improving the quality of care for Medicare beneficiaries with cancer. Each model used a different approach. Only one—the Comprehensive Assessment with Rapid Evaluation and Treatment (CARE Track) model—focused solely on end-of-life care, but all three models provided improved access to services and support that had the potential to improve end-of-life outcomes for patients who died while in the model.

The first model, the Community Oncology Medical Home (COME HOME) model from Innovative Oncology Business Solutions, created oncology medical homes at seven sites across the United States. The model had three main components to address the challenge of practice variation, care fragmentation, and high overall costs of care: triage pathways to help first responders and nurses identify and manage patient symptoms; enhanced access to care through a round-the-clock triage phone line, same-day appointments, extended night and weekend hours, and on-call providers; and diagnosis and treatment pathways based on nationally recognized, evidence-based standards to guide clinical decision making and support patient self-management to improve quality of care and health outcomes.¹⁷ All COME HOME features were supported through an electronic medical record system that enabled real-time access to patient information. Although COME HOME did not explicitly promote palliative care, it sought to help patients manage symptoms at home or in less costly outpatient settings.

The second model, the Patient Care Connect Program (PCCP) from the University of Alabama at Birmingham, was a patient navigation inter-

vention that was implemented at twelve sites in five southern states. The PCCP used nonclinical navigators to educate and empower cancer patients and survivors, connect patients and caregivers with resources, and improve adherence to care plans.¹⁸ The navigators also acted as liaisons between patients and health care providers, to clarify treatment plans and voice patients' concerns. One component of the PCCP was Respecting Choices™, a program that focused on advance care planning and goal setting with the patient and family at the end of life.¹⁹

In the third model, the Rector and Visitors of the University of Virginia promoted palliative care for patients with advanced stage cancer through CARE Track. A nurse coordinator conducted a patient-reported outcomes survey, which drew questions regarding physical and mental discomfort from the Patient-Reported Outcomes Measurement Information System to identify patients in most need of pain and symptom management. These patients were then referred for more intensive palliative care services. A subset of patients also had access to condensed radiation treatment.

The goal of this study was to examine how each of these three models affected end-of-life outcomes for patients with cancer. We applied a standard analytic approach to assess quality of care, utilization, and cost for patients who died in each model relative to propensity-matched comparison groups. Our findings are particularly timely given the recent launch of the CMS Oncology Care Model, which incorporates elements of oncology medical homes and patient navigation.²⁰ The lessons learned from these three models can inform the implementation of this and other CMS models.

Study Data And Methods

DATA SOURCE AND ANALYTIC SAMPLE The study population included patients in each of the three models who were enrolled in the period June 2012–December 2015 and died before December 31, 2015 (“participants”), as well as comparators matched to each participant (“comparison group”). We linked participants' enrollment information from the models to fee-for-service Medicare claims files in the CMS Chronic Conditions Data Warehouse. To compare populations with the same types of cancers across all three models, we included only those participants with breast cancer, lung cancer, colorectal cancer, lymphoma, male or female genitourinary cancers, or head or neck cancers in the analytic sample. We excluded participants from our analysis if they were enrolled in the model less than thirty days before death.

To identify comparison groups, we first found practices that were similar to the organizations implementing each model. For COME HOME, we selected similar outpatient oncology practices in the same geographic region as each implementation site. For the PCCP, we selected similar outpatient comprehensive cancer centers in the same geographic region. And for CARE Track, we identified cancer centers in the same state that provided a volume of oncology care similar to that of CARE Track.

Next, we used one-to-one propensity score matching to identify the patients from comparison practices who were most similar to model participants. We included demographic characteristics, comorbidities, and previous cost and utilization in the propensity score matching models. Since claims data contain limited information on cancer stage and severity, we used indicators for cancer treatment including surgery, chemotherapy, and radiation therapy and indicators for metastatic and “high-risk” cancers to adjust for observable differences in severity.²¹ For more detailed information about propensity scores and our comparison group selection, see the online Appendix.²²

STUDY DESIGN AND MEASURES We used a retrospective cohort study design for quantitative analysis, tracking each participant and propensity-matched comparator in the year before death.

We measured cost outcomes as the average total Medicare cost of care in the last 30, 90, and 180 days of life per patient. For costs in the last 90 and 180 days of life, we restricted our analytic sample to participants who were enrolled in the relevant model for at least 90 and 180 days, respectively. Cost outcomes were continuous and are presented as dollars per patient. We assessed utilization outcomes (hospitalizations and ED visits) as the number of hospitalizations or ED visits in the last 30 days of life. Outcomes for utilization were specified as count models (for example, the count of hospitalizations a patient experienced in the 30 days before death) and are presented per 1,000 patients. Quality of care outcomes included hospice care and chemotherapy, both of which were specified as binary (for example, whether or not a patient had chemotherapy) and measured as the numbers of patients using hospice or chemotherapy in the last two weeks of life.

STATISTICAL ANALYSIS For the three cost outcomes, we used log-linked generalized linear regression models with a gamma distribution to obtain estimates of the average adjusted difference between the model participants and propensity-matched comparators. We used negative binomial models for utilization outcomes and

logit models for quality-of-care outcomes, both with robust standard errors, to estimate the differences. Average adjusted differences were calculated as the average outcome in the intervention group minus the average outcome in the comparison group. Thus, a negative outcome indicated that the intervention group showed a decrease in the outcome relative to the comparison group. Statistical significance of the adjusted difference estimates was determined using Wald tests.

All models were adjusted for demographic characteristics (age, race, sex, and whether a patient was eligible for both Medicare and Medicaid), comorbidities (disability and Hierarchical Condition Category [HCC] risk score),²³ cost and utilization in the previous year, cancer treatment (chemotherapy, radiation, or surgery), whether the cancer was metastatic, number of cancer diagnoses, and whether “high-risk” cancer (lung, pancreatic, ovarian, or unspecified primary cancer) was present. All statistical analyses were completed using Stata, version 13.1.

LIMITATIONS The following limitations of our analyses should be noted. First, estimates across the three models were not directly comparable, since each model served a different segment of the Medicare cancer patient population and used a model tailored to its needs and care setting.

Second, because we used Medicare claims as the primary data source, we were only able to use covariates present in the claims data in the models. As cancer severity and disease stage information were not available in the claims data, we included proxies for disease stage and cancer treatment modality in our propensity and regression models. Specifically, we examined whether a patient had radiation, chemotherapy, surgery, or any combination of the three before the last 30, 90, and 180 days of life. We also included indicators for metastatic or “high-risk” cancers based upon diagnostic information in claims.²¹ Claims also lacked information on income, though we used dual eligibility for Medicaid and Medicare as a proxy for poverty status.

Third, we excluded model participants who were not covered by fee-for-service Medicare. We also excluded participants with cancers other than breast cancer, lung cancer, colorectal cancer, lymphoma, male or female genitourinary cancers, and head or neck cancers, which were the most prevalent cancers in the three models. Although we used these restrictions to ensure consistency across the model populations and thus to increase the validity of our comparisons, this means that our analyses might not have captured the overall impact of each of the models on their entire participant populations.

Fourth, CARE Track served only sixty partici-

pants, which limited our power to detect significant changes in cost, utilization, and quality-of-care outcomes for participants versus comparators.

Fifth, defining chemotherapy use in our analysis was based on Medicare Part B claims, which limited our ability to identify patients receiving oral chemotherapy paid for by Medicare Part D. For more details on this limitation, see the online Appendix.²²

Finally, the external generalizability of our findings may be limited. The models we studied had applied for a Health Care Innovation Award, which suggests that compared to typical oncology providers, they were particularly motivated to improve care and reduce costs.

Study Results

DESCRIPTIVE CHARACTERISTICS When we examined participants' demographic characteristics, we found that those for COME HOME and the PCCP were similar. For example, 51.3 percent of the COME HOME participants were female, 41.6 percent were ages 65–74, and 92.0 percent were white—compared to 45.6 percent female, 50.1 percent ages 65–74, and 84.7 percent white for PCCP participants (Exhibit 1). In contrast,

CARE Track participants were 63.3 percent female, 46.7 percent ages 65–74, and 81.7 percent white.

Approximately one-third of the participants in each of the models had metastatic cancer. Comorbidity burden, measured by the average HCC score, was highest for CARE Track participants. For all of the models, we observed no significant differences in characteristics between the participants and the matched comparison group.

COST OF CARE For the COME HOME model, we observed an increase in average cost reductions in participants versus comparators in the last 30 days (\$959), 90 days (\$3,346) and 180 days (\$5,790) of life (Exhibit 2). We found a similar pattern for the PCCP. The estimated differences between the participant and comparison groups ranged from a 6 percent decrease for 30-day costs for COME HOME to an 18 percent decrease for 90-day costs for the PCCP (Appendix Exhibit A7).²²

While we did not see statistically significant decreases in cost in CARE Track, likely because of the small sample size, we observed increasingly lower per participant costs in the last 30, 90, and 180 days of life, relative to the comparison group. The observed differences represent differ-

EXHIBIT 1

Characteristics of participants in three end-of-life cancer models and members of comparison groups

| | COME HOME | | PCCP | | CARE Track | |
|-----------------------------|--------------|------------|--------------|------------|--------------|------------|
| | Intervention | Comparison | Intervention | Comparison | Intervention | Comparison |
| Female | 51.3% | 50.6% | 45.6% | 46.1% | 63.3% | 60.0% |
| Age range (years) | | | | | | |
| Less than 65 | 8.4% | 7.5% | 1.1% | 0.5% | 28.3% | 23.3% |
| 65–69 | 18.6 | 21.9 | 25.0 | 27.1 | 26.7 | 28.3 |
| 70–74 | 23.0 | 20.3 | 25.1 | 25.8 | 20.0 | 15.0 |
| 75–79 | 20.8 | 19.3 | 21.6 | 20.5 | 6.7 | 18.3 |
| 80–84 | 14.6 | 15.8 | 16.2 | 14.0 | 13.3 | 6.7 |
| 85 or more | 14.5 | 15.3 | 11.1 | 12.1 | 5.0 | 8.3 |
| Race/ethnicity | | | | | | |
| White | 92.0% | 91.7% | 84.7% | 83.0% | 81.7% | 78.3% |
| Black | 5.4 | 5.1 | 14.1 | 12.6 | 18.3 | 21.7 |
| Other | 2.4 | 3.1 | 1.0 | 4.1 | 0.0 | 0.0 |
| Unknown | 0.2 | 0.2 | 0.3 | 0.4 | 0.0 | 0.0 |
| Metastatic cancer | 39.4% | 39.2% | 35.2% | 34.0% | 33.3% | 31.7% |
| Comorbidities | | | | | | |
| Average HCC score (SD) | 1.9 (1.6) | 1.9 (1.6) | 2.3 (1.8) | 2.4 (1.7) | 3.3 (2.1) | 3.2 (2.2) |
| Average number of HCCs (SD) | 2.7 (2.5) | 2.7 (2.5) | 3.1 (2.6) | 3.1 (2.4) | 3.9 (3.1) | 3.9 (2.9) |

SOURCE Authors' analysis of Medicare claims data for 2010–15 from three end-of-life cancer models, as follows. **NOTES** COME HOME is Community Oncology Medical Home; there were 1,244 people in both the intervention and comparison groups. PCCP is Patient Care Connect Program; there were 2,198 people in both the intervention and comparison groups. CARE Track is Comprehensive Assessment with Rapid Evaluation and Treatment model; there were 60 people in both the intervention and comparison groups. The average Hierarchical Condition Category (HCC) score is the average of patient risk scores calculated by the HCC algorithm. The average number of HCCs is the average of each patient's count of HCCs. SD is standard deviation.

ences between the two groups of 13 percent, 18 percent, and 15 percent, respectively (Appendix Exhibit A7).²²

USE OF CARE In the last thirty days of life, compared to members of the comparison group, participants in COME HOME had fewer hospitalizations (57 per 1,000 people) and a small and nonsignificant additional number of ED visits (11 per 1,000 people) (Exhibit 3). Relative to their respective comparison groups, PCCP participants had fewer hospitalizations and ED visits, while CARE Track participants had nonsignificant additional numbers of hospitalizations and ED visits.

QUALITY OF CARE In the last two weeks of life, relative to the comparison group, more PCCP participants received hospice care (85 per 1,000 people) (Exhibit 4). We observed the same pattern for the other two models, although the differences between participants and comparators were not statistically significant. In the same timeframe, both COME HOME and PCCP participants had lower rates of chemotherapy use relative to comparators, but these differences were not significant. CARE Track participants had a low overall rate of chemotherapy use (data not shown), which was consistent with the program's emphasis on end-of-life quality over intensive treatments with limited clinical value.

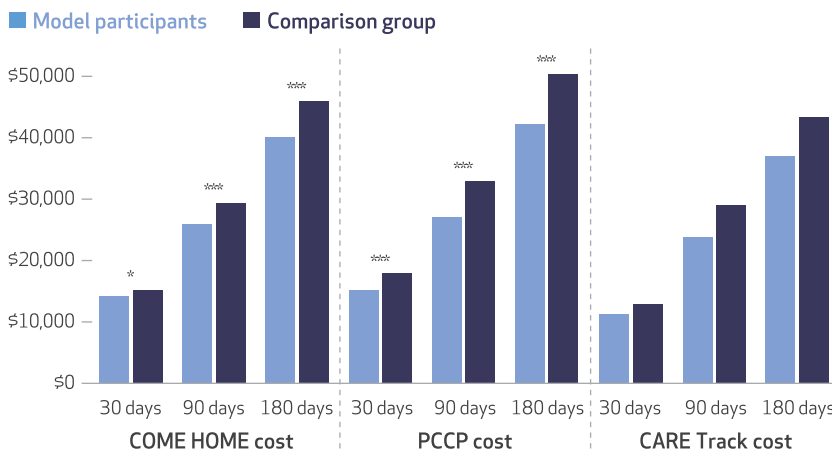
Discussion

As Medicare and other health care payers work to improve care and manage cost at the end of life, it will become increasingly important to implement innovative models of care for cancer patients. While a large body of evidence indicates the effectiveness of hospice models in meeting these goals, many patients do not enroll in hospice—often because they or their providers perceive doing so as giving up.¹⁴ The three models highlighted in this article provide insight into approaches that may enhance the experience of cancer patients at the end of life regardless of hospice enrollment, offering alternative palliative care options and reducing unnecessary utilization and costs.

Positive outcomes for these three alternative models of oncology care were aligned with the level of emphasis that each model placed on end-of-life care. Though COME HOME did not directly address palliative care, it seems that its enhanced access to health care providers likely helped patients manage symptoms and prevented the need for acute medical care. In the case of the PCCP, navigators' role in fostering end-of-life care discussions and identifying palliative care needs early in the dying process may have helped improve patients' quality of life

EXHIBIT 2

Total Medicare cost of care (per person) in the last 30, 90, and 180 days of life for participants in three end-of-life cancer models and members of comparison groups



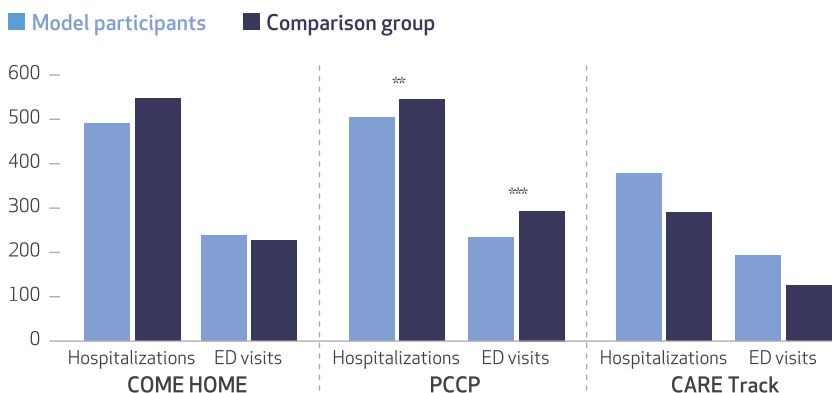
SOURCE Authors' analysis of Medicare claims data for 2010–15 from three end-of-life cancer models, as follows. **NOTES** COME HOME is Community Oncology Medical Home. PCCP is Patient Care Connect Program. CARE Track is Comprehensive Assessment with Rapid Evaluation and Treatment model. Costs are in 2013 dollars. For a list of adjustment factors, see the "Statistical Analysis" section. * $p < 0.10$ *** $p < 0.01$

though avoidance of costly treatments with limited clinical value. Participants in CARE Track had greater opportunity than they would have had with usual cancer care to communicate with health care providers about their pain and thus receive pain relief instead of aggressive medical treatments.

Our findings reinforce our previously reported qualitative analysis of patient and caregiver ex-

EXHIBIT 3

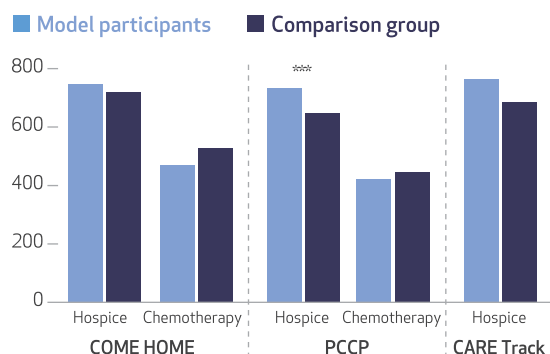
Hospitalizations and emergency department (ED) visits (per 1,000 people) in the last 30 days of life for participants in three end-of-life cancer models and members of comparison groups



SOURCE Authors' analysis of Medicare claims data for 2010–15 from three end-of-life cancer models. **NOTES** COME HOME is Community Oncology Medical Home. PCCP is Patient Care Connect Program. CARE Track is Comprehensive Assessment with Rapid Evaluation and Treatment model. For a list of adjustment factors, see the "Statistical Analysis" section. ** $p < 0.05$ *** $p < 0.01$

EXHIBIT 4

Users of hospice care and chemotherapy (per 1,000 people) in the last two weeks of life among participants in three end-of-life cancer models and members of comparison groups



SOURCE Authors' analysis of Medicare claims data for 2010–15 from three end-of-life cancer models. **NOTES** COME HOME is Community Oncology Medical Home. PCCP is Patient Care Connect Program. CARE Track is Comprehensive Assessment with Rapid Evaluation and Treatment model. We were unable to calculate adjusted estimates for chemotherapy use for CARE Track because of the small sample size. For a list of adjustment factors, see the "Statistical Analysis" section. *** $p < 0.01$

perience with these three models.²⁴ COME HOME participants reported that having enhanced access to providers enabled them to avoid ED visits and subsequent hospitalizations. Caregivers and patients in PCCP attested that patient navigators helped them assess and manage symptom flare-ups so that they did not need to visit the ED.

In addition, our findings both confirm previous research and introduce valuable new findings to the literature on cancer care. Though not significant, the positive results we observed for CARE Track add to a growing body of evidence that palliative care reduces costs at the end of life for terminally ill patients and can do so even if patients decline hospice care.^{25–27} Providers can promote palliative care in various ways: CARE Track is a successful example that used nurse care managers collaborating with oncologists.

A unique contribution of this study is its proof that the concept of the oncology medical home has potential for improving quality and reducing cost of care. To date, the literature in support of this model has been theoretical.^{28–30} One evaluation of the Michigan Oncology Medical Home Demonstration, published in 2014, relied on pre-post data and did not report on end-of-life outcomes.³¹ Ours is the first study that we know of to use robust comparison groups and to establish a clear association between use of the oncology medical home and cost reductions at the end of life.

Another novel finding is convincing evidence of the benefits of the patient navigation model for end-of-life cancer patients. The PCCP had the strongest findings regarding end-of-life quality of care, utilization, and spending. To date, patient navigation has mainly been linked with outcomes at the front end of cancer care, such as increased use of cancer screenings and improved follow-through with diagnostic care for patients with abnormal results.^{32,33} Although one small study³⁴ found an association between patient navigation and increased use of advance care planning and hospice care, no published study to date has demonstrated a relationship between patient navigation and reduced cost at the end of life. Patient navigators outside of hospice can play an important role in shepherding patients through end-of-life decision making and symptom management to prevent unneeded ED visits and hospitalizations.

Our COME HOME and PCCP findings are especially relevant to the CMS Oncology Care Model, which provides episode-based payments to physician group practices with financial and quality performance accountability for Medicare fee-for-service beneficiaries undergoing chemotherapy.³⁵ Under this model, participating practices are required to redesign themselves to include several aspects of COME HOME and the PCCP.^{20,35} Similar to COME HOME, practices in the Oncology Care Model will provide 24/7 access to appropriate clinicians with real-time access to the practice's medical records and use therapies consistent with nationally recognized clinical guidelines.^{20,36} Additionally, these practices will support "core functions of patient navigation," such as assisting with transitions between care settings and coordinating referrals.³⁶

Thus, the Oncology Care Model provides an opportunity to test elements of the oncology medical home and patient navigation interventions on a larger scale than in the Health Care Innovation Awards, and with payment mechanisms that could potentially support their increased implementation. Although practices in the model will be treating patients along the continuum of cancer care, they will need to consider how to approach end-of-life care for their sickest patients. Both COME HOME and the PCCP offer valuable lessons on how to help patients with terminal cancer avoid unnecessary acute care. Patient navigation in particular appears to be very effective in increasing hospice uptake and reducing utilization and costs in the last six month of life. The practices in the model could benefit from designing navigation services for patients with advanced cancer, adapting the PCCP's approach to their context.

Our study also makes the case for increased

payment for interventions that show promise in reducing end-of-life spending. However, non-clinical navigators such as those in the PCCP cannot be paid under current Medicare payment policy. Future research should consider how to sustain a nonclinical workforce for patient navigation in a fee-for-service payment universe that is still primarily focused on paying licensed professionals. Alternative payment models may offer an opportunity to engage a broader range of unlicensed health care providers in managing cancer care at the end of life.

Conclusion

Oncology medical home, patient navigation, and palliative care models all showed promise in re-

ducing costs at the end of life for cancer patients. The oncology medical home also showed reductions in hospitalizations, and the patient navigation model showed decreased hospitalizations and ED visits and increased use of hospice. A comprehensive approach to cancer care could include features from all three interventions described in this study to improve end-of-life outcomes, appropriately adapted to the target population and setting. The CMS Oncology Care Model provides an opportunity to test oncology medical homes and patient navigation on a larger scale. How practices in the model make the best use of patient navigation may determine their success in caring for patients with advanced cancer at the end of life. ■

The contents of this article are solely the responsibility of the authors and do not necessarily represent the official views of the US Department of Health and Human Services or any of its agencies. End-of-life care is a sensitive

issue. The care provided under these models is not intended to deny patients of life-saving treatment against the desires of the patient or his/her power of attorney. The Department of Health and Human Services does not support

assisted suicide or any coercion that could deny patients of life-saving treatment against the desires of the patient. The authors thank Angelina Lee, Dan Gilden, and Nancy Keating for their contributions to this study.

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- 22 To access the Appendix, click on the Appendix link in the box to the right of the article online.
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