Trends in Location of Death for Individuals With Primary Bone Tumors in the United States

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abstract

Background: Given the significant morbidity and mortality associated with primary bone cancer, provision of high-quality end-of-life care concordant with patient preferences is critical. This study aimed to evaluate trends in use of dedicated end-of-life care settings and investigate sociodemographic disparities in location of death among individuals with primary bone cancer. **Materials and Methods:** A retrospective, population-based review of patients who died of primary bone cancer-related causes was performed using the Underlying Cause of Death public use record from the Centers for Disease Control and Prevention Wide-ranging ONline Data for Epidemiologic Research (WONDER) database for the years 2003 through 2019. A total of 24,557 patients were included. **Results:** Over the study period, the proportion of primary bone cancer-related deaths occurring at home and in hospice increased, whereas those occurring in hospital, nursing home, and outpatient medical facility/emergency department settings decreased. Several sociodemographic factors were found to be associated with location of death, including age, marital status, and level of education. Moreover, patients of racial and ethnic minority groups were at significantly lower risk of experiencing death at home or in outpatient medical facility/emergency department settings relative to a hospital compared with White patients. **Conclusion**: Although rates of in-hospital death from primary bone cancer are decreasing, marked racial and ethnic disparities in use of dedicated end-of-life care settings exist. These gaps must be addressed to ensure all patients with primary bone cancer have equitable access to high-quality end-of-life care regardless of racial, ethnic, or socioeconomic status. [*Orthopedics*. 2025;48(1):44-50.]

In the United States, nearly 4000 individuals are diagnosed with primary malignant bone cancer each year.[1,2] Osteosarcoma is the most prevalent primary bone malignancy among all age groups, followed by chondrosarcoma in older adults and Ewing sarcoma in children and adolescents.[3] Primary bone malignancies carry a disproportionately high risk of mortality and collectively rank as the third leading cause of cancer-related

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death among patients 15 to 24 years old.[2,4] Despite recent advances in targeted and systemic multiagent therapies, 5-year survival rates remain low at only 27% and 22% for metastatic osteosarcoma and chondrosarcoma, respectively.[1] Patients with primary bone cancer are also three times more likely than the general population to develop cancer-related structural complications such as osteoporosis and fractures.[5,6] Considering the substantial negative impact of pain and structural complications on patient quality of life,[7] effective and humanistic palliative and end-of-life care is essential to maximize comfort and address secondary symptoms.

A growing emphasis on bettering quality of life for the seriously ill has heralded great strides in end-of-life care during the past few decades, promoted by improved cooperation between specialties, expansion of health care settings offering more personalized care, and advancements in palliative care protocols.[8-10] Additionally, in the midst of ongoing debate surrounding the utility of continuing cancer treatment for terminally ill patients, the transition to end-of-life care settings where therapies focus on patient goals and symptom management also helps to reduce the financial burden on patients, families, and the health care system.[11-14] Accordingly, numerous organizations, including the World Health Organization and the American Society of Clinical Oncology, have formally encouraged the integration of palliative care into a comprehensive care model.[15] Nevertheless, high-quality end-of-life care remains underutilized.[16] This is particularly concerning because terminally ill patients in institutional acute care settings have been reported to receive less respect, emotional support, and management of symptoms.[17] Patients have accordingly demonstrated preferences to instead die at home, in a nursing home, or in hospice where they may receive more personalized palliative care.[18-20] However, obtaining access to these end-of-life care settings can be difficult and complicated by issues of health literacy, cultural competency, health insurance coverage, and the ability to navigate health care networks. Moreover, recent studies suggest that disparities in access may also be perpetuated along racial, ethnic, and socioeconomic lines.[21,22] Therefore, understanding the impact of sociodemographic differences on access to high-quality end-of-life care is critical to establishing more integrated and effective care pathways and ensuring patients with primary bone cancer can achieve a desirable quality of life.

MATERIALS AND METHODS

This retrospective, population-based observational cohort study was conducted using the Underlying Cause of Death public use record from the Centers for Disease Control and Prevention Wide-ranging ONline Data for Epidemiologic Research (WONDER) database.[23] Because CDC WONDER is a de-identified, publicly available database, this study was determined to be exempt from institutional review board review.

For the years 2003 through 2019, US patients with malignant neoplasm of bone and articular cartilage were identified according to *International Classification of Diseases, Tenth Revision* (ICD-10) codes. Specifically, these included the following malignant neoplasms: scapula and long bones of upper limb (C40.0), short bones of upper limb (C40.1), long bones of lower limb (C40.2), short bones of lower limb (C40.3), overlapping sites of bone and articular cartilage of limb (C40.8), unspecified bones and articular cartilage of limb (C40.9), bones of skull and face (C41.0), mandible (C41.1), vertebral column (C41.2), ribs, sternum and clavicle (C41.3), pelvic bones, sacrum and coccyx (C41.4), and bone and articular cartilage, unspecified (C41.9). Sociodemographic information including age (≤64, 65-74, 75-84, or ≥85 years), sex, race (American Indian, Asian, Black, or White), ethnicity (non-Hispanic or Hispanic), marital status, and education (high school or less, some college or more) was obtained, and location of death (hospital, home, nursing facility, hospice facility, or outpatient medical facility/emergency department [ED]) was recorded for each patient. Patients with incomplete sociodemographic information or unknown location of death were excluded.

Statistical Analysis

All statistical analyses were performed using STATA, version 17.0, software (StataCorp). The number and frequency (percentage) of patients classified within each sociodemographic category was measured according to location of death, and the proportion of total deaths occurring in each location was quantified over the study period. Multivariable multinomial logistic regression analyses were performed to determine any associations between decedent sociodemographic characteristics and location of death, and results were reported as relative risk ratios (RRRs) with 95% CIs using death in the hospital as the reference location of death. $P<.05$ was considered statistically significant.

RESULTS

A total of 24,557 patients with primary metastatic bone cancer as the underlying cause of death were identified in this study, with 13,964 (56.86%) being male and 10,593 (43.14%) being female. The vast majority were White (20,883 patients, 85.04%), while 2778 (11.31%) were Black, 168 (0.68%) were American Indian, 728 (2.96%) were Asian, and 2663 (10.84%) were Hispanic. Most were non-Hispanic (89.16%), were unmarried (58.74%), had no more than a high school-level education (62.74%), and were younger than 64 years (50.10%) at the time of death (**Table 1**). Overall, the total number of deaths from primary metastatic bone cancer increased with each successive year assessed, rising 53% between 2003 (n=1194) and 2019 (n=1826). The proportion of primary metastatic

Table 1

Baseline Characteristics of Patients With Bone Cancer

	No.					
Characteristic	**Total cohort**	**Hospital**	**Home**	**Nursing home**	**Hospice**	**Outpatient medical facility/ED**
Total	24,557 (100.0%)	6567 (26.74%)	10,872 (44.27%)	3271 (13.32%)	2066 (8.41%)	1781 (7.25%)
Age						
≤64 y	13,286 (54.10%)	4798 (73.06%)	5826 (53.59%)	705 (21.55%)	1037 (50.19%)	920 (51.66%)
65-74 y	3894 (15.86%)	762 (11.60%)	1850 (17.02%)	585 (17.88%)	400 (19.36%)	297 (16.68%)
75-84 y	4187 (17.05%)	673 (10.25%)	1911 (17.58%)	946 (28.92%)	344 (16.65%)	313 (17.57%)
≥85 y	3190 (12.99%)	334 (5.09%)	1285 (11.82%)	1035 (31.64%)	285 (13.79%)	251 (14.09%)
Sex						
Female	10,593 (43.14%)	2637 (40.16%)	4542 (41.78%)	1647 (50.35%)	936 (45.30%)	831 (46.66%)
Male	13,964 (56.86%)	3930 (59.84%)	6330 (58.22%)	1624 (49.65%)	1130 (54.70%)	950 (53.34%)
Race						
American Indian/Alaska Native	168 (0.68%)	62 (0.94%)	70 (0.64%)	15 (0.46%)	9 (0.44%)	12 (0.67%)
Asian	728 (2.96%)	303 (4.61%)	277 (2.55%)	58 (1.77%)	36 (1.74%)	54 (3.03%)
Black	2778 (11.31%)	925 (14.09%)	1061 (9.76%)	301 (9.20%)	209 (10.12%)	282 (15.83%)
White	20,883 (85.04%)	5277 (80.36%)	9464 (87.05%)	2897 (88.57%)	1812 (87.71%)	1433 (80.46%)
Ethnicity						
Non-Hispanic	21,894 (89.16%)	5547 (84.47%)	9739 (89.58%)	3123 (95.48%)	1861 (90.08%)	1624 (91.18%)
Hispanic	2663 (10.84%)	1020 (15.53%)	1133 (10.42%)	148 (4.52%)	205 (9.92%)	157 (8.82%)
Marital status						
Unmarried	14,424 (58.74%)	3994 (60.82%)	5869 (53.98%)	2287 (69.92%)	1117 (54.07%)	1157 (64.96%)
Married	10,133 (41.26%)	2573 (39.18%)	5003 (46.02%)	984 (30.08%)	949 (45.93%)	624 (35.04%)
Education						
High school or less	15,408 (62.74%)	3984 (60.67%)	6928 (63.72%)	2216 (67.75%)	1154 (55.86%)	1126 (63.22%)
Some college or more	9149 (37.26%)	2583 (39.33%)	3944 (36.28%)	1055 (32.25%)	912 (44.14%)	655 (36.78%)

Abbreviation: ED, emergency department.

bone cancer-related deaths occurring in hospice increased 10-fold, from 0.84% in 2003 to consistently greater than 8.5% from 2011 onward. At-home death also became increasingly common, whereas the proportion of patients experiencing death in hospital, nursing home, and outpatient medical facility/ED settings decreased (**Figure 1**).

Location of death was found to vary significantly according to various sociodemographic parameters (**Table 2**). Specifically, compared with patients younger than 64 years, older patients exhibited greater risk of death in home, nursing home, hospice, and outpatient medical facility/ED settings than in a hospital. Sex was uniformly not associated with location of death with the exception that risk of death in hospice (male RRR: 0.85 [95% CI, 0.77-0.95], *P*<.01) and outpatient medical facility/ED (male RRR: 0.87 [95% CI, 0.78-0.97], *P*<.05) settings relative to a hospital was lower among males than females. Compared with unmarried patients, married patients had greater risk of death at home (RRR: 1.26 [95% CI, 1.17-1.34], *P*<.001) and in hospice (RRR: 1.19 [95% CI, 1.07-1.33], *P*<.01) than in a hospital. Risk of death in nursing home (RRR: 0.61 [95% CI, 0.55-0.67], *P*<.001) and outpatient medical facility/ED (RRR: 0.81 [95% CI, 0.72-0.91], *P*<.001) settings relative to a hospital was lower among married patients compared with unmarried patients.

Compared with White patients, patients identifying with racial minority groups were at significantly lower risk of experiencing death at home, in a nursing home, and in hospice than in the hospital. Risk of death in the outpatient medical facility/ED setting differed only between Asian and White patients, with Asian patients being 32% less likely to die in an outpatient medical facility/ED than in a hospital compared with White patients (Asian RRR: 0.68 [95% CI, 0.51-0.92], *P*<.05). Similarly, Hispanic ethnicity was associated with lower risk of death at home, in a nursing home, in hospice, and in an outpatient medical facility/ED than in a hospital. Finally, relative to risk of death in the hospital setting, compared with those with no more than a high school-level education, decedents with college exposure had reduced risk of death at home (RRR: 0.81 [95% CI, 0.76-0.86], *P*<.001) and in nursing facilities (RRR: 0.78 [95% CI, 0.71-0.86], *P*<.001) and greater risk of death in hospice (RRR: 1.15 [95% CI, 1.04-1.28], *P*<.01).

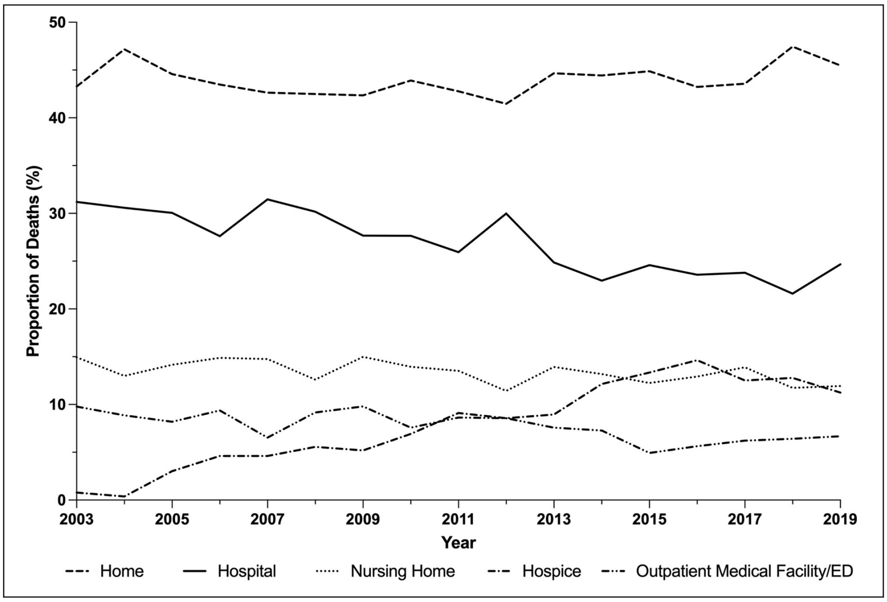

Figure 1: Trends in location of deaths for patients with bone cancer between 2003 and 2019. Abbreviation: ED, emergency department.

DISCUSSION

Supported by efforts to provide terminally ill patients with end-of-life care aligning with their goals and preferences and to alleviate the substantial financial burden associated with hospital and intensive care unit stays, the role of palliative and end-of-life care is expanding with the purpose of affirming life and recognizing death as a natural process of life.[24,25] Findings of the current study demonstrate that between 2003 and 2019, use of home and hospice settings for end-of-life care increased among patients with primary malignant bone cancer, while the proportions of patients who died in hospital, nursing home, or outpatient medical facility/ED settings decreased. Across the study period, decedents of primary bone cancer most commonly died at home, although this subpopulation accounted for fewer than half of all cases. The current study showed that older and married patients were more likely to receive end-of-life care at home or in hospice than in acute care hospital settings. Older patients were also more likely to die in nursing homes than in hospitals, although marriage was negatively associated with nursing home use. End-of-life care also varied significantly according to race and ethnicity. For example, non-White and Hispanic patients were less likely than their White and non-Hispanic counterparts to experience death at home, in a nursing home, or in the hospice setting. Moreover, college-educated patients were less likely to receive end-of-life care at home or in nursing facilities and more likely to die in hospice compared with the hospital setting.

The observed trends in end-of-life care setting use appear to be favorable considering emerging evidence indicating patients prefer to die at home and hospice care offers benefits of shorter hospital stays, greater average time spent at home, and improved caregiver outcomes.[26-28] Patients receiving dedicated palliative care services also undergo aggressive therapies less frequently and have greater access to opioids for symptom management.[29] Consequently, transitioning out of the hospital or intensive care unit to palliative care settings has been associated with improved patient-reported quality of life, lower rates of depression, improved management of symptoms, and greater provider satisfaction with patient care, all while mitigating costs of potentially ineffective or unwanted interventions in accordance with value-based practices.[13,30,31] The shrinking proportion of patients with primary bone cancer receiving end-of-life care in hospital settings appears to be predominantly reciprocated by increasing rates of hospice use, which rapidly outpaced the relatively slight increase in the proportion of patients dying at home over the study period. White, non-Hispanic, married, and college-educated patient cohorts, as well as those 65 years and older, each exhibited significantly higher relative risk of death in hospice care relative to the hospital setting, compared with their counterparts. Reasons for such differences are likely multifactorial. For example, younger patients may be more likely to receive more aggressive hospital care due to the belief that they may be more able to withstand intensive therapies than older patients and may have more to gain from life-sustaining interventions.[32] Married patients may exhibit stronger preferences to spend their remaining days in hospice, where spouses and families may visit more regularly and comfortably.

Table 2

Association Between Sociodemographic Characteristics and Location of Death for Patients With Bone Cancer With Hospital Location as Reference Group

	RRR (95% CI)			
Characteristic	**Home vs hospital (reference)**	**Nursing home vs hospital (reference)**	**Hospice vs hospital (reference)**	**Outpatient medical facility/ED vs hospital (reference)**
Age				
≤64 y	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
65-74 y	1.81 (1.65-1.99)[a]	5.33 (4.64-6.11)[a]	2.21 (1.92-2.55)[a]	2.04 (1.75-2.38)[a]
75-84 y	2.11 (1.91-2.32)[a]	8.99 (7.90-10.23)[a]	2.16 (1.86-2.50)[a]	2.36 (2.02-2.75)[a]
≥85 y	2.95 (2.59-3.35)[a]	17.62 (15.18-20.46)[a]	3.67 (3.08-4.37)[a]	3.58 (2.99-4.29)[a]
Sex				
Female	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Male	0.97 (0.91-1.04)[b]	0.97 (0.89-1.07)[b]	0.85 (0.77-0.95)[c]	0.87 (0.78-0.97)[d]
Race				
White	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
American Indian/Alaska Native	0.66 (0.47-0.94)[d]	0.53 (0.29-0.97)[d]	0.48 (0.24-0.97)[d]	0.74 (0.40-1.40)[b]
Asian	0.53 (0.45-0.63)[a]	0.42 (0.31-0.57)[a]	0.36 (0.25-0.51)[a]	0.68 (0.51-0.92)[d]
Black	0.67 (0.61-0.74)[a]	0.66 (0.57-0.77)[a]	0.72 (0.61-0.85)[a]	1.12 (0.97-1.31)[b]
Ethnicity				
Non-Hispanic	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Hispanic	0.66 (0.60-0.72)[a]	0.34 (0.28-0.41)[a]	0.69 (0.58-0.81)[a]	0.60 (0.50-0.72)[a]
Marital status				
Unmarried	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Married	1.26 (1.17-1.34)[a]	0.61 (0.55-0.67)[a]	1.19 (1.07-1.33)[c]	0.81 (0.72-0.91)[a]
Education				
High school or less	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Some college or more	0.81 (0.76-0.86)[a]	0.78 (0.71-0.86)[a]	1.15 (1.04-1.28)[c]	0.92 (0.82-1.03)[b]

Abbreviations: ED, emergency department; RRR, relative risk ratio.

[a] *P<.001.*

[b] *Not significant.*

[c] *P<.01.*

[d] *P<.05.*

Given that hospitals do not generally offer the same level of end-of-life supportive care, it is concerning that Black, American Indian/Alaska Native, and Asian patients with primary bone cancer were found to be more likely to die in this setting compared with home, nursing home, and hospice settings relative to their White counterparts. These observed differences in location of death are concordant with findings of prior studies indicating disparities in access and highlighting the intersectionality of race, ethnicity, and socioeconomic status underlying inequities in end-of-life care. In a study of Medicare beneficiaries, Paredes et al[33] found patients of racial and ethnic minority groups with pancreatic cancer to be 22% less likely than White patients to initiate hospice services prior to death, even after controlling for demographic characteristics and comorbidity burden. The decision to transition from intensive acute hospital care to the palliative care setting is difficult and complicated, influenced by several patient-, provider-, and system-level factors. White patients have previously been found more likely to opt against life-prolonging care and to establish do-not-resuscitate orders when facing a terminal diagnosis compared with Black and Hispanic patients, who demonstrate higher preferences for more burdensome end-of-life care provided in intensive care settings.[34,35] Notably, providers also play a role in influencing patient preferences during end-of-life care discussions. Failure to identify and address language barriers, historically rooted mistrust of health care professionals, or other barriers impairing understanding of diagnosis, prognosis, and therapeutic options among patients of minority groups can preclude informed decision-making that most closely aligns with patient desires.[21,36,37] Religiosity, cultural beliefs, and family dynamics have also consistently been shown to impact preferences for advanced directives, living wills, and end-of-life care.[35,38,39]

There are several limitations to consider when interpreting the results of this study. First, the study was limited to a 17-year span because the hospice location of death was not recorded in the CDC WONDER database until 2003. In addition, no information was available to determine whether hospice services may have been provided in non-hospice settings (eg, at home or in the hospital). Furthermore, patients who received end-of-life care in the hospital and those who were receiving care in a dedicated supportive care setting but experienced acute decompensation requiring hospital admission and resulting in-hospital death could not be delineated. Specific information regarding income, insurance status, health literacy, and social support could not be determined and may potentially confound analyses of sociodemographic differences in end-of-life care settings. Despite these limitations, this large population of patients with primary metastatic bone cancer as the underlying cause of death serves as a nationally representative sample of terminally ill patients, and this study provides a basis for further research investigating factors contributing to patterns and trends in end-of-life care.

CONCLUSION

While high-quality end-of-life care is essential to maximize patient comfort and address secondary symptoms, there are significant disparities in access to dedicated end-of-life care settings. This study revealed that most patients with primary bone cancer die in the hospital or at home, but there are marked disparities in the use of end-of-life care settings, with racial minority groups having decreased relative risk of death in home, nursing home, and hospice settings compared with the hospital. Considering patients in hospitals tend to receive less respect, emotional support, and adequate management of symptoms, these inequities must be addressed to ensure all patients with primary bone cancer have access to high-quality end-of-life care regardless of racial, ethnic, or socioeconomic status.

REFERENCES

1. Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics, 2022. *CA Cancer J Clin.* 2022;72(1):7-33. https://doi.org/10.3322/caac.21708
2. Siegel RL, Miller KD, Wagle NS, Jemal A. Cancer statistics, 2023. *CA Cancer J Clin.* 2023;73(1):17-48. https://doi.org/10.3322/caac.21763
3. Ferguson JL, Turner SP. Bone cancer: diagnosis and treatment principles. *Am Fam Physician*. 2018;98(4):205-213. https://www.aafp.org/pubs/afp/issues/2018/0815/p205.html
4. Bordbar M, Sarfaraz A, Haghpanah S, Zekavat O, Zareifar S, Zarei T. The outcome of children with malignant bone tumors: a single-center experience. *Glob Pediatr Health.* 2021;8:2333794X211042238. https://doi.org/10.1177/2333794X211042238
5. Pullan JE, Lotfollahzadeh S. Primary bone cancer. *Nurs Stand*. 2022;28(12):22. https://doi.org/10.7748/ns2013.11.28.12.22.s27
6. Vestergaard P, Rejnmark L, Mosekilde L. Fracture risk in patients with different types of cancer. *Acta Oncol*. 2009;48(1):105-115. https://doi.org/10.1080/02841860802167490
7. Clohisy DR, Mantyh PW. Bone cancer pain. *Cancer*. 2003;97(S3):866-873. https://doi.org/10.1002/cncr.11144
8. Wallerstedt B, Benzein E, Schildmeijer K, Sandgren A. What is palliative care? Perceptions of healthcare professionals. *Scand J Caring Sci*. 2019;33(1):77-84. https://doi.org/10.1111/scs.12603
9. Morrison RS, Dietrich J, Ladwig S, et al. The care span: palliative care consultation teams cut hospital costs for Medicaid beneficiaries. *Health Aff (Millwood)*. 2011;30(3):454-463. https://doi.org/10.1377/hlthaff.2010.0929
10. Kelley AS, Meier DE. Palliative care: a shifting paradigm. *N Engl J Med*. 2010;363(8):781-782. https://doi.org/10.1056/NEJMe1004139
11. Emanuel EJ, Young-Xu Y, Levinsky NG, Gazelle G, Saynina O, Ash AS. Chemotherapy use among Medicare beneficiaries at the end of life. *Ann Intern Med*. 2003;138(8):639. https://doi.org/10.7326/0003-4819-138-8-200304150-00011
12. Braga S. Why do our patients get chemotherapy until the end of life? *Ann Oncol.* 2011;22(11):2345-2348. https://doi.org/10.1093/annonc/mdr416
13. Dalal S, Bruera E. End-of-life care matters: palliative cancer care results in better care and lower costs. *Oncologist*. 2017;22(4):361-368. https://doi.org/10.1634/theoncologist.2016-0277
14. Schnipper LE, Smith TJ, Raghavan D, et al. American Society of Clinical Oncology identifies five key opportunities to improve care and reduce costs: the top five list for oncology. *J Clin Oncol*. 2012;30(14):1715-1724. https://doi.org/10.1200/JCO.2012.42.8375
15. Ferris FD, Bruera E, Cherny N, et al. Palliative cancer care a decade later: accomplishments, the need, next steps—from the American Society of Clinical Oncology. *J Clin Oncol*. 2009;27(18):3052-3058. https://doi.org/10.1200/JCO.2008.20.1558
16. Hui D, Kim S-H, Kwon JH, et al. Access to palliative care among patients treated at a comprehensive cancer center. *Oncologist*. 2012;17(12):1574-1580. https://doi.org/10.1634/theoncologist.2012-0192
17. Teno JM, Clarridge BR, Casey V, et al. Family perspectives on end-of-life care at the last place of care. *JAMA*. 2004;291(1):88. https://doi.org/10.1001/jama.291.1.88
18. Gomes B, Calanzani N, Gysels M, Hall S, Higginson IJ. Heterogeneity and changes in preferences for dying at home: a systematic review. *BMC Palliat Care*. 2013;12(1):7. https://doi.org/10.1186/1472-684X-12-7
19. Higginson IJ, Sen-Gupta GJ. Place of care in advanced cancer: a qualitative systematic literature review of patient preferences. *J Palliat Med*. 2005;3(3):287-300. https://doi.org/10.1089/jpm.2000.3.287
20. Gomes B, Higginson IJ, Calanzani N, et al. Preferences for place of death if faced with advanced cancer: a population survey in England, Flanders, Germany, Italy, the Netherlands, Portugal and Spain. *Ann Oncol*. 2012;23(8):2006-2015. https://doi.org/10.1093/annonc/mdr602
21. LoPresti MA, Dement F, Gold HT. End-of-life care for people with cancer from ethnic minority groups. *Am J Hosp Palliat Care*. 2016;33(3):291-305. https://doi.org/10.1177/1049909114565658
22. Reyes-Gibby CC, Anderson KO, Shete S, Bruera E, Yennurajalingam S. Early referral to supportive care specialists for symptom burden in lung cancer patients. *Cancer*. 2012;118(3):856-863. https://doi.org/10.1002/cncr.26312

23. Centers for Disease Control and Prevention. *CDC WONDER*. Accessed June 10, 2022. https://wonder.cdc.gov

24. Radbruch L, De Lima L, Knaul F, et al. Redefining palliative care: a new consensus-based definition. *J Pain Symptom Manage*. 2020;60(4):754-764. https://doi.org/10.1016/j.jpainsymman.2020.04.027

25. Langton JM, Blanch B, Drew AK, Haas M, Ingham JM, Pearson SA. Retrospective studies of end-of-life resource utilization and costs in cancer care using health administrative data: a systematic review. *Palliat Med*. 2014;28(10):1167-1196. https://doi.org/10.1177/0269216314533813

26. Hoare S, Morris ZS, Kelly MP, Kuhn I, Barclay S. Do patients want to die at home? A systematic review of the UK literature, focused on missing preferences for place of death. *PLoS One*. 2015;10(11):e0142723. https://doi.org/10.1371/journal.pone.0142723

27. Zuckerman RB, Stearns SC, Sheingold SH. Hospice use, hospitalization, and Medicare spending at the end of life. *J Gerontol B Psychol Sci Soc Sci*. 2016;71(3):569-580. https://doi.org/10.1093/geronb/gbv109

28. Currow DC, Agar MR, Phillips JL. Role of hospice care at the end of life for people with cancer. *J Clin Oncol*. 2020;38(9):937-943. https://doi.org/10.1200/JCO.18.02235

29. De Palma R, Fortuna D, Hegarty SE, Louis DZ, Melotti RM, Moro ML. Effectiveness of palliative care services: a population-based study of end-of-life care for cancer patients. *Palliat Med*. 2018;32(8):1344-1352. https://doi.org/10.1177/0269216318778729

30. Joynt KE, Jha AK. A path forward on Medicare readmissions. *N Engl J Med*. 2013;368(13):1175-1177. https://doi.org/10.1056/NEJMp1300122

31. McMahon KM, Eaton VP, Srikanth KK, et al. Survey of palliative care use in primary malignant bone tumors: a National Cancer Database review. *J Palliat Med*. 2023;26(8):1139-1146. https://doi.org/10.1089/jpm.2022.0365

32. Earle CC, Landrum MB, Souza JM, Neville BA, Weeks JC, Ayanian JZ. Aggressiveness of cancer care near the end of life: is it a quality-of-care issue? *J Clin Oncol*. 2008;26(23):3860-3866. https://doi.org/10.1200/JCO.2007.15.8253

33. Paredes AZ, Hyer JM, Palmer E, Lustberg MB, Pawlik TM. Racial/ethnic disparities in hospice utilization among Medicare beneficiaries dying from pancreatic cancer. *J Gastrointest Surg*. 2021;25(1):155-161. https://doi.org/10.1007/s11605-020-04568-9

34. Kypriotakis G, Francis LE, O'Toole E, Towe TP, Rose JH. Preferences for aggressive care in underserved populations with advanced-stage lung cancer: looking beyond race and resuscitation. *Support Care Cancer*. 2014;22(5):1251-1259. https://doi.org/10.1007/s00520-013-2079-x

35. Phipps E, True G, Harris D, et al. Approaching the end of life: attitudes, preferences, and behaviors of African-American and white patients and their family caregivers. *J Clin Oncol*. 2003;21(3):549-554. https://doi.org/10.1200/JCO.2003.12.080

36. Perry LM, Walsh LE, Horswell R, et al. Racial disparities in end-of-life care between black and white adults with metastatic cancer. *J Pain Symptom Manage*. 2021;61(2):342-349.e1. https://doi.org/10.1016/j.jpainsymman.2020.09.017

37. Mack JW, Paulk ME, Viswanath K, Prigerson HG. Racial disparities in the outcomes of communication on medical care received near death. *Arch Intern Med*. 2010;170(17):1533-1540. https://doi.org/10.1001/archinternmed.2010.322

38. Campbell C, Williams I, Orr T. Factors that impact end-of-life decision making in African Americans with advanced cancer. *J Pain Symptom Manage*. 2011;41(1):277-278. https://doi.org/10.1016/j.jpainsymman.2010.10.189

39. Smith AK, McCarthy EP, Paulk E, et al. Racial and ethnic differences in advance care planning among patients with cancer: impact of terminal illness acknowledgment, religiousness, and treatment preferences. *J Clin Oncol*. 2008;26(25):4131-4137. https://doi.org/10.1200/JCO.2007.14.8452