

## Original Article

# Palliative Care Clinician Overestimation of Survival in Advanced Cancer: Disparities and Association With End-of-Life Care



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## Abstract

**Context.** Clinicians frequently overestimate survival time in serious illness.

**Objective.** The objective of this study was to understand the frequency of overestimation in palliative care (PC) and the relation with end-of-life (EOL) treatment.

**Methods.** This is a multisite cohort study of 230 hospitalized patients with advanced cancer who consulted with PC between 2013 and 2016. We asked the consulting PC clinician to make their “best guess” about the patients’ “most likely survival time, assuming that their illnesses are allowed to take their natural course” (<24 hours; 24 hours to less than two weeks; two weeks to less than three months; three months to less than six months; six months or longer). We followed patients for up to six months for mortality and EOL treatment utilization. Patients completed a brief interviewer-facilitated questionnaire at study enrollment.

**Results.** Median survival was 37 days (interquartile range: 12 days, 97 days) and 186/230 (81%) died during the follow-up period. Forty-one percent of clinicians’ predictions were accurate. Among inaccurate prognoses, 85% were overestimates. Among those who died, overestimates were substantially associated with less hospice use (OR<sub>adj</sub>: 0.40; 95% CI: 0.16–0.99) and later hospice enrollment (within 72 hours of death OR<sub>adj</sub>: 0.33; 95% CI: 0.15–0.74). PC clinicians were substantially more likely to overestimate survival for patients who identified as Black or Latino compared to others (OR<sub>adj</sub>: 3.89; 95% CI: 1.64–9.22). EOL treatment preferences did not explain either of these findings.

**Conclusion.** Overestimation is common in PC, associated with lower hospice use and a potentially mutable source of racial/ethnic disparity in EOL care. *J Pain Symptom Manage* 2019;57:233–240. © 2018 American Academy of Hospice and Palliative Medicine. Published by Elsevier Inc. All rights reserved.

## Key Words

Prognosis, optimism, bias, patient-centered

## Introduction

This eleventh hour [hospice] referral pattern is at least partly due to doctors not recognizing the nearness of death.<sup>1</sup>

Estimating survival time in serious illness is a challenging and important task for clinicians who care for the seriously ill.<sup>2–11</sup> Previous work observes that clinicians are accurate about survival time only 20% to 30% of the time among patients who are within months of dying, including those with advanced cancer.<sup>2</sup> When

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clinicians err, they are far more likely to overestimate than to underestimate survival time.<sup>2,3,12–14</sup>

Most people report preferences for their medical care to transition from a primary focus on disease management and longevity toward a primary focus on maximizing comfort and quality of life in the weeks to months before their death.<sup>15</sup> Despite these stated preferences, more than eight of ten United States Medicare beneficiaries die without ever enrolling in hospice care or enrolling only within 72 hours of their death.<sup>16</sup> One hypothesized reason for this mismatch between end-of-life (EOL) preferences and EOL treatment is that clinicians' optimistic bias in survival estimation prevents patients and clinicians from knowing when EOL is happening. Little empirical work is available, however, that evaluates the longitudinal relationship between clinician overestimate of survival and actual EOL treatment in people who are seriously ill. This study addresses this important scientific gap with a focus on the clinical context of advanced cancer.

Palliative care (PC) improves quality-of-life and preference-concordant EOL treatment in advanced cancer,<sup>17</sup> and prognosis communication appears to be an important mechanism for this effect.<sup>5,7,8,11</sup> PC specialists are trained to estimate survival in serious illness. Recent evidence suggests that PC specialists' survival estimates tend to be moderately more accurate than other clinicians' estimates but remain susceptible to optimistic bias.<sup>14</sup> This study focuses on the setting of PC in advanced cancer to understand whether survival overestimation is associated with EOL treatment outcomes.

## Methods

### Overview

As described more fully elsewhere,<sup>18</sup> the Palliative Care Communication Research Initiative is a multisite observational cohort study. Between January 2013 and April 2016, we enrolled 240 hospitalized patients with advanced cancer at the time of referral for inpatient PC consultation. Four withdrew, three died, or two were discharged before completing the PC consultation. One person who completed the PC consultation withdrew participation before the postconsultation collection of the clinician's survival estimate. The remaining 230 are included in this analysis. We analyzed data from patient self-report before consultation and one day after the initial PC consultation; clinician self-report immediately after initial consultation; medical record review; and six months of mortality follow-up.

### Participants

The parent cohort study took place at two large academic medical centers in geographically distant areas

of the U.S.: the Northeast and West Coast. All English-speaking, hospitalized patients who were referred for inpatient PC consultation were eligible for this study if they met the following additional criteria: age >21 years, diagnosed with a metastatic nonhematologic cancer, not having a documented exclusively comfort-oriented plan of care at the time of referral, not expected to die within hours at the time of referral to PC, and able to consent for research either directly or via health care proxy (if lacking decision-making capacity as determined by the clinical team). All members of the palliative care team were eligible to participate and enrolled at study outset. Medical residents, nonpalliative care medical fellows, nursing students, and medical students were eligible to participate in the parent study and enrolled at the beginning of their two-week rotation on the palliative care service. This analysis includes 11 survival estimates reported by three trainees, all completed in direct consultation with the palliative care specialist with whom they were working, in almost all cases the attending PC physician.

### Measures

We designed all Palliative Care Communication Research Initiative measures to be easily understood, valid, and low-burden in the busy hospital environment to promote representative participation among a seriously ill population. All measure design and validation procedures are described more fully elsewhere.<sup>18</sup>

*PC Clinician Ratings of Survival Prognosis.* Immediately after the PC consultation, we asked PC clinicians to make their "best guess" about the patients' "most likely survival time, assuming that their illnesses are allowed to take their natural course" (<24 hours; 24 hours to less than two weeks; two weeks to less than three months; three months to less than six months; more than six months). In the U.S. context, enrollment in hospice requires physician estimation of likely survival to be less than six months under the assumption that at least the primary life-limiting disease is allowed to take its natural course. In some geographic locations, as those in this study, eligibility for some types of EOL services is informed by shorter life expectancies (e.g., residential comfort care homes tending toward fewer than three months of life expectancy). Thus, we chose the response options based on survival prognosis time intervals commonly considered by clinicians in the study sites. Palliative care clinicians found the item understandable and low burden during pilot testing.

*EOL Treatment Preferences.* We asked patient-participants the following modified version of the

SUPPORT Study<sup>19</sup> item: “During the last few months of my life, I would prefer a plan of treatment that focused on my comfort and quality of life, even if that meant not living quite as long.” Options included “strongly agree,” “somewhat agree,” “not sure,” “somewhat disagree,” and “strongly disagree.” In the U.S., hospice eligibility requires patients to forego treatments having the primary purpose of attempting to extend life for the life-limiting disease(s) that qualify them prognostically for hospice. Therefore, although many clinical situations do not actually present such a clear tradeoff, the consideration is relevant to hospice decision making in the sites in which this study happened. We considered people who answered “strongly agree” or “strongly disagree” to have established formed preferences.

*Follow-Up (Mortality, Hospice Enrollment, and Treatment Utilization).* At the time of enrollment, patient-participants identified a key informant for follow-up contact. For participants who died during the admission in which they enrolled in the study (i.e., index admission), we obtained date of death from hospital records. For participants who were discharged from the index admission, we contacted them or their key informants by telephone at one and six months after enrollment to identify interval hospice enrollment or death. We confirmed hospice enrollment with the hospice agency and obtained medical records for all hospitalizations that happened within 14 days of death. We identified whether participants received any of the three following interventions within 14 days of death because each is accepted to be for the purposes of life extension with little or no value to comfort in advanced cancer: cardiopulmonary resuscitation, mechanical endotracheal ventilation, artificial nutrition via percutaneous or nasogastric feeding tube.<sup>16</sup> We confirmed all reported deaths using hospital or obituary records.

*Other Analytic Variables.* Patient participants self-reported their gender, racial/ethnic identities, educational attainment, and religious affiliations. Clinician participants self-reported their gender, racial/ethnic identities, professional discipline, and years of palliative care practice. We evaluated financial strain by asking, “When you think about the amount of income that you have available in a typical month, how often is it enough for things you really need like food, clothing, medicine, repairs to the home, and transportation?” (None of the time; Some of the time; Most of the time; All of the time). This subjective assessment of financial resources is important for quality of decision making in cancer settings.<sup>20,21</sup> We assessed quality of life using the McGill Quality-of-life Questionnaire global item: “Considering all parts of your

life—physical, emotional, social, spiritual, and financial—over the past two days, how would you rate the quality of your life?” (0–10 scale from “very bad” to “excellent”).<sup>22,23</sup> We obtained key indicators of survival prognosis from the medical record (i.e., cancer types and stage, serum albumin, white blood cell count) and from the PC clinicians at the time of consultation (i.e., Palliative Performance Scale).<sup>24</sup>

### *Analytic Approach*

We calculated the frequency and distribution of all study variables. We defined survival overestimation to have occurred when the observed timing of patients’ death happened sooner than indicated by the clinicians. We defined accurate as an observed survival time that was concordant with the clinician estimate and underestimate when the actual survival was longer than the clinician estimate. We described the point estimate and 95% CIs for the prevalence of overestimation among the full sample and stratified by patient and clinician characteristics. We categorized race (nonmutually exclusive categories) and ethnicity based on observed disparities in EOL cancer care among people who self-identify as either Black or Latino/Hispanic.<sup>25–28</sup> For statistical significance testing purposes, we used t-tests for normally distributed continuous data and chi-square tests for categorical data. The association evaluated in this study is not a prespecified hypothesis of the parent cohort.

We evaluated potential effect modification using stratified analyses. We adjusted for potential confounding using two multiple logistic regression model building procedures. First, we used iterative inclusion of potential confounders and confounder sets, retaining those with substantial (~20%) change in the magnitude of the point estimate (i.e., odds ratio). Second, we used an automated stepwise approach that iteratively selects for retention of potential confounders based on their ultimate prediction of the dependent variable using an alpha threshold of 0.3. For all adjusted analyses, both methods led to the same conclusions; we present final results for the stepwise approach. For each association, we identified potential confounders as those variables demonstrating either a theoretical or observed association with the independent and dependent variable. In accordance with epidemiology standards, if the adjusted model point estimate did not depart substantially from the unadjusted estimate, then we considered the unadjusted estimate to be the most valid.<sup>29</sup>

### *Results*

As shown in [Table 1](#), participants’ median age was 63 years (interquartile range: 54–71 years), half were women, two-thirds were financially insecure, 15% did

**Table 1**  
**Description of Patient Characteristics by Survival Overestimate**

Participant Characteristics	Survival Overestimate		
	N	%	95% CI
Patient participants			
Full sample	230	50.4	43.9–56.9
Gender			
Women	114	45.6	36.4–54.8
Men	116	55.2	46.1–64.3
Age in yrs			
Under age 55	62	54.8	42.4–67.3
55–70 yrs	104	51.9	42.2–61.6
>70	64	43.8	31.5–56.0
Racial and ethnic identity			
Any Black identity	29	65.5	48.1–82.9
Any Hispanic/Latino identity	19	68.4	47.4–89.5
Any Black or Latino identity	47	66.0	52.3–79.06
No Black/Latino identity	183	46.4	39.2–53.7
Highest education			
≥Bachelors	67	49.3	37.2–61.3
HS/some college	126	54.0	45.2–62.7
<HS	36	38.9	22.8–54.9
Financial security			
Secure	87	46.0	35.4–56.5
Partially secure	63	61.9	49.8–74.0
Insecure	77	48.1	36.8–59.3
Any religious affiliation?			
Yes	173	49.1	51.6–56.6
No	57	54.4	41.4–67.4
Cancer type			
Lung	49	65.3	51.9–78.7
GI (non-CRC)	42	42.9	27.8–57.9
CRC/breast/prostate	50	56.0	42.1–69.9
Other	89	42.7	32.3–53.1
Quality of life (note: four participants did not rate their quality of life)			
High (7–10)	66	59.1	47.1–71.0
Medium (4–6)	76	50.0	38.7–61.3
Low (0–3)	84	46.4	35.7–57.2
Palliative Performance Scale			
≤40	88	44.3	33.9–54.8
50–60	90	52.2	41.8–62.6
≥70	52	57.7	44.2–71.2
EOL treatment preference for comfort > longevity			
Strongly agree	122	48.4	39.2–57.5
Other	87	52.9	41.9–63.7
Strongly disagree	14	50.0	23.0–76.9
Clinician Participants	Number of Survival Estimates Completed		
Professional discipline			
PC physicians (n = 22)	125	44.0	35.2–52.8
PC nurse practitioners (n = 6)	62	66.1	54.2–78.0
PC physician fellows (n = 13)	32	50.0	32.5–67.5
Trainees (n = 3)	11	36.4	2.5–70.3

(Continued)

**Table 1**  
**Continued**

Participant Characteristics	Survival Overestimate		
	N	%	95% CI
Years in PC practice			
<1 (n = 7)	31	54.3	37.6–70.9
1 to <5 (n = 21)	74	52.2	40.3–64.1
5 to <10 (n = 8)	49	39.0	24.0–54.1
>10 (n = 8)	73	52.9	41.1–64.6
Gender			
Women (n = 25)	128	52.9	43.9–61.9
Men (n = 19)	102	48.9	38.7–59.1
Any Black or Latino identity?			
Yes (n = 2)	3	66.7	0.0–87.1
No (n = 42)	227	50.2	43.7–56.8

GI = gastrointestinal; CRC = colorectal cancer; EOL = end-of-life; PC = palliative care.

If stratum values sum to less than 230, this indicates that the participant did not respond to that item.

not graduate from high school, and 24% self-identified as nonwhite. Approximately one in ten participated by proxy. Participants lived for a median of 37 days (interquartile range: 12 days, 97 days).

PC clinicians effectively discriminated between patients who would live longer and patients who would die sooner, relative to one another (see Fig. 1). Clinicians accurately predicted the survival time for 41% (94/230) of participants. Accuracy was better for patients with shorter survival times (see Table 2). When survival predictions were inaccurate, clinicians were almost six times more likely to overestimate than to underestimate survival time (85% vs. 15%, respectively).

Among the 186 participants who died during the six-month follow-up period, survival overestimation was associated with markers of more aggressive, disease-focused treatment before death (see Table 3 and Fig. 2). People whose clinician overestimated their survival time were substantially less likely to enroll in hospice at all or to do so within 72 hours of their death (OR: 0.45; 95% CI: 0.24–0.83). Controlling for potential confounding by age (both linear and squared), sex, race, education, financial strain, cancer type, EOL treatment preferences, functional status, quality of life, white blood cell count, discipline of prognosticator, and proxy participation status did not weaken this association (see Table 3). Excluding 15 people (6% of sample) with formed preferences for EOL treatment that did not favor comfort over longevity, the association between overestimation and late/absent hospice enrollment was stronger (OR: 0.39; 95% CI: 0.21–0.76).

Clinicians overestimated survival at similar rates for participants identifying as either Black or Latino (see Table 1). As shown in Figure 3, however,

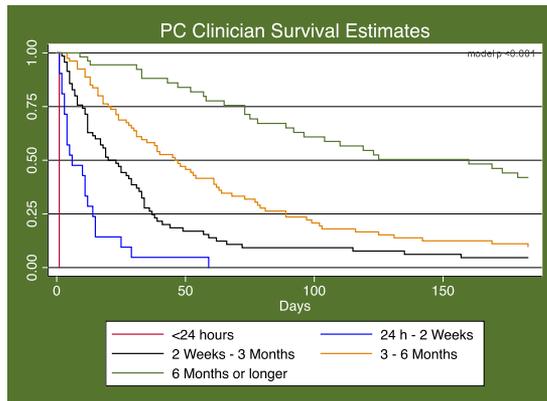


Fig. 1. Observed survival time by clinician estimates of survival. PC = palliative care.

overestimation was more common among people who self-identified as either Black or Latino compared to others (OR: 2.33; 95% CI: 1.19–4.56). This association was not attenuated by adjustment for potential confounding (OR<sub>adj</sub>: 3.89; 95% CI: 1.64–9.22). Duration of survival did not explain differences in clinician overestimates; participants who self-identified as Black or Latino lived equally long as others (HR 1.07; 95% CI: 0.76–1.51). Black or Latino participants were not substantially more likely than others to endorse formed preferences against EOL treatment favoring comfort over longevity (11.1% vs. 5.1%, *P* = 0.13). Excluding 15 (6% of sample) participants with formed preferences against EOL treatment favoring comfort over longevity, the strong association between Black or Latino identity and overestimation persisted (OR<sub>adj</sub>: 4.03; 95% CI: 1.69–9.63).

**Discussion**

The purpose of this cohort study analysis was to evaluate the prevalence of survival overestimation in palliative care and whether such overestimation was associated with the course of EOL treatment. We

observed four key findings that address these gaps in the science.

First, we observed that PC clinicians can distinguish which patients will live longer from those who will die sooner relative to one another. This is similar to other’s observations.<sup>2,13</sup> Regarding the absolute amount of survival time, clinicians were accurate for slightly more than four of 10 patients with advanced cancer. Our findings align with those from a recent cohort study by Thai et al. in which PC clinician survival expectations were accurate 40% of the time using a measure similar to ours.<sup>14</sup> Previous studies among non-PC clinicians report accuracy rates between 20% and 30% in similar patient populations.<sup>2,12</sup> However, most of this previous work defined “accurate” as ±33% in number of days between clinicians’ estimate and observed survival,<sup>2,12</sup> making direct comparison with our findings challenging. For example, Christakis et al. followed a cohort of 468 seriously ill patients receiving hospice care and found non-PC clinician estimates accurate only 20% of the time.<sup>13</sup>

Second, we found that PC specialists overestimated survival time for one of two patients and were five times more likely to make errors of overestimation than underestimation. For our measure of clinicians’ survival expectations, we used a root question that assumed a plan of care allowing illnesses to take their natural course and time-frame response options that became progressively wider with longer prognostic horizons. These item characteristics present clinicians with more opportunity to underestimate survival time rather than to overestimate it. Our findings align with the recent findings by Thai et al.,<sup>14</sup> thus providing further evidence that PC specialty clinicians are similarly prone to optimistic biases in their survival time judgments as observed among other clinicians.

Third, we observed that when clinicians overestimate survival, patients were substantially less likely to enroll in hospice or to do so without sufficient time to fully benefit from hospice care (e.g., within 72 hours of death<sup>16</sup>). These findings were not explained by patients’ stated preferences for EOL treatment, suggesting that overestimation of survival presents a barrier to achieving preference-concordant EOL treatment in advanced cancer. To our knowledge, this study is the first to identify an empirical link between clinician survival overestimation and actual patient EOL outcomes. This study does not identify the mechanism underlying this association. We hypothesize that overestimation might act via direct pathways (i.e., communication of prognostic estimate or confirmation of hospice eligibility) or indirect ones (i.e., focus of clinician’s diagnostic attention to treatment-related suffering) to influence hospice use. More research is needed to better understand these and other potential mechanisms. Given

Table 2  
Observed Accuracy by Clinician Estimate

Clinician Survival Estimate	Overestimate (n = 116)	Accurate (n = 94)	Underestimate (n = 20)
	n (Row Percent)		
≤24 hours (n = 2)	Ineligible	2 (100)	0
>24 hours to fewer than two weeks (n = 22)	4 (18.2)	12 (54.6)	6 (27.3)
Two weeks to fewer than three months (n = 71)	26 (36.6)	39 (54.9)	6 (8.5)
Three months to fewer than six months (n = 81)	58 (71.6)	15 (18.5)	8 (9.9)
Six months or longer (n = 54)	28 (51.9)	26 (48.2)	Ineligible

Chi-square *P* < 0.001.

Table 3  
Crude and Adjusted Association Between Survival Overestimate and Hospice Utilization

	Died	Hospice Ever		Hospice More Than 72 hours	
		<i>n</i>	OR (95% CI)	<i>n</i>	OR (95% CI)
Overestimate	116	75	0.42 (0.21–0.85)	52	0.45 (0.24–0.83)
No overestimate	70	57	Ref	45	Ref
Adjusted, EOL preference					
Exposure variable (overestimate)			0.38 (0.18–0.79)		0.41 (0.22–0.76)
Covariates					
Strongly agree			0.79 (0.21–2.95)		0.84 (0.22–3.15)
Somewhat agree/unsure/somewhat disagree			1.16 (0.30–4.50)		1.33 (0.34–5.19)
Adjusted, full model					
Exposure variable (overestimate)			0.40 (0.16–0.99)		0.33 (0.15–0.74)
Covariates					
Lung cancer			1.92 (0.70–5.29)		1.91 (0.68–5.36)
GI cancer (non-CRC)			0.37 (0.13–1.04)		0.35 (0.12–1.00)
Breast/CRC/prostate cancer			1.28 (0.45–3.62)		1.27 (0.44–3.64)
Age (yrs, continuous)					0.98 (0.95–1.01)
Black race			2.38 (0.79–7.21)		2.16 (0.68–6.79)
Latino ethnicity			12.14 (1.24–119.2)		11.36 (1.10–116.7)
Women			0.34 (0.15–0.75)		0.31 (0.14–0.69)
Palliative Performance Score (0–100, continuous)			1.72 (1.32–2.26)		1.77 (1.35–2.33)
Quality of life (0–10, continuous)			1.11 (0.97–1.26)		1.11 (0.97–1.27)
White blood cell count (continuous)			1.05 (0.99–1.12)		1.05 (0.99–1.12)
Prognosticator: physician			0.65 (0.31–1.39)		0.64 (0.30–1.38)
Participation by proxy			1.19 (0.86–1.66)		1.24 (0.89–1.73)

EOL = end-of-life.

the prevalence of overestimation and associated outcomes, we endorse systematic use of prognostic tools in clinical practice that are specifically calibrated for the serious illness context.<sup>30–33</sup>

Fourth, we observed that people who identified as either Black or Latino were substantially more likely than others to have the clinician overestimate their survival time. (Note that this tendency was not attributable to patients' stated EOL treatment preferences.) Previous work finds that some racial/ethnic disparities in EOL care may relate to poor communication about what the clinician believes to be true regarding survival time.<sup>28</sup> Our findings suggest that the accuracy of what clinicians believe to be true regarding survival prognosis differs by race/ethnicity. Although findings from this study do not inform why or how clinician overestimation differs by race/ethnicity, they

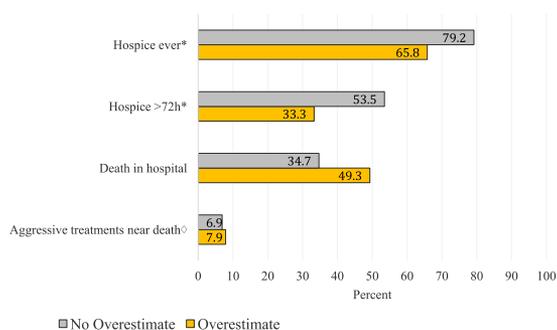


Fig. 2. Indicators of EOL treatment by survival overestimate. \* $P < 0.05$ .  $\diamond$  CPR, mechanical ventilation, or tube feeding in last two weeks of life. EOL = end-of-life.

identify a plausibly mutable target of intervention for reducing substantial existing disparities in preference-concordant EOL care.<sup>27,34–37</sup>

This study has important limitations. First, we included only English-speaking participants. Therefore, we do not know whether clinician overestimation differs among patients who experience barriers to communication in English-speaking settings. Second, this sample includes academic medical center sites in California and New York; inferences about other geographic or institutional sites with substantially different prognostication norms might not be valid. Third, as described previously, these findings might

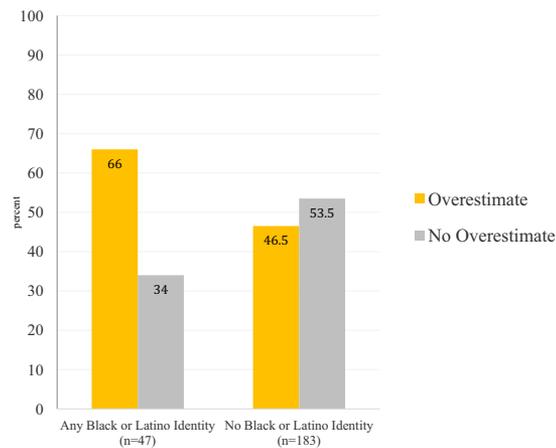


Fig. 3. Survival overestimate by Black or Latino identity.  $P < 0.05$ , difference in overestimation by Black or Latino identity.

underestimate the prevalence of survival overestimation in usual practice because our item structure made it harder to err on the side of overestimation. Fourth, this was an observational study; participants were not required to discuss prognosis as part of an intervention protocol. The choice of whether to discuss prognosis might be related to the estimate itself (i.e., proximity to death) or to propensity to choose hospice. Neither of these hypothetical conditions compromise the findings or interpretations we present here because our exposure variable is the overestimate, not the communication of it. However, we do suggest caution when attempting to extrapolate how overestimation might relate to hospice use in the context of an intervention that provides prognosis information outside of the natural processes of palliative care consultation. Fifth, preferences for EOL treatment are dynamic phenomena; it is possible that late or absent enrollment in hospice might represent concordant EOL treatment even among people whose reported EOL preferences at study enrollment would suggest this not to be the case. Other work, however, observes that the typical direction of change in EOL preferences is toward a greater comfort focus rather than away from it.<sup>38</sup>

In conclusion, we observed that clinician overestimation of survival prognosis is common in palliative care, that it is more common among patients who identify as Black or Latino, and that overestimation is associated with lower rates of hospice use. Many people of all racial and ethnic identities desire a course of medical treatment in the last weeks to months of life that favors attention to comfort and quality of life over longevity.<sup>15</sup> For patients, families, and clinicians alike, knowing when to act on these wishes requires a recognition that death is nearing. Our findings highlight the continued biases in modern medicine that lead even those clinicians who are expert in EOL care—PC specialists—to err toward overestimating survival time. Black and Latino patients appear more vulnerable than others to these clinician biases. Furthermore, we find that such overestimation has important effects on whether and when seriously ill patients ultimately receive preference-concordant EOL treatment. Collectively, our findings identify prognosis overestimation in advanced cancer to be an important, timely, and promising target for interventions that promote preference-concordant and equitable EOL care.

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**Ethical approval:** This study was approved by the protection of human subjects review committees at the University of Rochester Medical Center, the University of California, San Francisco, and the University of Vermont Medical Center.

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