

Accuracy of Oncologists' Life-Expectancy Estimates Recalled by Their Advanced Cancer Patients: Correlates and Outcomes

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Abstract

Background: Oncologists are often reluctant to discuss life-expectancy estimates with their patients because of concerns about their inaccuracy and limited evidence regarding benefits.

Objective: Determine oncologist accuracy in predicting their advanced cancer patients' life expectancy and correlates associated with accuracy.

Design: Multicenter prospective, longitudinal study of patients with advanced cancer, assessed once at baseline and followed to death. At baseline, patients were asked whether their oncologist had provided them with a life-expectancy estimate.

Setting/Subjects: Eighty-five patients with advanced cancer recruited from outpatient cancer clinics.

Measurements: Patients' baseline sociodemographic and time to death, and clinical characteristics were examined to determine their associations with the accuracy of the oncologists' life-expectancy estimates as recalled by their patients.

Results: Seventy-four percent (63/85) of patients recalled that physician life-expectancy estimates were accurate to within a year; estimates were most accurate when patients had 9–12 months to live. Factors significantly ($p < 0.05$) positively associated with oncologists' greater accuracy to within a year were the patient's age, recruitment from a community-based oncology clinic, poor performance status, and quality-of-life at baseline. Oncologists' prognoses that were accurate to within a year were associated with greater likelihood of patients, at baseline, acknowledging that they were terminally ill (OR = 12.20, 95% CI = 2.24–66.59), engaging in an end-of-life discussion (OR = 4.22, 95% CI = 1.45–12.29), completing a do-not-resuscitate (DNR) order (OR = 2.94, 95% CI = 1.03–8.41), a lower likelihood of using palliative chemotherapy (OR = 0.30, 95% CI = 0.11–0.85), and clinical trial enrollment (OR = 0.09, 95% CI = 0.02–0.50).

Conclusions: Oncologists are able to estimate their patients' life expectancy to within a year. Accuracy to within a year is associated with higher rates of DNR order completion, advance care planning, and lower likelihood of chemotherapy use near death.

Introduction

MOST ADVANCED CANCER PATIENTS report that they want to know their prognosis.^{1,2} In a study of terminally ill cancer patients who were asked: "If your doctor knew how long you had left to live, would you want him/her to tell you?" Seventy-one percent responded "yes." Despite this preference, in the same sample of terminally ill patients, only 18% reported that their oncologist provided them with a prognostic estimate.¹ A realistic sense of life expectancy has been shown to facilitate end-of-life discussions and planning,

which leads to lower medical care costs, avoidance of unnecessarily aggressive care, and improved quality of death.^{2–6} Nevertheless, physicians are reluctant to communicate a life-expectancy estimate to their patients.^{1,3,7,8}

One reason for physicians' reluctance to communicate life-expectancy estimates to their patients is that survival estimates are considered challenging to predict.^{8,9} In one study, nearly 60% of physicians reported that making such estimates was "difficult" and "stressful."⁹ In general, reports on the prognostic accuracy of physicians conclude that physician estimates are inaccurate.^{10–13} For example, in a

large review article published in 2003 that is often cited as evidence of physician inaccuracy, Glare et al.¹¹ found that in a population with median survival of 29 days, only 61% of physicians accurately estimated survival to within four weeks. In 1999, in another frequently cited example, Viganò et al.¹² report that in a patient population with a median survival of 15 weeks, the median physician survival estimate overestimated actual survival by 1.1 months. These studies both conclude that physicians are not accurate when it comes to predicting life expectancy; however, no criteria are offered for making that determination. There remains a need to investigate associations between prognoses and outcomes, such as illness understanding, advance care planning, and use of palliative chemotherapy to characterize thresholds for “good enough” prognostic accuracy.

It has been suggested, but not shown, that prognostic accuracy to within one year may be sufficient for patients to realize that they are terminally ill.^{1,14} To further investigate this, we use a prognostic accuracy cutoff of within one year of survival to determine the factors that best predict accuracy to within a year of patients’ death. We also determine whether accuracy to within a year is associated with patients’ increased likelihood of do-not-resuscitate (DNR) order completion, avoidance of chemotherapy use, engagement in end-of-life (EoL) planning, and clinical trial participation. The use of an accuracy cutoff of one year is intended not as a definition of accuracy, but as a measure beyond which an estimate can no longer be reasonably considered accurate. We hypothesize that patient-recalled physician life-expectancy estimates accurate only to within a year will be significantly positively associated with acknowledgment of terminal illness, DNR order completion, and avoidance of chemotherapy and trial participation, suggesting that this estimate may be good enough to inform EoL decision making.

Materials and Methods

Study sample

The Coping with Cancer cohort is a multisite prospective cohort with patients enrolled from September 2002 to February 2008 at seven outpatient clinics. Participating clinics included the Yale Cancer Center (New Haven, CT), Veterans’ Affairs Connecticut Healthcare System Comprehensive Cancer Clinics (West Haven, CT), Memorial Sloan Kettering Cancer Center (New York, NY), Simmons Comprehensive Cancer Care Center and Parkland Hospital Palliative Care Service (Dallas, TX), Massachusetts General Hospital and Dana-Farber Cancer Institute (Boston, MA), and New Hampshire Oncology-Hematology (Hooksett, NH). Patients were considered eligible if they (1) were diagnosed with metastatic cancer with disease progression after at least first-line chemotherapy, (2) age ≥ 20 years, (3) had an informal caregiver, and (4) had adequate stamina to complete an interview. Exclusion criteria included serious cognitive impairment¹⁵ or inability to speak English or Spanish. The study was approved by the internal review board of each participating site.

Of 993 eligible patients, 726 (73%) were enrolled, and no significant sociodemographic differences were identified between participants and nonparticipants, except that participants were more likely to be Hispanic (12.1% vs. 5.8%; $p = .005$). This cohort was restricted to 590 patients with

nonmissing prognostic disclosure data, and of this cohort, 491 of the 590 (83.2%) participants had complete survival follow-up data and 16.1% (95 of 590) of patients reported that their physician had disclosed a life-expectancy estimate (highlighting the need for increasing oncologists’ prognostic disclosures, particularly if they are accurate and associated with better EoL care). Only 85 patients received a prognosis and had survival data available and thus comprised the final analysis cohort.

Protocol and measures

On entry and written informed consent, patients completed a 45-minute interview with trained interviewers in English or Spanish. Clinical information was confirmed with medical record review. Patients were followed until study closure (March 2010) or death (the last death occurring in 2011). Survival of patients beyond study closure was determined through National Death Index search.

Assessments

Information collected on study participants has been extensively described elsewhere¹ and includes clinical factors, psychosocial/demographic factors, prognostic disclosure (and desire for/understanding of prognostic disclosure), psychosocial distress and patient–physician relationship, and EoL care preferences and advance care planning.

Clinical factors. Diagnosis and chemotherapy use were identified through medical record review at the baseline assessment. Performance status was assessed through the Charlson comorbidity index,¹⁶ Karnofsky performance score,¹⁷ and Eastern Cooperative Oncology Group.¹⁸

Psychosocial and demographic factors. Patients self-reported race/ethnicity, age, sex, marital status, family income, health insurance status, education, and religious affiliation. Religiousness/spirituality,¹⁹ religious coping,²⁰ and quality of life¹⁹ were obtained using validated assessment tools.

Prognostic disclosure. In the present study, physician life-expectancy estimates were based on patient reports. Patients were asked “Have the doctors talked with you about how much time you have left to live?” Patients who responded “yes” were asked to indicate the estimate they were provided in months or years. Open-ended responses were recorded verbatim.

Psychological distress and patient–physician relationship. Patients were assessed for a sad/depressed mood and worry/anxiety,²¹ and mental illness.^{22,23} In addition, five items assessed patients’ trust and respect for physicians.^{3,24,25}

TABLE 1. ACCURACY OF PATIENT-RECALLED PHYSICIAN LIFE-EXPECTANCY ESTIMATE

Estimate accuracy	n/N (%)
± 3 months of patients’ survival	22/85 (25.9)
± 6 months of patients’ survival	48/85 (56.5)
± 12 months of patients’ survival	63/85 (74.1)

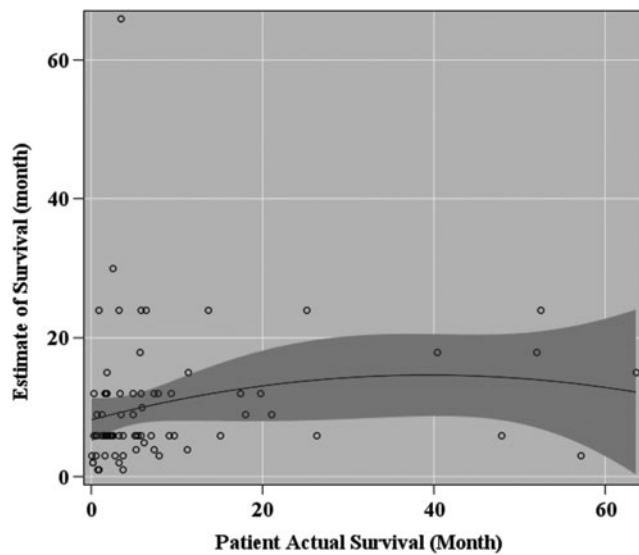


FIG. 1. Comparison of patient-recalled oncologist life expectancy estimates and actual survival. Estimates beyond 70 months were excluded to allow for better visualization of patterns.

This measure has been previously shown to predict quality of life near death,²⁴ and a positive response to all five questions was considered a strong patient–physician relationship.

EoL care preferences and advance care planning. On study entry, patients were asked if they had a living will, DNR order, and/or healthcare proxy. In addition, patient preferences were assessed regarding life extension and palliative care.⁵

Statistical analyses

Physicians' prognostic accuracy was defined as the physicians' life-expectancy estimate being within ± 3 , 6, or 12 months of patient survival. Associations between the prognostic accuracy to within 12 months and patient demographics, recruitment sites, disease characteristics, psychosocial factors, treatment preferences, DNR order completion, and chemotherapy use at baseline were examined using Fisher's exact test for binary characteristics and *t*-test or Wilcoxon Kruskal–Wallis test for continuous characteristics. Univariable and multivariable logistic regression analyses were used to identify the demographic and clinical factors associated with accurate prognostication to within 12 months. Using a stepwise selection model, demographic and baseline characteristics significantly associated with estimate accuracy to within 12 months

were entered into the models at a significance threshold of $p < 0.2$ and were retained in the final models if significant at $p < 0.05$. Univariate logistic regression was also used to estimate the association between prognostic accuracy and factors related to quality of EoL care (e.g., chemotherapy use). All analyses were conducted using SAS software (version 9.3; SAS Institute, Cary, NC).

Results

Sample characteristics

The final study sample consisted of 85 patients who recalled prognostic estimates and had survival data collected. The sample was 55% male ($n = 47$) with an average age of 60.5 years ($SD = 12.1$). It consisted of 66 white (78%) and 7 black (8%) patients. The median survival was 3.7 months (IQR: 1.73 to 9.33 months). More than 90% of these patients were recruited from New Hampshire Oncology Hematology ($n = 45$, 53%), Parkland Hospital ($n = 22$, 26%), and Dana-Farber Cancer Institute/Massachusetts General Hospital ($n = 12$, 14%). Lung cancer ($n = 17$, 20%), colon cancer ($n = 11$, 13%), and pancreatic cancer ($n = 9$, 11%) were the most common diagnoses.

Accuracy of patient-recalled oncologist life-expectancy estimates

Seventy-four percent ($n = 63$) of patient-recalled oncologist life-expectancy estimates were accurate to within a year (i.e., ± 12 months of actual survival), 57% ($n = 48$) were accurate to within 6 months, and 26% ($n = 22$) were accurate to within 3 months (Table 1). As shown in Figure 1 and Table 2, patient recall of physicians' estimates tended to *overestimate* patients' survival to a greater extent as time got closer to the patient's actual death. When patients had 0–3 months to live, survival was overestimated by a median of 4.4 months, and prognostic estimates were most accurate (0.2 month underestimate) when patients had 9–12 months to live. Physicians *underestimated* patients' survival by a median of 12 months when the patients' survival was over 12 months (Table 2).

Characteristics predicting accuracy of prognostic estimates to within 12 months

The ability of providers to predict survival to within 12 months significantly differs by a number of factors, including patient age, hospital setting, patient religion, performance status, quality of life, psychosocial factors, and treatment preferences (Table 3). In the univariable logistic regression analyses (Table 4), the life-expectancy estimates were more likely to be accurate to within a year when patients were older

TABLE 2. DIFFERENCE OF PATIENT-RECALLED PHYSICIAN LIFE-EXPECTANCY ESTIMATES FROM PATIENTS' SURVIVAL TIME

Difference of oncologist estimate by actual survival	Time to death				
	0–3 months (n=34)	3–6 months (n=20)	6–9 months (n=8)	9–12 months (n=6)	>12 months (n=17)
Median	4.4	3.5	1.7	–0.2	–12.0
Q1–Q3	3.6 to 10.2	0.4 to 7.9	–2.2 to 11.2	–3.7 to 3.7	–28.4 to –5.3

TABLE 3. BASELINE PATIENT CHARACTERISTICS ASSOCIATED WITH ACCURACY OF PATIENT-RECALLED PHYSICIAN LIFE-EXPECTANCY ESTIMATE WITHIN/OUTSIDE 12 MONTHS

<i>Patient characteristic</i>	<i>Accuracy within 12 months (N=63; 74.1%)</i>	<i>Accuracy outside 12 months (N=22; 25.9%)</i>	<i>p*</i>
Sociodemographics			
Mean age ± SD (N)	62.1±11.0 (63)	56.0±14.1 (22)	0.044
Gender, n (%)			0.457
Male	33 (52.4)	14 (63.6)	
Female	30 (47.6)	8 (36.4)	
Family income ≥ \$31,000, n (%)	25 (62.5)	13 (68.4)	0.775
Marriage status, n (%)	42 (66.7)	16 (76.2)	0.587
Insurance, n (%)	43 (70.5)	17 (77.3)	0.593
Mean education ± SD (N)	12.7±3.9 (63)	13.9±4.9 (22)	0.244
Race, n (%)			0.496
White	50 (79.4)	16 (72.7)	0.559
Black	5 (7.9)	2 (9.1)	1.000
Hispanic	7 (11.1)	3 (13.6)	0.714
Asian	0 (0.0)	1 (4.5)	0.259
Religion, n (%)			0.003
Catholic	41 (65.1)	5 (22.7)	<0.001
Protestant	9 (14.3)	6 (27.3)	0.199
Jewish	1 (1.6)	3 (13.6)	0.052
Muslim	1 (1.6)	0 (0.0)	1.000
No religion	3 (4.8)	1 (4.5)	1.000
Pentecostal	1 (1.6)	0 (0.0)	1.000
Baptist	3 (4.8)	0 (0.0)	0.565
Recruitment site, n (%)			
Yale Cancer Center	0 (0.0)	1 (4.5)	0.259
Simmons Center	2 (3.2)	3 (13.6)	0.107
Parkland Hospital	16 (25.4)	6 (27.3)	1.000
Dana Farber and Massachusetts General	7 (11.1)	5 (22.7)	0.283
New Hampshire Oncology Hematology	38 (60.3)	7 (31.8)	0.027
Cancer type, n (%)			0.196
Lung	14 (22.6)	3 (13.6)	0.539
Pancreatic	9 (14.5)	0 (0.0)	0.104
Gallbladder	0 (0.0)	0 (0.0)	—
Colon	8 (12.9)	3 (13.6)	1.000
Brain	2 (3.2)	0 (0.0)	1.000
Stomach	2 (3.2)	1 (4.5)	1.000
Esophageal	3 (4.8)	0 (0.0)	0.563
Mean performance status ± SD (N)			
Karnofsky score	59.8±15.2 (61)	69.5±17.9 (22)	0.017
Zubrod score	2.0±0.8 (61)	1.7±0.9 (22)	0.096
Charlson index	9.3±2.9 (62)	7.3±2.1 (22)	0.003
Mean McGill quality of life ± SD (N)			
Physical functioning ^a	4.8±2.7 (62)	6.5±2.2 (22)	0.012
Symptoms ^a	4.4±2.0 (62)	5.9±2.2 (22)	0.004
Psychological ^a	6.6±2.8 (62)	7.2±2.3 (22)	0.319
Depressed ^b	3.3±3.3 (62)	2.6±2.7 (22)	0.381
Worried ^b	3.7±3.4 (62)	2.5±2.9 (22)	0.129
Sad ^b	3.7±3.3 (62)	2.9±2.7 (22)	0.311
Terrified ^b	3.1±3.2 (62)	3.0±2.6 (21)	0.852
Support ^a	8.4±1.8 (62)	7.5±2.6 (22)	0.141
Sum score of QoL ^a	6.1±1.6 (62)	6.8±1.8 (22)	0.061
Doctor–patient relationship, n (%)			
Trust your doctor	62 (98.4)	21 (95.5)	0.453
Respect your doctor	62 (98.4)	22 (100.0)	1.000
Doctor respect your patient	63 (100.0)	22 (100.0)	—
Seen as a whole person	58 (93.5)	19 (90.5)	0.640
Mean comfortable asking questions about care ± SD (N)	0.9±0.2 (63)	0.9±0.2 (22)	0.527
Therapeutic alliance	44 (69.8)	17 (77.3)	0.591

(continued)

TABLE 3. (CONTINUED)

<i>Patient characteristic</i>	<i>Accuracy within 12 months (N=63; 74.1%)</i>	<i>Accuracy outside 12 months (N=22; 25.9%)</i>	<i>p*</i>
Mean general self-efficacy \pm SD (N)	32.4 \pm 4.3 (61)	34.3 \pm 4.0 (21)	0.103
Mean active brief coping \pm SD (N)	1.5 \pm 0.8 (63)	1.7 \pm 1.0 (21)	0.261
Mean emotional brief coping \pm SD (N)	2.6 \pm 0.7 (63)	2.5 \pm 0.7 (21)	0.607
Mean behavioral brief coping \pm SD (N)	0.3 \pm 0.5 (63)	0.2 \pm 0.6 (21)	0.672
Peacefulness	39 (62.9)	14 (66.7)	0.799
Positive religious coping, mean \pm SD (N)	10.4 \pm 6.1 (63)	8.9 \pm 7.2 (21)	0.346
Negative religious coping, mean \pm SD (N)	1.3 \pm 2.5 (61)	2.0 \pm 3.2 (20)	0.910
Total religious coping, mean \pm SD (N)	11.7 \pm 7.2 (61)	11.2 \pm 9.0 (20)	0.799

*For binary outcomes, Fisher's exact test was used; for continuous outcomes, *t*-test or Wilcoxon Kruskal-Wallis test was used.

^aHigher score indicates better health status.

^bHigher score indicates worse psychological status.

(OR = 1.04, *p* = 0.05) or Catholic (OR = 6.33, *p* < 0.001). Sicker patients, as indicated by a lower Karnofsky score, higher Charlson Comorbidity Index, and lower McGill Quality-of-Life scores at the baseline assessment, were also more likely to have accurate estimates of their life expectancy.

In the multivariable regression analysis, including all of the factors bivariately significant at *p* < 0.2 (Table 4), only a high Charlson Comorbidity Index, a low McGill Quality-of-Life Questionnaire score, and the patient being Catholic remained statistically significant in predicting the accuracy of physicians' life-expectancy estimates to within 12 months.

Associations of prognostic estimate accuracy with factors relating to quality of EoL care

Patients whose prognoses were accurate to within a year were 2.94 times (95% CI = 1.03–8.41) more likely to have DNR order completion (*p* = 0.04), 3.03 times (95% CI = 1.11–8.27) more likely to acknowledge being terminally ill (*p* = 0.03), and 4.22 times (95% CI = 1.45–12.29) more likely to have reported at baseline an EOL discussion with their physician (*p* = 0.008) (Table 5) than those whose recalled physician prognosis was beyond a year. Those patients were also less likely to prefer chemotherapy (OR = 0.26, 95% CI = 0.07–0.96, *p* = 0.04) and antibiotics (OR = 0.30, 95% CI = 0.10–0.93, *p* = 0.04) near death. They were also less likely to be receiving palliative chemotherapy (OR = 0.30, 95% CI = 0.11–0.85, *p* = 0.02) and

less likely to be enrolled in a clinical trial (OR = 0.09, 95% CI = 0.02–0.50, *p* = 0.006) (Table 5).

Discussion

In our sample of 85 patients with advanced cancer from a multisite, prospective cohort, we found that 74% of patients reported receiving physician life-expectancy estimates that were accurate to within a year. We also found recalled physician prognostic estimates were most accurate when patients had 9–12 months to live. Patient-reported life-expectancy estimates were more likely to be accurate to within a year when patients were older, Catholic, sicker, and cared for at a community clinic (New Hampshire Oncology Hematology) compared to academic medical centers. In addition, patients who recalled prognostic estimates accurate to within a year were more likely at baseline to acknowledge their terminal illness, engage in discussions of EoL planning with their doctors, and to complete a DNR order, and less likely to participate in a clinical trial or undergo chemotherapy. Comorbidity status (Charlson Comorbidity Index), quality of life (McGill Quality-of-Life Questionnaire), and patients being Catholic were the most robust predictors of greater recalled prognostic accuracy.

Relatively few studies have explored clinical characteristics related to prognostic accuracy, much less prognostic accuracy to within a year of the patient's death. We found,

TABLE 4. MULTIVARIABLE LOGISTIC REGRESSION MODEL PREDICTING PATIENT-RECALLED PHYSICIAN LIFE-EXPECTANCY ESTIMATES ACCURATE TO WITHIN 12 MONTHS OF THE PATIENTS' ACTUAL DEATH

<i>Baseline characteristics</i>	<i>Univariable analysis</i>		<i>Multivariable analysis</i>	
	<i>Odds (95% CI)</i>	<i>p</i>	<i>Odds (95% CI)</i>	<i>p</i>
Age	1.04 (1.00–1.09)	0.05		
Catholic	6.33 (2.06–19.48)	0.001	4.45 (1.11–17.83)	0.03
Jewish	9.78 (0.96–99.58)	0.05		
New Hampshire Oncology Hematology	3.26 (1.16–9.12)	0.02		
Karnofsky score	0.96 (0.93–0.99)	0.02		
Zubrod score	1.66 (0.91–3.03)	0.10		
Charlson index	1.36 (1.09–1.69)	0.006	1.52 (1.07–2.16)	0.02
McGill QOL physical functioning	0.78 (0.63–0.95)	0.02	0.72 (0.55–0.94)	0.01
McGill QOL symptoms	0.72 (0.57–0.92)	0.007		
McGill sum score	0.75 (0.56–1.02)	0.07		

TABLE 5. CLINICAL CORRELATES OF PATIENT-RECALLED PHYSICIAN LIFE-EXPECTANCY ESTIMATES ACCURATE TO WITHIN 12 MONTHS OF THE PATIENTS' ACTUAL DEATH

<i>Baseline characteristics</i>	<i>Univariable analysis</i>	
	<i>Odds (95% CI)</i>	<i>p</i>
End-of-life discussion	4.22 (1.45–12.29)	0.008
Terminal illness acknowledgment	3.03 (1.11–8.27)	0.03
Would want doctor to tell life expectancy	12.20 (2.24–66.59)	0.004
Extend life preference	0.37 (0.12–1.10)	0.07
Completed do-not-resuscitate order	2.94 (1.03–8.41)	0.04
Prefer feeding tube	0.36 (0.13–1.00)	0.05
Prefer chemotherapy	0.26 (0.07–0.96)	0.04
Prefer antibiotics	0.30 (0.10–0.93)	0.04
Use of palliative chemotherapy	0.30 (0.11–0.85)	0.02
Enrollment in clinical trial	0.09 (0.02–0.50)	0.006

consistent with other results,^{11,13} that older and sicker patients are more likely to receive more accurate prognoses. Old age and poor health status are important indicators of poor prognosis, and thus, a greater number of estimates are accurate to within a year when patients are closer to death. Similarly, there is strong evidence in the literature supporting our finding that performance status and clinical factors can improve life-expectancy estimates.^{11,26} Patients receiving care in a community-based clinic, New Hampshire Oncology Hematology, were more likely to receive a prognosis than patients recruited from the academic medical centers, and these prognoses were more likely to be accurate to within a year. One possible explanation is that physicians at academic medical centers have been shown to be less likely to acknowledge that their patients were dying.²⁷ Although one study found that there was no association with age, sex, race, religion, or marital status,²⁸ we found that Catholic patients tended to have more accurate prognoses. Elsewhere we have shown that patients who used religion as their primary resource for coping were less likely to acknowledge that they were terminally ill²⁹ and Catholic patients were less likely than Baptist patients to be “religious copers.”³⁰ More research is needed to understand these relationships but suffice to say that religious faith appears important in shaping how patients and providers think about life expectancy.

Our study identified the best set of predictors of prognostic accuracy to within a year. The few factors that survived multivariable analysis were the Charlson Comorbidity Index, the quality-of-life measures, and Catholic religion. The McGill Quality-of-Life Questionnaire was developed specifically for a palliative care patient population,²¹ yet has rarely been used as a prognostic indicator. Despite limited evidence that these measures can improve the accuracy of prognostic estimates,^{31,32} our findings suggest the need for future research to confirm best predictors of patient-recalled oncology provider accuracy of life-expectancy estimates.

It is challenging to put our findings into context, given the significant variation in median survival of different study populations, and varying ways in which accuracy is discussed.³³ Compared to studies with a similar median sur-

vival, we find that the accuracy estimates reported here are within the range of previously published values.³³ Chow et al.¹⁰ found that providers tended to be less accurate and overestimated survival to a greater extent than we report (average overestimate of 12.3 weeks vs. our finding of 6.8 weeks) and Kondziolka et al.³⁴ found that providers were more accurate in predicting survival to within a year (82% vs. our finding of 74% of physicians predicting life expectancy to within a year). Studies that use the surprise question (i.e., would you be surprised if this patient died within a year?) to assess prognostic accuracy have found that physicians can have a predictive sensitivity of up to 90% and a specificity of 75%.³⁵ Overall, the prognostic accuracy we report here is similar to previously reported values in both magnitude and direction.

Finally, we found that providers tended to overestimate patient survival to a greater extent when patients were closer to death. This is a commonly observed finding,^{10,12,28} however, several studies report that providers are more accurate when patients are closer to death (i.e., the horizon effect).¹¹ In our study, the counterintuitive result that providers were less accurate when patients were closer to death could be a product of providers communicating an estimate longer than they actually expect the patient to live as the time to live gets increasingly short. This could be due to providers having more difficulty telling a patient he or she is dying when it is quickly approaching rather than a function of their ability to know/determine that death was imminent. This is important because overestimates at the end of life resulting from communication challenges may result in unnecessary delays in hospice referrals.

Although many studies claim that clinician-estimated prognoses are inaccurate, we contend that accuracy should be based on the extent to which estimates are associated with an outcome of clinical interest. In this study, we find that patient-recalled provider estimates of life expectancy that are accurate to within a year are associated with patients' greater likelihood of acknowledging that they are terminally ill, participating in EoL planning, having a preference for avoiding aggressive EoL care, completing a DNR order, and avoiding chemotherapy and clinical trial participation. As long as life-expectancy estimates were accurate to within a year, patients were more likely to have a realistic sense of life expectancy and receive less burdensome, if not futile, care. It is important to note though that the patients who recalled a prognosis accurate to within one year tended to have a worse prognosis (i.e., they were older, sicker, and had worse median survival). It is likely easier to prognosticate for this population and their worse performance status may have played a role in their illness understanding and treatment decisions.

Elsewhere it has been shown that nonspecific ranges of life-expectancy estimates (e.g., months, not years) provide patients with a realistic sense of prognosis.¹⁴ Further research should evaluate the effectiveness of nonspecific time estimates (e.g., months, not years) or temporal ranges (e.g., best case, worst case, and most likely case)³⁶ in communicating prognosis.

There are several limitations to this study. Most importantly, physician life-expectancy estimates were patient reported, which may be subject to recall bias and/or physicians communicating an estimate at odds with their true expectation⁸ or patient mishearing. One study showed that patients remembered less than half of what their providers told

them,³⁷ and this may be compounded by the emotional stress of the situation.³⁸ Finally, the data presented here were collected from 2002 to 2011, however, there is no evidence to suggest that the accuracy of physician estimates has changed substantially in the interim.³⁴

In summary, this study finds that 74% of physician life-expectancy estimates are accurate to within a year, and the accuracy of prognostic estimates may be improved if clinicians take into account the McGill Quality-of-Life questionnaire and the Charlson Comorbidity Index. Although physician-estimated life expectancies are often considered inaccurate, our estimates were similar to previously reported values and provided patients with a significantly more realistic understanding of their prognosis and a higher quality of care at the end of life. Communicating a prognosis is an important, yet difficult and often nuanced undertaking; oncologists should be reassured that their prognoses do not have to be perfect for their patients to benefit.

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Author Disclosure Statement

No competing financial interests exist.

References

- Enzinger AC, Zhang B, Schrag D, Prigerson HG: Outcomes of prognostic disclosure: Associations with prognostic understanding, distress, and relationship with physician among patients with advanced cancer. *J Clin Oncol* 2015; 33:3809–3816.
- Innes S, Payne S: Advanced cancer patients' prognostic information preferences: A review. *Palliat Med* 2009;23: 29–39.
- Wright AA, Zhang B, Ray A, et al.: Associations between end-of-life discussions, patient mental health, medical care near death, and caregiver bereavement adjustment. *JAMA* 2008;300:1665–1673.
- Zhang B, Wright AA, Huskamp HA, et al.: Health care costs in the last week of life: Associations with end-of-life conversations. *Arch Intern Med* 2009;169:480–488.
- Weeks JC, Cook EF, O'Day SJ, et al.: Relationship between cancer patients' predictions of prognosis and their treatment preferences. *JAMA* 1998;279:1709–1714.
- Smith TJ, Hillner BE: Bending the cost curve in cancer care. *N Engl J Med* 2011;364:2060–2065.
- Weeks JC, Catalano PJ, Cronin A, et al.: Patients' expectations about effects of chemotherapy for advanced cancer. *N Engl J Med* 2012;367:1616–1625.
- Lamont EB, Christakis NA: Prognostic disclosure to patients with cancer near the end of life. *Ann Intern Med* 2001; 134:1096–1105.
- Christakis NA, Iwashyna TJ: Attitude and self-reported practice regarding prognostication in a national sample of internists. *Arch Intern Med* 1998;158:2389–2395.
- Chow E, Davis L, Panzarella T, et al.: Accuracy of survival prediction by palliative radiation oncologists. *Int J Radiat Oncol Biol Phys* 2005;61:870–873.
- Glare P, Virik K, Jones M, et al.: A systematic review of physicians' survival predictions in terminally ill cancer patients. *BMJ* 2003;327:195–198.
- Vigano A, Dorgan M, Bruera E, Suarez-Almazor ME: The relative accuracy of the clinical estimation of the duration of life for patients with end of life cancer. *Cancer* 1999;86: 170–176.
- Clement-Duchene C, Carnin C, Guillemin F, Martinet Y: How accurate are physicians in the prediction of patient survival in advanced lung cancer? *Oncologist* 2010;15: 782–789.
- Epstein AS, Prigerson HG, O'Reilly EM, Maciejewski PK: Discussions of life expectancy and changes in illness understanding in patients with advanced cancer. *J Clin Oncol* 2016;34:2398–2403.
- Pfeiffer E: A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. *J Am Geriatr Soc* 1975;23:433–441.
- Charlson ME, Pompei P, Ales KL, MacKenzie CR: A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *J Chronic Dis* 1987;40:373–383.
- Karnofsky DA: Determining the extent of the cancer and clinical planning for cure. *Cancer* 1968;22:730–734.
- Oken MM, Creech RH, Tormey DC, et al.: Toxicity and response criteria of the Eastern Cooperative Oncology Group. *Am J Clin Oncol* 1982;5:649–655.
- Fetzer Institute: *Multidimensional Measurement of Religiousness/Spirituality for Use in Health Research: A Report of the Fetzer Institute/National Institute on Aging Working Group*. Kalamazoo, MI: John E. Fetzer Institute, 2003.
- Pargament KI, Koenig HG, Perez LM: The many methods of religious coping: Development and initial validation of the RCOPE. *J Clin Psychol* 2000;56:519–543.
- Cohen SR, Mount BM, Strobel MG, Bui F: The McGill Quality of Life Questionnaire: A measure of quality of life appropriate for people with advanced disease. A preliminary study of validity and acceptability. *Palliat Med* 1995;9:207–219.
- Endicott J: Measurement of depression in patients with cancer. *Cancer* 1984;53(10 Suppl):2243–2249.
- First M, Spitzer, RL, Gibbon M, Williams JBW: *Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Research Version, Patient Edition. (SCID-IP)*. New York, NY: Biometrics Research Department; 2002.
- Zhang B, Nilsson ME, Prigerson HG: Factors important to patients' quality of life at the end of life. *Arch Intern Med* 2012;172:1133–1142.
- Mack JW, Block SD, Nilsson M, et al.: Measuring therapeutic alliance between oncologists and patients with advanced cancer: The Human Connection Scale. *Cancer* 2009;115:3302–3311.
- Chow E, Harth T, Hruby G, et al.: How accurate are physicians' clinical predictions of survival and the available prognostic tools in estimating survival times in terminally ill cancer patients? A systematic review. *Clin Oncol (R Coll Radiol)* 2001;13:209–218.
- Prigerson HG: Socialization to dying: Social determinants of death acknowledgement and treatment among terminally ill geriatric patients. *J Health Soc Behav* 1992;33: 378–395.
- Christakis NA, Lamont EB: Extent and determinants of error in doctors' prognoses in terminally ill patients: Prospective cohort study. *BMJ* 2000;320:469–472.

29. Phelps AC, Maciejewski PK, Nilsson M, et al.: Religious coping and use of intensive life-prolonging care near death in patients with advanced cancer. *JAMA* 2009;301:1140–1147.
30. Balboni TA, Balboni M, Enzinger AC, et al.: Provision of spiritual support to patients with advanced cancer by religious communities and associations with medical care at the end of life. *JAMA Intern Med* 2013;173:1109–1117.
31. Quinten C, Coens C, Mauer M, et al.: Baseline quality of life as a prognostic indicator of survival: A meta-analysis of individual patient data from EORTC clinical trials. *Lancet Oncol* 2009;10:865–871.
32. Birim O, Kappetein AP, Bogers AJ: Charlson comorbidity index as a predictor of long-term outcome after surgery for nonsmall cell lung cancer. *Eur J Cardiothorac Surg* 2005;28:759–762.
33. Cheon S, Agarwal A, Popovic M, et al.: The accuracy of clinicians' predictions of survival in advanced cancer: A review. *Ann Palliat Med* 2016;5:22–29.
34. Kondziolka D, Parry PV, Lunsford LD, et al.: The accuracy of predicting survival in individual patients with cancer. *J Neurosurg* 2014;120:24–30.
35. Moss AH, Lunney JR, Culp S, et al.: Prognostic significance of the “surprise” question in cancer patients. *J Palliat Med* 2010;13:837–840.
36. Stockler MR, Tattersall MH, Boyer MJ, et al.: Disarming the guarded prognosis: Predicting survival in newly referred patients with incurable cancer. *Br J Cancer* 2006;94:208–212.
37. Jansen J, Butow PN, van Weert JC, et al.: Does age really matter? Recall of information presented to newly referred patients with cancer. *J Clin Oncol* 2008;26:5450–5457.
38. Schwabe L, Wolf OT, Oitzl MS: Memory formation under stress: Quantity and quality. *Neurosci Biobehav Rev* 2010;34:584–591.

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