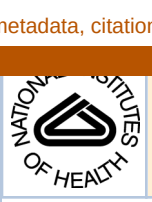

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Treatment Recommendations for Locally Advanced, Non-small Cell Lung Cancer: The Influence of Physician and Patient Factors

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Abstract

Purpose—To determine the impact of patient age, comorbidity, and physician factors on treatment recommendations for locally-advanced, unresectable non-small cell lung cancer (NSCLC).

Methods and Materials—We surveyed radiation oncologists regarding their recommendations for treatment (chemoradiation, radiation alone, chemotherapy alone, or no therapy) for hypothetical patients with stage IIIB NSCLC who varied by age (55 vs. 80 years) and comorbid illness (none, moderate, or severe chronic obstructive pulmonary disease [COPD]). Multinomial logistic regression was used to assess the impact of physician and practice characteristics on radiation oncologists' treatment recommendations for 3 scenarios with the least agreement.

Results—Of 214 radiation oncologists, nearly all (99%) recommended chemoradiation for a healthy 55-year-old. However, there was substantial variability in recommendations for a 55-year-old with severe COPD, an 80-year-old with moderate COPD, and an 80-year-old with severe COPD. Physicians seeing a lower volume of lung cancer patients were statistically less likely to recommend radiotherapy for younger or older patients with severe COPD (both $p < 0.05$) but the impact was modest.

Conclusions—Nearly all radiation oncologists report following evidence-based recommendations of chemoradiation for young, otherwise healthy patients with locally advanced, unresectable NSCLC; but there is substantial variability in treatment recommendations for older or sicker patients, probably related to the lack of clinical trial data for such patients. The physician and practice characteristics we examined only weakly impacted treatment recommendations.

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Additional clinical trial data are needed to guide recommendations for treatment of elderly patients and patients with poor pulmonary function in order to optimize their management.

Keywords

Radiation; non-small cell lung cancer; comorbidity; recommendations; patient age

INTRODUCTION

Treatment options for locally advanced, non-metastatic non-small cell lung cancer (NSCLC) include combined modality therapy with a combination of chemotherapy and radiation therapy (CRT), radiation therapy alone (RT), chemotherapy alone, or best supportive care. The latter two options are purely palliative, while treatment with radiation therapy (with or without chemotherapy) may be curative in some patients. Randomized trials have shown that CRT is superior to RT for stage III non-small cell lung cancer, with the addition of chemotherapy producing an absolute improvement in 2-year overall survival of approximately 10%.[1–3] As a result, recently published practice guidelines consistently recommend CRT for unresectable NSCLC.[4–7]

However, not all patients are able to tolerate combined therapy, and the randomized trials establishing the superiority of CRT over other approaches largely excluded patients with significant comorbidity and included relatively few patients over age 70. Although retrospective analyses demonstrate greater toxicity with combined modality therapy in older patients compared with younger patients treated on the same protocol,[8,9] these same studies found no difference in survival for older versus younger patients. Studies in a number of diseases have suggested that, at least for properly selected patients, aggressive therapy can be tolerated in older patients, so that age alone should not be a criterion for denying therapy. In addition, the parameters to define which patients have pulmonary function that would preclude their treatment with aggressive combined modality therapy, and that might correlate with patient age, is not well defined. Thus, it is unclear to what extent older and/or sicker patients will benefit from CRT. Prior observational studies demonstrate that older patients and those with more comorbidities are less often treated with chemotherapy in addition to radiation for lung cancer,[10,11] and such differences may result from uncertainty about their likely benefit.

The data guiding treatment for individuals with significant comorbidities is even more limited. Because of the association between smoking and lung cancer, patients with NSCLC frequently have additional comorbidities, including some degree of chronic obstructive pulmonary disease (COPD). The risk of radiation pneumonitis is often dose-limiting in treating patients with locally advanced disease, and the addition of chemotherapy may increase the risk of pulmonary toxicity after radiation.[12,13] Patients with poor lung function at baseline are less likely to tolerate treatment-associated decreases in pulmonary function; moreover, pre-existing COPD increases the risk of radiation pneumonitis.[14] Thus, less aggressive therapy may be appropriate in patients with significant lung disease.

To understand better the influence of patient age and pulmonary comorbidity on physicians' treatment recommendations for locally advanced NSCLC, we surveyed radiation oncologists caring for patients with lung cancer. The purpose of our study was to document the degree of concordance in treatment recommendations for a range of clinical scenarios and thus to identify areas in which additional clinical trial data might be most helpful in guiding future recommendations. Furthermore, we sought to determine whether physician and practice characteristics influenced treatment recommendations in scenarios with substantial discordance.

METHODS AND MATERIALS

Study design

Data for this study were collected as part of a national study of variations and outcomes of care for patients with lung or colorectal cancer undertaken by the Cancer Care Outcomes Research and Surveillance (CanCORS) Consortium.[15,16] CanCORS is examining care delivered to 5,150 patients diagnosed with lung cancer during 2003–2005 living in Northern California, Los Angeles County, North Carolina, Iowa, or Alabama, or who received care in one of 5 large health maintenance organizations or 10 Veterans Administration Health Care System sites. Data collection included patient interviews, medical record abstractions, physician surveys, and surveys of informal caregivers. The study was approved by the human subjects committees at all participating institutions. This analysis uses only physician survey data.

Study population

As described previously,[17] we surveyed physicians named by patients as providing important roles in their care. Of the 6871 physicians whose contact information was verified, 4188 (61%) responded. Respondents did not differ by sex (P=0.97). Radiation oncologists vs. other physicians responded more frequently (69.8% vs. 60.7%, P=0. 005). We restricted the sample for this analysis to the 217 physicians who identified themselves as radiation oncologists and who cared for at least one patient with lung cancer in the past year. Further details are included in the appendix. Data collection was closed and the dataset (version 1.6.1) finalized in March 2007.

Survey Instrument

To understand the influence of patient age (55 vs. 80 years) and level of pulmonary comorbidity (none, moderate, severe) on radiation oncologists' treatment recommendations for locally advanced, unresectable NSCLC, each physician responded to the following scenario: What treatments would you recommend for the following asymptomatic patients with stage IIIB non-small cell lung cancer: a 55-year old man with … (1) a remote smoking history, no dyspnea, and no other medical problems (FEV1>2.4L; >80% predicted), (2) moderate COPD with dyspnea walking 2 blocks (FEV1=1.5L; 50% predicted), (3) severe COPD with dyspnea on dressing (FEV1=0.75L; 25% predicted). Physicians selected one of four choices with 1=both chemotherapy and radiation therapy, 2=radiotherapy only, 3=chemotherapy only, 4=neither chemotherapy nor radiotherapy. The scenario was repeated using an 80-year old man as the patient. Physicians also provided information about personal and practice characteristics, including age, sex, race/ethnicity, board certification, United States medical graduate, teaching involvement, practice site, percentage of patients in managed care, number of lung cancer patients cared for in the last month, whether their practice is part of the Community Clinical Oncology Program (CCOP), whether they practice at an NCI-designated cancer center, attendance at tumor board meetings, whether they enroll patients in clinical trials, and base clinical income, and financial incentives for providing radiation therapy (whether their income increases as a result of more computed tomography based treatment planning, using greater number of fractions, or using intensity-modulated radiation). We also documented study site for each physician. Variables were categorized as in Table 1.

Statistical analysis

Item non-response was <2–3% for most variables. We excluded 3 physicians who did not respond to 4 or more of the items on chemotherapy recommendations. The final sample

included 214 physicians. We used multiple imputation to impute missing data for remaining items.[18,19]

We described physicians' treatment recommendations and then used multinomial logistic regression models to estimate the independent effect of physician and practice characteristics associated with treatment recommendations for the three scenarios with the most variability: the 55 year-old with severe COPD, the 80 year-old with moderate COPD, and the 80 year-old with severe COPD. A separate regression was performed for each of the 3 scenarios. Independent variables included all physician variables with P<.20 on bivariate testing for at least one of the three scenarios, including physician age, number of lung-cancer patients treated per month, study site, frequency of tumor board participation, practice site, board certification, practice at an NCI cancer center, and practice part of a CCOP. We calculated adjusted rates of the outcomes of interest for our patient population using a standardized regression approach.[20] All tests of statistical significance were two-sided. We limited multivariable analyses to these 3 scenarios because there was very little variability in responses to be explained by physician and practice characteristics in the other 3 scenarios.

RESULTS

The mean (SD) age of the radiation oncologist cohort was 50.3 (10.4). Most (81%) were male, and less than half (36%) were engaged in teaching. Respondents had seen an average of 10.0 (SD=12.5) lung cancer patients in the previous month (median=6). Other characteristics of the cohort are presented in Table 1.

Radiation oncologists' treatment recommendations varied substantially by patient age and severity of COPD (Figure). Nearly all physicians (99%) recommended CRT for a 55-year-old with a remote smoking history (no COPD). For the 55-year-old with moderate COPD or the 80-year-old with a remote smoking history, a large majority (>80%) still recommended CRT. On the other hand, less aggressive treatment was more frequently recommended for patients with increased comorbidity and older age. For each of the three remaining scenarios (55-year-old/severe COPD, 80-year-old/moderate COPD, and 80-year-old/severe COPD), less than half of those surveyed recommended CRT. In particular, severe COPD appeared to be a major deterrent to recommending radiation (either with or without chemotherapy) while older age primarily appeared to decrease the frequency of including chemotherapy as part of the recommendation. As a result, for the 80-year-old with severe COPD, only 3% recommended CRT, and over 40% recommended no therapy.

For the three scenarios in which CRT was less often recommended, there was substantial variability in recommendations, with no clear majority favoring any of the 4 treatment options. We, therefore, analyzed whether physician or practice characteristics influenced treatment recommendations. In the adjusted analysis (Table 2), the number of lung patients seen per month was significantly associated with recommendations for the two scenarios involving a patient with severe COPD, with the lowest volume radiation oncologists recommending radiation as a component of therapy less often than higher-volume radiation oncologists (both P<.05). Physicians in hospital-based vs. office-based practices were more likely to include chemotherapy in their recommendations for the 80-year old patient with moderate COPD and physicians practicing at NCI cancer centers were somewhat less likely than other physicians to recommend CRT to an 80-year old patient with moderate COPD and more likely to recommend no treatment; however, these findings were of borderline statistical significance (both P=.06) and differences in recommendations were modest. None of the remaining variables were significantly associated with treatment recommendations in any of the three scenarios modeled.

DISCUSSION

In this survey of geographically diverse radiation oncologists, we found that nearly all of them would recommend CRT for a 55-year-old man with stage III NSCLC and only a remote smoking history. However, there was less agreement regarding recommendations for patients who were older and/or had moderate to severe COPD. In the three scenarios with the greatest variability, the only physician variable that was significantly associated with treatment recommendations was the volume of lung-cancer patients treated. Prospective randomized trials comparing CRT with RT alone for unresectable, locally advanced NSCLC have clearly demonstrated improved overall survival with the addition of chemotherapy to radiation.[1–3] As a result, treatment guidelines from a number of different expert panels recommend CRT with curative intent for patients with unresectable NSCLC.[4–7] Thus, it is not surprising that there was essentially unanimous agreement on recommending CRT for the young, otherwise healthy patient. Our findings confirm that a strong consensus is achievable with high-quality, randomized data.

However, in the scenarios which are likely to be more representative of typical lung-cancer patients, who are older and have some degree of COPD, the decreasing consensus likely reflects the uncertainty in the literature regarding optimal treatment for patients who are not ideal candidates for CRT. The trials establishing the superiority of CRT over RT generally included only patients with good performance status (Zubrod 0–1) and minimal weight loss (<5%), and the published treatment guidelines are firm in recommending CRT only for such patients. For patients who do not meet these criteria, recommendations vary from offering CRT to patients with borderline performance status only after careful consideration to offering only palliative therapy for symptomatic patients with poor performance status or greater than 10% weight loss.

Notably, treatment guidelines generally do not recommend offering less aggressive therapy on the basis of advanced age alone. Randomized data on the importance of age are limited since some trials excluded or included relatively few patients who were over 70 years-old.[2,21] Retrospective analyses specifically examining the benefit of adding chemotherapy in the elderly have yielded mixed results, depending in part on the outcome of interest. For instance, a quality-adjusted survival analysis showed that RT alone yielded the best quality-adjusted survival in patients over 70 years-old.[22] More recently, a randomized trial of concurrent versus sequential CRT showed a similar benefit to concurrent CRT between patients older than 70 and younger than 70.[23] Based on currently available data, most experts advocate treating “fit” (performance status 0–1) elderly patients in a fashion similar to their younger counterparts.[6,7] Consistent with this recommendation, most (85%) radiation oncologists in our cohort reported they would treat an 80-year-old man without COPD similarly to the 55-year-old, although 13% of physicians would recommend RT alone for such men.

Differences in recommendations based on patient age were amplified in the setting of moderate or severe COPD, with radiation oncologists tending to recommend less aggressive therapy overall for older patients. This finding is consistent with findings of the Patterns of Care Study, which showed that patients younger than 70 were more likely than those older than 70 to receive chemotherapy in addition to radiation for stage III NSCLC.[10] This difference may reflect concern about the potential increased risk of toxicity among older patients receiving chemotherapy in addition to radiation therapy.[8,9] The question of whether such concern is justified would ideally be addressed in a randomized trial of CRT versus RT alone designed specifically for older patients, who were under-represented in prior trials.

Because the Patterns of Care Study[10] included only patients who received radiation as a component of their treatment, it does not provide information on the proportion of patients treated with either chemotherapy alone or best supportive care. Our study suggests that most radiation oncologists would not recommend any radiation in patients with severe COPD, regardless of age. The sharp decrease in the frequency of radiation being recommended is likely related to concern that patients with severe COPD may not tolerate the potential pulmonary toxicity associated with radiation. It is also consistent with the statement in the ACCP guidelines that a patient with FEV1 <1L/s is unlikely to withstand definitive therapy.[4] However, there are no good prospective data demonstrating that an attempt at definitive RT would indeed be detrimental in patients with severe COPD.

Potential reasons for the lack of consensus in the three most variable scenarios include a shortage of evidence to guide therapy in non-ideal candidates for CRT or physician factors that could lead to treatment recommendations in the absence of strong data. Among the radiation oncologists studied, we found that variability in responses was influenced only by the number of lung-cancer patients treated per month. Overall, however, the variability we observed in the scenarios with “non-ideal” patients was not well-explained by physician characteristics. Thus, our data suggest that the variability we observed for older and sicker patients is unlikely to be significantly reduced by addressing any particular subset of physicians.

The reluctance of “low volume” physicians in this study to offer radiation in the scenarios involving patients with severe COPD suggests that those with less experience may be more concerned about the reported increase risk of pulmonary toxicity in those with pre-existing lung disease.[14] Prior studies have shown that higher patient volume may improve outcomes for cancer patients, particularly for patients undergoing surgery.[24] Radiation oncologists who treat fewer patients with lung cancer may be less comfortable managing radiation-induced lung toxicity in part because of their own lack of experience and in part because their colleagues (within the same institution but in other specialties) may also have less experience managing the side effects of lung radiation. It has been reported that increased volume at the institutional level is associated with improved survival for locally advanced lung cancer.[25] Although the recommendations of the lower-volume physicians in this study may be appropriate, our data suggest that, in general, the impact of patient volume on outcomes may be related not only to technical factors but also to differences in the overall approach to therapy.

A limitation of this study is our use of clinical vignettes and our reliance on physicians’ self-reports to assess care. Although others have demonstrated that vignettes can provide a valid measure of clinical care,[26] physicians might overestimate their propensity to provide guideline-concordant care. Moreover, the lack of detail in each scenario may have contributed to the variability in physician response. Furthermore, the vignette patients represented only 2 ages and 3 levels of severity of a single medical condition, and responses may have been different had we used an illness other than COPD. Also, although the vignettes describe the patients’ symptoms, there was no specific information about performance status or degree of weight loss, which some recommendations suggest should be used to guide care.

In addition, the response options were limited to CRT, RT alone, chemotherapy alone, or neither and did not distinguish between sequential and concurrent CRT, or between definitive and palliative RT; nor did they allow physicians to provide reasons for their recommendations. Recent data show concurrent CRT offers superior cancer control in comparison to sequential therapy but is also more toxic.[27,28] In practice, patients who are suboptimal candidates for concurrent CRT may be offered sequential therapy, so it is likely

that increasing the number of possible responses would have increased the variability we observed, particularly in the 55-year-old with moderate COPD or the 80-year-old with no COPD. Similarly, it is possible that those who recommended RT alone would have been divided with regard to whether the RT was given with curative or palliative intent.

Finally, only radiation oncologists were questioned about recommendations for treatment of patients with unresectable lung cancer; medical oncologists may have had differing views. Moreover, our survey is subject to non-response bias and patients' reports may not have identified all radiation oncologists in an area, so we cannot be certain that the radiation oncologists in our sample were representative of those caring for cancer patients in the regions studied or nationally. However, the correlation between our results and those of the Patterns of Care Study suggest that our data do provide a reasonable sample of physicians in the United States.

In conclusion, nearly all radiation oncologists recommended CRT for stage III NSCLC for a young, otherwise healthy patient, demonstrating that radiation oncologists are willing to follow strong, randomized data. However, they differ widely on recommendations for patients who are older or have significant lung disease, suggesting that radiation oncologists are less willing to extrapolate the results of randomized trials to patients who were not actually included on the trials. Thus, additional clinical trial data are needed to guide recommendations for older patients and those with moderate to severe COPD, populations that have been largely excluded from previous trials. Although such trials are challenging to conduct given heterogeneity in patients' baseline pulmonary function, tumor characteristics, and other comorbidities, given that these patients, in fact, comprise the majority of "real world" patients, such trials would likely optimize care for these patients by decreasing variations due to poorly substantiated, individual or regional beliefs about the likely benefits and risks of available treatments in different types of patients.

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Appendix. CanCORS Physician Survey Development and Administration

Survey Development

The CanCORS physician survey was designed to collect information that can only be obtained reliably from physicians, including physicians' beliefs about treatments, physicians' style of practice, physicians' practice characteristics and financial arrangements, and physicians' demographics. When possible, items were taken (or adapted) from previously developed instruments. When items were not available from prior surveys, new questions were developed.

Five versions of the survey instrument were developed, each tailored to the type of physician who would be responding based on the role reported by the patient: (1) surgeons, (2) chemotherapy providers, (3) radiation therapy providers, (4) non-cancer specialists caring for colorectal cancer patients, and (5) non-cancer specialists caring for lung cancer patients. Where possible, questions on each version were identical. Some versions had additional questions specific to that discipline (for example, surgeons had questions specifically about volume of surgical operations).

The survey instruments underwent 2 rounds of cognitive testing by survey development staff at Westat, Inc., each followed by revisions to the instrument. In the first round of cognitive testing, 12 physicians from the Washington, D.C. metropolitan area provided feedback about specific questions. After revisions to the questionnaire, 16 physicians from around the country completed the self-administered survey and then were interviewed by research staff. The survey instrument was revised to improve clarity and decrease the length. Questions were dropped if they were difficult to answer, were not likely to provide data with variation, or were of lower priority relative to the CanCORS synthesis document and analytic work plans.

Cohort

The target population of the provider survey was physicians who had important roles in the care of patient participants in CanCORS. The CanCORS patient cohort is a population-based cohort of individuals diagnosed with lung or colorectal cancer at one of the participating sites (8 counties in Northern California, Los Angeles County, the state of Iowa, the state of Alabama, 22 counties in central/eastern North Carolina, 5 integrated delivery systems, and 10 Veterans Administration Medical Centers). Table A1 summarizes the cohorts of newly diagnosed patients who were ascertained and enrolled. CanCORS participants are similar to patients diagnosed with cancer in the U.S. as a whole (Catalano et al, unpublished manuscript.

In the patient survey, we identified physicians who played important roles in each patient's care, including physicians who discussed and/or provided surgery, chemotherapy, or radiation therapy, providers important in referring patients to surgeons (lung cancer patients only), chemotherapy providers, or radiation providers, and providers most likely to know if the patient has a symptom. If a patient did not discuss surgery, chemotherapy, or radiation therapy with any providers, then we surveyed the doctor that they reported was most important in treatment decisions.

At one site (Veterans Administration hospitals), the patient survey was not used to identify physicians. Rather, researchers identified all physicians with whom patients had interactions based on review of the inpatient and outpatient medical records. Because many patients had interactions with residents and fellows that were transiently at the VA hospitals, and because these trainees were working with attending physicians, only attending physicians are included in analyses.

Each site verified the names and contact information of physicians. Attempts were made to verify physicians' specialties to assure that the appropriate survey instrument be mailed to them. For example, if the doctor with whom a patient discussed surgery was actually their primary care doctor, then the physician would receive a survey instrument tailored to a non-cancer specialist rather than one tailored to a surgeon.

Physicians who were mental health providers were ineligible for participation, consistent with the decision in CanCORS to not collect information about patients' mental health. If physicians had moved or retired, attempts were still made to contact those physicians, although such attempts were typically unsuccessful.

Survey Administration Procedures

Physicians were mailed a self administered questionnaire. The questionnaire was accompanied by a cover letter printed on letterhead from the primary data collection site and was co-signed by the Director of the National Cancer Institute and the Medical Director of the American Cancer Society. Each packet also included one or more letters of endorsement matched to the recipient's specialty (including the American College of Surgeons, American Society of Clinical Oncologists, American Society of Therapeutic Radiology and Oncology, American Thoracic Society, American College of Chest Physicians, American Gastroenterological Association, American College of Physicians, and American Academy of Family Physicians).

Surveys were mailed by priority mail with a stamped, pre-addressed return envelope. Physicians were also given the option of responding to the survey via a secure website, after logging in with a username and password. Each survey was coded with a unique identifier to be used to link providers with patients and for follow-up of nonresponders. Three weeks after the initial mailing, another copy of the survey and cover letter was sent by first class mail to all nonresponders. Approximately two weeks later, a research assistant placed phone calls to the offices of nonresponding physicians to verify that the survey had been received, encourage physicians to complete and return it, and offer to mail or fax a replacement questionnaire. Up to 10 attempts were made to reach each nonresponding physician. After another 6–8 weeks, a third mailing of the survey and cover letter was sent to non-responding physicians.

For each survey, the initial mailing included an incentive. At most sites, this incentive was in the form of a $20 check. At two sites, the incentive was a non-monetary gift card with a $20 value. At the one site, this incentive was a $50 check incentive, due to the concern that $20 would not be sufficient compensation to positively influence survey response in this

area. At a final site, a randomized trial of a $50 check or a $20 check incentive was conducted for the first 578 physicians; because of a significantly higher response rate, the remaining physicians received a $50 check (Keating et al, Med Care 2008, in press).

One Primary Data Collection and Research Center (PDCR) site made the initial contact with physicians by email. In this case, the body of the email included a brief message that mentioned the survey, described the attachments (cover letter and endorsement letter), included the URL to take the survey via the internet, and noted that they will be receiving a mailing within the week that included a $20 check and a paper copy of the instrument.

The survey administration procedures were tested at each site using a run-in period during the summer of 2004 where each site mailed the first 30 surveys. The remaining surveys were administered on a rolling basis during January 2005 through March 2007, although only 2% of the surveys were mailed after May 2006.

Data Entry

For web-based survey responses (13% of responses), data were entered directly into the Statistical Coordinating Center database from the web survey instrument. For paper survey responses, data were double entered by staff at each PDCR site into a web version of the instrument specifically designed for data entry.

Response Rates

We calculated absolute response rates and participation rates. The absolute response rate was defined as the response rate among all physicians who are believed to have cared for CanCORS patients. This includes a small number of physicians who are deceased or no longer in practice and physicians named by patients but whom sites were not able to identify valid contact information. The absolute response rate for the survey was 53.2%. The participation rate was defined as the response rate among physicians who cared for CanCORS patients, are not deceased or retired, and for whom sites were able to identify valid contact information. The overall participation rate was 61.0%. Absolute response rates and participation rates by site and physician characteristics are included in Table A2.

Physicians in Northern California, Iowa, Los Angeles County, and those practicing in the Cancer Research Network managed care organizations were most likely to respond. Response rates did not differ by physician sex, but physicians who graduated from medical school in 1983–1989 were less likely than others to respond. Physicians providing radiation therapy were most likely to respond, and non-cancer specialists caring for colorectal cancer patients were least likely to respond.

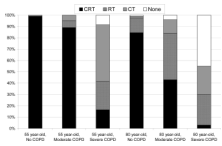

FIGURE.
Unadjusted frequencies of treatment recommendations for each clinical scenario.

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Table 1

Physician characteristics, N=214

Physician characteristic	Categories	Percent of physicians	Physician characteristic	Categories	Percent of physicians
Physician age	19–42	27	# lung cancer patients per month	0–4	33
	43–49	24		5–6	20
	50–59	25		7–12	25
	60+	24		13+	22
US medical graduate	Yes	87	Practice part of CCOP	Yes	41
	No	13		No	59
Board certified	Yes	96	NCI Cancer Center	Yes	20
	No	4		No	80
Gender	Male	81	Attend tumor board	Weekly	82
	Female	19		Monthly or less	18
Race	Non-Hispanic white	73	Enroll patients in clinical trials	Yes	65
	Hispanic	3		No	35
	Non-Hispanic black	2			
	Asian	20	Base clinical income	Not productivity based	45
	Other	3		Productivity based	55
Teaching	None	64	Any financial incentives for providing radiation*	Yes	56
	1–5 days/month	17		No	44
	6+ days	19			
			Study site	5 HMOs	11
Practice site	Office	29		Northern California	21
	Hospital	71		Los Angeles County	22
				Alabama	16
% patients in managed care	0–20%	28		Iowa	13
	21–40%	25		North Carolina	11
	41–70%	24		Veterans Affairs hospitals	6
	78–100%	23			

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* Including incentives for more computed tomography-based treatment planning, greater number of fractions, or use of intensity-modulated radiation therapy

CCOP=Community Clinical Oncology Program, NCI=National Cancer institute, HMO=health maintenance organization

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Table 2

Adjusted rates of recommendations for treatment of a 55-year-old with severe COPD, an 80-year old with moderate COPD and an 80-year old with severe COPD associated with physician and practice characteristics*

	% recommending each treatment for a 55 year-old / severe COPD					% recommending each treatment for a 80 year-old / moderate COPD					% recommending each treatment for a 80 year-old / severe COPD				
	CRT	**RT**	**CT**	**None**	**p-val**	**CRT**	**RT**	**CT**	**None**	**p-val**	**CRT**	**RT**	**CT**	**None**	**p-val**
# Lung cancer patients treated/month					0.036					0.48					0.02
0–3	12	17	54	18		34	46	17	3		0	15	30	55	
4–9	24	20	50	6		47	40	7	6		10	31	22	37	
10–18	13	40	45	2		46	40	7	7		1	35	26	37	
19+	20	25	48	6		48	38	13	2		5	32	18	44	
Practice site					0.55					0.06					0.78
Office	17	20	51	12		37	51	5	8		4	26	21	49	
Hospital	16	27	50	7		45	37	16	2		3	28	27	43	
Practice at NCI cancer center					0.10					0.06					0.73
No	19	23	49	10		46	40	11	2.5		3	28	26	44	
Yes	6	34	57	3		31	45	12	12.5		8	23	22	46	

*Based on multinomial logistic regression; model includes: study site, physician age, number of lung cancer patients treated per month, board certification, practice site, practice at a community clinical oncology program, practice at National Cancer Institute cancer center, and frequency of participation at multidisciplinary tumor board. The table includes variables associated with recommendations in any of the 3 scenarios above with P<.10.

COPD=Chronic obstructive pulmonary disease; CRT=combined chemotherapy and radiation therapy; RT=radiation therapy; CT=chemotherapy, NCI=National Cancer Institute

Table A1

CanCORS patient ascertainment and enrollment

	Lung Cancer	Colorectal Cancer	Total
All ascertained cases*	14327	13304	27631
Sampled cases	11659	10250	21909
Physician consent to enroll	11329	10042	21371
Successful contact of household	8352	7848	16200
Eligible after contact	7914	7309	15223
Enrolled	5150	4914	10064
Absolute response rate (response rate among patients approved by physician for contact and not known to be ineligible)	47.3%	51.7%	49.3%
Participation rate among patients contacted & eligible	65.1%	67.2%	66.1%

* Cases were ascertained by rapid case ascertainment.

Data prepared December 13, 2007.

Table A2

Response rates by site and physician characteristics*

Characteristic	Absolute response rate	P value†	Participation rate	P value†
	N=7874		N=6871	
Overall	**53.2**		**61.0**	
Primary data collection site		<.001		<.001
Northern California	63.4		66.4	
Los Angeles County	57.2		61.6	
Alabama	44.4		58.2	
Iowa	59.4		64.3	
North Carolina	47.6		53.8	
Cancer Research Network	55.4		64.9	
Veterans Administration	38.8		53.7	
Sex‡		.32		.97
Male	59.6		63.9	
Female	58.1		63.8	
Year graduated from medical school‡		.008		.005
Before 1976	62.7		65.8	
1976–1982	60.3		62.5	
1983–1989	57.1		60.5	
1990 or later	59.9		65.3	
Survey version		.006		.001
Surgeon	54.3		62.5	
Chemotherapy physician	50.8		61.2	
Radiation physician	57.3		69.8	
Non-cancer specialist caring for colorectal cancer patient	50.9		57.8	
Non-cancer specialist caring for lung cancer patient	55.0		61.3	

* The absolute response rate was defined as the response rate among all physicians who are believed to have cared for CanCORS patients. This includes a small number of physicians who are deceased or no longer in practice and physicians named by patients but for who sites were not able to identify valid contact information. The participation rate was defined as the response rate among physicians who cared for CanCORS patients, are not deceased or retired, and for whom sites were able to identify valid contact information.

† Using the Pearson chi square test.

‡ There were 972 nonresponders with missing information on sex and 916 nonresponders with missing information on year graduated from medical school, and these individuals not included. Thus, the analyses assume that the distribution of those with missing information is similar to those with complete information.

Data based on Physician Survey Data Version 1.6.1, prepared March 2007.