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ORIGINAL REPORT

Lung Cancer in Elderly Patients: An Analysis of the Surveillance, Epidemiology, and End Results Database

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ABSTRACT

Purpose
To study the burden and outcome of lung cancer in the elderly, particularly for patients aged 80 years and older.

Patients and Methods
The national Surveillance, Epidemiology, and End Results database was analyzed for lung cancer outcomes during the period 1988 to 2003. A comparison was carried out between patients with lung cancer 80 years and older, 70 to 79 years, and younger than 70 years for demographics; stage distribution; 5-year relative survival; and survival based on histology, sex, race, stage, and treatment. The temporal trends in survival during the years 1988 to 1997 and 1998 to 2003 were also analyzed.

Results
Of 316,682 patients eligible for the analysis, 45,912 (14%) were 80 years or older (ie, very elderly); 103,963 (33%) were 70 to 79 years; and 166,807 (53%) were younger than 70 years. The distribution by stage and histology was comparable for all the three groups. Overall survival rate at 5 years was lower in the very elderly (7.4% *v* 12.3% *v* 15.5%; $P < .0001$) across sex, histologic subtypes, stages, and racial categories. Patients aged 80 years or older were less likely to receive local therapy (no surgery or radiation) than younger patients (47% *v* 28% and 19% for the age subgroups $\geq$ 80 years, 70 to 79 years, and $<$ 70 years, respectively). Overall outcomes for patients who underwent surgical therapy or radiation were comparable across the three age groups. In general, survival outcomes for the subgroup aged 70 to 79 years were similar to those of the subgroup aged 80 years and older who received single modality local therapy.

Conclusion
Patients 80 years or older account for 14% (70 years or older accounted for 47%) of all lung cancers, are less likely to be subjected to surgery or radiation, and have inferior outcomes when compared with younger patients.

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INTRODUCTION

The population older than 65 years constitutes the fastest-growing segment of the United States and is projected to double, from the current estimate of 35 million, to 70 million by the year 2030. Within this group, the so-called oldest old (those 85 years or older) are growing the fastest. Compared with the general US population that grew about four times (from 76 million to 281 million people), the oldest old subgroup grew 34 times (from 122,000 in 1900 to 4.2 million by 2000).[1,2] Similar trends have been projected both for other industrialized nations and for the developing countries, although in a less pronounced manner, which makes this a worldwide phenomenon. Lung cancer is a global problem, and more than 1 million deaths are reported annually. It is, to a major extent, a disease of the elderly.[2] The prevalence and societal burden of this disease will increase as more people survive into old age.

Elderly patients with cancer are significantly under-represented in all clinical trials, including in those for lung cancer.[3-6] A retrospective analysis of all patients enrolled onto Southwest Oncology Group (SWOG) trials between 1993 and 1996 demonstrated that only 25% were 65 years or older, whereas this age subgroup made up 63% of the US population of patients with cancer.[6] The low enrollment of patients older than 70 years was largely responsible for this discrepancy.[6] The underrepresentation of the elderly is not inconsequential, because treatment recommendations for lung cancer based on data obtained from clinical trials that enroll predominantly younger patients limit the

extension of such data to elderly patients in routine clinical practice. Physiologic changes of aging, such as increased body fat, reduced total body water, and reduced renal and hepatic function reserves, are significantly different between the elderly and younger populations.[7] These factors may have pharmacokinetic implications for drug disposition that lead to pharmacodynamic consequences, especially with drugs that require conversion to active intermediates. Also, an increased likelihood of drug-drug interactions and treatment-related toxicities exists with the higher prevalence of comorbid conditions in the elderly. In addition, concerns regarding increased perioperative morbidity and mortality result in a reluctance to offer curative surgery for very elderly patients with early stage disease.[8-10]

Although increasing number of studies are being prospectively targeted for patients older than 70 years,[11-15] the subgroup of patients older than 80 years, which constitutes the fastest growing subpopulation, has not been well studied. There is an important need to thoroughly characterize the scope of the problem and to establish data regarding outcomes for patients with lung cancer aged 80 years and older. Therefore, we analyzed the national Surveillance, Epidemiology and End Results (SEER) database record that spanned the years 1988 to 2003 to study the outcomes for lung cancer in the very elderly.

The SEER database collects information regarding cancer incidence and outcome from population-based registries that serve as sentinel sites for the entire US population. The program has expanded from nine sentinel sites that cover approximately 10% of the US population in 1973 to 18 sites that cover 25% of the population in 2000; it is generalizable to the entire US population.[16] All newly diagnosed instances of cancer in persons living in the SEER area are captured, with a 98% complete patient case ascertainment rate.[16] We accessed the national SEER database (SEER-17)[17] in November 2005 and then updated the data in April 2007. Data for all patients with a diagnosis of lung cancer (non–small-cell and small-cell carcinomas) between January 1, 1988, and December 31, 2003, were retrieved. Exclusion criteria were second or later primaries; diagnosis made by death certificate or autopsy; incomplete or invalid records of age, race, or sex; and lack of survival time while patient is still alive.

PATIENTS AND METHODS

Demographic data, including age, sex, and race, were retrieved along with the specific details of the cancer (ie, histology and stage). The histologic tumor type and the tumor stage were coded according to the SEER Extent of Disease staging manual, EOD-88. The manual was based on the WHO International Classification of Diseases, ICD-0, and on the American Joint Committee on Cancer staging manual. We also retrieved information about the type of therapy administered (site-specific surgery, radiation, or neither of these treatments). Information about chemotherapy was not available in the SEER record. Relative survival at 5 years was generated for all patients using an actuarial method, in which the observed survival is adjusted for the normal life expectancy for the age. The entire patient population was divided into three age groups: less than 70 years, 70 to 79 years, and 80 years or older at diagnosis. The 5-year relative survival was compared among the three age groups as defined by sex, race, histologic subtype, stage, and therapy. Furthermore, we compared disease outcome between the years 1988 to 1997, which represents past practice standards, and the years 1998 to 2003, which represents contemporary practice.

Statistical analysis of differences in the relative survival rates among the defined groups was performed by z-test, using the SEER*Stat program, Version 6.2.4 (National Cancer Institute, Bethesda, MD). All *P* values were two-sided and were considered significant at less than .05. The stepdown Bonferroni adjustment was made for multiple comparisons.

RESULTS

Demographics

A total of 400,884 patient cases with lung cancer were registered during the 15-year period, of which 316,682 patient cases (79%) met the study entry criteria; 45,912 patients (14%) were 80 years or older (median, 82.5 years), 33% were 70 to 79 years (median, 74.5 years), and 53% of patients were younger than 70 years (Table 1). Men constituted approximately 57%, and distribution was comparable among the three age groups. White patients accounted for 81% to 86%, and African American patients constituted 7% to 13% (Table 1).

Histology and Staging

Non–small-cell lung cancer (NSCLC) accounted for 84% of patients who were less than 70 years, 85% in the 70 to 79 years group and 90% of $\geq$ 80 years group. Squamous cell histology represented approximately 20% of all patient cases in each of the three groups. There were more patient cases of adenocarcinoma in the younger age group: 33% in the subgroup younger than 70 years compared with 27% in the subgroup 70 to 79 years and with 23% in the subgroup of those 80 years or older. Bronchioloalveolar carcinoma made up 3% of patient cases in each group (Table 1). Stage distribution at the time of diagnosis was similar for the three groups; stages III or IV represented more than 80% of all patients (Table 2).

Initial Therapy

The SEER database contained records of treatment within the initial 4 months after diagnosis. Overall, 10%, 11%, and 5% of patients younger than 70 years, 70 to 79 years, and 80 years or older, respectively, received site-directed surgery; 27%, 24%, and 21%, respectively, received radiation only; and 42%, 37%, and 27%, respectively, received a combination of surgery and radiation. In contrast, 19% of the younger patients, 28% of septuagenarians, and 47% of patients 80 years or older received neither surgery nor radiation (Table 2).

Survival

The 5-year relative overall survival was 15.5% for the younger group, 12.3% for the subgroup aged 70 to 79 years, and 7.4% in the elderly group 80 years or older ($P < .0001$). The very elderly patients had the poorest overall survival in the three racial categories considered: 6.2% in African Americans, and 7.5% in whites and in the other racial groups (Table 3; $P < .0001$ for all comparisons). Similarly, the very elderly had the worst outcome among both men and women; relative survival rates were 6.1% and 8.6% in men and women, respectively, compared with 13.7% and 18%, respectively, in patients younger than 70 years (Table 3). Analysis by stage demonstrated the lowest survival rates in the very elderly, 80 years or older, and the best 5-year survival for the younger group in all stages (40% *v* 60.6% for stage I, 22% *v* 37% for stage II, 3.7% *v* 12% for stage III, and 1% *v* 2.1% for stage IV; $P < .0001$ for all comparisons). Analysis according to tumor histology showed a similar trend; the elderly patients had worse outcomes than the other two groups of patients. Worse outcomes were noted with squamous histology (9.4% *v* 15.5% *v* 19.1% in subgroups of those who were 80 years or older, 70 to 79 years, and younger than 70 years, respectively); for bronchioalveolar histology (36.7 *v* 48.2 *v* 49.1%, respectively); and for small-cell histology (2.2% *v* 3.9% *v*

Table 1. Distribution According to Sex, Race, and Histology of Lung Cancer, by Age Group

Distribution	Age Group (years)					
	< 70		70-79		≥ 80	
	No. of Patients	%	No. of Patients	%	No. of Patients	%
Overall						
1988-2003	166,807		103,963		45,912	
1988-1997	81,641	49	47,513	46	18,511	40
1998-2003	85,166	51	56,450	54	27,401	60
Sex						
Male	98,355	59	58,854	57	23,651	52
Female	68,452	41	45,109	43	22,261	48
Race/ethnicity						
African American	22,367	13	8,570	8	3,077	7
White	134,450	81	89,190	86	39,922	87
Other	9,990	6	6,203	6	2,913	6
Histology						
Carcinoma, NOS						
1988-2003	32,055	19	25,275	24	18,571	40
1988-1997	12,415	15	9,793	21	6,931	37
1998-2003	19,640	23	16,482	29	11,640	42
Large-cell carcinoma						
1988-2003	12,723	8	6,743	6	2,358	5
1988-1997	7,243	9	3,593	8	1,162	6
1998-2003	5,480	6	3,150	6	1,196	4
Squamous-cell cancer						
1988-2003	32,630	20	24,228	23	8,357	18
1988-1997	17,416	21	12,024	25	3,702	20
1998-2003	15,214	18	12,204	22	4,655	17
Adenocarcinoma						
1988-2003	54,841	33	27,999	27	10,634	23
1988-1997	26,993	33	12,584	26	4,159	22
1998-2003	27,848	33	15,415	27	6,475	24
Bronchioalveolar carcinoma						
1988-2003	4,700	3	3,303	3	1,160	3
1988-1997	2,176	3	1,454	3	409	2
1998-2003	2,524	3	1,849	3	751	3
Adenosquamous carcinoma						
1988-2003	2,105	1	1,214	1	324	1
1988-1997	1,148	1	627	1	143	1
1998-2003	957	1	587	1	181	1
Small-cell cancer						
1988-2003	27,753	16	15,201	15	4,508	10
1988-1997	14,250	17	7,438	16	2,005	11
1998-2003	13,503	16	7,763	14	2,503	9

Abbreviation: NOS, not otherwise specified.

7.1%, respectively; $P < .0001$; Table 3). Survival analysis based on treatment modality demonstrated comparable survival with surgery or radiation therapy, but elderly patients had a poorer outcome when radiation and surgery were combined or when no therapy was instituted (Table 4).

Temporal Trend Analysis

The elderly group constituted a higher proportion of total patient cases (16%) in the more recent period, 1998 to 2003, compared with the earlier period of 1988 to 1997, in which they made up 12% (Table 1). The proportion of patients aged 70 to 79 years in the earlier and later time periods was 32% and 33%, respectively (Table 1). There was no significant change in the stage distribution across the three age groups, but there was a trend toward increased use of surgery and reduced use of radiation between the periods of 1988 to 1997 and 1998 to 2003 (Table 2). The survival pattern was similar during both time periods; young patients had the best outcome, followed by the septuagenarians and then the very elderly. Although modest, there was a trend of better overall survival during 1998 to 2003 for all groups (Table 3). A similar trend persisted across all stages of disease, and the most dramatic improvement was noted in the outcome of stage III disease in the very elderly (from 1.4% to 5.1%; Table 4). There was a substantial improvement in disease outcome for all age groups with

Table 2. Distribution According to Disease Stage and Treatment of Subjects With Lung Cancer, by Age Group

Distribution	Age Group (years)					
	< 70		70-79		≥ 80	
	No. of Patients	%	No. of Patients	%	No. of Patients	%
Stage						
I						
1988-2003	20,826	15	14,541	18	4,572	15
1988-1997	10,243	16	6,362	19	1,618	15
1998-2003	10,583	15	8,179	18	2,954	16
II						
1988-2003	4,643	3	2,568	3	520	2
1988-1997	2,573	4	1,282	4	201	2
1998-2003	2,070	3	1,288	3	309	1
III						
1988-2003	41,426	30	25,638	33	11,386	39
1988-1997	19,113	30	10,884	32	4,230	39
1998-2003	22,313	31	14,754	33	7,156	38
IV						
1988-2003	69,854	51	36,051	46	13,094	44
1988-1997	32,476	50	15,490	46	4,883	44
1998-2003	37,378	52	20,561	46	8,211	44
Therapy						
Surgery only						
1988-2003	22,891	10	13,334	22	2,699	5
1988-1997	11,398	10	6,059	10	957	5
1998-2003	11,493	11	7,275	11	1,742	6
Radiation only						
1988-2003	57,754	27	30,657	24	10,520	21
1988-1997	29,641	28	15,375	26	4,672	22
1998-2003	28,113	27	15,282	23	5,848	19
Surgery and radiation						
1988-2003	89,448	42	46,887	37	13,536	27
1988-1997	45,989	43	23,003	39	5,781	28
1998-2003	43,459	41	23,884	36	7,755	26
No treatment						
1988-2003	41,117	19	34,985	28	24,217	47
1988-1997	18,987	18	15,117	25	9,571	46
1998-2003	22,130	21	19,868	30	14,646	49

any treatment (surgery, radiation, or combination), but a worsening of the outcome was noted in patients receiving neither surgery nor radiation during 1998 to 2003. Subset analysis in patients with early stage NSCLC (stages I to III) who are potential candidates for local therapy also showed a consistent trend of poorer outcome in the elderly and a better survival across all age groups in the 1998 to 2003 time period relative to the 1988 to 1997 period (Table 5). This improvement was noticeable with all treatment groups, including in those patients who received neither surgery nor radiation (Table 5).

DISCUSSION

This analysis characterizes lung cancer presentation and outcome in the very elderly patient population and compares it with that of septuagenarians and with the younger patient population. A high proportion of patient cases (14%) occur in patients 80 years or older. Minority patients are over-represented, which is consistent with previous analyses of the SEER database.[16,18] The location of many SEER registries in urban centers might account for this observation. However, this may also be an indication of a higher burden of lung cancer in the minority population because of racial differences in the prevalence and pattern of tobacco use and because of potential differences in genetic predisposition to the carcinogenic effect of tobacco smoke.[19-21] The preponderance of male patients is consistent with historical and epidemiologic data, which show that lung cancer was more prevalent in males during the period studied.[19] A higher proportion of patients in the subgroup 80 years or older had the histologic diagnosis of a carcinoma subtype not otherwise specified. This may be related in part to lesser use of invasive diagnostic procedures in older patients, which could limit the availability of a tissue specimen to make an accurate subhistologic diagnosis.

Our findings confirm the observation that female patients have better survival than males.[22] It must be pointed out, however, that the study was not intended to compare the survival rates between elderly male and female patients. Overall, patients who were 80 years or older had worse survival outcomes than septuagenarians and patients younger than 70 years of age. This was observed for all stages of disease

Table 3. Characteristics Associated With Relative 5-Year Survival Rates, by Age Group

Characteristic	Relative 5-Year Survival Rate (%)			*P*
	Age < 70 Years	Age 70-79 Years	Age ≥ 80 Years	
Overall				
1988-2003	15.5	12.3	7.4	< .0001*
1988-1997	15.2	12.1	7.3	< .0001*
1998-2003	15.4	12.4	7.6	< .0001*
Sex				
Male	13.7	11.2	6.1	< .0001*
Female	18.0	13.6	8.6	< .0001*
Race/ethnicity				
African American	12.5	9.2	6.2	< .0001*
White	15.9	12.5	7.5	< .0001*
Other	16.8	12.7	7.5	< .0001*
Histology				
Carcinoma, NOS	8.2	5.2	3.3	< .0001*
1988-1997	7.6	5.2	3.8	< .0001*
1998-2003	8.6	5.4	2.9	< .0001*
Large-cell carcinoma	14.6	10.0	7.6	< .0001*
1988-1997	13.7	9.3	7.5	< .0001*
1998-2003	15.3	11.5	7.8	< .0001*
Squamous carcinoma	19.1	15.5	9.4	< .0001*
1988-1997	18.4	15.2	8.2	< .0001*
1998-2003	19.9	15.9	11.3	< .0001*
Adenocarcinoma	18.7	16.2	11.4	< .0001*
1988-1997	18.2	15.6	10.8	< .0001*
1998-2003	18.6	16.4	10.7	< .0001*
BAC	49.1	48.2	36.7	.003†; < .0001‡§
1988-1997	47.8	44.9	35.9	.006†; < .0001‡; .008§
1998-2003	48.5	49.7	38	.154†; < .0001‡§
Adenosquamous	25.0	24.6	21.3	.404†; .009‡; .052§
1988-1997	24.4	21.9	18.4	.119†; .039‡; .22§
1998-2003	24	27.6	23.1	.687†; .15‡; .11§
SCLC	7.1	3.9	2.2	< .0001*
1988-1997	7.2	4	2.1	< .0001*
1998-2003	6.5	3.4	2.4	< .0001*

Abbreviations: NOS, not otherwise specified; BAC, bronchoalveolar carcinoma; SCLC, small-cell lung cancer.
*P for comparison of age groups < 70 years *v* 70-79 years, of < 70 years *v* ≥ 80 years, and of 70-79 years *v* ≥ 80 years.
†P for comparison of age groups < 70 years *v* 70-79 years.
‡P for comparison of age groups < 70 years *v* ≥ 80 years.
§P for comparison of age groups 70-79 years *v* ≥ 80 years.

and across racial and sex subgroups. We were able to exclude potential factors, such as differing histologic subtypes or stages at diagnosis, as responsible for this finding, because they were comparable in all three groups. Furthermore, by using relative survival for comparison, we adequately corrected for the differences in expected longevity at different ages. We observed a consistent trend of lower rates of surgery and radiation therapy with increased age, whereby more than 80% of the younger population received this active therapy compared with 70% of septuagenarians and with only 50% of the very elderly within the initial 4 months after diagnosis. Although our own analysis could not address all forms of therapy, especially chemotherapy, the SEER database is reputed with a high degree of information ascertainment;[16] as such, the record regarding radiation and surgery could serve as a dependable measure of the overall treatment intervention for these patients. Moreover, a previous analysis of the linked SEER-Medicare database of patients with lung cancer who were older than 65 years and diagnosed between 1994 and 1999, a period covered by the present study, revealed that elderly patients older than 75 years were less likely to receive chemotherapy. This correlated with poorer survival outcome.[23]

The increased likelihood of using less aggressive forms of therapy out of fear of increased toxicity in very elderly patients with greater comorbidities is a possible contributor to the poor survival outcome. Our analysis showed that very elderly patients were twice as likely to receive no therapy and to undergo only cancer-site–directed surgical intervention at half the rate of those who are younger despite a comparable proportion of early stage lung cancer in both groups. This is almost analogous to the results from an analysis of a regional cancer registry data, in which only 50% of the elderly patients received surgical intervention for early NSCLC, compared with 80% of the younger patients.[24] In contrast, our data show that very elderly patients do benefit from appropriate therapeutic intervention and have comparable outcomes to septuagenarians and to those younger than 70 years. For patients 80 years or older who received single-modality, cancer-directed surgery, presumably for early stage disease, the outcome was statistically inferior. However, we view these as clinically

Table 4. Cancer Stages and Forms of Therapy Associated With Relative 5-Year Survival Rates, by Age Group

Stage and Therapy	Relative 5-Year Survival Rate			*P*
	Age < 70 Years	Age 70-79 Years	Age ≥ 80 Years	
Overall, 1988-2003	15.5	12.3	7.4	< .0001*
Stage				
I				
1988-2003	60.6	50.6	40.0	< .0001*
1988-1997	60.3	50.5	38.2	< .0001*
1998-2003	60.6	50.3	41.2	< .0001*
II				
1988-2003	37.0	26.9	22.0	< .0001*
1988-1997	35.4	25.4	21.7	< .0001†‡; .058§
1998-2003	38	26.4	21.8	< .0001†‡; .001§
III				
1988-2003	12.0	6.9	3.7	< .0001*
1988-1997	10.4	6	1.4	< .0001*
1998-2003	13.4	7.7	5.1	< .0001*
IV				
1988-2003	2.1	1.4	1.0	< .0001*
1988-1997	1.8	1.2	1.0	< .0001*
1998-2003	2.2	1.6	0.8	< .0001*
Therapy				
Surgery only				
1988-1997	58.9	54.9	54.5	< .0001†; .004‡; .47§
1998-2003	61.5	56.5	60.7	< .0001†‡; .447§
Radiation only				
1988-1997	4.6	4.1	4.5	.165†; .712‡; > .9§
1998-2003	5.6	5.4	4.8	< .0001†‡; .031§
Surgery and radiation				
1988-1997	21.2	19.1	13.9	< .0001*
1998-2003	22.7	21.8	18.1	< .0001*
No therapy				
1988-1997	7.4	6.3	4.5	< .0001*
1998-2003	4.4	3.1	2.3	< .0001*

Abbreviation: NSCLC, non–small-cell lung cancer.
*P for comparison of age groups < 70 years v 70-79 years, of < 70 years $v \geq$ 80 years, and of 70-79 years $v \geq$ 80 years.
†P for comparison of age groups < 70 years v 70-79 years.
‡P for comparison of age groups < 70 years $v \geq$ 80 years.
§P for comparison of age groups 70-79 years $v \geq$ 80 years.

comparable results, which assume statistical significance because of the ability of a large sample size to detect minor differences. It is noteworthy that the survival gap is smaller on temporal trend analysis when we consider data collected between 1998 and 2003, which is the time period that represents contemporary practice. It raises the question of whether patients 80 years or older will do as well as younger patients when optimal care is administered for their stage of disease.

Published evidence suggests that elderly patients are denied potentially beneficial treatment and participation in clinical trials solely because of chronological age and because of the physician perception that they are too frail to withstand treatment.[25,26] On the contrary, the benefit of active therapy is well demonstrated in the elderly population in general and is comparable to the benefit obtained by younger patients.[14,15,26,27] Unfortunately, the reluctance to treat is still very high, even in the fit elderly patient.[8-10,27,28] A frequent reason for withholding therapy from elderly patients are the fears of toxicity and of increased operative morbidity and mortality, which could be a genuine, but not always justified, concern. Unanticipated toxicity can be minimized by careful patient selection, close monitoring during treatment, and the development of predictive models for toxicity that consider a broad range of factors in addition to the patient's chronological age, performance status, or comorbid conditions.[27,29,30] Although the need for a systematic study of the factors responsible for this problem is gaining recognition, the best approach to address it remains unsettled.[5,31] Clinical trial enrichment by increased representation of the elderly in age-unspecified trials and in elderly-specific clinical trials could help define toxicity profiles before the specific regimen is used in the general population of elderly patients.[32-34]

The temporal trend analysis shows that increasing proportions of lung cancer are diagnosed in very elderly patients. A 30% increase in the proportion of patients aged 80 years or older was observed from the decade of 1988 to 1997 to the 6-year period of 1998 to 2003. Although we noted no substantial change in the stage distribution of disease across these time periods, we observed a trend of improved overall outcome across all stages. We also noticed a similar trend with respect to treatment with surgery, radiation, or a combination of both, but we observed a poorer outcome with lack of surgery or radiation therapy. A 3% to 5% increase across all age groups was observed in the proportion of patients not receiving either radiation or surgery during 1998 to 2003. This increase, though minor, is still disturbing because

Table 5. NSCLC Therapy (stages I, II, and III) Associated With Relative 5-Year Survival Rates by Age Group

NSCLC Therapy	Relative 5-Year Survival Rate, %			*P*
	Age < 70 Years	Age 70-79 Years	Age ≥ 80 Years	
Radiation				
1988-1997	7	5.5	4.6	< .0001†‡;.002§
1998-2003	10.4	8.5	8.5	< .0001†‡;.001§
Surgery				
1988-1997	61.1	56.3	56.9	< .0001†;.006‡;.72§
1998-2003	63.2	58.4	61.4	< .0001†‡;.129§
Radiation and surgery				
1988-1997	34.7	30.3	22.2	< .0001*
1998-2003	38.1	33.6	29.2	< .0001*
No therapy				
1988-1997	14.5	11.4	6.8	< .0001*
1998-2003	5.3	3.9	3.3	< .0001*

Abbreviation: NSCLC, non–small-cell lung cancer.
*P for comparison of age groups < 70 years *v* 70-79 years, of < 70 years *v* ≥ 80 years, and of 70-79 years *v* ≥ 80 years.
†P for comparison of age groups < 70 years *v* 70-79 years.
‡P for comparison of age groups < 70 years *v* ≥ 80 years.
§P for comparison of age groups 70-79 years *v* ≥ 80 years.

of the poorer survival outcome registered for this cohort. To minimize the impact of the lack of data on chemotherapy on survival outcomes, we performed a subset analysis of the temporal pattern of survival in stages I, II, and III NSCLC. An improved survival was noted during the more recent period in these patients, who were candidates for local therapy but received neither radiation nor surgery. We suspect that these patients were the most likely to have received alternative therapy, which was most likely chemotherapy. The improved survival in the more recent period may also be a reflection of better supportive care measures, use of novel systemic therapy regimens, or merely a function of stage migration resulting from advanced imaging modalities. The attribution to improved systemic therapy is substantiated by a recent SEER-Medicare data analysis that demonstrated the increased use of chemotherapy from 1994 to 1999 in elderly patients. Platinum-containing regimens were more likely to be administered in the latter period and were associated with improved survival.[23]

Our study suffers from limitations imposed by its retrospective nature, which makes it impossible to control for potentially confounding variables, such as tobacco use, comorbid illnesses, treatment-related toxicity, and complete treatment history during the entire course of the disease. We also were unable to analyze such important considerations as cultural preferences and value judgments of individual patients on their choices of therapy. The lack of information on the impact of chemotherapy on disease outcome is another limitation of our study. Although the linked SEER-Medicare database contained information regarding chemotherapy for patients who were 65 years or older at diagnosis,[35,36] we anticipated that up to half of the study population would be younger than 65 years and therefore would have incomplete records, thereby making a valid comparison difficult. For this reason, we decided to exclude this variable from the analysis rather than limit the scope of our study.

In conclusion, our study has generated important information about the burden of lung cancer and the outcomes in the very elderly patients 80 years or older. It will be important to address potential barriers to optimal care of the very elderly patients with lung cancer prospectively, thus enabling effective treatments to be tailored to this group of patients.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

The author(s) indicated no potential conflicts of interest.

AUTHOR CONTRIBUTIONS

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