



Lung Cancer Survival Among Chinese Americans, 2000 to 2010

abstract

Purpose Despite being the leading cause of cancer death, no prior studies have characterized survival patterns among Chinese Americans diagnosed with lung cancer. This study was conducted to identify factors associated with survival after lung cancer in a contemporary cohort of Chinese patients with lung cancer.

Methods The study design is a prospective descriptive analysis of population-based California Cancer Registry data. Multivariable Cox proportional hazards models were used to estimate hazard ratios (HRs) for overall mortality. Participants were Chinese American residents diagnosed with first primary invasive lung cancer from 2000 to 2010 (2,216 men and 1,616 women).

Results Among Chinese men, decreased mortality was associated with care at a National Cancer Institute cancer center (HR, 0.85; 95% CI, 0.73 to 0.99) and adenocarcinoma versus small-cell carcinoma (HR, 0.78; 95% CI, 0.65 to 0.92). Women had better survival compared with men (HR, 0.82; 95% CI, 0.75 to 0.89), with mortality associated with never married versus currently married status (HR, 1.36; 95% CI, 1.11 to 1.66), lower versus higher neighborhood socioeconomic status (HR, 1.38; 95% CI, 1.10 to 1.72 comparing lowest to highest quintile), care at a cancer center (HR, 0.80; 95% CI, 0.67 to 0.96), and squamous cell relative to small-cell carcinoma (HR, 1.60; 95% CI, 1.04 to 2.48).

Conclusion Focusing on factors associated with marital status, community socioeconomic status, and characteristics unique to National Cancer Institute–designated cancer centers may help to identify potential strategies for improving the length of survival for Chinese Americans.

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INTRODUCTION

Chinese Americans are the largest Asian group in the United States, with 4.0 million Chinese Americans counted in the 2010 Census.¹ In California, the most populous US state for Chinese Americans, this population increased 30% over a decade from 2000 to 2010, numbering nearly 1.5 million.² Lung cancer is the second and fourth most common cancer among US Chinese men and women, respectively,³ and the most common cause of cancer death for both men and women, followed by prostate and colorectal cancers for men and breast and colorectal cancer for women.⁴ We previously documented differences across multiple Asian American ethnic groups in survival after lung cancer among patients in the California Cancer Registry (CCR)⁵ and among a series of female never-smoker patients.⁶ However, no prior studies, to our knowledge, have characterized the survival patterns specific for Chinese Americans, particularly as the biology of the disease may be unique among this population, with a

higher incidence of epidermal growth factor receptor (EGFR) tyrosine kinase domain–activating mutations⁷ and, among Chinese women, a majority of lung cancers presenting among never-smokers.⁶ Considering the high burden of disease in Chinese Americans, an examination of survival patterns and prognostic factors, with attention to both clinicopathologic and sociodemographic factors, may inform strategies to improve survival and potentially early detection by identifying subgroups with poor survival who may benefit from targeted screening efforts.

To provide insight into the prognostic factors for lung cancer among the growing Chinese American population, we used population-based CCR data enhanced with information regarding immigrant status and neighborhood-level information on socioeconomic status (SES) and residence in ethnic enclaves to examine patterns in lung cancer survival among Chinese persons in California, the US state with the largest Chinese population (one third of the US Chinese population).⁸



METHODS

Case Selection

We obtained data for all first primary invasive lung cancers (International Classification of Diseases [ICD] for Oncology, third edition, site codes, C34.0 to C34.9, excluding histologic codes 9050 to 9055, 9140, and 9590 to 9992) among Chinese American residents of California during the period between January 1, 2000, and December 31, 2010, from the CCR (comprised of four registries [San Francisco Bay Area, San Jose/Monterey, Los Angeles, and Greater California] within the National Cancer Institute [NCI] SEER program; $n = 4,537$). We excluded patients diagnosed without microscopic confirmation ($n = 390$), those diagnosed at autopsy or via death certificate ($n = 59$), and patients with survival time less than 30 days who did not undergo any first course of treatment ($n = 256$). The final study cohort included 2,216 male and 1,616 female patients with lung cancer (total, $N = 3,832$). Other patient and clinical characteristics obtained from CCR data include age and year of diagnosis, birthplace, sex, residential address and stage at diagnosis, histologic subtype (coded using ICD for Oncology, third edition, histology codes as follows: small-cell carcinoma, 8041 to 8045 and 8246; squamous cell carcinoma, 8051, 8052, 8070 to 8078, 8083, and 8084; adenocarcinoma, 8050, 8140 to 8147, 8201, 8230, 8250 to 8255, 8260, 8263, 8290, 8310, 8320, 8323, 8220, 8350, 8441, 8460, 8470, 8471, 8480, 8481, 8490, 8500, 8503, 8507, 8550, and 8570 to 8576; large-cell carcinoma, 8011 to 8015, 8082, and 8123; and non-small-cell lung cancer [NSCLC], not otherwise specified, 8010, 8020 to 8022, 8030 to 8035, 8046, 8094, 8120, 8130, 8170, 8200, 8240 to 8249, 8340, 8430, 8525, 8551, 8560, 8562, 8580, 8940, 8972, and 8980), and first course of treatment (extent of surgical resection, chemotherapy [yes/no], and radiation [yes/no]). All data used in this analysis came from the CCR. Smoking status is not collected by the cancer registry.

Information on patient race and ethnicity from cancer registry data is primarily based on information abstracted from hospital records and usually self-reported by patients,⁹ but for a small proportion of patients, race and ethnicity may be based on assumptions or inferences by hospital personnel from other patient data including maiden name, surname, birthplace, or death records. Chinese ethnicity in cancer registry data includes Taiwanese. Because our previous studies have shown that Asian patients in the CCR with

unknown registry birthplace are more likely to be US born,^{10,11} random imputation of nativity (US or foreign born) for patients with unknown birthplace would thus lead to an underestimate of US-born patients. To more accurately impute nativity, we applied a statistical imputation method based on the age at issue of Social Security number (SSN), using a crosswalk file provided by the Social Security Administration that indicates the year of issuance for each SSN sequence. By comparing the age of SSN issue with self-reported birthplace in previously interviewed cancer patients ($n = 1,836$) and based on maximization of the area under the receiver operating characteristic curve and confirmation with logistic regression modeling, patients receiving an SSN before age 25 years were considered US born, and those who had received an SSN at or after age 25 years were considered foreign born. This age cut point resulted in 84% sensitivity and 80% specificity for assigning foreign-born status across the Asian populations.¹² For our study, registry-based birthplace data were available for 93% of the Chinese patients (72% from hospital records and 21% from death certificates). Nativity was imputed using the method described earlier for approximately 7% of patients without registry birthplace information. For the remaining less than 1% of patients for whom SSNs were missing or invalid, we randomly assigned nativity based on the overall sample's joint distributions of race/ethnicity, sex, and age.

Patient residential address at diagnosis was geocoded and assigned to a census block group, which was then linked to block group–level census measures. Neighborhood SES is a composite index developed previously from principal component analysis, incorporating information on education, occupation, employment, household income, poverty, and rent and house values from the Census 2000 Summary File (for patients diagnosed from 2000 to 2005) and American Community Survey (ACS) 2007 to 2011 data (applied to patients diagnosed from 2006 to 2010 because ACS replaced the decennial census long form after 2000).^{13,14} Ethnic enclave is defined as a neighborhood that maintains more Asian ethnic mores and norms and/or is ethnically distinct from its surrounding area. It is characterized using a composite index based on the following four census indicator variables: percentage of recent immigrants, percentage of Asian/Pacific Islander (API) language-speaking households that were linguistically isolated, percentage of API language speakers with limited English proficiency, and percentage of API population.¹⁵ For patients

diagnosed during the period from 2000 to 2005, this information was derived from the summary files of Census 2000; for patients diagnosed from 2006 to 2010, we used the Census 2000 data because the component variables are lacking or unreliable in the ACS. Both neighborhood SES and ethnic enclave measures were classified into quintiles based on distributions across California block groups.

Determination of Follow-Up and Vital Status

CCR routinely collects information on patients with cancer through active and passive follow-up until confirmation of their death using linkages to data from the diagnosing hospital, state and national vital statistics databases, and other data sources. Underlying causes of death, coded by ICD, 10th edition (used in the CCR for deaths starting in 1999), were obtained from death certificates, and deaths assigned codes C34.0 to C34.9 (ICD, 10th edition) were identified as being a result of lung cancer. Follow-up time for overall mortality was computed as the number of days between the date of diagnosis and the first occurrence of the following dates: date of death, date of last known contact, or end date of follow up (December 31, 2012).

Statistical Analysis

To describe overall survival time after lung cancer diagnosis among Chinese Americans in California, we estimated median all-cause survival among patients, overall and by demographic, neighborhood, and tumor factors by sex. To assess the independent influence of patient, tumor, or treatment characteristics on survival and identify possible prognostic factors, we conducted Cox proportional hazards multivariable regression by sex. We tested the proportional hazards assumption based on correlation test of time versus scaled Schoenfeld residuals. The assumption of proportional hazards was violated for chemotherapy, and the test statistic was marginally significant for SEER summary stage (local, regional, distant, or unknown). Therefore, hazard ratios (HRs) and 95% CIs were computed using stratified Cox multivariable models, with stratification on chemotherapy and SEER summary stage, which allowed the baseline hazards within each model to vary by the strata variable(s). All of the independent variables of interest in Table 1 that were statistically significant at $P < .10$ in unadjusted models were included in the multivariable model, and covariates included in the final models included year of diagnosis, age, marital status, nativity, neighborhood SES, neighborhood ethnic

enclave, urban or rural region, surgery type, radiation, cancer center, and histologic subtype. All statistical analyses were performed using SAS version 9.3 (SAS Institute, Cary, NC). All statistical tests were two-sided with an $\alpha = 0.05$.

RESULTS

Patient Characteristics

Among Chinese American men in California diagnosed with lung cancer between 2000 and 2010, more than half (55.8%) were age 70 years or older at diagnosis (Table 1). The vast majority (90.5%) were foreign born (66.2% born in China, 6.1% born in Taiwan, and 4.3% born in Hong Kong). Most were married (80.4%), were insured on public insurance (45% on Medicaid, military, or other public insurance), lived in the highest two statewide SES quintiles (23.5% in SES quintile 4 and 26.9% in quintile 5), and lived in the most Asian ethnic neighborhoods (73.9% in quintile 5). A small proportion of patients (11.7%) were reported by an NCI cancer center (includes comprehensive and noncomprehensive designation). Most male patients (60.8%) were diagnosed with distant disease, and nearly half (46.5%) were diagnosed with adenocarcinomas, although a relatively high proportion (23.4%) had NSCLC, not otherwise specified. Twenty-two percent of patients received any surgery, 38.9% received radiation, and 49.3% received chemotherapy.

Among Chinese American female patients, slightly more than half were diagnosed at age 70 years or older, and nearly 90% were foreign born. Relative to Chinese American men, a considerably lower proportion of women (58.4%) were married at diagnosis, whereas nearly one third (30.8%) were previously married (separated, divorced, or widowed). The distributions of primary health insurance, neighborhood SES, and ethnic enclave were similar to those for men. A small proportion of female patients (12.9%) received care at an NCI-designated cancer center. Although a slightly higher proportion of female patients, relative to male patients, were diagnosed at local stage (14.7% v 13.6%, respectively), women also had a slightly higher rate of distant disease compared with men (63.3% v 60.8%, respectively). Of note, a considerably higher proportion of tumors were adenocarcinomas in women versus men (65.5% v 46.5%, respectively), whereas women had lower rates of small-cell and squamous cell histologies.

Survival

Table 2 lists the median survival time and adjusted HRs for overall (all-cause) mortality after diagnosis

Table 1 – Characteristics of Chinese American Patients With Lung Cancer by Sex, California, 2000 to 2010

Characteristic	% of Patients		χ^2 Test P
	Men (n = 2,216)	Women (n = 1,616)	
Age at diagnosis, years			< .01
< 60	20.2	25.9	
60-69	24.0	23.3	
70+	55.8	50.8	
Nativity			.09
US born	9.5	11.1	
Foreign born	90.5	88.9	
Marital status			< .01
Married	80.4	58.4	
Never married	6.9	8.7	
Separated/divorced/widowed	10.3	30.8	
Unknown	2.4	2.0	
Health insurance (primary payer source)			.04
Uninsured	2.4	1.5	
Private	38.8	41.6	
Public/Medicaid	44.5	42.8	
Medicare	11.5	11.8	
Military	0.5	0.1	
Unknown	2.3	2.2	
Neighborhood SES, quintile			< .01
1 (low SES)	13.4	10.4	
2	16.9	15.2	
3	19.3	18.0	
4	23.5	24.3	
5 (high SES)	26.9	32.1	
Neighborhood ethnic enclave, quintile			.03
1 (least ethnic)	1.5	0.9	
2	3.4	4.1	
3	6.5	7.8	
4	13.0	12.9	
5 (most ethnic)	73.9	71.7	
Unknown	1.6	2.7	
Care at NCI cancer center			.26
Yes	11.7	12.9	
No	88.3	87.1	
Stage			.04
Local	13.6	14.7	
Regional	20.4	18.3	
Distant	60.8	63.3	
Unknown	5.1	3.7	

(Continued on following page)

with lung cancer. Among Chinese American men, the median survival time was 13.0 months (95% CI, 12.0 to 14.2 months) overall, with minor differences between US-born patients (median, 12.5 months; 95% CI, 10.5 to 17.7 months) and foreign-born patients (median, 13.0 months; 95% CI, 12.0 to 14.2 months). In multivariable hazard models, independent associations with better overall survival were found for receiving care at an NCI-designated cancer center and specific histologies including adenocarcinoma and large-cell carcinoma (although the latter association was of borderline statistical significance). Married men had somewhat lower mortality than unmarried men, but this association was not statistically significant (HR, 1.22; 95% CI, 0.98 to 1.51).

Among Chinese American women, overall median survival was higher than for men (18.7 months; 95% CI, 17.1 to 20.6 months) overall. In a multivariable model including both men and women, the HR comparing risk of death among women to men was 0.82 (95% CI, 0.75 to 0.89; data not shown), suggesting that the female survival benefit was not explained by other variables. In the multivariable hazard model, higher mortality was independently associated with never being married, living in lower SES neighborhoods, receiving care from facilities other than NCI-designated cancer centers, and having squamous cell histology (relative to small-cell histology).

DISCUSSION

In this analysis of survival among all Chinese American patients with lung cancer in California from 2000 to 2010, we found that social factors such as birthplace, marital status, and SES were important prognostic factors for women but less so for men. Among Chinese American women, median survival varied substantially, by as much as 12 months among those living in the highest and lowest socioeconomic groups. We also found significantly higher survival among Chinese American women compared with Chinese American men, with a 5-month difference in median survival. Although we did not have data on smoking status among the patients with cancer, prior studies in Chinese Americans have shown that the majority of female patients are never-smokers (eg, 70% in one study),⁶ whereas the majority of male patients are current or former smokers (eg, 86% in the same study).⁶ These major discrepancies in smoking history by sex suggest either that the survival differences we observed may be in part

Table 1 – Characteristics of Chinese American Patients With Lung Cancer by Sex, California, 2000 to 2010 (Continued)

Characteristic	% of Patients		χ^2 Test <i>P</i>
	Men (n = 2,216)	Women (n = 1,616)	
Histology			< .01
Small-cell carcinoma	9.6	3.7	
NSCLC			
Squamous	15.0	5.4	
Adenocarcinoma	46.5	65.5	
Large cell	4.2	3.8	
NSCLC, not otherwise specified	23.4	20.5	
Other lung cancer	1.4	1.1	
Surgery			.07
None	77.9	74.3	
Wedge resection	2.7	3.2	
Lobectomy	19.0	22.2	
Other surgery	0.4	0.4	
Radiation			< .01
No	61.1	67.3	
Yes	38.9	32.7	
Unknown	0	0.1	
Chemotherapy			.92
No	48.9	49.6	
Yes	49.3	48.7	
Unknown	1.8	1.7	
Urbanicity (census tract level)			.02
Rural	0.6	0.6	
Town	0.2	0.1	
City	6.3	6.8	
Suburban metropolitan	48.9	52.3	
Metropolitan	42.5	37.6	
Unknown	1.5	2.6	
Deaths, No. of patients			
All cause	1,832	1,235	< .01
Lung cancer	1,551	1,051	< .01

Abbreviations: NCI, National Cancer Institute; NSCLC, non–small-cell lung cancer; SES, socioeconomic status.

attributable to our inability to measure smoking as a prognostic factor and/or that lung cancer among smokers is a different, perhaps more aggressive disease entity than lung cancer among never-smokers.⁷ The improved survival among women compared with men has been consistently observed and is thought to indicate sex as an independent prognostic factor that may be related to differences in tumor molecular or biologic profile, drug metabolism, and/or DNA damage

susceptibility and repair capacity.¹⁶ Social factors are suggested from the results to be potentially important prognostic factors after lung cancer diagnosis, although more so for Chinese women than for Chinese men. Improved survival among patients who are married compared with those who are unmarried has been well documented across multiple cancer sites,¹⁷ other health outcomes, and overall mortality.¹⁸ This association is often suggested to be attributed to greater social support among patients with cancer who are married. However, we do not observe a difference in survival when comparing married patients with those who were previously married (ie, separated, divorced, widowed), suggesting that additional factors may be responsible for the higher mortality among never-married patients that is distinct from previously married patients. The successively higher mortality with lower neighborhood SES suggests mechanisms related to access to health care and other resources. Although we were able to account for health insurance and other tumor and treatment characteristics, we were not able to account for quality of care, detailed treatment, comorbidities, use of palliative care, and other factors that may mediate the association between SES and survival.

We found that among both male and female Chinese American patients, the small proportion of patients receiving care at an NCI-designated cancer center had improved survival compared with those receiving care at non–cancer center facilities. NCI-designated cancer centers are academic centers that are characterized by their cancer research, but with relevance to cancer care, they may also provide more state-of-the-art cancer care, integrated care and tumor boards, and access to clinical trials. We cannot discount that unmeasured sociodemographic or clinical patient characteristics may confound these survival patterns; for example, patients with *EGFR* mutations may more likely be referred to an NCI cancer center for treatment.

Interestingly, because we included small-cell lung cancers in our analysis, we were able to compare survival for NSCLC histologic subtypes with survival for small-cell lung cancer, and we found that, as expected, mortality for adenocarcinoma was lower than that for small-cell cancer among Chinese American men; however, we did not find a comparable mortality difference among Chinese women. In contrast, we found markedly worse survival for squamous cell lung cancer than small-cell lung cancer among women. These results should be interpreted with caution, however,

Table 2 – Median Survival and Adjusted HRs for All-Cause Mortality Among Chinese Americans Diagnosed With Lung Cancer by Sex, California, 2000 to 2010

Characteristic	Men		Women	
	Median Survival, Months (95% CI)	HR (95% CI)	Median Survival, Months (95% CI)	HR (95% CI)
Total	13.0 (12.0 to 14.2)	—	18.7 (17.1 to 20.6)	—
Nativity				
US born	12.5 (10.5 to 17.7)	1.05 (0.89 to 1.25)	23.4 (16.2 to 37.3)	0.92 (0.74 to 1.14)
Foreign born	13.0 (12.0 to 14.2)	1.0	18.4 (16.7 to 20.4)	1.0
Marital status				
Married	14.0 (12.7 to 15.3)	1.0	21.8 (18.8 to 24.3)	1.0
Never married	8.7 (6.6 to 10.8)	1.22 (0.98 to 1.51)	18.7 (13.0 to 23.0)	1.36* (1.11 to 1.66)
Separated/divorced/widowed	10.1 (7.7 to 13.4)	1.10 (0.93 to 1.29)	14.3 (11.9 to 16.5)	1.08 (0.94 to 1.25)
Unknown	12.7 (8.4 to 22.3)	0.82 (0.58 to 1.15)	25.0 (14.9 to 35.2)	1.05 (0.76 to 1.44)
Health insurance				
Uninsured	10.5 (6.4 to 23.8)	1.10 (0.72 to 1.69)	16.4 (4.2 to 39.5)	1.04 (0.62 to 1.74)
Private	14.7 (12.9 to 16.8)	1.0	23.9 (20.1 to 27.3)	1.0
Public/Medicaid	11.8 (10.8 to 13.2)	0.94 (0.84 to 1.06)	16.3 (13.8 to 19.2)	0.92 (0.79 to 1.06)
Medicare	12.9 (9.1 to 16.9)	0.96 (0.82 to 1.13)	16.2 (11.9 to 18.8)	0.91 (0.73 to 1.12)
Military	13.7 (4.5 to 26.2)	1.72 (0.91 to 3.23)	—	0.44* (0.31 to 0.62)
Unknown	12.5 (4.4 to 18.3)	1.19 (0.89 to 1.59)	24.8 (9.6 to 34.6)	1.07 (0.73 to 1.58)
Neighborhood SES, quintile				
1 (low SES)	10.4 (8.3 to 13.3)	1.16 (0.98 to 1.38)	10.9 (8.4 to 15.1)	1.38* (1.10 to 1.72)
2	11.0 (8.9 to 13.2)	1.12 (0.95 to 1.32)	17.3 (13.1 to 21.7)	1.22* (1.01 to 1.47)
3	13.3 (11.2 to 16.9)	1.11 (0.95 to 1.28)	17.3 (13.5 to 23.4)	1.18 (0.98 to 1.41)
4	13.9 (11.7 to 16.2)	1.06 (0.93 to 1.22)	19.8 (16.7 to 22.9)	0.97 (0.82 to 1.15)
5 (high SES)	15.2 (12.8 to 17.9)	1.0	23.0 (19.7 to 26.7)	1.0
Ethnic enclave, quintile				
1 (least ethnic)	12.8 (4.8 to 31.9)	1.0	22.4 (5.7 to 72.6)	1.0
2	15.7 (11.0 to 25.8)	0.92 (0.59 to 1.47)	19.6 (11.8 to 35.2)	1.03 (0.56 to 1.91)
3	14.1 (11.3 to 17.1)	1.14 (0.77 to 1.71)	19.0 (15.2 to 24.3)	1.12 (0.63 to 2.00)
4	14.3 (11.3 to 19.6)	1.11 (0.75 to 1.63)	17.9 (14.7 to 23.7)	1.22 (0.69 to 2.15)
5 (most ethnic)	12.6 (11.3 to 14.0)	1.13 (0.78 to 1.64)	18.2 (16.3 to 20.5)	1.01 (0.58 to 1.77)
Unknown	10.5 (5.9 to 27.5)	2.42 (0.91 to 6.43)	—	—
Care at NCI-designated cancer center				
Yes	22.4 (18.3 to 25.9)	0.85* (0.73 to 0.99)	34.2 (22.8 to 39.8)	0.80* (0.67 to 0.96)
No	12.1 (11.2 to 13.1)	1.0	17.6 (16.0 to 19.5)	1.0
Stage				
Local	64.0 (44.5 to 88.6)	—	—	—
Regional	27.1 (23.8 to 32.1)	—	52.3 (42.0 to 59.8)	—
Distant	8.0 (7.1 to 8.7)	—	11.5 (10.2 to 12.9)	—
Unknown	16.2 (12.7 to 21.3)	—	16.0 (13.3 to 26.0)	—
Tumor histology				
Small-cell carcinoma	9.7 (8.0 to 11.0)	1.0	12.0 (9.1 to 16.8)	1.0
NSCLC				
Squamous	13.5 (11.4 to 15.3)	0.91 (0.74 to 1.11)	10.6 (6.0 to 14.2)	1.60* (1.04 to 2.48)
Adenocarcinoma	19.2 (16.7 to 21.2)	0.78* (0.65 to 0.92)	25.0 (22.5 to 28.9)	1.00 (0.69 to 1.45)

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Table 2 – Median Survival and Adjusted HRs for All-Cause Mortality Among Chinese Americans Diagnosed With Lung Cancer by Sex, California, 2000 to 2010 (Continued)

Characteristic	Men		Women	
	Median Survival, Months (95% CI)	HR (95% CI)	Median Survival, Months (95% CI)	HR (95% CI)
Large cell	11.8 (8.4 to 19.2)	0.76 (0.55 to 1.04)	12.7 (9.6 to 19.9)	0.98 (0.60 to 1.58)
NSCLC, NOS	8.9 (7.4 to 10.6)	0.92 (0.76 to 1.10)	11.4 (8.7 to 13.1)	1.21 (0.82 to 1.78)
Other lung cancer	12.4 (8.9 to 17.6)	0.60 (0.37 to 0.97)	10.9 (5.7 to 23.9)	0.97 (0.47 to 2.01)

NOTE. HRs computed via multivariable Cox proportional hazards models stratified by SEER summary stage and chemotherapy, and adjusted for all factors shown in the table in addition to age at diagnosis, year of diagnosis, urbanicity, surgery type, and radiation. —, Not estimated.

Abbreviations: HR, hazard ratio; NCI, National Cancer Institute; NOS, not otherwise specified; NSCLC, non–small-cell lung cancer; SES, socioeconomic status.

*Statistically significant at $P < .05$.

considering the high proportion of tumors classified here as NSCLC, not otherwise specified (23% among men and 20% among women). The proportion of NSCLCs diagnosed with histology not otherwise specified has steadily declined over time¹⁹ as a result of the availability of targeted therapies for specific lung cancer histologies; the majority of these are likely adenocarcinomas.

The primary limitation in our study involves the absence of cancer registry data on potentially important prognostic factors for lung cancer, including specific treatments, tumor genetic markers (such as *EGFR* and *ALK* mutation status), smoking history, and comorbid conditions that affect treatment decisions and survival time. Sex differences in *EGFR* mutations may well explain the survival differences between Chinese men and women; however, it is unlikely that *EGFR* mutations would confound the associations between marital status and SES with survival. Although it is possible that our study results are biased as a result of misclassification of race or ethnicity, prior

research shows minimal misclassification of Chinese ethnicity in cancer registry data.²⁰

In summary, despite generally poor survival for lung cancer, our study did identify several non-clinical factors associated with lung cancer survival among Chinese Americans, including sex, marital status, and SES. Focusing on factors that differ between female married and unmarried patients (eg, greater social and/or instrumental support or improved economic resources) and patients who live in low versus high SES communities (eg, greater socioeconomic resources, ability to access and pay for treatments), as well as characteristics unique to NCI-designated cancer centers (eg, presence of tumor boards, access to clinical trials), may help to identify potential strategies for improving the length and quality of survival for Chinese Americans after diagnosis of lung cancer.

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AUTHORS' DISCLOSURES OF

POTENTIAL CONFLICTS OF INTEREST

Lung Cancer Survival Among Chinese Americans, 2000 to 2010

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