Surgeon specialty and surveillance after resection for non–small cell lung cancer

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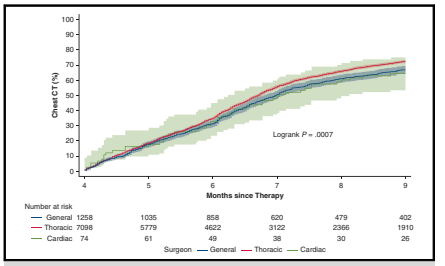

Receipt of surveillance by CT scan 4 to 9 months after therapy by surgeon specialty.

CENTRAL MESSAGE

Patients with lung cancer treated by thoracic specialty designated surgeons were more likely to adhere to posttreatment surveillance guidelines, although there was no significant difference in survival.

Surveillance after treatment for non–small cell lung cancer is important for early detection of recurrence or second primary lung cancer ensuring appropriate subsequent management.[1] Even in the case of early-stage disease, recurrence rates following curative-intent treatment range from 30% to 50%.[2] Data suggest that many patients do not receive guideline-recommended surveillance following treatment and that those at greatest risk are those undergoing surgery as their primary treatment.[3] Some studies have identified differences in lung cancer outcomes and adherence to standards that may be linked to surgeon specialty.[4] Here, we aimed to look at the association between surgeon specialty on rates of posttreatment lung cancer surveillance (IRB-46841; August 9, 2023).

To look at the influence of surgeon specialty, we utilized a large national database from the Veterans Health Administration (VHA), which represents an integrated health care system capturing patterns and rates of surveillance across the United States. The cohort consisted of 10,240 veterans who received surgery for stages I through III non–small cell lung cancer diagnosed between 2008 and 2016 and survived more than 6 months after definitive lung cancer therapy. We queried surgical procedures, comorbidities, vital status, and receipt of surveillance imaging. Surgeon specialty was defined by treating specialty (within VHA, termed "bed section"; VHA Handbook 1006.02) associated with the surgical procedure (88% of surgeries included in analysis) or with admission or transfers during the inpatient stay during which the surgery occurred. We selected only treating specialties specifically labeled as general surgery, thoracic surgery, or cardiac surgery. We prioritized the procedure specialty over specialties associated with the hospitalization. If more than 1 specialty was found, we assigned a single specialty using the hierarchy: thoracic, cardiac, general surgery. For type of surgery, veterans with procedure codes for more than 1 surgery on the same date were categorized according to the hierarchy: pneumonectomy, bi/lobectomy, segmentectomy, wedge resection. Segmentectomy and wedge resection were combined into a single category due to small numbers. Primary outcome was surveillance, defined as chest computed tomography (CT) scan during the initial surveillance period of 4 to 9 months after the later of surgery or initiation of adjuvant therapy. Rates of imaging were analyzed using univariate and multivariable models.

Of the 10,240 veterans who underwent surgical resection, 1749 were excluded due to inability to determine surgeon specialty or surgery outside of VHA, resulting in 8491 patients with complete data. Most patients had surgery completed by thoracic-designated surgeons (n = 7147 [84%]). A minority of cases were completed by general

TABLE 1. Baseline patient characteristics by surgeon specialty

Variable	Surgeon specialty				*P* value
	Thoracic	Cardiac	General	Total	
Overall	7147 (84.2)	74 (0.9)	1270 (15.0)	8491 (100.0)	
Age (y)	65.6 ± 7.7	67.0 ± 8.3	65.3 ± 7.8	65.6 ± 7.7	.125
Sex					.756
Female	244 (3.4)	≤10	48 (3.8)	294 (3.5)	
Male	6903 (96.6)	72 (97.3)	1222 (96.2)	8197 (96.5)	
Region					<.001
Mid-Atlantic	1866 (26.1)	25 (33.8)	526 (41.4)	2417 (28.5)	
Midwest	1251 (17.5)	≤10	198 (15.6)	1455 (17.1)	
Northeast	769 (10.8)	13 (17.6)	137 (10.8)	919 (10.8)	
South	2098 (29.4)	≤10	207 (16.3)	2313 (27.2)	
West	1163 (16.3)	22 (29.7)	202 (15.9)	1387 (16.3)	
Race					<.001
White	5443 (76.2)	50 (67.6)	961 (75.7)	6454 (76.0)	
Black	1013 (14.2)	13 (17.6)	169 (13.3)	1195 (14.1)	
Other	301 (4.2)	≤10	67 (5.3)	374 (4.4)	
Unknown	390 (5.5)	≤10	73 (5.7)	468 (5.5)	
Married					<.001
No	3867 (54.1)	42 (56.8)	662 (52.1)	4572 (53.8)	
Yes	3273 (45.8)	32 (43.2)	604 (47.6)	3909 (46.0)	
Smoking status					<.001
Current	3306 (51.9)	38 (55.9)	673 (61.5)	4017 (53.3)	
Former	2113 (33.2)	20 (29.4)	281 (25.7)	2414 (32.0)	
Never	952 (14.9)	10 (14.7)	140 (12.8)	1102 (14.6)	
Charlson comorbidity index					.968
0-1	4790 (67.0)	50 (67.6)	861 (67.8)	5701 (67.1)	
2-3	1795 (25.1)	18 (24.3)	316 (24.9)	2129 (25.1)	
4+	562 (7.9)	≤10	93 (7.3)	661 (7.8)	
Histology					.282
Adenocarcinoma	3093 (53.5)	35 (58.3)	555 (56.7)	3683 (54.1)	
Squamous cell carcinoma	2093 (36.2)	21 (35.0)	323 (33.0)	2437 (35.8)	
Large cell	121 (2.1)	≤10	13 (1.3)	135 (2.0)	
Non–small-cell carcinoma NOS	222 (3.8)	≤10	40 (4.1)	262 (3.8)	
Other specified carcinomas	247 (4.3)	≤10	47 (4.8)	297 (4.4)	
Stage					.037
I/0	3628 (50.8)	35 (47.3)	620 (48.8)	4283 (50.4)	
II	1174 (16.4)	14 (18.9)	182 (14.3)	1370 (16.1)	
III	683 (9.6)	≤10	116 (9.1)	806 (9.5)	
Treatment regimen					.024
Surgery + chemotherapy	1204 (16.8)	≤10	178 (14.0)	1389 (16.4)	
Surgery + radiation	294 (4.1)	≤10	49 (3.9)	348 (4.1)	
Surgery + chemotherapy + radiation	493 (6.9)	≤10	89 (7.0)	583 (6.9)	
Surgery alone	5156 (72.1)	61 (82.4)	954 (75.1)	6171 (72.7)	
Surgery extent					<.001
Segmentectomy	938 (13.1)	≤10	247 (19.4)	1195 (14.1)	
Bi/lobectomy	5632 (78.8)	49 (66.2)	899 (70.8)	6580 (77.5)	
Pneumonectomy	358 (5.0)	≤10	40 (3.1)	404 (4.8)	

Values are presented as n (%) or mean ± SD. Number and proportions may not sum to total due to data missingness.

(n = 1270 [10%]) and cardiac (n = 74 [1%]) surgeons. There was no significant difference in the age, sex, comorbidities, histology, or tumor grade between groups. Differences in surgeon specialty were observed based on regional distribution, with a larger proportion of general surgeons performing cases in the Mid-Atlantic region

(thoracic, 26%; cardiac, 34%; and general, 41%) ($P < .001$). General surgeons were more likely to operate on patients who smoked (62%) compared with thoracic (52%) and cardiac surgeons (56%) ($P < .001$).

Although there was no significant difference in histology, a larger proportion of surgeries by general and cardiac surgeons were sublobar resections (wedge or segmentectomy) (cardiac; 25%; general, 26%) compared with thoracic surgeons (16%) ($P < .001$) (Table 1). We observed small but statistically significant differences between surgeons by stage of lung cancer resected ($P = .037$) and receipt of (neo)adjuvant therapy ($P = .024$).

The overall rate of initial surveillance CT for the entire cohort was 72%. Resection by thoracic surgeons was associated with higher rate of CT scan within 4 to 9 months: thoracic, 72%; cardiac, 64%; general, 67% ($P = .0007$) (Figure 1). After adjusting for surgical procedure, age, sex, race, comorbidities, and stage, patients with thoracic (hazard ratio [HR], 1.13; 95% CI, 1.05-1.22; $P = .001$) but not cardiac (HR, 0.99; 95% CI, 0.74-1.33; $P = .95$) surgeons were more likely to adhere to surveillance guidelines compared with general surgeons (Table E1). Of note, the mean time from therapy to surveillance scans was 488 days (~16 months), approximately 7 months beyond initial guideline-recommended surveillance. Nonetheless, there was no significant difference in adjusted 5-year survival (thoracic, 60%; general, 59%; and cardiac, 51%; $P = .11$) or relative mortality risk (thoracic HR, 0.94; 95% CI, 0.85-1.03; $P = .18$; cardiac HR, 1.23, 95% CI, 0.88-1.73; $P = .23$), by surgeon type (Figure E1 and Table E1).

Patients with lung cancer treated by thoracic specialty designated surgeons were more likely to adhere to posttreatment surveillance guidelines. Reasons for this variation in surveillance adherence are not clear, although likely multifactorial. Responsibility for posttreatment surveillance is variably defined in clinical practice, and surgeons such as general and cardiac surgeons whose practice consists of a wider variety of conditions may not be as well resourced to follow guidelines. Enhanced patient navigation and coordination for posttreatment follow-up may improve these rates.

Our study has several limitations, including generalizability to the non-Veterans Affairs population. The Department of Veterans Affairs treats approximately 8000 cases of lung cancer annually, or roughly 3% of the lung cancer diagnosed in the United States with comparable survival rates for early-stage disease (60%-70%).[5] The VHA is a unique health ecosystem, which may in fact facilitate surveillance akin to other universal access systems. In fact, the observed rates of surveillance are higher than those reported in non-Veterans Affairs populations; nonetheless, there are many contributing factors that can influence a patient's ability to receive recommended surveillance.[3] Although this study does not identify all barriers to surveillance, we have minimized the effects of factors such as

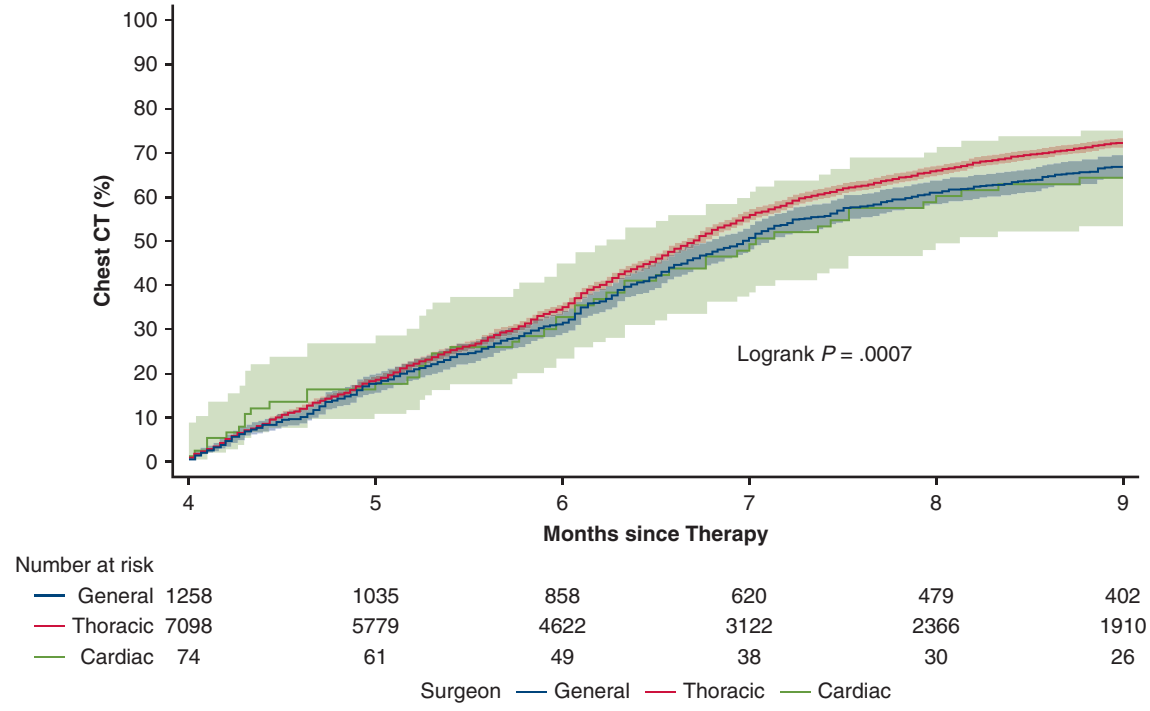

FIGURE 1. Receipt of surveillance by computed tomography scan 4 to 9 months after therapy by surgeon specialty. Thoracic surgeon surveillance adherence 72% (95% CI, 71%-73%), cardiac surgeon surveillance adherence 64% (95% CI, 54%-75%), general surgeon surveillance adherence 67% (95% CI, 64%-70%) ($P = .0007$). *CT*, Computed tomography.

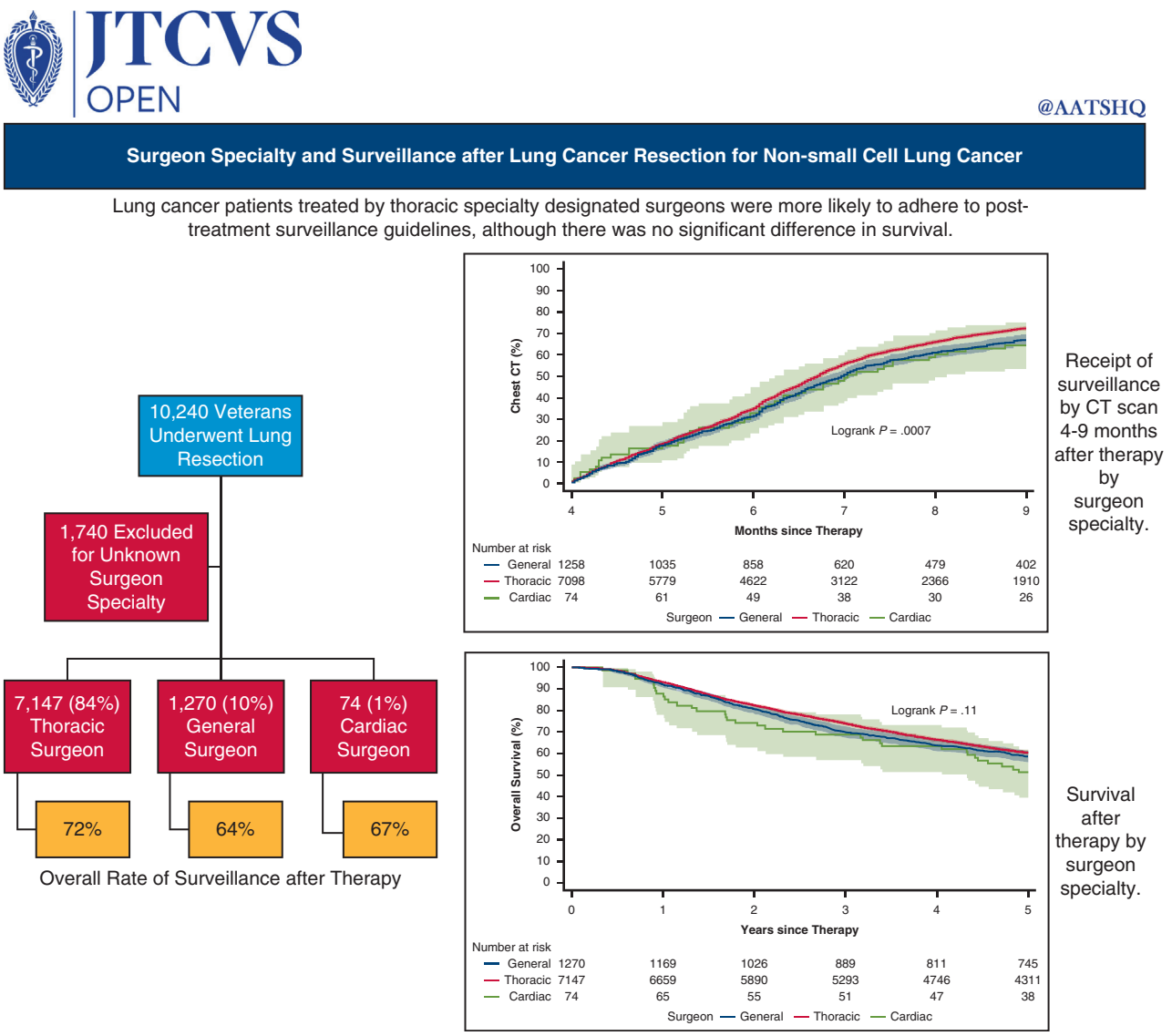

FIGURE 2. Graphical abstract. *CT*, Computed tomography.

insurance eligibility and access to specialty care by using VHA data that are well suited for studying inquiries like the association between surgeon specialty and lung cancer surveillance.

In addition to the limitation in generalizability, misclassification and data missingness are inherent challenges to large databases studies like this. In our study, 17% of patients were excluded due to lack of surgeon specialty designation in the electronic health record or receipt of definitive surgery outside of VHA facilities. In addition, the effect of multidisciplinary team on surveillance care was not captured in this dataset and surveillance imaging conducted outside the VHA is unaccounted for. Finally, we found no difference in long-term survival associated with surgeon specialty in this surgical population (Figure 2). Thus, linking improvements to posttreatment surveillance to maximize early detection of lung cancer recurrence and second primary cancers toward improved survival remains unanswered.

Conflict of Interest Statement

Dr Backhus has served as an advisory panel member/speaker for Genentech/Roche, Bristol Myers Squibb, Astra Zeneca, and Johnson and Johnson/Ethicon. All other authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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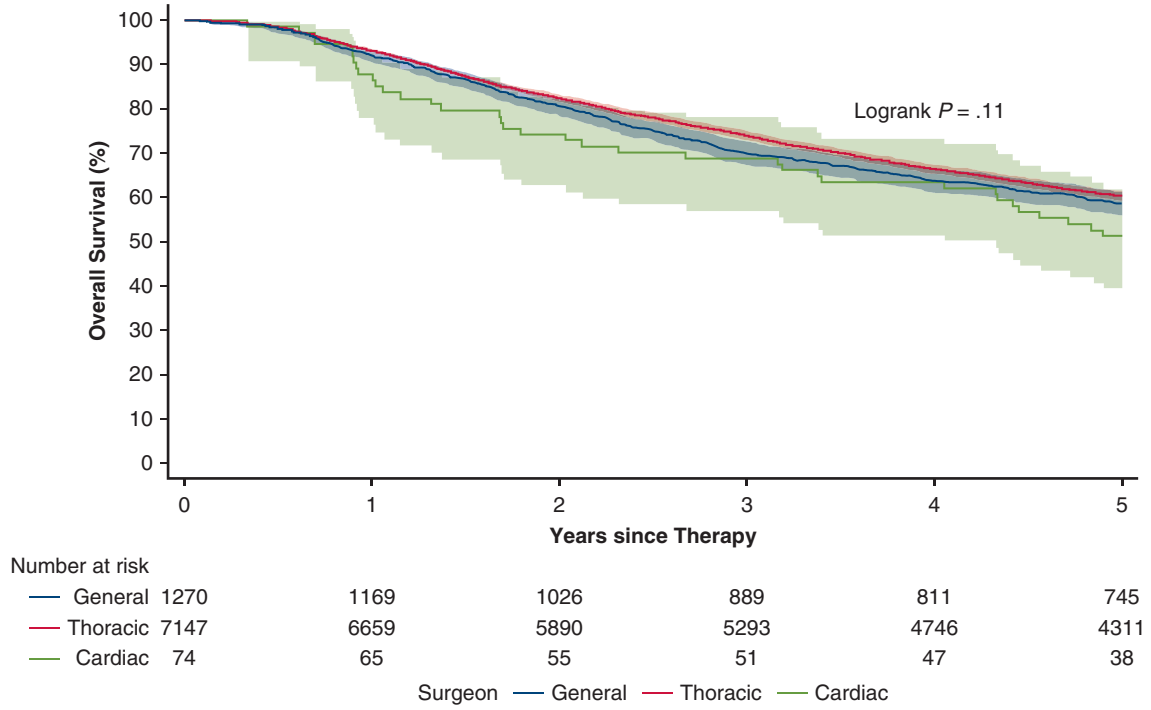

FIGURE E1. Survival after therapy by surgeon specialty. Thoracic surgeon survival 60% (95% CI, 59%-61%), cardiac surgeon survival 51% (95% CI, 40%-62%), and general surgeon survival 59% (95% CI, 56%-61%) ($P = .11$).

TABLE E1. Adjusted hazard ratios (*HRs*) for receipt of surveillance by chest computed tomography (*CT*) within 4 to 9 months of therapy, and mortality within 5 years of therapy, from Cox proportional hazards regression models, comparing specialty surgeons to general surgeons

	Chest CT surveillance			Mortality		
Variable	**HR**	**95% CI**	***P* value**	**HR**	**95% CI**	***P* value**
Thoracic	1.13	1.05-1.22	.001	0.94	0.85-1.03	.18
Cardiac	0.99	0.74-1.33	.95	1.23	0.88-1.73	.23
General	Ref.			Ref.		

Adjusted for: sex, race, marital status, region, Charlson comorbidity index, smoking status, stage, treatment regimen, and surgery extent. *Ref.*, Reference category.