CHEST Online Supplement

The Impact of Persistent Smoking After Surgery on Long-term Outcomes After Stage I Non-small Cell Lung Cancer Resection

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e-Table 1: Patient demographics, treatment characteristics, and outcomes among individuals who persistently smoke and individuals who relapse

	Patients smoking at time of surgery (i.e., individuals who currently smoke)			Patients not smoking at time of surgery (i.e., individuals who formerly smoked)		
Characteristics	**Patients smoking at 1 year after surgery ("continued smoking") N=2,648**	**Patients not smoking at 1 year after surgery N=1,914**	**P-Value**	**Patients smoking at 1 year after surgery ("relapsed smoking") N=573**	**Patients not smoking at 1 year after surgery N=2,354**	**P-Value**
Demographics						
Age (SD)	64.53 (7.12)	67.03 (7.53)	<0.001	66.56 (7.23)	69.72 (7.73)	<0.001
Sex (%)			0.577			0.425
Male	2,542 (96)	1,831 (95.66)		548 (95.64)	2,268 (96.35)	
Female	106 (4)	83 (4.34)		25 (4.36)	86 (3.65)	
Race (%)			0.389			0.432
White	2,145 (81)	1,534 (80.15)		495 (86.39)	1,994 (84.71)	
Black	449 (16.96)	326 (17.03)		65 (11.34)	314 (13.34)	
Other	31 (1.17)	32 (1.67)		10 (1.75)	29 (1.23)	
Unknown	23 (0.87)	22 (1.15)		3 (0.52)	17 (0.72)	
BMI (SD)	25.60 (5.13)	27.15 (5.28)	<0.001	27.06 (5.71)	28.43 (5.34)	<0.001
Area Deprivation Index (SD)	54.45 (15.13)	53.57 (14.92)	0.053	56.66 (14.77)	54.5 (14.78)	0.002
Charlson/Deyo score (SD)	6.48 (2.16)	6.69 (2.15)	0.001	6.85 (2.13)	7.21 (2.21)	0.001
Smoking cessation pharmacotherapy prescribed after surgery (within 1 year)	1,361 (51.40)	643 (33.59)	<0.001	268 (46.77)	394 (16.74)	<0.001
Post-operative appointments (in 1 year after surgery)						
Cardiothoracic surgeon (>1 visit)	1,601 (60.46)	1,158 (60.50)	0.978	366 (63.87)	1,484 (63.04)	0.7109
Oncologist	1,155 (43.62)	834 (43.57)	0.976	240 (41.88)	1,072 (45.54)	0.115
Primary care provider	2,478 (93.58)	1,795 (93.78)	0.7816	544 (94.94)	2,214 (94.05)	0.415

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Treatment Characteristics						
Wait time to surgery, days						
Median (IQR)	65 (41,97.5)	59 (38,91)	0.764	63 (42,92)	61 (41,93)	0.226
>12 weeks (%)	871 (32.89)	556 (29.05)	0.006	163 (28.45)	692 (29.4)	0.654
Tumor size, mm (SD)	22.46 (10.51)	23.04 (10.45)	0.072	22.99 (10.78)	23.44 (10.69)	0.375
Resection (%)			0.193			0.916
Lobectomy	1,853 (70.06)	1,383 (72.41)		409 (71.5)	1,650 (70.24)	
Wedge	599 (22.65)	382 (20)		123 (21.5)	533 (22.69)	
Segment	160 (6.05)	118 (6.18)		33 (5.77)	133 (5.66)	
Pneumonectomy	33 (1.25)	27 (1.41)		7 (1.22)	33 (1.4)	
Surgical approach (%)			0.214			0.133
VATS	1,058 (41.87)	727 (39.99)		221 (39.75)	982 (43.26)	
Thoracotomy	1,469 (58.13)	1,091 (60.01)		335 (60.25)	1,288 (56.74)	
Histology (%)			0.132			0.176
Adenocarcinoma	1,357 (51.27)	1,032 (53.95)		285 (49.74)	1,261 (53.59)	
Squamous cell	940 (35.51)	626 (32.72)		208 (36.3)	815 (34.64)	
Other	350 (13.22)	255 (13.33)		80 (13.96)	277 (11.77)	
Grade (%)			0.009			0.577
I	234 (9.53)	225 (12.61)		80 (14.73)	320 (14.63)	
II	1,308 (53.28)	942 (52.8)		295 (54.33)	1,143 (52.26)	
III	589 (33.02)	589 (33.02)		158 (29.1)	694 (31.73)	
IV	34 (1.38)	28 (1.57)		10 (1.84)	30 (1.37)	
Pathologic stage (%)			0.277			0.054
I	2,255 (88.26)	1,621 (88.00)		471 (85.33)	2,026 (88.86)	
II	192 (7.51)	156 (8.47)		55 (9.96)	162 (7.11)	
III	108 (4.23)	65 (3.53)		26 (4.71)	92 (4.04)	

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Outcomes						
Length of stay, days (IQR)	6 (4,10)	7 (4,10)	0.018	7 (4,10)	7 (4,9)	0.020
Complications (%)						
Pneumonia	148 (5.59)	110 (5.75)	0.820	42 (7.33)	111 (4.72)	0.012
MI	18 (0.68)	17 (0.89)	0.426	2 (0.35)	30 (1.27)	0.056
Empyema	23 (0.87)	18 (0.94)	0.800	7 (1.22)	14 (0.59)	0.111
Renal Failure	22 (0.83)	26 (1.36)	0.085	7 (1.22)	27 (1.15)	0.881
Respiratory/Cardiac Failure	104 (3.93)	85 (4.44)	0.390	25 (4.36)	86 (3.65)	0.425
Stroke	3 (0.11)	5 (0.26)	0.239	1 (0.17)	9 (0.38)	0.445
30-D readmission (%)	193 (7.29)	148 (7.74)	0.573	55 (9.62)	171 (7.26)	0.059

Data are presented as No. (%), mean (standard deviation), or median (interquartile range). ADI, area deprivation index; BMI, body mass index; VATS, video-assisted thoracoscopic surgery

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e-Table 2: Factors independently associated with smoking relapse at 1 year after surgery (n=2927)

Variable	Odds Ratio	95% Wald Confidence Limits		P-value
Quit smoking between diagnosis and surgery (yes vs. no)	4.729	3.711	6.025	<.0001
Age	0.951	0.935	0.968	<.0001
Sex (female vs. male)	0.593	0.318	1.106	0.1001
Race (reference = white)				
Black	0.660	0.465	0.937	0.0200
Other	1.941	0.862	4.369	0.1094
Unknown	0.831	0.175	3.942	0.8158
BMI	0.962	0.941	0.982	0.0004
Charlson/Deyo score	1.060	1.000	1.125	0.0513
Area Deprivation Index	1.013	1.005	1.021	0.0008
Delayed surgery >12 weeks (yes vs. no)	0.776	0.604	0.996	0.0468
Resection type (reference = lobectomy)				
Pneumonectomy	0.579	0.215	1.560	0.2800
Segmentectomy	0.769	0.444	1.331	0.3479
Wedge	1.021	0.770	1.354	0.8852
Surgical approach (VATS vs. thoracotomy)	1.019	0.810	1.282	0.8698
Tumor size (reference ≤ 10 mm)				
11-20	0.819	0.547	1.225	0.3316
21-30	0.804	0.547	1.226	0.3113
31-40	0.771	0.481	1.236	0.2803
41-50	0.793	0.450	1.398	0.4229
Unknown	1.484	0.718	3.069	0.2863
Pathologic stage (reference = I)				
II	1.793	1.216	2.645	0.0032
III	0.989	0.550	1.781	0.9719
Major complication (yes vs. no)	0.990	0.684	1.432	0.9567
Readmission (yes vs. no)	1.403	0.940	2.093	0.0974
Post-operative appointments (in 1 year after surgery)				
Cardiothoracic surgeon (>1 visit)	0.864	0.685	1.091	0.2193
Oncologist	0.811	0.647	1.018	0.0705
Primary care provider	1.128	0.694	1.836	0.6267

ADI, area deprivation index; BMI, body mass index; VATS, video-assisted thoracoscopic surgery

Multivariable model controlling for all covariates displayed in the table.

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e-Table 3: Multivariable cox proportional hazards model for overall survival

Variable	Hazard Ratio	95% Wald Confidence Limits		P-value
Smoking at 1 year after surgery (reference = no)	1.291	1.197	1.392	<.0001
Age, y	1.023	1.018	1.029	<.0001
Female vs male, sex	0.681	0.540	0.859	0.0012
Race (reference = white)				
Black	0.893	0.806	0.989	0.0303
Other	0.746	0.528	1.052	0.0950
Unknown	0.948	0.637	1.409	0.7912
BMI	0.981	0.974	0.988	<.0001
Charlson/Deyo score	1.088	1.068	1.108	<.0001
Area Deprivation Index	1.001	0.998	1.003	0.6679
Annual hospital volume, y	1.000	0.999	1.001	0.5875
Surgical year	0.976	0.961	0.990	0.0009
Type of operation (reference = lobectomy)				
Pneumonectomy	0.901	0.671	1.209	0.4867
Segmentectomy	1.081	0.914	1.278	0.3643
Wedge	1.387	1.268	1.517	<.0001
Incision type (reference = thoracotomy)				
VATS	0.983	0.907	1.065	0.6724
Histology (reference = adenocarcinoma)				
Squamous cell carcinoma	1.087	1.004	1.178	0.0403
Other	1.155	1.025	1.301	0.0181
Grade (reference = I)				
II	1.321	1.162	1.502	<.0001
III	1.420	1.241	1.624	<.0001
IV	1.781	1.315	2.413	0.0002
Tumor size (reference = 0-10mm)				
11-20mm	0.879	0.772	1.001	0.0522
21-30mm	0.969	0.847	1.109	0.6493
31-40mm	1.103	0.950	1.281	0.1990
40+ mm	1.152	0.964	1.377	0.1205
Unknown	0.539	0.382	0.762	0.0005
Lymph node collection (reference <10)	0.908	0.839	0.983	0.0171
Major complication (reference = no)	1.180	1.045	1.331	0.0074
Length of stay	1.014	1.008	1.020	<.0001
30-day readmission (reference = no)	1.002	0.875	1.148	0.9712
Pathologic stage (reference = I)				
II	1.309	1.146	1.496	<.0001
III	2.178	1.850	2.564	<.0001

ADI, area deprivation index; BMI, body mass index; VATS, video-assisted thoracoscopic surgery

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e-Table 4: Multivariable competing risk model for disease-free survival

Variable	Hazard Ratio	95% Wald Confidence Limits		P-value
Smoking at 1 year after surgery (reference = no)	0.989	0.884	1.106	0.8441
Age, y	0.991	0.983	0.999	0.0265
Female vs male, sex	0.789	0.586	1.063	0.1191
Race (reference = white)				
Black	1.083	0.939	1.249	0.2721
Other	0.803	0.503	1.282	0.3580
Unknown	0.682	0.344	1.353	0.2731
BMI	0.997	0.986	1.007	0.5481
Charlson/Deyo score	1.018	0.990	1.046	0.2046
Area Deprivation Index	1.000	0.997	1.003	0.9941
Annual hospital volume, y	1.001	1.000	1.002	0.2909
Surgical year	0.990	0.971	1.009	0.2951
Type of operation (reference = lobectomy)				
Pneumonectomy	0.875	0.559	1.370	0.5591
Segmentectomy	1.224	0.966	1.553	0.0947
Wedge	1.395	1.224	1.589	<.0001
Incision type (reference = thoracotomy)				
VATS	0.965	0.859	1.083	0.5436
Histology (reference = adenocarcinoma)				
Squamous cell carcinoma	0.837	0.742	0.945	0.0039
Other	1.049	0.882	1.247	0.5884
Grade (reference = I)				
II	1.435	1.190	1.731	0.0002
III	1.552	1.273	1.893	<.0001
IV	1.474	0.900	2.415	0.1232
Tumor size (reference = 0-10mm)				
11-20mm	1.040	0.852	1.270	0.6995
21-30mm	1.332	1.085	1.635	0.0062
31-40mm	1.512	1.206	1.895	0.0003
40+ mm	1.485	1.131	1.949	0.0044
Unknown	1.140	0.772	1.685	0.5103
Lymph node collection (reference <10)	0.865	0.769	0.973	0.0161
Major complication (reference = no)	1.067	0.887	1.283	0.4934
Length of stay	0.996	0.987	1.006	0.4653
30-day readmission (reference = no)	1.176	0.962	1.437	0.1137
Pathologic stage (reference = I)				
II	1.715	1.448	2.032	<.0001
III	1.741	1.377	2.200	<.0001

ADI, area deprivation index; BMI, body mass index; VATS, video-assisted thoracoscopic surgery

Multivariable model controlling for all covariates displayed in the table.

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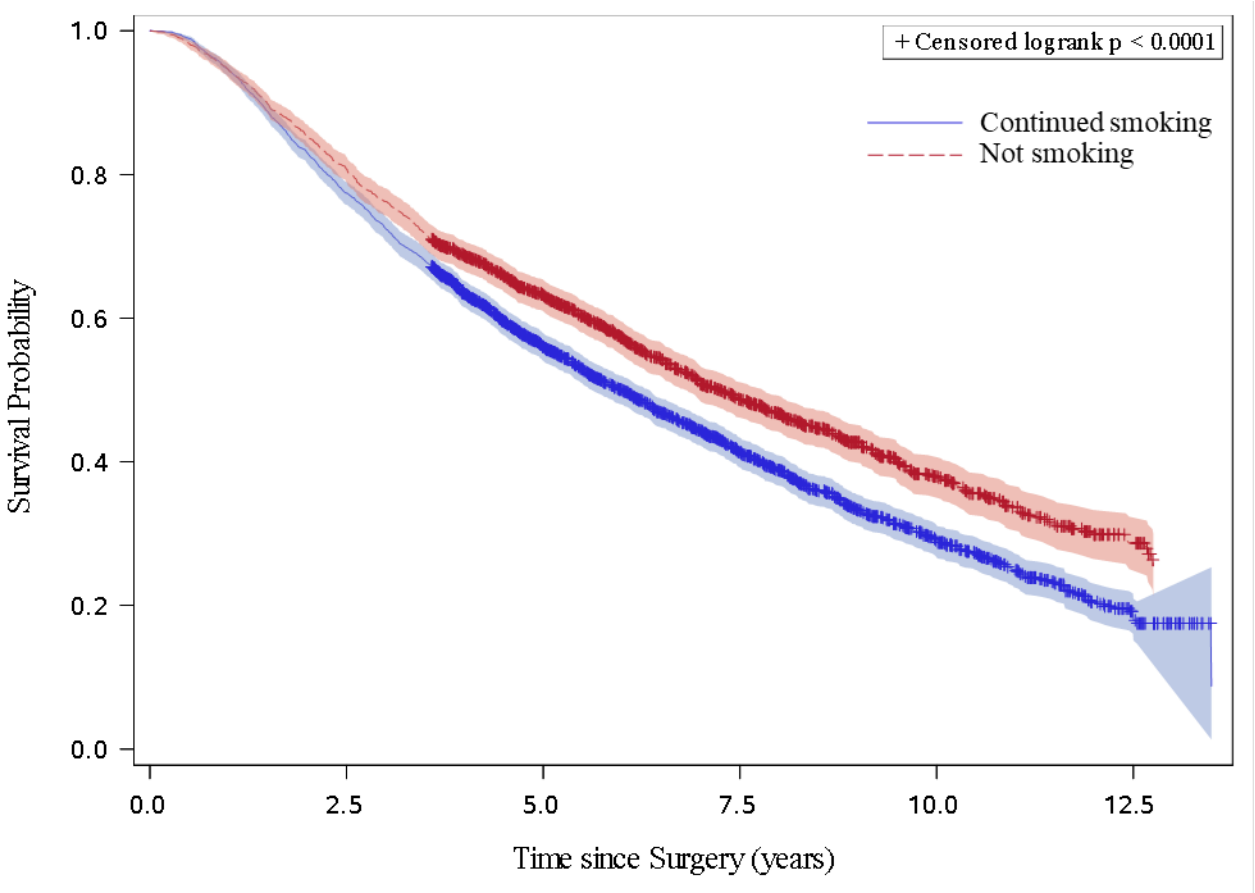
e-Figure 1: Overall Survival Based on Continued Smoking Status 1 Year After Surgical Treatment



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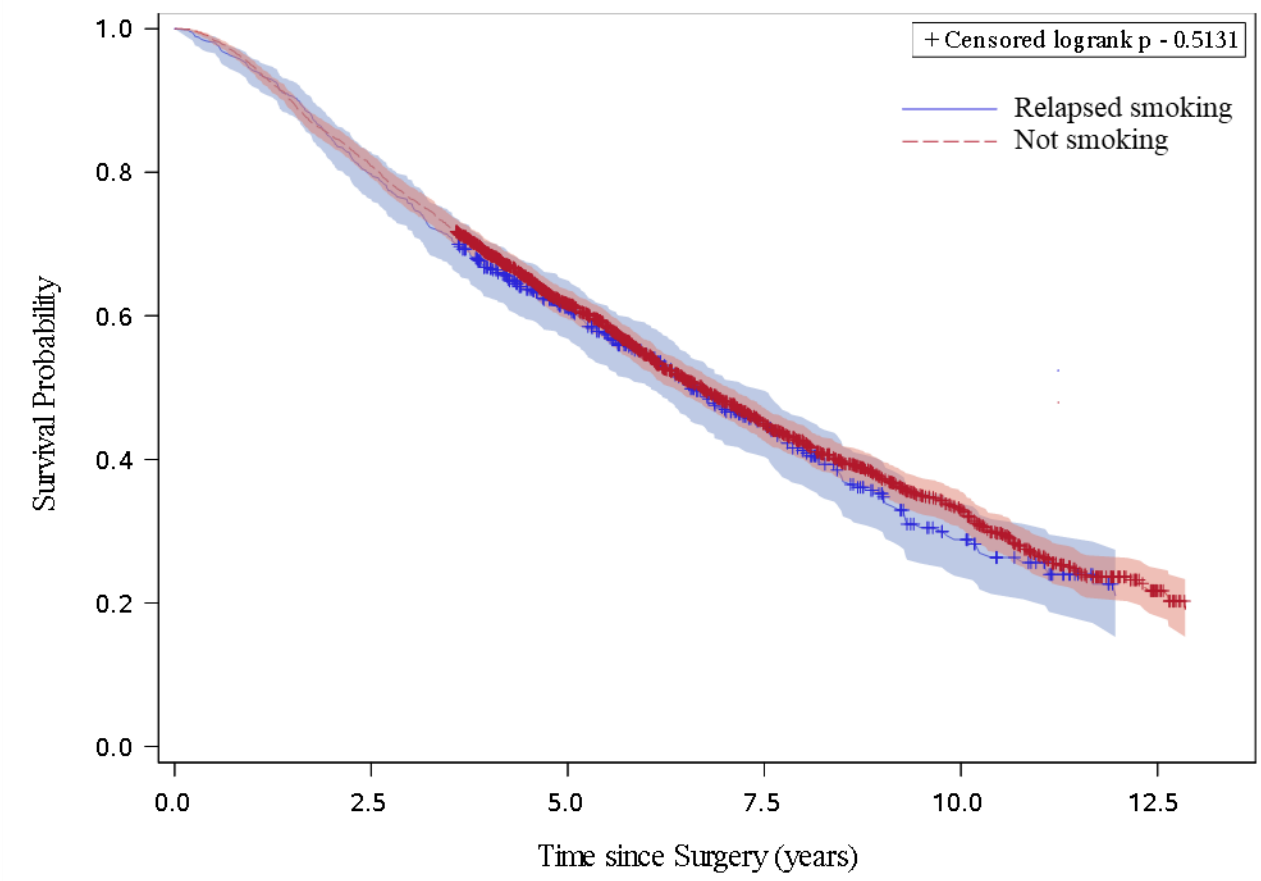
e-Figure 2: Overall Survival Based on Relapsed Smoking Status 1 Year After Surgical Treatment



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