Table S1 Baseline characteristics of patients undergoing lung cancer resection in the National Cancer Database in 2016 stratified by operation type

Factor	Wedge resection	Segmentectomy	Lobectomy	Sleeve lobectomy	Extended lobectomy	Pneumonectomy	Extended pneumonectomy	Other	P value
N	7017	1704	25893	45	1044	1155	16	267	
Age (years), median (IQR)	70.0 (63.0, 75.0)	69.0 (63.0, 75.0)	68.0 (61.0, 74.0)	58.0 (50.0, 66.0)	66.0 (59.0, 73.0)	63.0 (56.0, 70.0)	69.0 (61.0, 74.5)	67.0 (60.0, 73.0)	<0.001
Sex									<0.001
Male	2953 (42.1%)	692 (40.6%)	11854 (45.8%)	26 (57.8%)	526 (50.4%)	730 (63.2%)	7 (43.8%)	151 (56.6%)	
Female	4064 (57.9%)	1012 (59.4%)	14039 (54.2%)	19 (42.2%)	518 (49.6%)	425 (36.8%)	9 (56.3%)	116 (43.4%)	
Race									0.026
White	6082 (86.7%)	1513 (88.8%)	22523 (87.0%)	39 (86.7%)	909 (87.1%)	1006 (87.1%)	16 (100.0%)	227 (85.0%)	
Black	596 (8.5%)	108 (6.3%)	2174 (8.4%)	4 (8.9%)	99 (9.5%)	91 (7.9%)	0 (0.0%)	30 (11.2%)	
Native American	25 (0.4%)	4 (0.2%)	73 (0.3%)	1 (2.2%)	4 (0.4%)	4 (0.3%)	0 (0.0%)	1 (0.4%)	
Asian	192 (2.7%)	55 (3.2%)	796 (3.1%)	1 (2.2%)	22 (2.1%)	31 (2.7%)	0 (0.0%)	7 (2.6%)	
Unknown	122 (1.7%)	24 (1.4%)	327 (1.3%)	0 (0.0%)	10 (1.0%)	23 (2.0%)	0 (0.0%)	2 (0.7%)	
CDCC Score[1]									<0.001
0	3710 (52.9%)	880 (51.6%)	14640 (56.5%)	25 (55.6%)	608 (58.2%)	702 (60.8%)	7 (43.8%)	164 (61.4%)	
1	1892 (27.0%)	484 (28.4%)	6707 (25.9%)	15 (33.3%)	266 (25.5%)	280 (24.2%)	6 (37.5%)	74 (27.7%)	
2	844 (12.0%)	212 (12.4%)	2752 (10.6%)	3 (6.7%)	108 (10.3%)	105 (9.1%)	1 (6.3%)	21 (7.9%)	
≥3	571 (8.1%)	128 (7.5%)	1794 (6.9%)	2 (4.4%)	62 (5.9%)	68 (5.9%)	2 (12.5%)	8 (3.0%)	
Clinical T Status									<0.001
T1a	1307 (18.6%)	226 (13.3%)	1438 (5.6%)	4 (8.9%)	26 (2.5%)	13 (1.1%)	0 (0.0%)	11 (4.1%)	
T1b	3083 (43.9%)	767 (45.0%)	7553 (29.2%)	14 (31.1%)	129 (12.4%)	69 (6.0%)	0 (0.0%)	23 (8.6%)	
T1c	1047 (14.9%)	339 (19.9%)	5547 (21.4%)	4 (8.9%)	117 (11.2%)	79 (6.8%)	1 (6.3%)	24 (9.0%)	
T2a	587 (8.4%)	208 (12.2%)	4932 (19.0%)	9 (20.0%)	169 (16.2%)	200 (17.3%)	0 (0.0%)	27 (10.1%)	
T2b	139 (2.0%)	44 (2.6%)	1918 (7.4%)	4 (8.9%)	107 (10.2%)	140 (12.1%)	2 (12.5%)	12 (4.5%)	
T3	315 (4.5%)	71 (4.2%)	2625 (10.1%)	3 (6.7%)	250 (23.9%)	302 (26.1%)	5 (31.3%)	36 (13.5%)	
T4	373 (5.3%)	28 (1.6%)	1505 (5.8%)	7 (15.6%)	222 (21.3%)	322 (27.9%)	6 (37.5%)	73 (27.3%)	
Unknown	166 (2.4%)	21 (1.2%)	375 (1.4%)	0 (0.0%)	24 (2.3%)	30 (2.6%)	2 (12.5%)	61 (22.8%)	
Clinical N Status									<0.001
N0	5759 (82.1%)	1513 (88.8%)	21012 (81.1%)	34 (75.6%)	744 (71.3%)	646 (55.9%)	8 (50.0%)	96 (36.0%)	
N1	171 (2.4%)	30 (1.8%)	1583 (6.1%)	2 (4.4%)	119 (11.4%)	231 (20.0%)	3 (18.8%)	24 (9.0%)	
N2	291 (4.1%)	28 (1.6%)	1377 (5.3%)	3 (6.7%)	98 (9.4%)	161 (13.9%)	1 (6.3%)	71 (26.6%)	
N3	66 (0.9%)	2 (0.1%)	97 (0.4%)	0 (0.0%)	7 (0.7%)	7 (0.6%)	1 (6.3%)	26 (9.7%)	
Unknown	730 (10.4%)	131 (7.7%)	1824 (7.0%)	6 (13.3%)	76 (7.3%)	110 (9.5%)	3 (18.8%)	50 (18.7%)	
Tumor Size (mm), median (IQR)	15.0 (11.0, 22.0)	18.0 (13.0, 25.0)	25.0 (17.0, 37.0)	24.0 (14.0, 40.0)	41.0 (25.0, 60.0)	50.0 (35.0, 70.0)	69.0 (50.0, 131.0)	37.0 (22.0, 65.0)	<0.001
Tumor Location									<0.001
Main Bronchus	6 (0.1%)	4 (0.2%)	72 (0.3%)	10 (22.2%)	10 (1.0%)	120 (10.4%)	1 (6.3%)	24 (9.0%)	
Right Upper Lobe	2173 (31.0%)	325 (19.1%)	8628 (33.3%)	17 (37.8%)	395 (37.8%)	200 (17.3%)	0 (0.0%)	57 (21.3%)	
Right Middle Lobe	367 (5.2%)	23 (1.3%)	1703 (6.6%)	3 (6.7%)	70 (6.7%)	35 (3.0%)	1 (6.3%)	9 (3.4%)	
Right Lower Lobe	1270 (18.1%)	370 (21.7%)	4849 (18.7%)	2 (4.4%)	195 (18.7%)	95 (8.2%)	1 (6.3%)	32 (12.0%)	
Left Upper Lobe	1879 (26.8%)	569 (33.4%)	6224 (24.0%)	3 (6.7%)	156 (14.9%)	330 (28.6%)	7 (43.8%)	48 (18.0%)	
Left Lower Lobe	1022 (14.6%)	359 (21.1%)	3843 (14.8%)	5 (11.1%)	81 (7.8%)	193 (16.7%)	1 (6.3%)	36 (13.5%)	
Bilateral	4 (0.1%)	0 (0.0%)	4 (<1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Overlapping Lesion of the Lung	48 (0.7%)	9 (0.5%)	231 (0.9%)	3 (6.7%)	96 (9.2%)	114 (9.9%)	3 (18.8%)	2 (0.7%)	
Unknown	248 (3.5%)	45 (2.6%)	339 (1.3%)	2 (4.4%)	41 (3.9%)	68 (5.9%)	2 (12.5%)	59 (22.1%)	
Histology									<0.001
Adenocarcinoma	3815 (54.4%)	932 (54.7%)	13838 (53.4%)	1 (2.2%)	445 (42.6%)	329 (28.5%)	7 (43.8%)	115 (43.1%)	
Squamous Cell Carcinoma	1295 (18.5%)	329 (19.3%)	5910 (22.8%)	12 (26.7%)	341 (32.7%)	579 (50.1%)	4 (25.0%)	64 (24.0%)	
Large Cell Carcinoma	91 (1.3%)	29 (1.7%)	440 (1.7%)	2 (4.4%)	31 (3.0%)	21 (1.8%)	1 (6.3%)	4 (1.5%)	
Adenosquamous Cell Carcinoma	127 (1.8%)	24 (1.4%)	557 (2.2%)	1 (2.2%)	33 (3.2%)	18 (1.6%)	0 (0.0%)	5 (1.9%)	
Carcinoid	633 (9.0%)	132 (7.7%)	1677 (6.5%)	20 (44.4%)	64 (6.1%)	67 (5.8%)	1 (6.3%)	20 (7.5%)	
Tumors Formerly Classified as Bronchioalveolar Carcinoma	637 (9.1%)	179 (10.5%)	2078 (8.0%)	1 (2.2%)	54 (5.2%)	54 (4.7%)	0 (0.0%)	2 (0.7%)	
Non-Small Cell Lung Cancer, Not Otherwise Specified	69 (1.0%)	11 (0.6%)	349 (1.3%)	2 (4.4%)	20 (1.9%)	17 (1.5%)	0 (0.0%)	13 (4.9%)	
Small Cell Lung Cancer	173 (2.5%)	29 (1.7%)	412 (1.6%)	0 (0.0%)	9 (0.9%)	13 (1.1%)	0 (0.0%)	23 (8.6%)	
Carcinoma	17 (0.2%)	6 (0.4%)	97 (0.4%)	1 (2.2%)	12 (1.1%)	5 (0.4%)	0 (0.0%)	1 (0.4%)	
Other	160 (2.3%)	33 (1.9%)	535 (2.1%)	5 (11.1%)	35 (3.4%)	52 (4.5%)	3 (18.8%)	20 (7.5%)	
Grade									<0.001
Well-differentiated	1411 (20.1%)	341 (20.0%)	4256 (16.4%)	15 (33.3%)	109 (10.4%)	88 (7.6%)	1 (6.3%)	13 (4.9%)	
Moderately-differentiated	2689 (38.3%)	731 (42.9%)	10492 (40.5%)	7 (15.6%)	340 (32.6%)	412 (35.7%)	3 (18.8%)	49 (18.4%)	
Poorly Differentiated	1649 (23.5%)	381 (22.4%)	7515 (29.0%)	14 (31.1%)	405 (38.8%)	468 (40.5%)	10 (62.5%)	81 (30.3%)	
Undifferentiated	124 (1.8%)	24 (1.4%)	419 (1.6%)	0 (0.0%)	25 (2.4%)	19 (1.6%)	0 (0.0%)	4 (1.5%)	
Unknown	1144 (16.3%)	227 (13.3%)	3211 (12.4%)	9 (20.0%)	165 (15.8%)	168 (14.5%)	2 (12.5%)	120 (44.9%)	
Insurance Status									<0.001
Uninsured	67 (1.0%)	11 (0.6%)	302 (1.2%)	2 (4.4%)	16 (1.5%)	26 (2.3%)	1 (6.3%)	7 (2.6%)	
Private Insurance/managed care	1745 (24.9%)	439 (25.8%)	7802 (30.1%)	22 (48.9%)	339 (32.5%)	466 (40.3%)	6 (37.5%)	79 (29.6%)	
Medicaid	348 (5.0%)	79 (4.6%)	1516 (5.9%)	6 (13.3%)	69 (6.6%)	99 (8.6%)	0 (0.0%)	23 (8.6%)	
Medicare	4707 (67.1%)	1140 (66.9%)	15631 (60.4%)	13 (28.9%)	595 (57.0%)	517 (44.8%)	9 (56.3%)	148 (55.4%)	
Other Government	78 (1.1%)	14 (0.8%)	380 (1.5%)	0 (0.0%)	13 (1.2%)	33 (2.9%)	0 (0.0%)	8 (3.0%)	
Unknown	72 (1.1%)	21 (1.2%)	262 (1.0%)	2 (4.4%)	12 (1.1%)	14 (1.2%)	0 (0.0%)	2 (0.7%)	
Facility Type									<0.001
Community Cancer Program	406 (5.8%)	117 (6.9%)	1451 (5.6%)	1 (2.2%)	66 (6.3%)	78 (6.8%)	0 (0.0%)	34 (12.7%)	
Comprehensive Community Cancer Program	2610 (37.2%)	562 (33.0%)	10371 (40.1%)	5 (11.1%)	417 (39.9%)	401 (34.7%)	5 (31.3%)	112 (41.9%)	
Academic/research Program	3138 (44.7%)	755 (44.3%)	10182 (39.3%)	30 (66.7%)	428 (41.0%)	484 (41.9%)	10 (62.5%)	91 (34.1%)	
Integrated Cancer Network	829 (11.8%)	260 (15.3%)	3656 (14.1%)	2 (4.4%)	111 (10.6%)	158 (13.7%)	0 (0.0%)	26 (9.7%)	
Unknown	34 (0.5%)	10 (0.6%)	233 (0.9%)	7 (15.6%)	22 (2.1%)	34 (2.9%)	1 (6.3%)	4 (1.5%)	
Distance from the Hospital (miles), median (IQR)	11.6 (5.0, 27.5)	11.4 (5.2, 26.5)	12.1 (5.4, 28.3)	18.2 (11.8, 60.3)	13.1 (5.5, 33.3)	16.4 (6.4, 39.8)	28.0 (6.5, 81.8)	11.7 (4.7, 31.5)	<0.001
Income ($)[2]									<0.001
<40,227	967 (13.8%)	189 (11.1%)	3931 (15.2%)	6 (13.3%)	174 (16.7%)	213 (18.4%)	3 (18.8%)	51 (19.1%)	
40227-50353	1215 (17.3%)	290 (17.0%)	4846 (18.7%)	8 (17.8%)	201 (19.3%)	240 (20.8%)	4 (25.0%)	57 (21.3%)	
50354-63332	1429 (20.4%)	307 (18.0%)	5419 (20.9%)	9 (20.0%)	214 (20.5%)	246 (21.3%)	4 (25.0%)	47 (17.6%)	
>63332	2494 (35.5%)	628 (36.9%)	7916 (30.6%)	12 (26.7%)	302 (28.9%)	309 (26.8%)	5 (31.3%)	79 (29.6%)	
Unknown	912 (13.0%)	290 (17.0%)	3781 (14.6%)	10 (22.2%)	153 (14.7%)	147 (12.7%)	0 (0.0%)	33 (12.4%)	
Education[3]									<0.001
≥17.6%	1146 (16.3%)	225 (13.2%)	4251 (16.4%)	7 (15.6%)	179 (17.1%)	211 (18.3%)	2 (12.5%)	68 (25.5%)	
10.9-17.5%	1577 (22.5%)	374 (21.9%)	6082 (23.5%)	13 (28.9%)	258 (24.7%)	298 (25.8%)	4 (25.0%)	57 (21.3%)	
6.3-10.8%	1805 (25.7%)	430 (25.2%)	6571 (25.4%)	7 (15.6%)	252 (24.1%)	283 (24.5%)	5 (31.3%)	53 (19.9%)	
<6.3%	1588 (22.6%)	386 (22.7%)	5251 (20.3%)	8 (17.8%)	207 (19.8%)	218 (18.9%)	5 (31.3%)	56 (21.0%)	
Unknown	901 (12.8%)	289 (17.0%)	3738 (14.4%)	10 (22.2%)	148 (14.2%)	145 (12.6%)	0 (0.0%)	33 (12.4%)	
Surgical Approach									<0.001
Open	2430 (34.6%)	609 (35.7%)	11040 (42.6%)	23 (51.1%)	581 (55.7%)	797 (69.0%)	13 (81.3%)	88 (33.0%)	
Video-assisted Thoracoscopic Surgery	3539 (50.4%)	774 (45.4%)	9056 (35.0%)	15 (33.3%)	279 (26.7%)	192 (16.6%)	0 (0.0%)	114 (42.7%)	
Robotic	750 (10.7%)	273 (16.0%)	4303 (16.6%)	4 (8.9%)	77 (7.4%)	39 (3.4%)	0 (0.0%)	8 (3.0%)	
Unknown	298 (4.2%)	48 (2.8%)	1494 (5.8%)	3 (6.7%)	107 (10.2%)	127 (11.0%)	3 (18.8%)	57 (21.3%)	

[1], CDCC = Charlson comorbidity score; [2], National Cancer Database (NCDB) codes income level as average household income of the zip code where the patient lives; [3], NCDB codes education level as the number of adults age 25 or older in the patient's zip code who did not graduate from high school.

Table S2 Baseline characteristics of patients undergoing lung cancer resection in the National Cancer Database in 2017 stratified by operation type

Factor	Wedge resection	Segmentectomy	Lobectomy	Sleeve lobectomy	Extended lobectomy	Pneumonectomy	Extended pneumonectomy	Other	P value
N	6692	1814	26008	52	927	1017	24	310	
Age (years), median (IQR)	70.0 (63.0, 75.0)	69.0 (63.0, 75.0)	68.0 (61.0, 74.0)	58.0 (37.0, 69.0)	67.0 (59.0, 73.0)	63.0 (56.0, 70.0)	65.5 (59.5, 70.5)	66.0 (59.0, 72.0)	<0.001
Sex									<0.001
Male	2756 (41.2%)	716 (39.5%)	11386 (43.8%)	27 (51.9%)	487 (52.5%)	620 (61.0%)	15 (62.5%)	166 (53.5%)	
Female	3936 (58.8%)	1098 (60.5%)	14622 (56.2%)	25 (48.1%)	440 (47.5%)	397 (39.0%)	9 (37.5%)	144 (46.5%)	
Race									0.008
White	5815 (86.9%)	1604 (88.4%)	22503 (86.5%)	42 (80.8%)	790 (85.2%)	894 (87.9%)	19 (79.2%)	265 (85.5%)	
Black	566 (8.5%)	124 (6.8%)	2210 (8.5%)	7 (13.5%)	94 (10.1%)	71 (7.0%)	4 (16.7%)	32 (10.3%)	
Native American	21 (0.3%)	6 (0.3%)	81 (0.3%)	0 (0.0%)	7 (0.8%)	5 (0.5%)	1 (4.2%)	1 (0.3%)	
Asian	187 (2.8%)	50 (2.8%)	858 (3.3%)	1 (1.9%)	23 (2.5%)	29 (2.9%)	0 (0.0%)	10 (3.2%)	
Unknown	103 (1.5%)	30 (1.7%)	356 (1.4%)	2 (3.8%)	13 (1.4%)	18 (1.8%)	0 (0.0%)	2 (0.6%)	
CDCC Score[1]									<0.001
0	3553 (53.1%)	918 (50.6%)	14820 (57.0%)	27 (51.9%)	548 (59.1%)	618 (60.8%)	13 (54.2%)	185 (59.7%)	
1	1718 (25.7%)	524 (28.9%)	6641 (25.5%)	17 (32.7%)	236 (25.5%)	262 (25.8%)	4 (16.7%)	68 (21.9%)	
2	783 (11.7%)	204 (11.2%)	2675 (10.3%)	4 (7.7%)	91 (9.8%)	89 (8.8%)	4 (16.7%)	32 (10.3%)	
≥3	638 (9.5%)	168 (9.3%)	1872 (7.2%)	4 (7.7%)	52 (5.6%)	48 (4.7%)	3 (12.5%)	25 (8.1%)	
Clinical T Status									<0.001
T1a	1239 (18.5%)	223 (12.3%)	1579 (6.1%)	5 (9.6%)	19 (2.0%)	31 (3.0%)	0 (0.0%)	22 (7.1%)	
T1b	3014 (45.0%)	902 (49.7%)	7916 (30.4%)	12 (23.1%)	129 (13.9%)	50 (4.9%)	1 (4.2%)	35 (11.3%)	
T1c	1000 (14.9%)	366 (20.2%)	5642 (21.7%)	8 (15.4%)	115 (12.4%)	75 (7.4%)	2 (8.3%)	25 (8.1%)	
T2a	565 (8.4%)	181 (10.0%)	4723 (18.2%)	13 (25.0%)	136 (14.7%)	167 (16.4%)	2 (8.3%)	30 (9.7%)	
T2b	115 (1.7%)	30 (1.7%)	1942 (7.5%)	7 (13.5%)	89 (9.6%)	122 (12.0%)	0 (0.0%)	18 (5.8%)	
T3	280 (4.2%)	65 (3.6%)	2660 (10.2%)	4 (7.7%)	214 (23.1%)	276 (27.1%)	5 (20.8%)	37 (11.9%)	
T4	319 (4.8%)	38 (2.1%)	1312 (5.0%)	1 (1.9%)	212 (22.9%)	266 (26.2%)	13 (54.2%)	80 (25.8%)	
Unknown	160 (2.4%)	9 (0.5%)	234 (0.9%)	2 (3.8%)	13 (1.4%)	30 (2.9%)	1 (4.2%)	63 (20.3%)	
Clinical N Status									<0.001
N0	5410 (80.8%)	1595 (87.9%)	21321 (82.0%)	34 (65.4%)	672 (72.5%)	556 (54.7%)	11 (45.8%)	139 (44.8%)	
N1	146 (2.2%)	32 (1.8%)	1435 (5.5%)	5 (9.6%)	102 (11.0%)	211 (20.7%)	4 (16.7%)	22 (7.1%)	
N2	285 (4.3%)	38 (2.1%)	1315 (5.1%)	6 (11.5%)	77 (8.3%)	140 (13.8%)	6 (25.0%)	65 (21.0%)	
N3	69 (1.0%)	6 (0.3%)	74 (0.3%)	0 (0.0%)	7 (0.8%)	15 (1.5%)	0 (0.0%)	28 (9.0%)	
Unknown	782 (11.7%)	143 (7.9%)	1863 (7.2%)	7 (13.5%)	69 (7.4%)	95 (9.3%)	3 (12.5%)	56 (18.1%)	
Tumor Size (mm), median (IQR)	15.0 (11.0, 22.0)	18.0 (13.0, 24.0)	25.0 (16.0, 36.0)	23.0 (15.0, 38.0)	40.0 (25.0, 64.0)	47.0 (32.0, 70.0)	77.0 (34.0, 110.0)	35.0 (19.0, 58.0)	<0.001
Tumor Location									<0.001
Main Bronchus	9 (0.1%)	6 (0.3%)	69 (0.3%)	12 (23.1%)	12 (1.3%)	89 (8.8%)	0 (0.0%)	38 (12.3%)	
Right Upper Lobe	2047 (30.6%)	392 (21.6%)	8625 (33.2%)	22 (42.3%)	314 (33.9%)	156 (15.3%)	4 (16.7%)	48 (15.5%)	
Right Middle Lobe	324 (4.8%)	22 (1.2%)	1768 (6.8%)	6 (11.5%)	81 (8.7%)	28 (2.8%)	0 (0.0%)	17 (5.5%)	
Right Lower Lobe	1216 (18.2%)	358 (19.7%)	4795 (18.4%)	3 (5.8%)	166 (17.9%)	86 (8.5%)	4 (16.7%)	39 (12.6%)	
Left Upper Lobe	1771 (26.5%)	632 (34.8%)	6255 (24.1%)	2 (3.8%)	148 (16.0%)	324 (31.9%)	7 (29.2%)	64 (20.6%)	
Left Lower Lobe	1002 (15.0%)	351 (19.3%)	3924 (15.1%)	5 (9.6%)	76 (8.2%)	166 (16.3%)	2 (8.3%)	30 (9.7%)	
Bilateral	6 (0.1%)	1 (0.1%)	2 (<1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.3%)	
Overlapping Lesion of the Lung	61 (0.9%)	15 (0.8%)	189 (0.7%)	0 (0.0%)	87 (9.4%)	109 (10.7%)	4 (16.7%)	10 (3.2%)	
Unknown	256 (3.8%)	37 (2.0%)	381 (1.5%)	2 (3.8%)	43 (4.6%)	59 (5.8%)	3 (12.5%)	63 (20.3%)	
Histology									<0.001
Adenocarcinoma	3693 (55.2%)	957 (52.8%)	14111 (54.3%)	4 (7.7%)	367 (39.6%)	321 (31.6%)	8 (33.3%)	129 (41.6%)	
Squamous Cell Carcinoma	1256 (18.8%)	380 (20.9%)	5814 (22.4%)	14 (26.9%)	322 (34.7%)	498 (49.0%)	7 (29.2%)	83 (26.8%)	
Large Cell Carcinoma	107 (1.6%)	26 (1.4%)	414 (1.6%)	1 (1.9%)	20 (2.2%)	11 (1.1%)	1 (4.2%)	0 (0.0%)	
Adenosquamous Cell Carcinoma	121 (1.8%)	28 (1.5%)	462 (1.8%)	0 (0.0%)	22 (2.4%)	23 (2.3%)	1 (4.2%)	4 (1.3%)	
Carcinoid	559 (8.4%)	131 (7.2%)	1727 (6.6%)	24 (46.2%)	79 (8.5%)	61 (6.0%)	2 (8.3%)	27 (8.7%)	
Tumors Formerly Classified as Bronchioloalveolar Carcinoma	559 (8.4%)	205 (11.3%)	2192 (8.4%)	1 (1.9%)	55 (5.9%)	29 (2.9%)	1 (4.2%)	8 (2.6%)	
Non-Small Cell Lung Cancer, Not Otherwise Specified	62 (0.9%)	14 (0.8%)	258 (1.0%)	0 (0.0%)	20 (2.2%)	19 (1.9%)	1 (4.2%)	10 (3.2%)	
Small Cell Lung Cancer	186 (2.8%)	33 (1.8%)	395 (1.5%)	0 (0.0%)	11 (1.2%)	10 (1.0%)	0 (0.0%)	25 (8.1%)	
Carcinoma	16 (0.2%)	9 (0.5%)	101 (0.4%)	0 (0.0%)	5 (0.5%)	9 (0.9%)	1 (4.2%)	1 (0.3%)	
Other	133 (2.0%)	31 (1.7%)	534 (2.1%)	8 (15.4%)	26 (2.8%)	36 (3.5%)	2 (8.3%)	23 (7.4%)	
Grade									<0.001
Well-differentiated	1349 (20.2%)	355 (19.6%)	4137 (15.9%)	15 (28.8%)	96 (10.4%)	66 (6.5%)	0 (0.0%)	20 (6.5%)	
Moderately-differentiated	2559 (38.2%)	752 (41.5%)	10691 (41.1%)	11 (21.2%)	302 (32.6%)	339 (33.3%)	7 (29.2%)	65 (21.0%)	
Poorly Differentiated	1498 (22.4%)	415 (22.9%)	7198 (27.7%)	9 (17.3%)	365 (39.4%)	436 (42.9%)	10 (41.7%)	84 (27.1%)	
Undifferentiated	109 (1.6%)	24 (1.3%)	366 (1.4%)	0 (0.0%)	17 (1.8%)	19 (1.9%)	1 (4.2%)	9 (2.9%)	
Unknown	1177 (17.6%)	268 (14.8%)	3616 (13.9%)	17 (32.7%)	147 (15.9%)	157 (15.4%)	6 (25.0%)	132 (42.6%)	
Insurance Status									<0.001
Uninsured	53 (0.8%)	9 (0.5%)	284 (1.1%)	1 (1.9%)	8 (0.9%)	24 (2.4%)	0 (0.0%)	11 (3.5%)	
Private Insurance/managed care	1621 (24.2%)	469 (25.9%)	7527 (28.9%)	22 (42.3%)	264 (28.5%)	401 (39.4%)	10 (41.7%)	90 (29.0%)	
Medicaid	346 (5.2%)	86 (4.7%)	1554 (6.0%)	5 (9.6%)	70 (7.6%)	96 (9.4%)	2 (8.3%)	21 (6.8%)	
Medicare	4528 (67.7%)	1222 (67.4%)	16012 (61.6%)	22 (42.3%)	552 (59.5%)	461 (45.3%)	11 (45.8%)	180 (58.1%)	
Other Government	81 (1.2%)	15 (0.8%)	402 (1.5%)	2 (3.8%)	20 (2.2%)	19 (1.9%)	1 (4.2%)	7 (2.3%)	
Unknown	63 (0.9%)	13 (0.7%)	229 (0.8%)	0 (0.0%)	13 (1.4%)	16 (1.6%)	0 (0.0%)	1 (0.3%)	
Facility Type									<0.001
Community Cancer Program	365 (5.5%)	94 (5.2%)	1314 (5.1%)	0 (0.0%)	65 (7.0%)	70 (6.9%)	1 (4.2%)	20 (6.5%)	
Comprehensive Community Cancer Program	2320 (34.7%)	551 (30.4%)	10384 (39.9%)	11 (21.2%)	349 (37.6%)	356 (35.0%)	4 (16.7%)	118 (38.1%)	
Academic/research Program	3185 (47.6%)	938 (51.7%)	10479 (40.3%)	21 (40.4%)	389 (42.0%)	428 (42.1%)	15 (62.5%)	130 (41.9%)	
Integrated Cancer Network	792 (11.8%)	222 (12.2%)	3590 (13.8%)	6 (11.5%)	104 (11.2%)	137 (13.5%)	3 (12.5%)	34 (11.0%)	
Unknown	30 (0.4%)	9 (0.5%)	241 (0.9%)	14 (26.9%)	20 (2.2%)	26 (2.6%)	1 (4.2%)	8 (2.6%)	
Distance from the Hospital (miles), median (IQR)	12.5 (5.6, 28.9)	13.1 (5.7, 31.9)	12.5 (5.5, 29.4)	17.5 (7.6, 54.3)	14.4 (6.0, 30.7)	15.2 (6.9, 36.2)	14.6 (5.7, 70.7)	14.8 (5.0, 37.6)	<0.001
Income ($)[2]									<0.001
<40,227	945 (14.1%)	209 (11.5%)	3902 (15.0%)	9 (17.3%)	134 (14.5%)	150 (14.7%)	4 (16.7%)	56 (18.1%)	
40227-50353	1153 (17.2%)	307 (16.9%)	4774 (18.4%)	9 (17.3%)	218 (23.5%)	202 (19.9%)	3 (12.5%)	58 (18.7%)	
50354-63332	1323 (19.8%)	320 (17.6%)	5256 (20.2%)	12 (23.1%)	190 (20.5%)	230 (22.6%)	4 (16.7%)	71 (22.9%)	
>63332	2284 (34.1%)	666 (36.7%)	7985 (30.7%)	15 (28.8%)	247 (26.6%)	275 (27.0%)	9 (37.5%)	71 (22.9%)	
Unknown	987 (14.7%)	312 (17.2%)	4091 (15.7%)	7 (13.5%)	138 (14.9%)	160 (15.7%)	4 (16.7%)	54 (17.4%)	
Education[3]									<0.001
≥17.6	1053 (15.7%)	247 (13.6%)	4197 (16.1%)	11 (21.2%)	147 (15.9%)	171 (16.8%)	1 (4.2%)	64 (20.6%)	
10.9-17.5	1457 (21.8%)	362 (20.0%)	5881 (22.6%)	18 (34.6%)	224 (24.2%)	250 (24.6%)	6 (25.0%)	68 (21.9%)	
6.3-10.8	1686 (25.2%)	445 (24.5%)	6558 (25.2%)	6 (11.5%)	246 (26.5%)	254 (25.0%)	6 (25.0%)	78 (25.2%)	
<6.3	1523 (22.8%)	448 (24.7%)	5323 (20.5%)	10 (19.2%)	173 (18.7%)	184 (18.1%)	7 (29.2%)	48 (15.5%)	
Unknown	973 (14.5%)	312 (17.2%)	4049 (15.6%)	7 (13.5%)	137 (14.8%)	158 (15.5%)	4 (16.7%)	52 (16.8%)	
Surgical Approach									<0.001
Open	2074 (31.0%)	536 (29.5%)	9878 (38.0%)	33 (63.5%)	508 (54.8%)	656 (64.5%)	17 (70.8%)	112 (36.1%)	
Video-assisted Thoracoscopic Surgery	3363 (50.3%)	794 (43.8%)	9117 (35.1%)	10 (19.2%)	230 (24.8%)	168 (16.5%)	4 (16.7%)	124 (40.0%)	
Robotic	941 (14.1%)	417 (23.0%)	5441 (20.9%)	4 (7.7%)	90 (9.7%)	76 (7.5%)	1 (4.2%)	21 (6.8%)	
Unknown	314 (4.7%)	67 (3.7%)	1572 (6.0%)	5 (9.6%)	99 (10.7%)	117 (11.5%)	2 (8.3%)	53 (17.1%)	

[1], CDCC = Charlson comorbidity score; [2], National Cancer Database (NCDB) codes income level as average household income of the zip code where the patient lives; [3], NCDB codes education level as the number of adults age 25 or older in the patient's zip code who did not graduate from high school.

Table S3 Pathologic characteristics and perioperative outcomes of patients undergoing lung cancer resection in the National Cancer Database in 2016 stratified by operation type

Factor	Wedge resection	Segmentectomy	Lobectomy	Sleeve lobectomy	Extended lobectomy	Pneumonectomy	Extended pneumonectomy	Other	P value
N	7017	1704	25893	45	1044	1155	16	267	
Pathologic T Status									<0.001
T1a	1155 (16.5%)	204 (12.0%)	1313 (5.1%)	4 (8.9%)	26 (2.5%)	15 (1.3%)	0 (0.0%)	11 (4.1%)	
T1b	2510 (35.8%)	623 (36.6%)	6204 (24.0%)	15 (33.3%)	100 (9.6%)	51 (4.4%)	0 (0.0%)	29 (10.9%)	
T1c	773 (11.0%)	271 (15.9%)	4646 (17.9%)	4 (8.9%)	95 (9.1%)	55 (4.8%)	0 (0.0%)	26 (9.7%)	
T2a	1327 (18.9%)	350 (20.5%)	6439 (24.9%)	10 (22.2%)	177 (17.0%)	207 (17.9%)	1 (6.3%)	33 (12.4%)	
T2b	129 (1.8%)	43 (2.5%)	1800 (7.0%)	4 (8.9%)	86 (8.2%)	123 (10.6%)	2 (12.5%)	14 (5.2%)	
T3	587 (8.4%)	140 (8.2%)	3564 (13.8%)	4 (8.9%)	296 (28.4%)	332 (28.7%)	5 (31.3%)	36 (13.5%)	
T4	342 (4.9%)	50 (2.9%)	1537 (5.9%)	4 (8.9%)	241 (23.1%)	345 (29.9%)	6 (37.5%)	46 (17.2%)	
Unknown	194 (2.8%)	23 (1.3%)	390 (1.5%)	0 (0.0%)	23 (2.2%)	27 (2.3%)	2 (12.5%)	72 (27.0%)	
Pathologic N Status									<0.001
N0	4818 (68.7%)	1461 (85.7%)	19998 (77.2%)	30 (66.7%)	717 (68.7%)	446 (38.6%)	5 (31.3%)	60 (22.5%)	
N1	176 (2.5%)	75 (4.4%)	3290 (12.7%)	12 (26.7%)	169 (16.2%)	476 (41.2%)	7 (43.8%)	14 (5.2%)	
N2	296 (4.2%)	67 (3.9%)	2160 (8.3%)	1 (2.2%)	115 (11.0%)	211 (18.3%)	4 (25.0%)	15 (5.6%)	
N3	9 (0.1%)	1 (0.1%)	17 (0.1%)	0 (0.0%)	3 (0.3%)	7 (0.6%)	0 (0.0%)	6 (2.2%)	
Unknown	1718 (24.5%)	100 (5.9%)	428 (1.7%)	2 (4.4%)	40 (3.8%)	15 (1.3%)	0 (0.0%)	172 (64.4%)	
Pathologic M Status									<0.001
M0	5326 (75.9%)	1457 (85.5%)	22640 (87.4%)	37 (82.2%)	836 (80.1%)	936 (81.0%)	9 (56.3%)	82 (30.7%)	
M1	470 (6.7%)	41 (2.4%)	469 (1.8%)	3 (6.7%)	41 (3.9%)	33 (2.9%)	2 (12.5%)	69 (25.8%)	
Unknown	1221 (17.4%)	206 (12.1%)	2784 (10.8%)	5 (11.1%)	167 (16.0%)	186 (16.1%)	5 (31.3%)	116 (43.4%)	
Number of Lymph Nodes Examined	4093 (60.9%)	1462 (89.6%)	24524 (98.7%)	41 (97.6%)	939 (96.4%)	1095 (99.1%)	14 (100.0%)	97 (39.6%)	<0.001
Number of Lymph Nodes Examined, median (IQR)	2.0 (0.0, 6.0)	6.0 (3.0, 10.0)	11.0 (7.0, 17.0)	9.0 (5.0, 22.0)	12.0 (7.0, 20.0)	16.0 (11.0, 24.0)	16.0 (7.5, 25.5)	0.0 (0.0, 5.0)	<0.001
Surgical Margins									<0.001
Negative Margins	6204 (88.4%)	1615 (94.8%)	24787 (95.7%)	37 (82.2%)	920 (88.1%)	1025 (88.7%)	13 (81.3%)	100 (37.5%)	
Positive Margins	574 (8.2%)	69 (4.0%)	958 (3.7%)	4 (8.9%)	108 (10.3%)	119 (10.3%)	3 (18.8%)	60 (22.5%)	
Unknown	239 (3.4%)	20 (1.2%)	148 (0.6%)	4 (8.9%)	16 (1.5%)	11 (1.0%)	0 (0.0%)	107 (40.1%)	
Length of Stay (Days), median (IQR)	3.0 (2.0, 5.0)	4.0 (2.0, 5.0)	5.0 (3.0, 7.0)	5.0 (4.0, 7.0)	6.0 (4.0, 8.0)	5.0 (4.0, 7.0)	6.0 (4.0, 10.0)	3.0 (0.0, 6.0)	<0.001
30-day Readmission									<0.001
No	6749 (96.2%)	1641 (96.3%)	24727 (95.5%)	42 (93.3%)	992 (95.0%)	1071 (92.7%)	15 (93.8%)	260 (97.4%)	
Yes	237 (3.4%)	49 (2.9%)	981 (3.8%)	2 (4.4%)	38 (3.6%)	70 (6.1%)	1 (6.3%)	5 (1.9%)	
Unknown	31 (0.4%)	14 (0.8%)	185 (0.7%)	1 (2.2%)	14 (1.3%)	14 (1.2%)	0 (0.0%)	2 (0.7%)	
30-day Mortality									<0.001
No	6815 (97.1%)	1669 (97.9%)	25223 (97.4%)	43 (95.6%)	1008 (96.6%)	1077 (93.2%)	16 (100.0%)	223 (83.5%)	
Yes	114 (1.6%)	14 (0.8%)	398 (1.5%)	1 (2.2%)	22 (2.1%)	73 (6.3%)	0 (0.0%)	32 (12.0%)	
Unknown	88 (1.3%)	21 (1.2%)	272 (1.1%)	1 (2.2%)	14 (1.3%)	5 (0.4%)	0 (0.0%)	12 (4.5%)	
90-day Mortality									<0.001
No	6637 (94.6%)	1645 (96.5%)	24615 (95.1%)	41 (91.1%)	969 (92.8%)	1027 (88.9%)	14 (87.5%)	195 (73.0%)	
Yes	234 (3.3%)	30 (1.8%)	763 (2.9%)	3 (6.7%)	50 (4.8%)	113 (9.8%)	2 (12.5%)	57 (21.3%)	
Unknown	146 (2.1%)	29 (1.7%)	515 (2.0%)	1 (2.2%)	25 (2.4%)	15 (1.3%)	0 (0.0%)	15 (5.6%)	

Table S4 Pathologic characteristics and perioperative outcomes of patients undergoing lung cancer resection in the National Cancer Database in 2017 stratified by operation type

Factor	Wedge resection	Segmentectomy	Lobectomy	Sleeve lobectomy	Extended lobectomy	Pneumonectomy	Extended pneumonectomy	Other	P value
N	6692	1814	26008	52	927	1017	24	310	
Pathologic T Status									<0.001
T1a	1101 (16.5%)	205 (11.3%)	1462 (5.6%)	4 (7.7%)	18 (1.9%)	30 (2.9%)	0 (0.0%)	19 (6.1%)	
T1b	2385 (35.6%)	737 (40.6%)	6540 (25.1%)	13 (25.0%)	102 (11.0%)	48 (4.7%)	0 (0.0%)	36 (11.6%)	
T1c	716 (10.7%)	288 (15.9%)	4633 (17.8%)	10 (19.2%)	88 (9.5%)	50 (4.9%)	2 (8.3%)	28 (9.0%)	
T2a	1326 (19.8%)	363 (20.0%)	6334 (24.4%)	9 (17.3%)	148 (16.0%)	150 (14.7%)	0 (0.0%)	41 (13.2%)	
T2b	107 (1.6%)	30 (1.7%)	1837 (7.1%)	5 (9.6%)	71 (7.7%)	111 (10.9%)	0 (0.0%)	21 (6.8%)	
T3	565 (8.4%)	137 (7.6%)	3599 (13.8%)	7 (13.5%)	270 (29.1%)	287 (28.2%)	6 (25.0%)	42 (13.5%)	
T4	317 (4.7%)	44 (2.4%)	1363 (5.2%)	2 (3.8%)	217 (23.4%)	308 (30.3%)	16 (66.7%)	51 (16.5%)	
Unknown	175 (2.6%)	10 (0.6%)	240 (0.9%)	2 (3.8%)	13 (1.4%)	33 (3.2%)	0 (0.0%)	72 (23.2%)	
Pathologic N Status									<0.001
N0	4613 (68.9%)	1539 (84.8%)	20196 (77.7%)	34 (65.4%)	617 (66.6%)	413 (40.6%)	10 (41.7%)	77 (24.8%)	
N1	174 (2.6%)	71 (3.9%)	3175 (12.2%)	8 (15.4%)	179 (19.3%)	412 (40.5%)	7 (29.2%)	25 (8.1%)	
N2	285 (4.3%)	81 (4.5%)	2264 (8.7%)	8 (15.4%)	100 (10.8%)	169 (16.6%)	6 (25.0%)	21 (6.8%)	
N3	10 (0.1%)	3 (0.2%)	20 (0.1%)	0 (0.0%)	1 (0.1%)	3 (0.3%)	0 (0.0%)	4 (1.3%)	
Unknown	1610 (24.1%)	120 (6.6%)	353 (1.4%)	2 (3.8%)	30 (3.2%)	20 (2.0%)	1 (4.2%)	183 (59.0%)	
Pathologic M Status									<0.001
M0	5967 (89.2%)	1743 (96.1%)	25354 (97.5%)	50 (96.2%)	883 (95.3%)	967 (95.1%)	21 (87.5%)	119 (38.4%)	
M1	410 (6.1%)	39 (2.1%)	450 (1.7%)	1 (1.9%)	23 (2.5%)	26 (2.6%)	2 (8.3%)	69 (22.3%)	
Unknown	315 (4.7%)	32 (1.8%)	204 (0.8%)	1 (1.9%)	21 (2.3%)	24 (2.4%)	1 (4.2%)	122 (39.4%)	
Number of Lymph Nodes Examined	4035 (63.0%)	1544 (89.5%)	24790 (98.7%)	49 (100.0%)	852 (96.7%)	969 (98.6%)	23 (95.8%)	101 (40.7%)	<0.001
Number of Lymph Nodes Examined, median (IQR)	2.0 (0.0, 6.0)	7.0 (3.0, 12.0)	11.0 (7.0, 17.0)	13.5 (6.0, 25.5)	12.0 (7.0, 20.0)	16.0 (10.0, 24.0)	17.0 (11.5, 22.5)	1.0 (0.0, 19.0)	<0.001
Surgical Margins									<0.001
Negative Margins	5977 (89.3%)	1727 (95.2%)	24873 (95.6%)	36 (69.2%)	826 (89.1%)	897 (88.2%)	15 (62.5%)	98 (31.6%)	
Positive Margins	478 (7.1%)	66 (3.6%)	972 (3.7%)	13 (25.0%)	92 (9.9%)	108 (10.6%)	9 (37.5%)	66 (21.3%)	
Unknown	237 (3.5%)	21 (1.2%)	163 (0.6%)	3 (5.8%)	9 (1.0%)	12 (1.2%)	0 (0.0%)	146 (47.1%)	
Length of Stay (Days), median (IQR)	3.0 (2.0, 5.0)	3.0 (2.0, 5.0)	4.0 (3.0, 7.0)	5.0 (4.0, 6.5)	6.0 (4.0, 9.0)	5.0 (4.0, 7.0)	8.5 (6.0, 12.5)	2.0 (0.0, 5.0)	<0.001
30-day Readmission									0.14
No	6387 (95.4%)	1744 (96.1%)	24799 (95.4%)	48 (92.3%)	867 (93.5%)	958 (94.2%)	24 (100.0%)	294 (94.8%)	
Yes	262 (3.9%)	55 (3.0%)	1034 (4.0%)	3 (5.8%)	48 (5.2%)	49 (4.8%)	0 (0.0%)	13 (4.2%)	
Unknown	43 (0.6%)	15 (0.8%)	175 (0.7%)	1 (1.9%)	12 (1.3%)	10 (1.0%)	0 (0.0%)	3 (1.0%)	