



Quality Gaps and Comparative Effectiveness in Lung Cancer Staging and Diagnosis

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e-Appendix 1.

Methods

SEER and TCR algorithms for determining stage:

For TCR, we used dss00s1 (2004+) and sssm2z1 (2003-) for 'regional' stage. For SEER, we used sss77v1 (2000-), sssm2z1 (2001-2003) for 'regional' stage, and dajccm1, dajccn1 (2004+) for M0 and N1,N2,N3 stages. For 2004+ patients, we used dajcct1 to remove T4 patients. So in summary, TCR patients had regional stage disease, SEER patients from 2003 and before had regional stage disease and we were able to identify their T stage, and for SEER patients from 2004-2007 we had detailed information on their complete TNM stage (T1-T3, N1-3, and M0).

Participants and rationale for algorithm criteria

Patients in HMO's were excluded since detailed claims data were required for the analysis. Patients with known T4 disease were excluded since patients with direct mediastinal invasion on imaging would be at least stage IIIA and lymph node sampling might not be required in such cases.²⁻⁴ Because staging is mainly relevant for treatment planning patients were only included if they received some form of treatment. Treatment was defined as any chemotherapy, radiation or surgery. The type of treatment received was determined by analyzing CPT codes (e-Table 1).

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Test sequencing definitions, categories, and rationale

If mediastinal lymph node sampling was performed on the same day as surgical resection, this was categorized as mediastinal lymph node sampling first. Bronchoscopy without TBNA was considered as a biopsy of the peripheral lesion without mediastinal lymph node sampling. While CT-guided needle biopsy of mediastinal lymph nodes can be performed, this is rarely done since it is associated with a much higher complication rate than EBUS-TBNA and as such it represents an inferior technique. Therefore, CT-guided needle biopsy was considered as inconsistent with guidelines when done as a first procedure.

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e-Table 1. ICD9 and CPT codes for determining diagnostic testing, treatments, and outcomes

Procedures	ICD-9 Diagnosis Codes	ICD-9 Procedure Codes	CPT/HCPCS codes
Diagnostic Tests			
CT-guided Biopsy			32405, 10022
Bronch without TBNA			31622, 31623, 31624, 31625, 31627, 31628, 31632, 31645, no 31629
Bronch with TBNA			31629 but no 31620
Bronch with TBNA+EBUS			31629 and 31620
Mediastinotomy or Mediastinoscopy			39000,39010,39220,39400,32662
Endoscopy with ultrasound			43232
Thoracotomy			19272, 31786, 32095, 32100, 32440, 32442, 32445, 32480, 32482, 32484, 32486, 32488, 32500, 32503, 32504, 32520, 32522, 32525, 32602, 32606, 32657, 32662, 32663,38746
Complications			
Pneumothorax	512		
Pneumothorax requiring a chest tube	512	34.04	32002,32020
Hemorrhage requiring blood transfusion	998.1	99.03, 99.04	36430
Respiratory failure		96.04 plus 96.7	31500
Treatments			
Radiation Therapy			77371-77373, 77401-77525, 77761-77799, G0251, G0339, G0340, G0174
Chemotherapy			96400 – 96549, J9000 – J9999, Q0083 – Q0085, J8520, J8521, J8530, J8540, J8560, J8597, J8610, J8999; EXCLUDE ALL OF THE FOLLOWING CODES: J9003, J9165, J9175, J9202, J9209, J9212- J9226, J9240, J9395
Surgery			19272, 32440, 32442, 32445, 32480, 32482, 32484, 32486, 32488, 32500, 32503, 32504, 32520, 32522, 32525, 32657, 32662, 32663,38746

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e-Table 2. Cross-table of SEER and TCR

Variables	SEER	TCR	Total	p value
	N (%)	N (%)	N (%)	
All subjects	12363 (100)	3568 (100)	15931 (100)	
Age				0.31
66-70	3784 (30.61)	1133 (31.75)	4917 (30.86)	
71-75	3798 (30.72)	1115 (31.25)	4913 (30.84)	
76-80	3008 (24.33)	823 (23.07)	3831 (24.05)	
>80	1773 (14.34)	497 (13.93)	2270 (14.25)	
Gender				<.0001
Female	5865 (47.44)	1556 (43.61)	7421 (46.58)	
Male	6498 (52.56)	2012 (56.39)	8510 (53.42)	
Comorbidities				0.05
0	6290 (50.88)	1749 (49.02)	8039 (50.46)	
1	3678 (29.75)	1067 (29.9)	4745 (29.79)	
2+	2395 (19.37)	752 (21.08)	3147 (19.75)	
Cancer type				0.63
NSCLC	10656 (86.19)	3064 (85.87)	13720 (86.12)	
Small cell	1707 (13.81)	504 (14.13)	2211 (13.88)	
Practice Pattern and Mediastinal Sampling				0.001
Guideline consistent, mediastinal sampling done first	2435 (19.7)	720 (20.18)	3155 (19.8)	
Guideline inconsistent, NSCLC present, mediastinal sampling done 2nd or later	3713 (30.03)	946 (26.51)	4659 (29.25)	
Guideline inconsistent, NSCLC present, mediastinal sampling never done	4488 (36.3)	1393 (39.04)	5881 (36.92)	
Guideline inconsistent, Small cell present	1247 (10.09)	374 (10.48)	1621 (10.18)	
No Evaluation Recorded	480 (3.88)	135 (3.78)	615 (3.86)	
Guideline consistency				0.54
Consistent	2435 (20.49)	720 (20.97)	3155 (20.6)	
Not consistent	9448 (79.51)	2713 (79.03)	12161 (79.4)	

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e-Table 3. Characteristics of propensity score case-matched pairs of lung cancer patients

Variables	Guideline Consistent	Guideline Inconsistent	Total	p value
	N (%)	N (%)	N (%)	
All subjects	2859 (100)	2859 (100)	5718 (100)	
Age				0.1921
66-70	961 (33.61)	960 (33.58)	1921 (33.6)	
71-75	908 (31.76)	945 (33.05)	1853 (32.41)	
76-80	689 (24.1)	627 (21.93)	1316 (23.02)	
>80	301 (10.53)	327 (11.44)	628 (10.98)	
Gender				0.3682
Female	1362 (47.64)	1396 (48.83)	2758 (48.23)	
Male	1497 (52.36)	1463 (51.17)	2960 (51.77)	
Race				0.7953
Non-Hispanic White	2491 (87.13)	2511 (87.83)	5002 (87.48)	
Hispanic	118 (4.13)	119 (4.16)	237 (4.15)	
Non-Hispanic Black	171 (5.98)	158 (5.53)	329 (5.75)	
Non-Hispanic Other	79 (2.76)	71 (2.48)	150 (2.62)	
Year of Diagnosis				0.9655
1995	104 (3.64)	112 (3.92)	216 (3.78)	
1996	82 (2.87)	83 (2.9)	165 (2.89)	
1997	88 (3.08)	85 (2.97)	173 (3.03)	
1998	82 (2.87)	86 (3.01)	168 (2.94)	
1999	74 (2.59)	61 (2.13)	135 (2.36)	
2000	190 (6.65)	207 (7.24)	397 (6.94)	
2001	315 (11.02)	298 (10.42)	613 (10.72)	
2002	278 (9.72)	271 (9.48)	549 (9.6)	
2003	354 (12.38)	364 (12.73)	718 (12.56)	
2004	349 (12.21)	350 (12.24)	699 (12.23)	
2005	310 (10.84)	297 (10.39)	607 (10.62)	
2006	320 (11.19)	306 (10.7)	626 (10.95)	
2007	313 (10.95)	339 (11.86)	652 (11.4)	
SEER/TCR Region				0.9881
Atlanta & Rural Georgia	65 (2.27)	55 (1.92)	120 (2.1)	
California	586 (20.5)	609 (21.3)	1195 (20.9)	
Connecticut	225 (7.87)	216 (7.56)	441 (7.71)	

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Detroit	304 (10.63)	309 (10.81)	613 (10.72)	
Hawaii	23 (0.8)	19 (0.66)	42 (0.74)	
Iowa	165 (5.77)	159 (5.56)	324 (5.67)	
Kentucky	181 (6.33)	169 (5.91)	350 (6.12)	
Louisiana	94 (3.29)	109 (3.81)	203 (3.55)	
New Jersey	340 (11.89)	334 (11.68)	674 (11.79)	
New Mexico	44 (1.54)	41 (1.43)	85 (1.49)	
Seattle	127 (4.44)	129 (4.51)	256 (4.48)	
Texas	671 (23.47)	675 (23.61)	1346 (23.54)	
Utah	34 (1.19)	35 (1.22)	69 (1.21)	
Charlson Comorbidity Index				0.5577
0	1488 (52.05)	1525 (53.34)	3013 (52.69)	
1	862 (30.15)	850 (29.73)	1712 (29.94)	
2+	509 (17.8)	484 (16.93)	993 (17.37)	
T stages				0.7454
T0/T1	839 (29.35)	864 (30.22)	1703 (29.78)	
T2	1272 (44.49)	1281 (44.81)	2553 (44.65)	
T3	157 (5.49)	153 (5.35)	310 (5.42)	
Unknown	591 (20.67)	561 (19.62)	1152 (20.15)	
Cancer type				0.8407
NSCLC	2643 (92.44)	2647 (92.58)	5290 (92.52)	
Small cell	216 (7.56)	212 (7.42)	428 (7.49)	

NSCLC: Non-small cell lung cancer

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