Do Physician Patient Sharing Networks Impact Disparities in Access to Multidisciplinary Cancer Consultation for Early Stage Lung Cancer?

A SEER-Medicare Network Analysis

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Disclosure

- Employer: Dartmouth Health (Lebanon, NH)
- I have no conflicts of interest to disclose.

Learning Objectives

- After this quick pitch, attendees will be able to ***identify and describe*** how linchpin analyses can characterize physician workforces in new ways.

Thank You

- Research team: Eunice Liu, Rachel Schmidt, Erika Moen

Background: Measurement matters

Access to the cancer care is associated with utilization and outcomes:

- Low oncologist density associated with higher cancer mortality rates (Aneja and Yu 2012; Odisho et al 2010)
- Greater travel burden to oncologists associated with lower utilization of cancer services (Lin et al 2015; Lin et al 2016)

However, "traditional" means of measuring provider density are limited by:

- Geography (limited to zip, county, HRR/HSA, etc.)
- Provider specialty (vs disease focus)

A Novel Method: Network Analysis

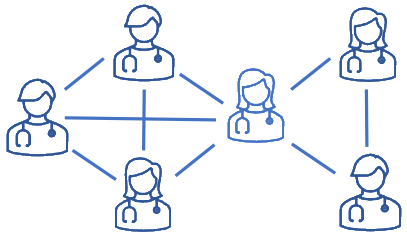
Network analyses study **shared relationships (typically patients)** to explore health care structure and delivery

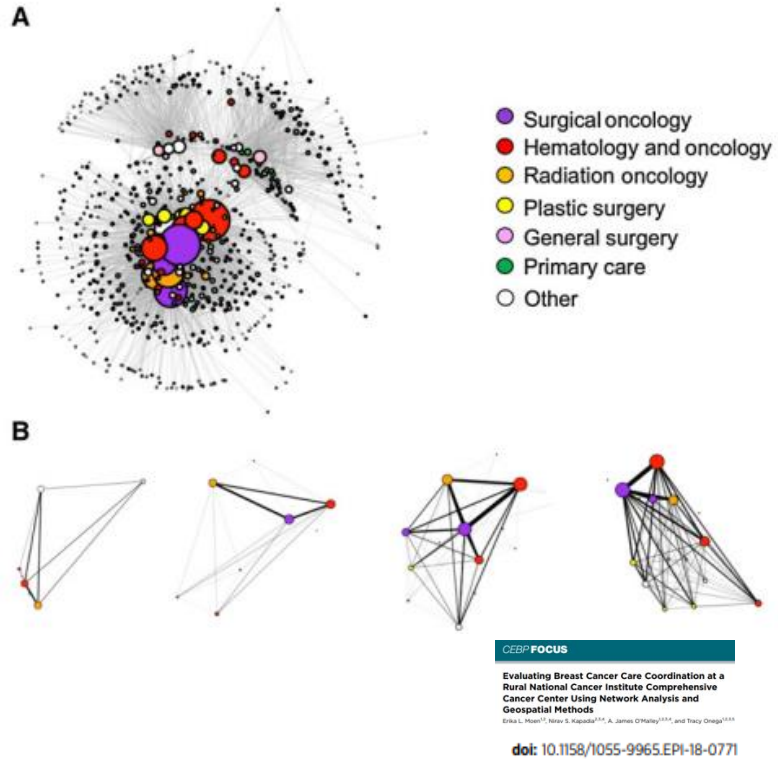
Traditional inputs:

Workforce, population, speciality, and **geography**

Network Analysis:

Relationships between specialists

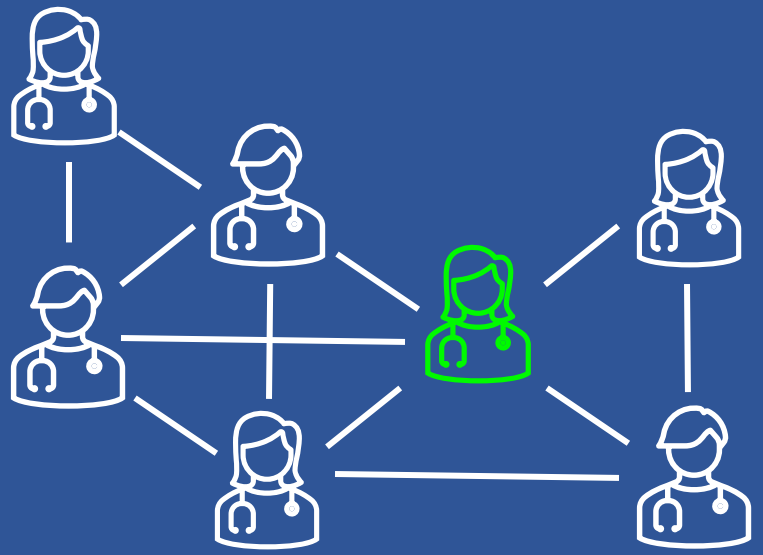




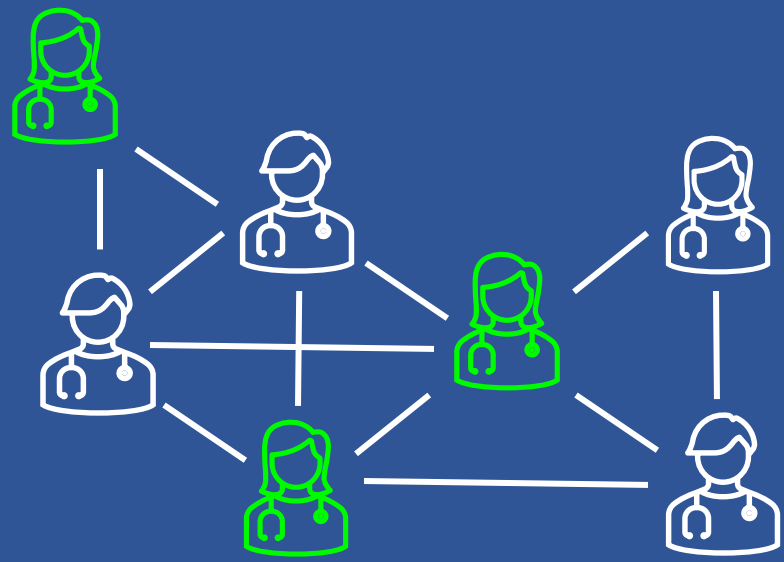
CEBP FOCUS
Evaluating Breast Cancer Care Coordination at a Rural National Cancer Institute Comprehensive Cancer Center Using Network Analysis and Geospatial Methods
doi: 10.1158/1055-9965.EPI-18-0771

Linchpin score: a measure of network sensitivity

Patient-sharing physician networks: edges (lines) represent shared patients



High linchpin score



Low linchpin score

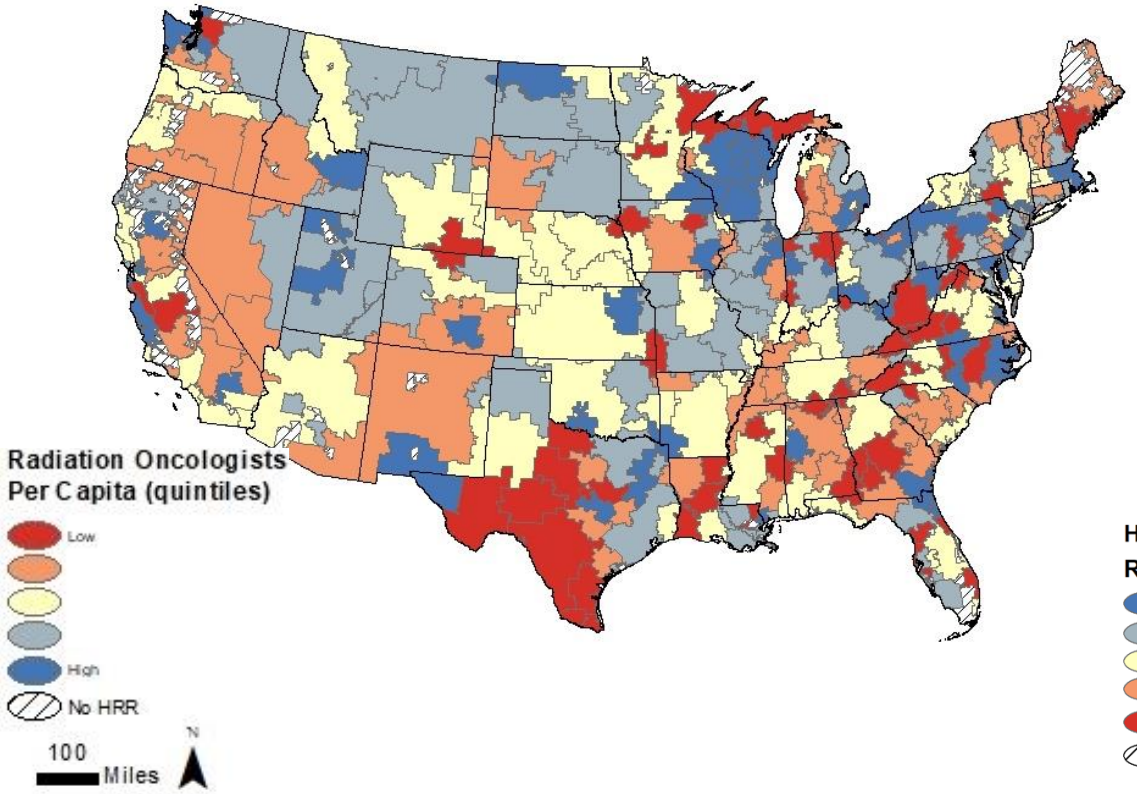
Key
Radiation oncologist
Other physician

Nemesure et al, *Appl Netw Sci,* 2021

Network analyses can provide a different view

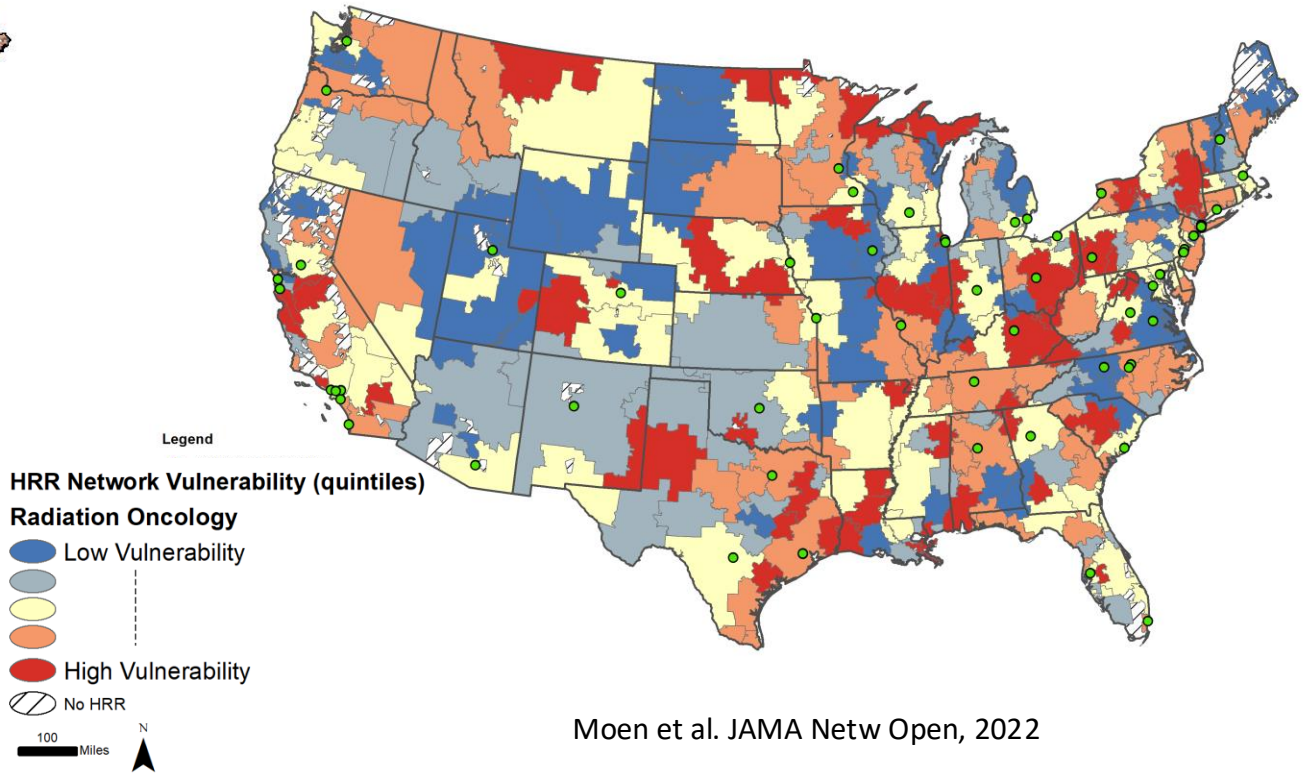
Traditional R/O HRR supply map

(Hospital Referral Region provider density per capita)



R/O Network Map

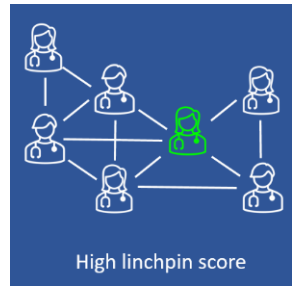
(R/O Linchpins for colorectal, lung, and breast cancer)



Moen et al. JAMA Netw Open, 2022

Our use case:
Linchpin analysis of lung cancer care networks

SEER-Medicare analysis of 6,120 patients with stage I-IIA NSCLC living in vulnerable networks



Patients residing in **linchpin radiation oncologist** predominant HRRs
(i.e. patients residing in HRRs with ***high rad/onc network vulnerability***):

- 1.42 (95% CI: 1-12 - 1.75) greater relative risk of exclusively consulting a surgeon vs consulting both a radiation oncologist and a surgeon
- 1.50 (95% CI: 1.03 – 2.27) decreased odds of receiving SBRT vs surgery

Patients residing in **linchpin surgeon** predominant HRRs:

- 3.16 (95% CI: 2.09 - 4.81) greater relative risk of exclusively consulting a radiation oncologist vs consulting both a radiation oncologist and a surgeon
- 1.90 (95% CI: 1.17 - 3.09) greater odds of receiving SBRT instead of surgery

Appendix

Figure 1. Linchpin Score Calculation

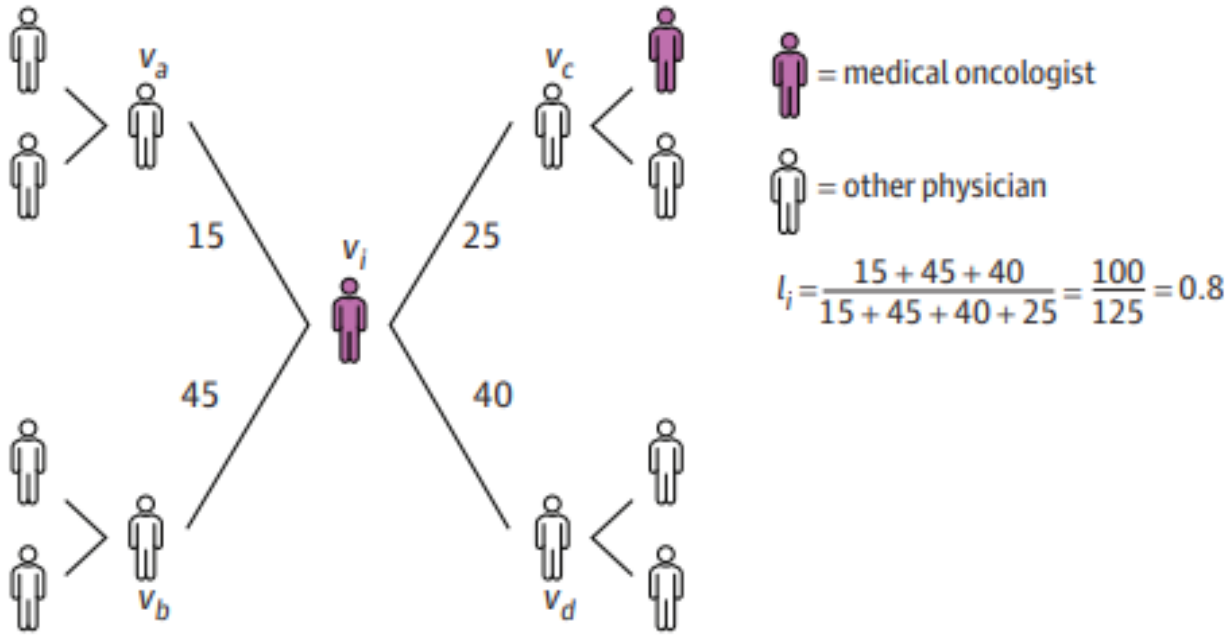


Illustration of linchpin score calculation that is found by summing edges with peers who lack ties to another medical oncologist (eg, v_a, v_b, and v_d) and dividing by the sum of all shared ties (eg, v_a, v_b, v_c, and v_d). Numbers adjacent to edge lines represent shared patients.

JAMA Network Open. 2022;5(12):e2245995. doi:10.1001/jamanetworkopen.2022.45995

Table 2. Impact of NSCLC patient characteristics on receipts of consultations

	Only Radiation Oncologist vs Received MDCc		Only Surgeon vs Received MDCc		Neither vs Received MDCc	
	RRR (95% CI)	*P*-value	RRR (95% CI)	*P*-value	RRR (95% CI)	*P*-value
Female	1.05 (0.88-1.25)	0.62	0.99 (0.84-1.18)	0.95	1.06 (0.89-1.27)	0.49
Age (years)						
66-69	1.0 (Referent)		1.0 (Referent)		1.0 (Referent)	
70-74	1.33 (1.00-1.77)	0.05	0.89 (0.69-1.15)	0.37	1.18 (0.90-1.54)	0.23
75-79	1.48 (1.11-1.97)	<0.01	0.74 (0.57-0.96)	0.02	1.04 (0.79-1.37)	0.77
80-84	2.10 (1.55-2.83)	<0.001	0.46 (0.35-0.62)	<0.001	0.89 (0.66-1.19)	0.43
85+	3.28 (2.35-4.57)	<0.001	0.28 (0.20-0.40)	<0.001	1.10 (0.79-1.54)	0.58
Race						
White	1.0 (Referent)		1.0 (Referent)		1.0 (Referent)	
Black	1.15 (0.79-1.69)	0.46	0.89 (0.61-1.30)	0.55	1.29 (0.89-1.86)	0.18
Other	1.17 (0.66-2.08)	0.58	1.87 (1.10-3.21)	0.02	1.87 (1.08-3.24)	0.03
Hispanic	0.68 (0.41-1.14)	0.15	1.07 (0.66-1.73)	0.79	1.35 (0.84-2.17)	0.22
Cancer Stage						
IA	1.0 (Referent)		1.0 (Referent)		1.0 (Referent)	
IB	0.79 (0.64-0.97)	0.02	1.23 (1.00-1.50)	0.05	1.00 (0.81-1.23)	0.99
IIA	0.55 (0.43-0.70)	<0.001	0.69 (0.54-0.88)	<0.01	0.70 (0.55-0.89)	<0.01
COPD	1.39 (1.13-1.72)	<0.01	0.72 (0.59-0.88)	<0.01	0.85 (0.69-1.05)	0.13
Charlson comorbidity						
0	1.0 (Referent)		1.0 (Referent)		1.0 (Referent)	
1	1.06 (0.77-1.46)	0.72	0.79 (0.59-1.05)	0.11	0.76 (0.56-1.02)	0.07
2+	1.19 (0.88-1.62)	0.26	0.65 (0.49-0.87)	<0.01	0.77 (0.58-1.03)	0.08
Non-Metro	1.03 (0.79-1.33)	0.85	1.05 (0.81-1.37)	0.67	1.01 (0.78-1.31)	0.92
Yost Quintile						
1 (lowest SES)	1.0 (Referent)		1.0 (Referent)		1.0 (Referent)	
2	0.92 (0.67-1.27)	0.62	1.02 (0.74-1.41)	0.91	0.63 (0.46-0.86)	<0.01
3	0.72 (0.52-0.99)	0.04	0.89 (0.65-1.22)	0.47	0.57 (0.42-0.78)	<0.001
4	0.73 (0.53-1.01)	0.06	1.00 (0.73-1.38)	0.99	0.52 (0.38-0.72)	<0.001
5 (highest SES)	0.62 (0.45-0.86)	<0.01	1.13 (0.82-1.56)	0.45	0.46 (0.34-0.64)	<0.001
Proportion Linchpin Surgeons						
Low	1.0 (Referent)		1.0 (Referent)		1.0 (Referent)	
Medium	1.51 (1.24-1.84)	<0.001	1.19 (0.98-1.44)	0.07	1.45 (1.19-1.76)	<0.001
High	3.16 (2.08-4.81)	<0.001	1.35 (0.87-2.08)	0.18	2.72 (1.78-4.15)	<0.001
Proportion Linchpin Radiation Oncologists						
Low	1.0 (Referent)		1.0 (Referent)		1.0 (Referent)	
Medium	0.71 (0.57-0.89)	0.02	1.11 (0.90-1.39)	0.33	0.86 (0.69-1.07)	0.17
High	0.78 (0.58-1.06)	0.12	1.14 (0.84-1.54)	0.41	1.11 (0.82-1.50)	0.51

Table 3. Patient characteristics associated with receipt of SBRT instead of surgery

	Adjusted OR (95% CI)	*P*-value
Female Sex	1.06 (0.92-1.21)	0.44
Age at diagnosis (years)		
66-69	1.0 (Referent)	
70-74	1.75 (1.42-2.16)	<0.001
75-79	2.23 (1.80-2.77)	<0.001
80-84	4.52 (3.57-5.72)	<0.001
85+	19.07 (14.08-25.82)	<0.001
Race		
White	1.0 (Referent)	
Black	1.39 (1.04-1.86)	0.03
Other	0.75 (0.49-1.13)	0.16
Hispanic	0.70 (0.46-1.05)	0.09
Cancer Stage		
IA	1.0 (Referent)	
IB	0.50 (0.42-0.58)	<0.001
IIA	0.18 (0.13-0.24)	<0.001
COPD	1.86 (1.58-2.19)	<0.001
Charlson comorbidity		
0	1.0 (Referent)	
1	1.45 (1.14-1.84)	<0.01
2+	1.95 (1.55-2.46)	<0.001
Non-Metropolitan	0.87 (0.69-1.08)	0.20
Yost Quantile		
1 (lowest SES)	1.0 (Referent)	
2	1.12 (0.88-1.44)	0.35
3	0.92 (0.72-1.19)	0.53
4	0.87 (0.67-1.13)	0.30
5 (highest SES)	0.78 (0.60-1.02)	0.07
Receive MDCc	5.32 (4.27-6.63)	<0.001
Proportion Linchpin Surgeons		
Low	1.0 (Referent)	
Medium	1.15 (0.84-1.57)	0.40
High	1.90 (1.17-3.09)	<0.01
Proportion Linchpin Radiation Oncologists		
Low	1.0 (Referent)	
Medium	0.70 (0.50-0.97)	0.03
High	0.66 (0.44-0.97)	0.04

Note. OR, odds ratio; MDCc, multidisciplinary cancer consultation; COPD, chronic obstructive pulmonary disease; SES, socioeconomic status