

Patient Sharing Networks in the USA— A Pathway to Identifying Building Blocks to Better Health Care

Bruce Landon, M.D., M.B.A.

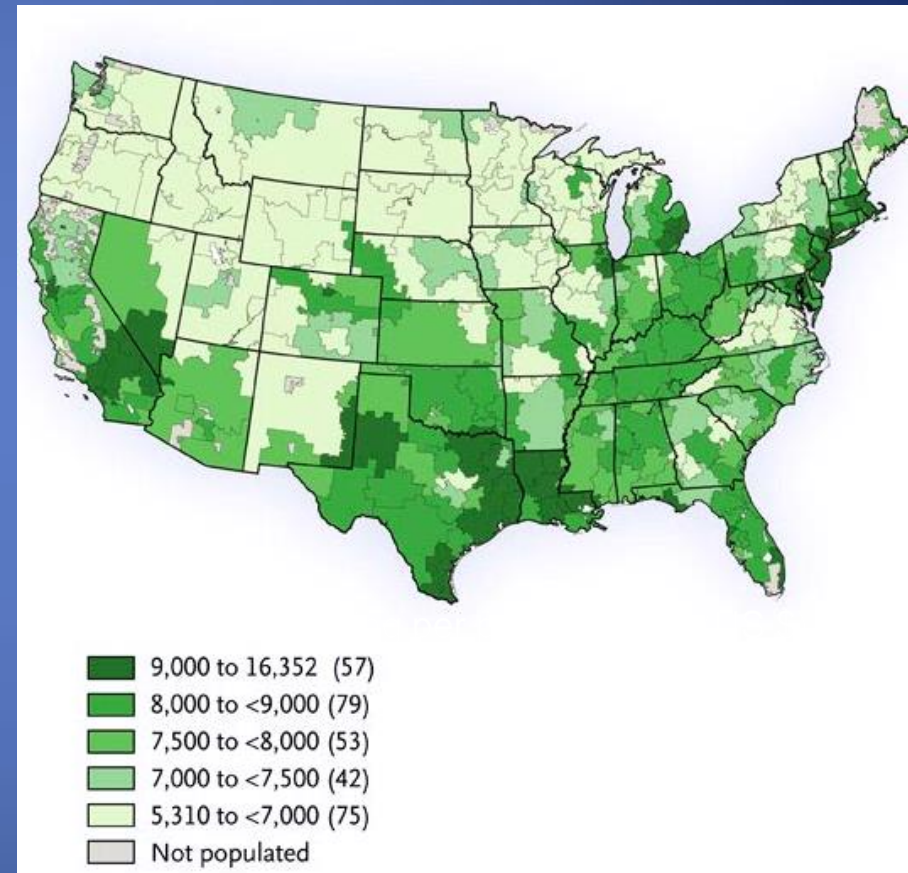
Department of Health Care Policy, Harvard Medical School and the Division of General Medicine and Primary Care, Beth Israel Deaconess Medical Center



Presented to: the Zi Health Services Research Conference
September 13, 2017

Geographic Variation

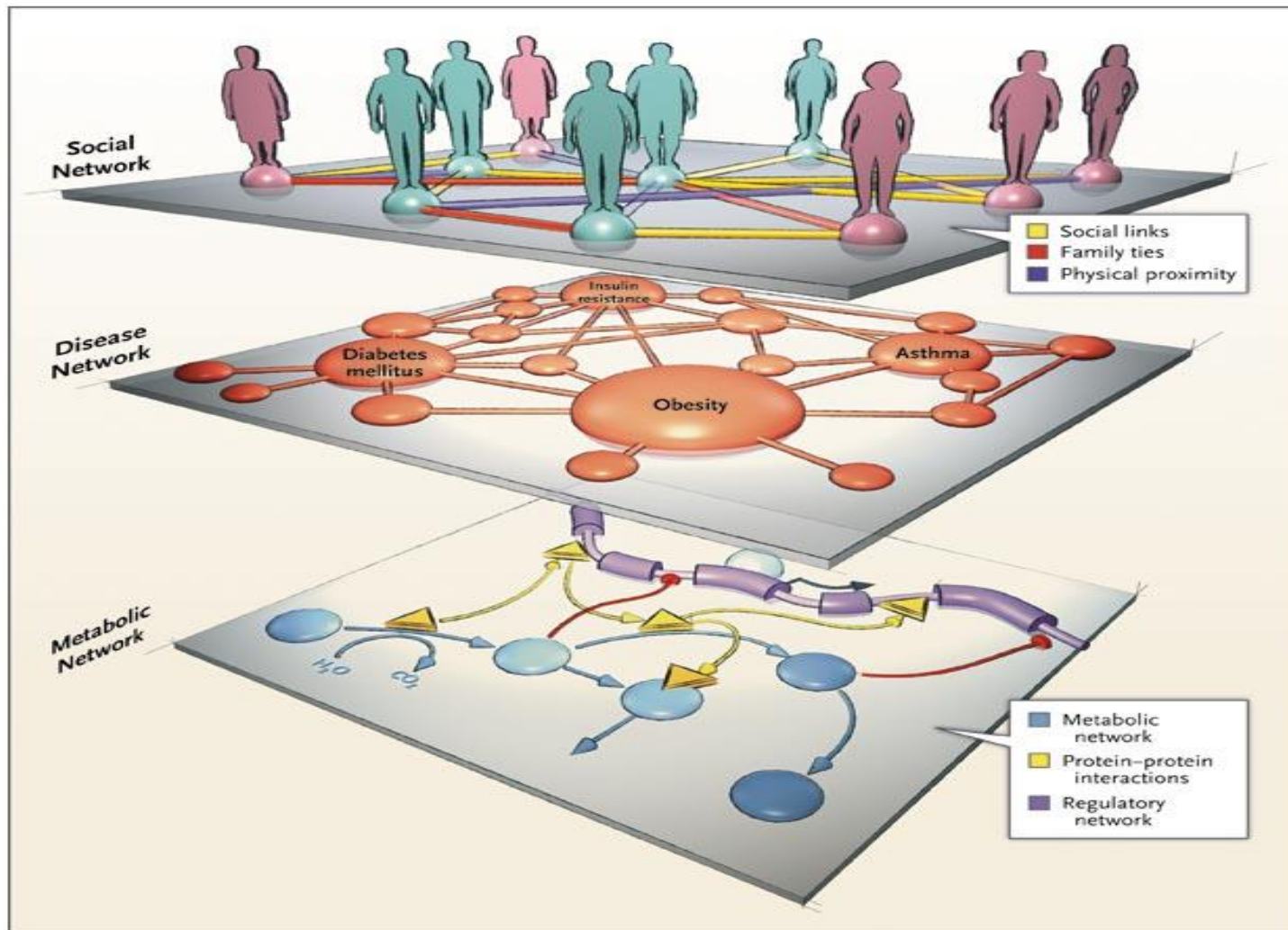
- Wide variation in health care delivery
 - Hospital and regional level
 - More care \neq better health
 - Same patient satisfaction
 - Same mortality
- Variation not explained by:
 - Demographics
 - Cost of living
 - Patient preferences
 - Severity of patient illness
- **Local medical practice style is key**



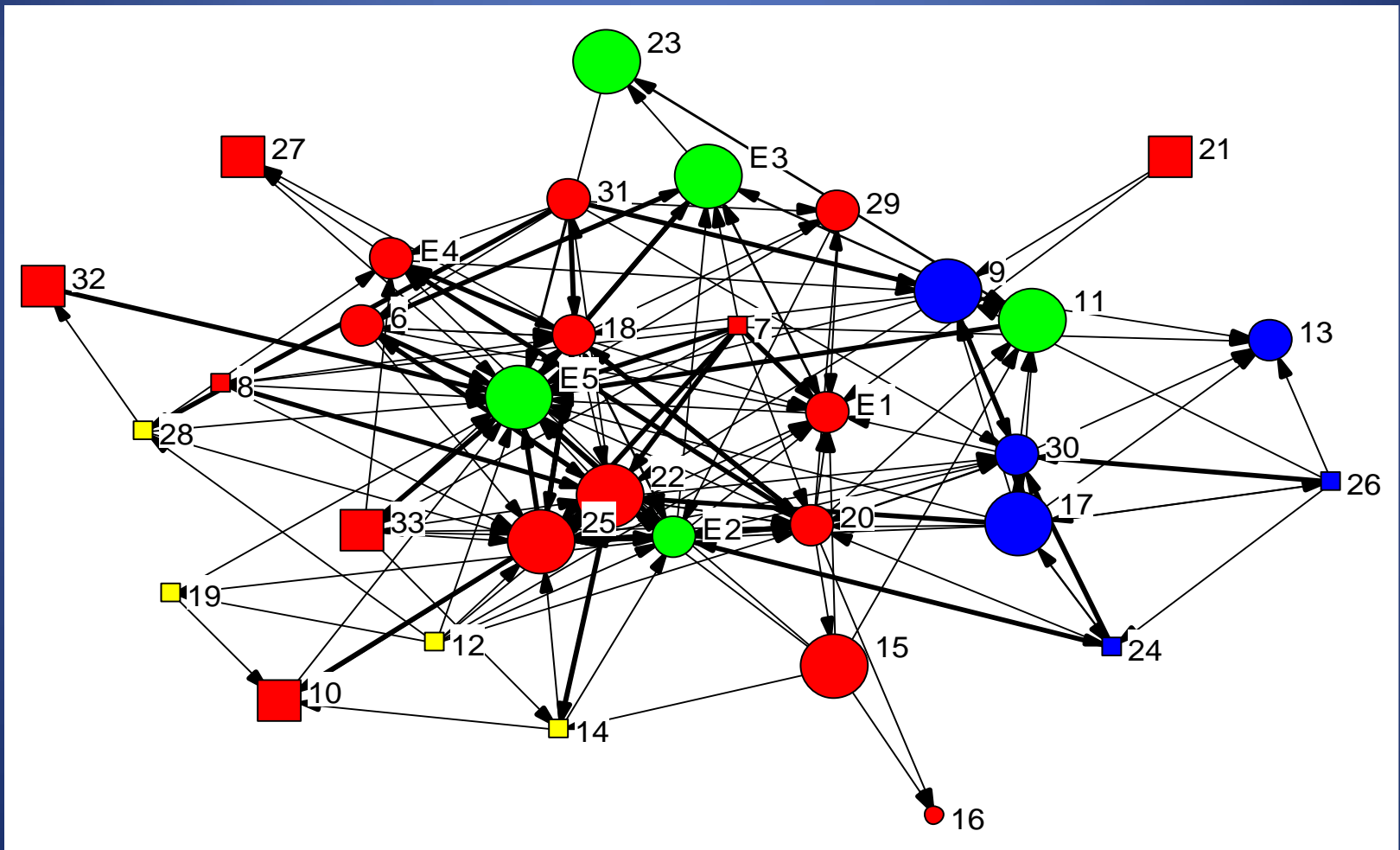
What Determines local norms?

- Physician socialization
- Practice context/peers/colleagues influence practice
- Rarely studied, but intuitively appealing

Can Network Science Provide Insights?



A Local Physician Network Defined by Information Flow



Source: Keating NL, Ayanian JZ, Cleary P, Marsden PV. Factors Affecting Influential Discussions Among Physicians: A Social Network Analysis of a Primary Care Practice. JGIM.

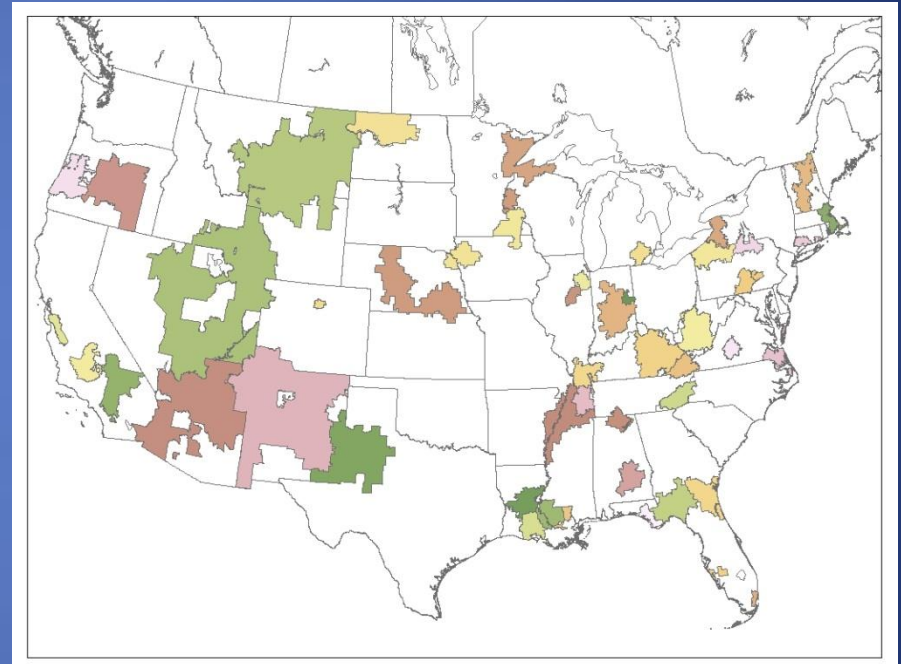
Measuring physician networks with traditional methods is difficult

- Low survey response rates
- Difficult to get complete data
- Expensive and resource intensive to administer

What about using administrative data to infer physician relationships?

Constructing Networks from Medicare Data

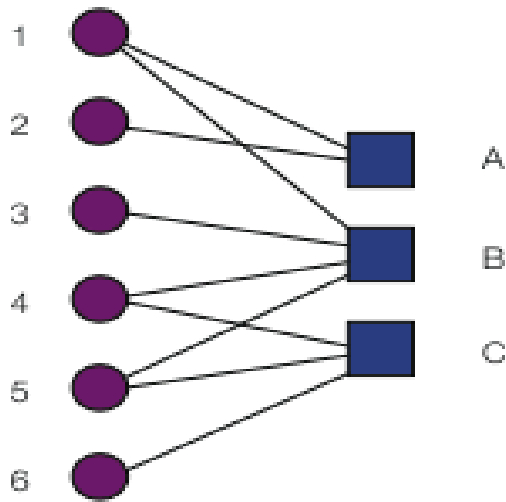
- 2005-2010 Medicare Claims
- 100% of patients living in 50 randomly sampled hospital referral regions in addition to Boston



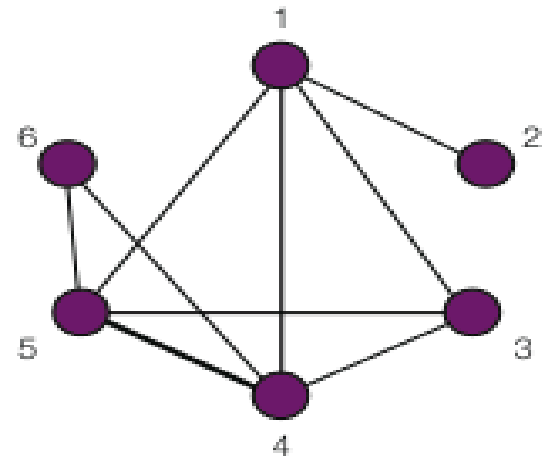
Sampled regions in the US

Building Physician Networks

Doctors Patients



Doctors



$$B_{6 \times 3} = \begin{array}{ccc|c} & A & B & C \\ \hline 1 & 1 & 1 & 0 & 1 \\ 2 & 1 & 0 & 0 & 2 \\ 3 & 0 & 1 & 0 & 3 \\ 4 & 0 & 1 & 1 & 4 \\ 5 & 0 & 1 & 1 & 5 \\ 6 & 0 & 0 & 1 & 6 \end{array}$$

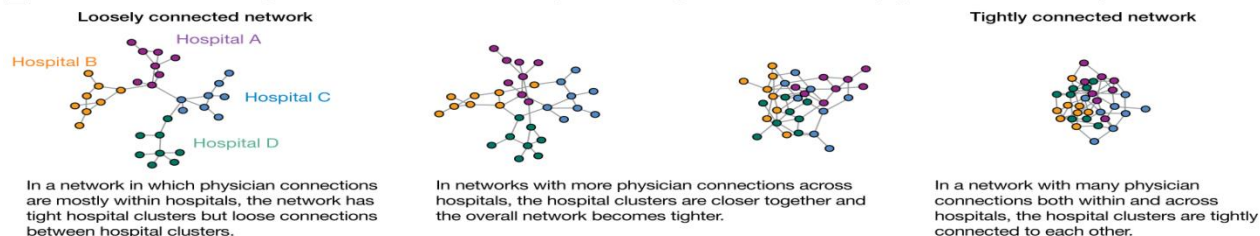
$$A_D_{6 \times 6} = BB^T =$$

$$\begin{array}{cccccc|c} & 1 & 2 & 3 & 4 & 5 & 6 & \\ \hline 2 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 & 2 \\ 1 & 0 & 1 & 1 & 1 & 1 & 0 & 3 \\ 1 & 0 & 1 & 2 & 2 & 1 & 1 & 4 \\ 1 & 0 & 1 & 2 & 2 & 1 & 1 & 5 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 6 \end{array}$$

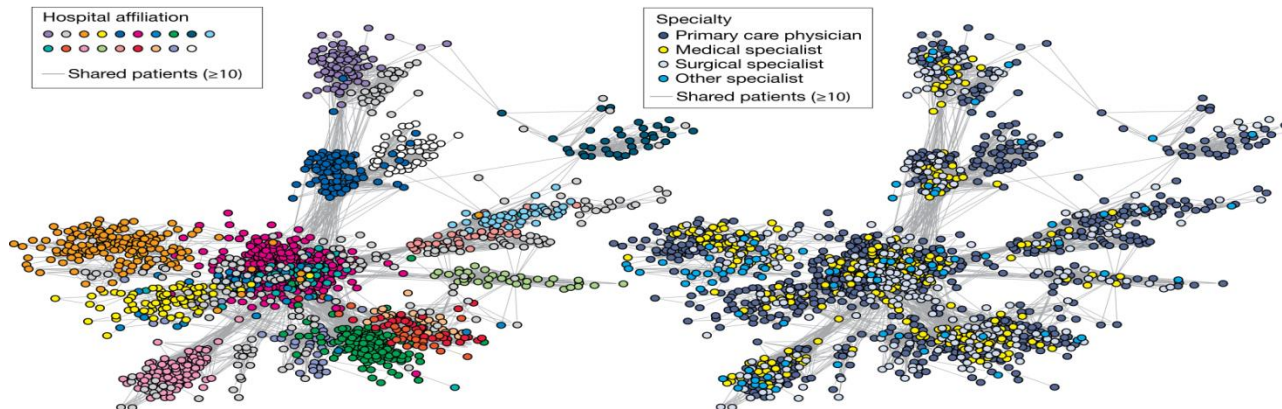
From: Variation in Patient-Sharing Networks of Physicians Across the United States

JAMA. 2012;308(3):265-273. doi:10.1001/jama.2012.7615

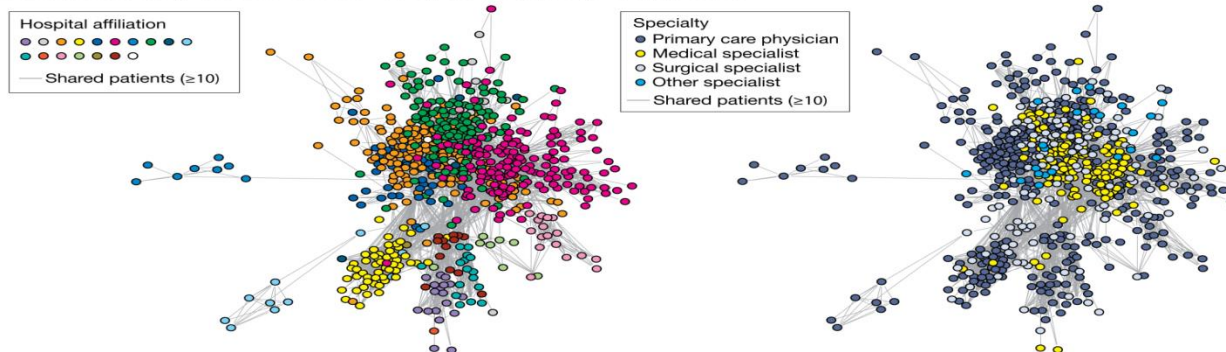
A Variations in network configurations based on the number of patient-sharing connections between physicians at different hospitals



B Example of a loosely connected network: Albuquerque, NM (n=1391 physicians)



C Example of a tightly connected network: Minneapolis/St Paul, MN (n=596 physicians)



Validating Our Approach

- Survey participants:
 - 616 office-based specialists and PCPs in a large academic physicians' organization
 - Response rate: 63% (386 respondents)
- Initial postal contact with \$5 incentive
- Web-based survey instrument
- Timeline:
 - February 2010: Pilot
 - March-May 2010: Survey

Physician Survey Design: Question Sample

Informal Physician Relationships Survey

Please check all the boxes that apply to indicate your relationship with each physician listed below:

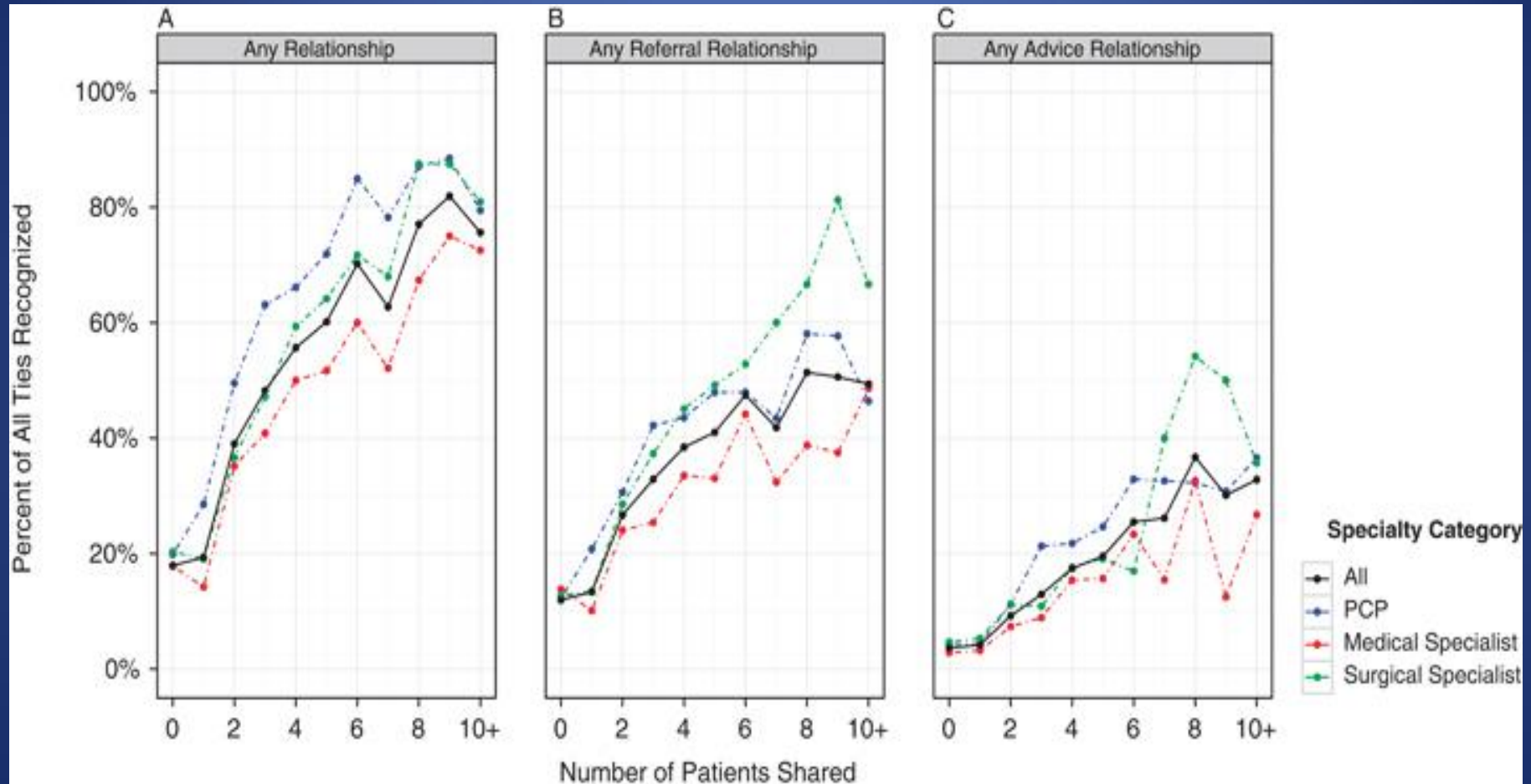
After this, there is one more page of physicians' names.

	I refer patients to him/her.	I receive referrals from him/her.	We share patients but don't refer to each other.	I seek him/her out for informal clinical advice.	He/she seeks me out for informal clinical advice.	Member of my practice.	None of these options apply.
Bruce Landon	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Nancy Keating	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
James O'Malley	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alan Zaslavsky	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Laurie Meneades	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
James Fowler	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Albert-Laszlo Barabasi	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barbara McNeill	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Paul Allison	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yulei He	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

back next

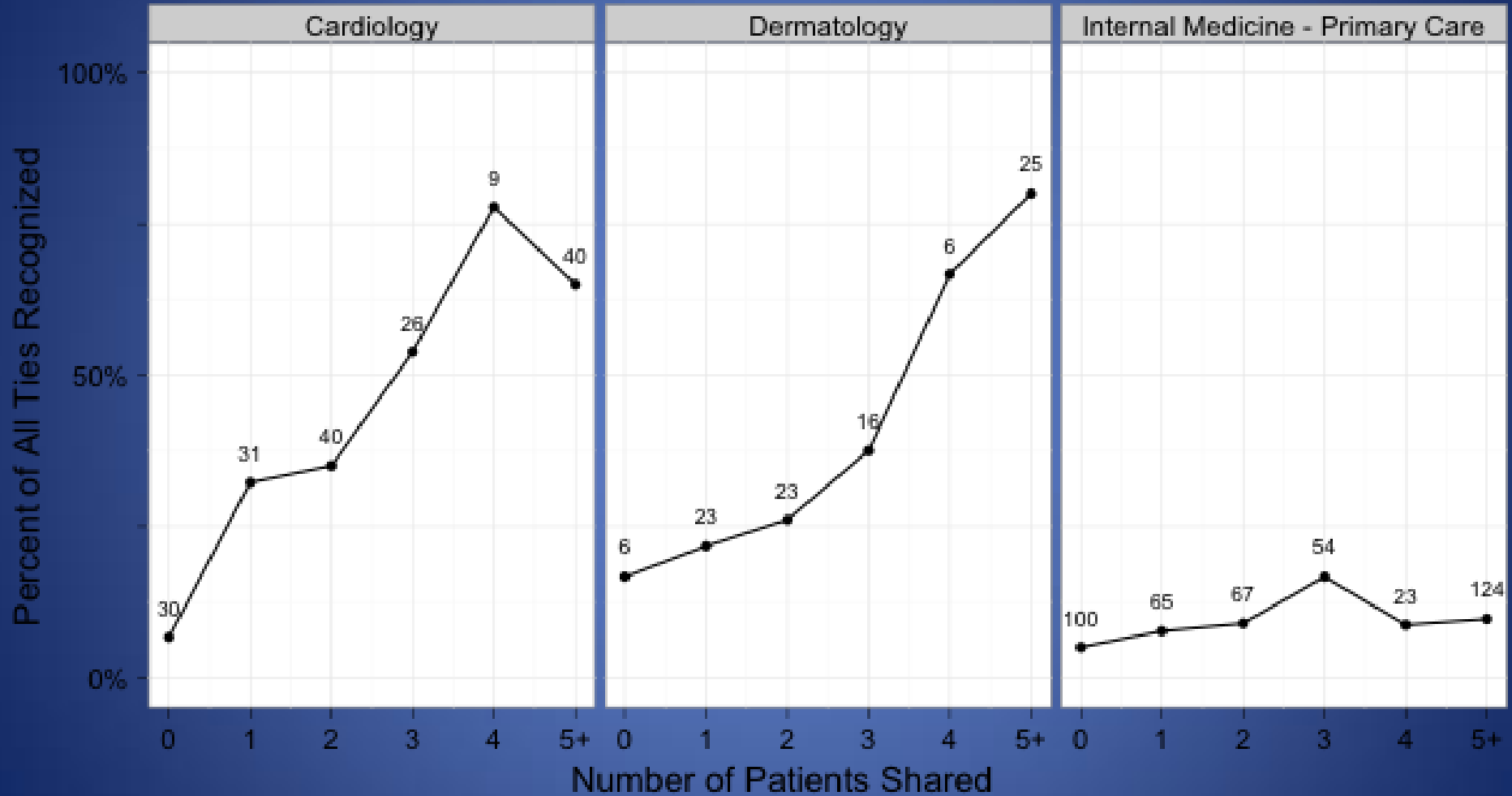
Each respondent gets 16 names from ties in the claims network + 4 non-ties
 What is the likelihood that a tie of n shared patients is perceived as a relationship?

Results: Roster and Patient Sharing



Patient Sharing as a “Diagnostic Test”: AUC = 0.73

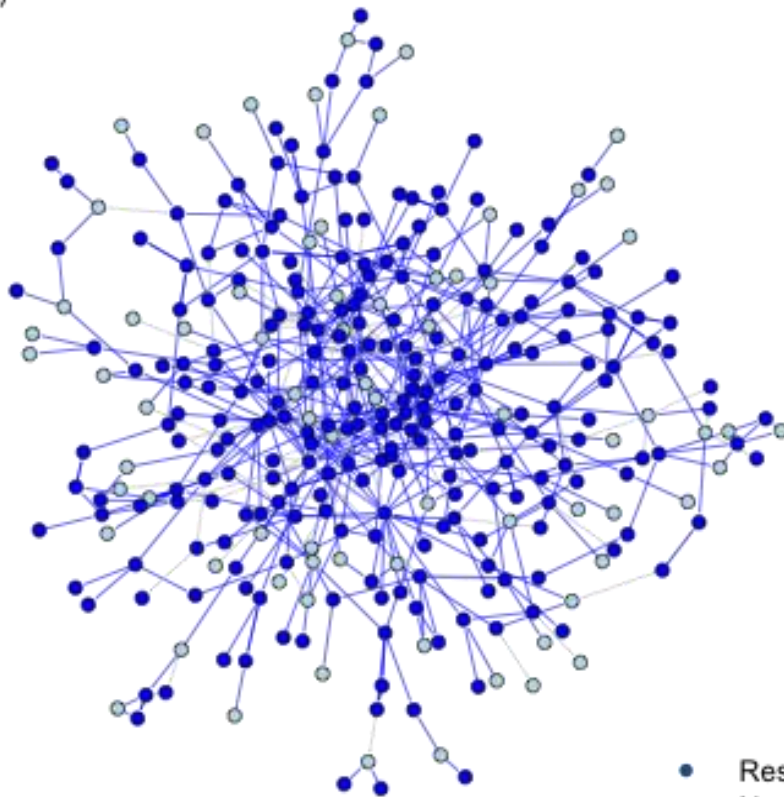
Specialty Pairs with Primary Care Internists



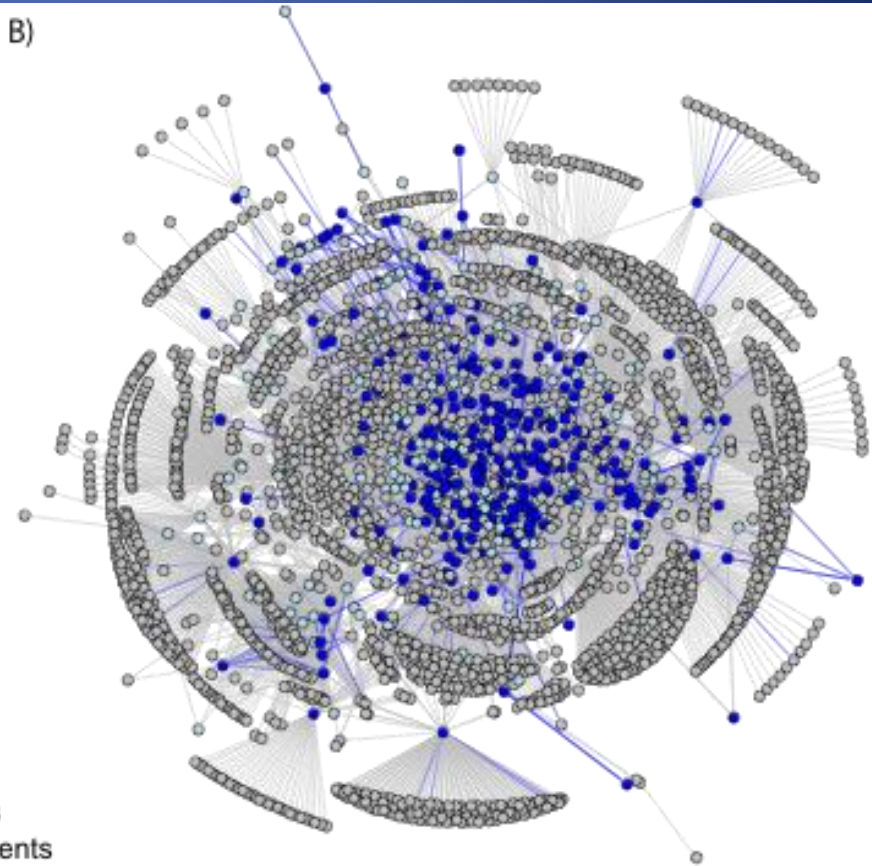
Source: Barnett et al, Health Services Research 2011.

Results: Network Mapping

A)



B)



- Respondents
- Non-respondents
- Other connected physicians
- Ties recognized in survey
- Ties recognized in claims only

Survey-measured network

Claims-measured network

Source: Barnett et al, Health Services Research 2011.

Applications

- Who Should Become an Accountable Care Organization (responsible for providing the care for a population within a budget)?
- Predictors of spending and outcomes

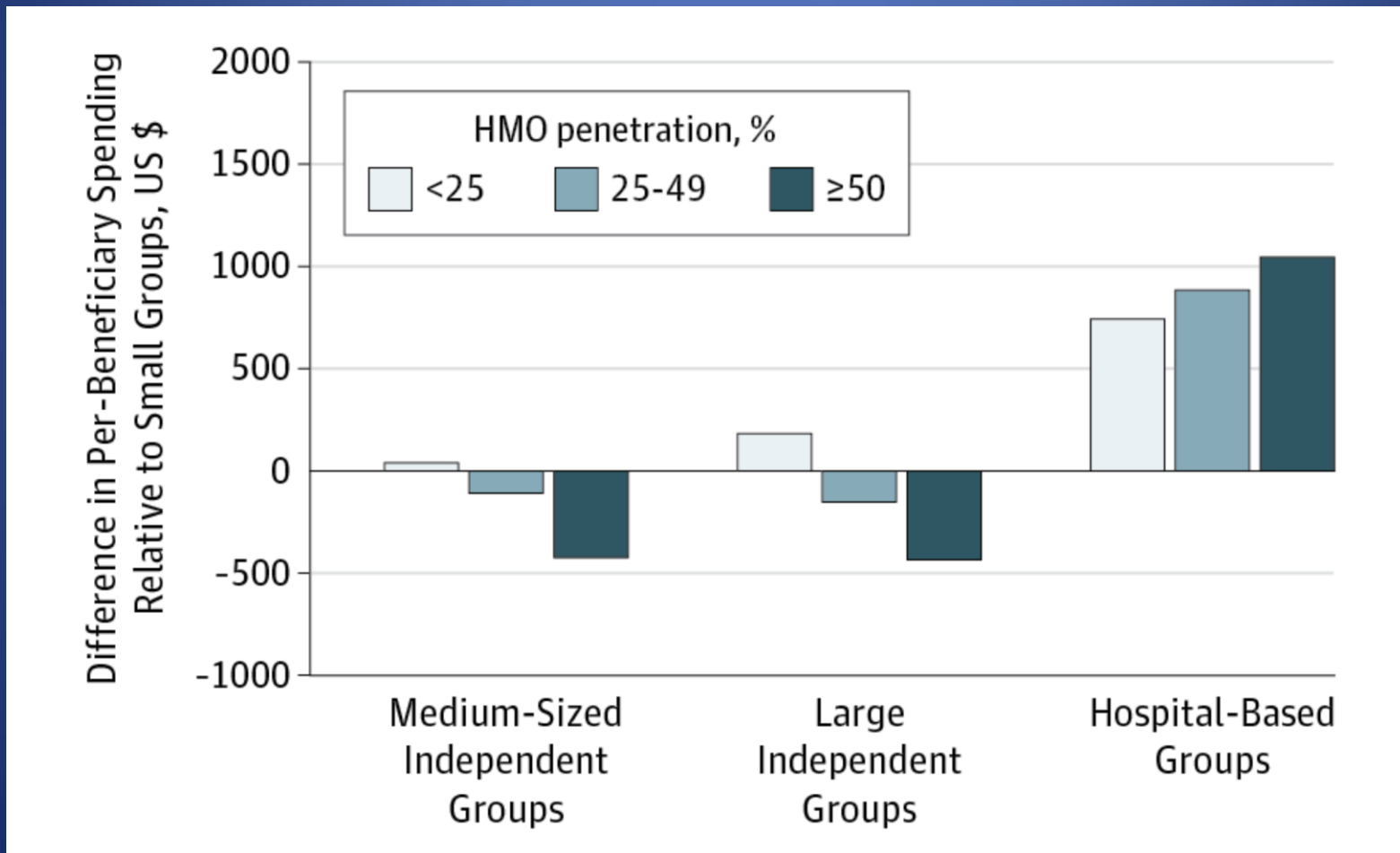
Identifying ACOs

- Organic networks could form the rational basis for ACOs
 - To identify organizations ready to become ACOs
 - To identify markets ready to transition to global payment
- Monitoring performance
 - Measuring cohesiveness over time using a variety of measures
 - Measuring leakage

Profligate Spenders v. Organized Groups?

- Profligate Spenders
 - Loosely connected
 - Poorly integrated
 - Culture of excess
- Organized Groups
 - Tightly integrated
 - Tightly managed
 - Culture of value

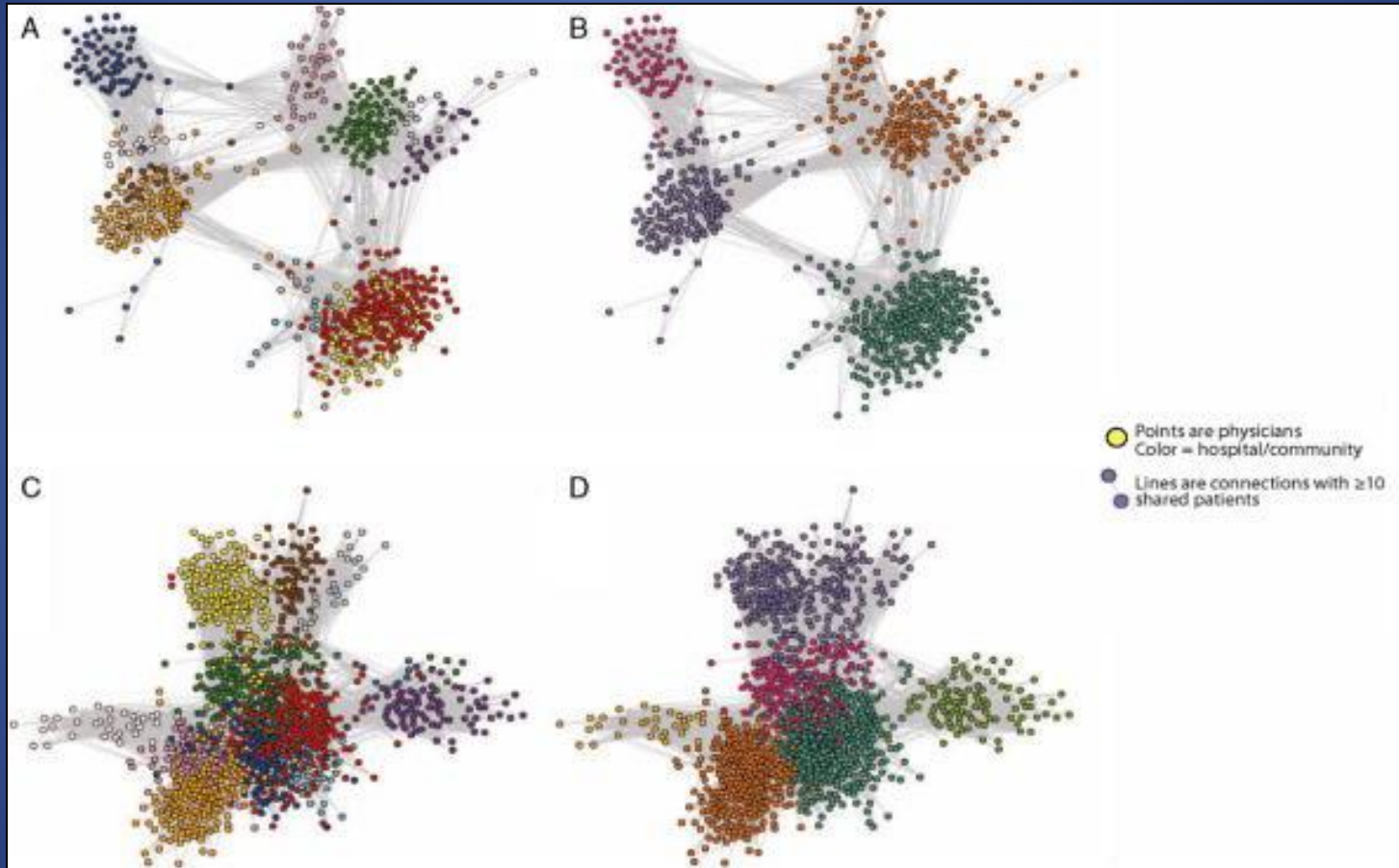
Potential Winners and Losers?



Methods: Community Detection

- Network communities are associated with functional networks
- Identify sets of nodes that are more connected than expected—optimize assignment across communities
- Straw man—compare properties with hospital affiliation networks

Tallahassee FL and Norfolk VA



Using Administrative Data to Identify Naturally Occurring Networks of Physicians.

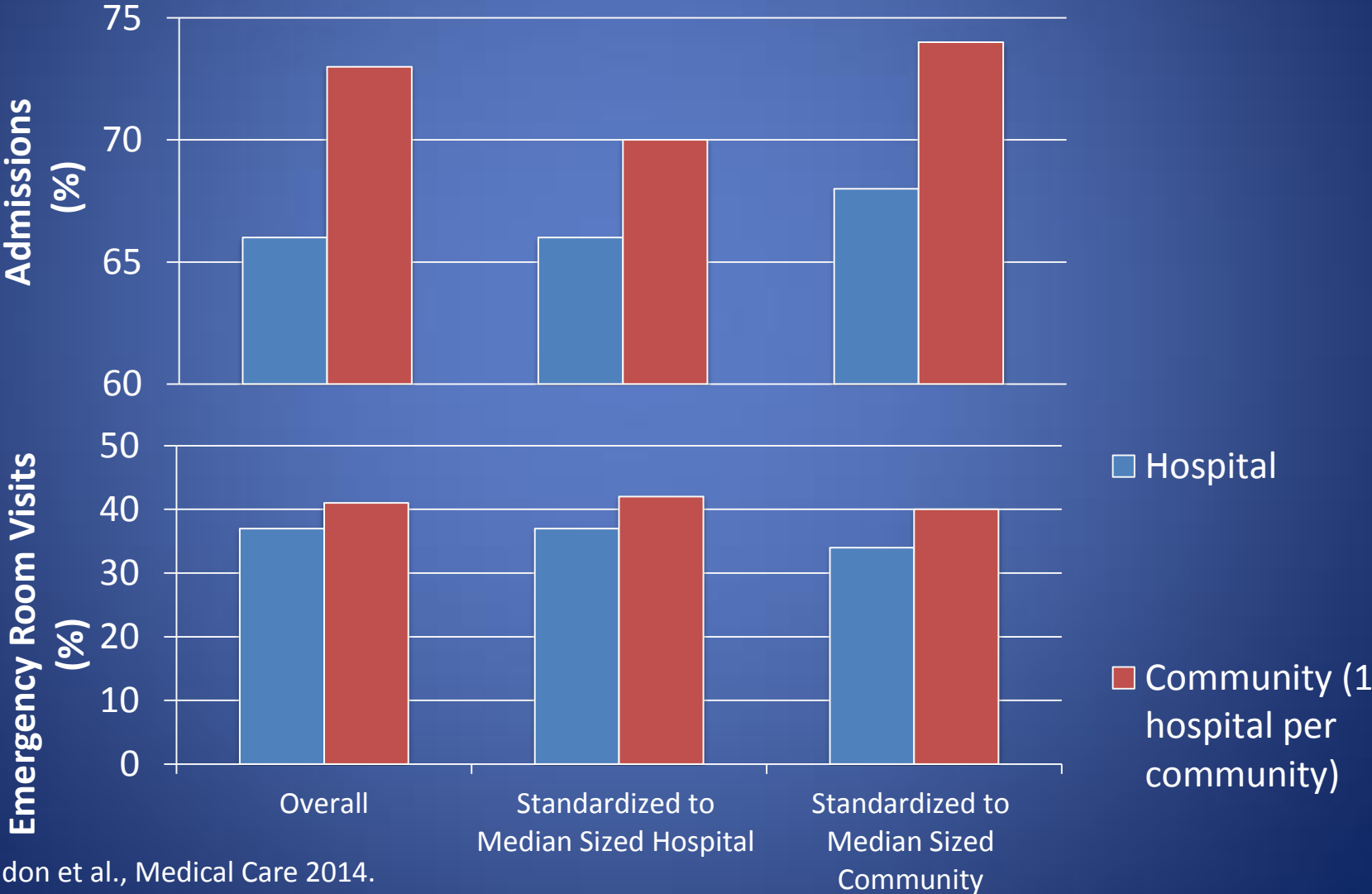
Landon, Bruce; MD, MBA; Onnela, Jukka-Pekka; Keating, Nancy; MD, MPH; Barnett, Michael; Paul, Sudeshna; O'Malley, Alistair; Keegan, Thomas; Christakis, Nicholas; MD, PhD *Medical Care*. 51(8):715-721, August 2013.

Network Characteristics of Community and Hospital Networks

	Communities (n=273)	Hospitals (n=416)
Percent with at least 1:		
Orthopedist	97	97
Ophthalmologist	9	92
Cardiologist	96	87***
Neurologist	91	82**
Psychiatrist	84	76*
Dermatologist	85	75*
Gastroenterologist	86	82

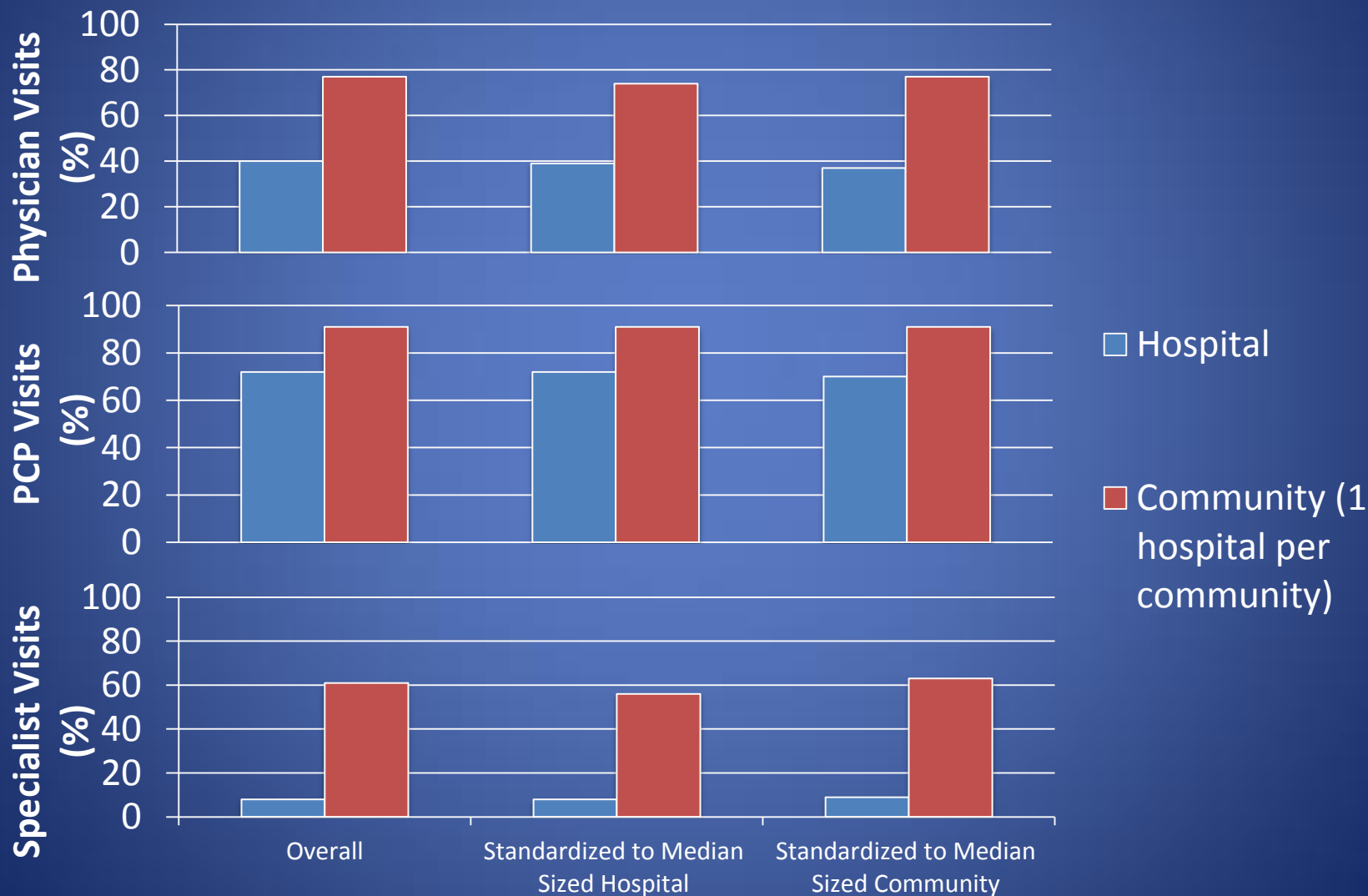
Source: Landon et al., Medical Care 2014.

Percentage of Care in Potential ACOs, at Least 5 PCPs and 3,000+ Patients



Source: Landon et al., Medical Care 2014.

Percentage of Care in Potential ACOs, at Least 5 PCPs and 3,000+ Patients



Source: Landon et al., Medical Care 2014.

Conclusions

- Network science offers a potential tool for understanding how physician social interactions influence care provision
- Data from administrative claims can be used to measure physician social networks at a large scale
- Network measures consistent with poor coordination of care are associated with higher costs and care intensity
- But...the best ways that organizations might use tools to improve both “stickiness” and coordination are still unclear

Acknowledgements

- Nancy Keating, MD, MPH
- James O'Malley, PhD
- Jukka Pekka Onnela, PhD
- Laurie Meneades
- Michael Barnett MD, MPH
- Nicholas Christakis, MD, PhD

Thank you!

- landon@hcp.med.harvard.edu
- blandon@bidmc.harvard.edu

Similar Finding for Hospital Outcomes

