Jan Koetsenruijter
Department of General Practice and Health Services Research
Heidelberg University Hospital

Coordination in physician patient-sharing networks and the continuity and quality of care for type 2 diabetes patients:

A Social Network Approach

Content

- Background
  - Networks, cooperation, and coordination
  - Aim
- Methods
  - (Quantitative) Social Network Analysis
  - Data and network construction
  - (Network) measures
- (Preliminary) results
- Conclusion and discussion

Background

Coordinated care is necessary to deliver best care for diabetes patients

- Within professions
  - Sharing knowledge / practices
  - Sharing patients
- Between professions
  - Sharing patients
  - Exchanging information of patients

Background

- Social Network Analysis can provide insight in how physicians actually collaborate
  - With which other physicians?
  - Patterns of collaborating physicians
  - Who is more ‘connected‘?

How to collect data on networks?

- Method: patient-sharing networks
  - Based on healthcare claims
  - Connections formed by shared patients

However: how to interpret those networks?

Background

- Meaning and use of patient-sharing networks
  - Defining collaboration groups
  - Indication of coordination

Sharing ≠ Coordination

- Referring as coordination
  - Characteristics of a strong primary care system
  - Enhance coordination

Data so far unsuitable

Background
Research aims

- *To explore variation in how physicians who treat type 2 diabetes patients form networks with other physicians, both intra and inter-disciplinary.*

- *To study how coordination of care in the form of referrals takes place within those networks.*

- *To test if networks in which physicians refer patients more often perform better?*

What is Social Network Analysis?

- Method with roots in the Social Science
- Underlying idea: People act not independently but are influenced by others
- These patterns of connections can be studied
  - Sociology, biology, computer science, neurology
- Quantitative method
  - Nodes → Actors
  - Ties → Connections
- Outcomes
  - Network parameters
  - Sociograms

Methods

Data

- Reimbursement data AOK BW health insurer
  - 4 million patients
- Included physicians:
  - General physicians
  - Internists
  - Ophthalmologists
- Creating physicians‘ patient-sharing network
  - Connection when sharing >4 patients

Methods

Networks levels

- Full network
  - One network including all physicians and links
- Ego network
  - Only including directly connected physicians to a specific node
- Local communities
  - Smaller subnetworks
  - Using a multi-level modularity optimization algorithm for finding community structures, sets of densely connected nodes were detected

Methods

Measures: referrals

Identifying referral ties

1. Remove ‘self-referrals‘
2. Select only: GP → Specialist ties
3. Timeframe < 3 months
4. Select only: >1 referral tie

Methods
Network measures

- Ego network characteristics
  - Number of connections
  - Density, Betweenness, Constraint
  - Proportion of referred ties

- (Sub)Network characteristics
  - Density, Centrality
  - Proportion of referred ties

Methods – Measures

- **Physician characteristics:**
  - Physician's specialization
  - Age and Gender
  - Involvement in a type 2 diabetes program

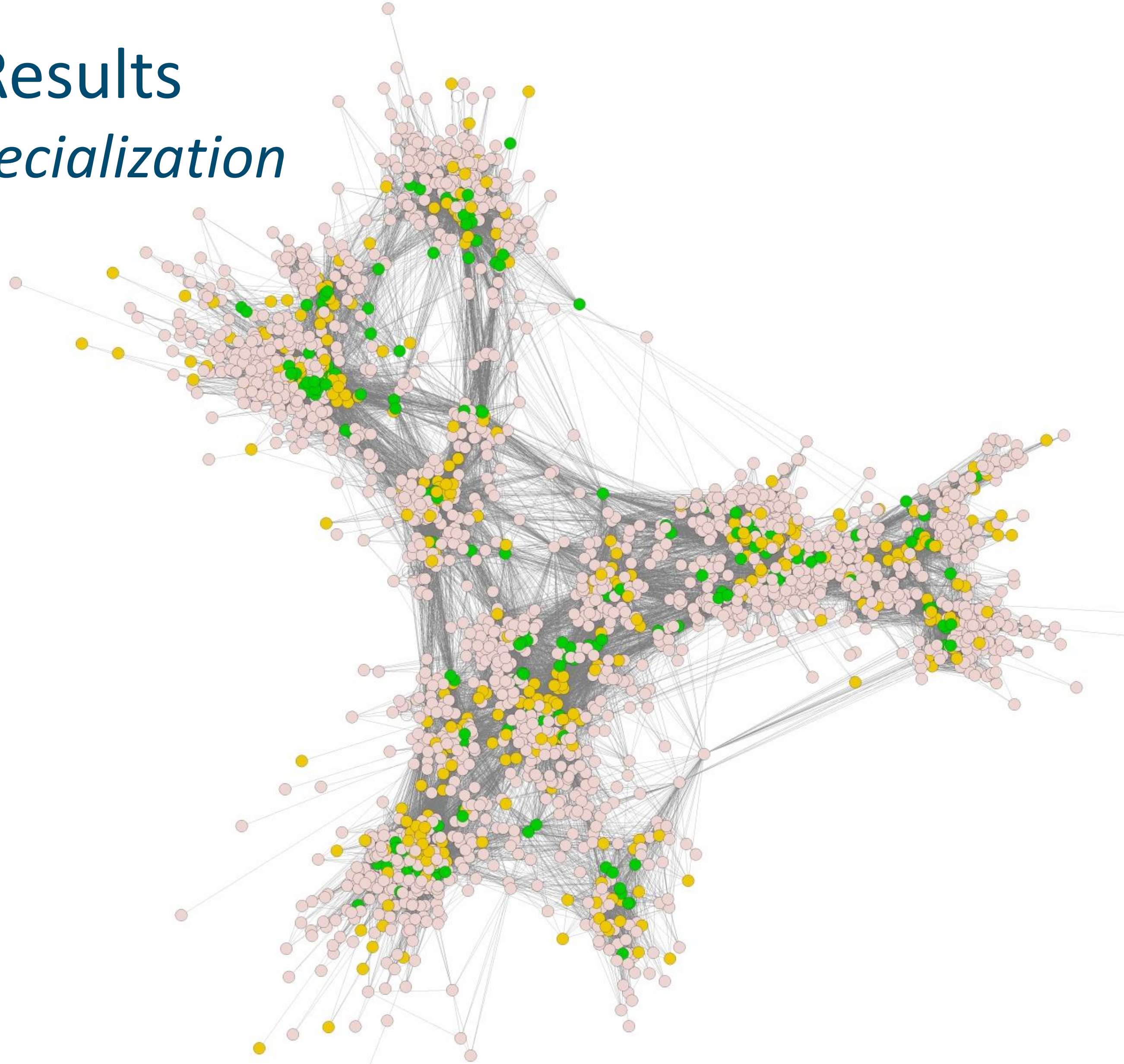
- **Outcomes at patient level**
  - Continuity of care: - number of physician visits
    - number of different physicians per specialization
  - Suboptimal treatment - Complications
    - Hospitalization

(Preliminary) Results
Descriptive

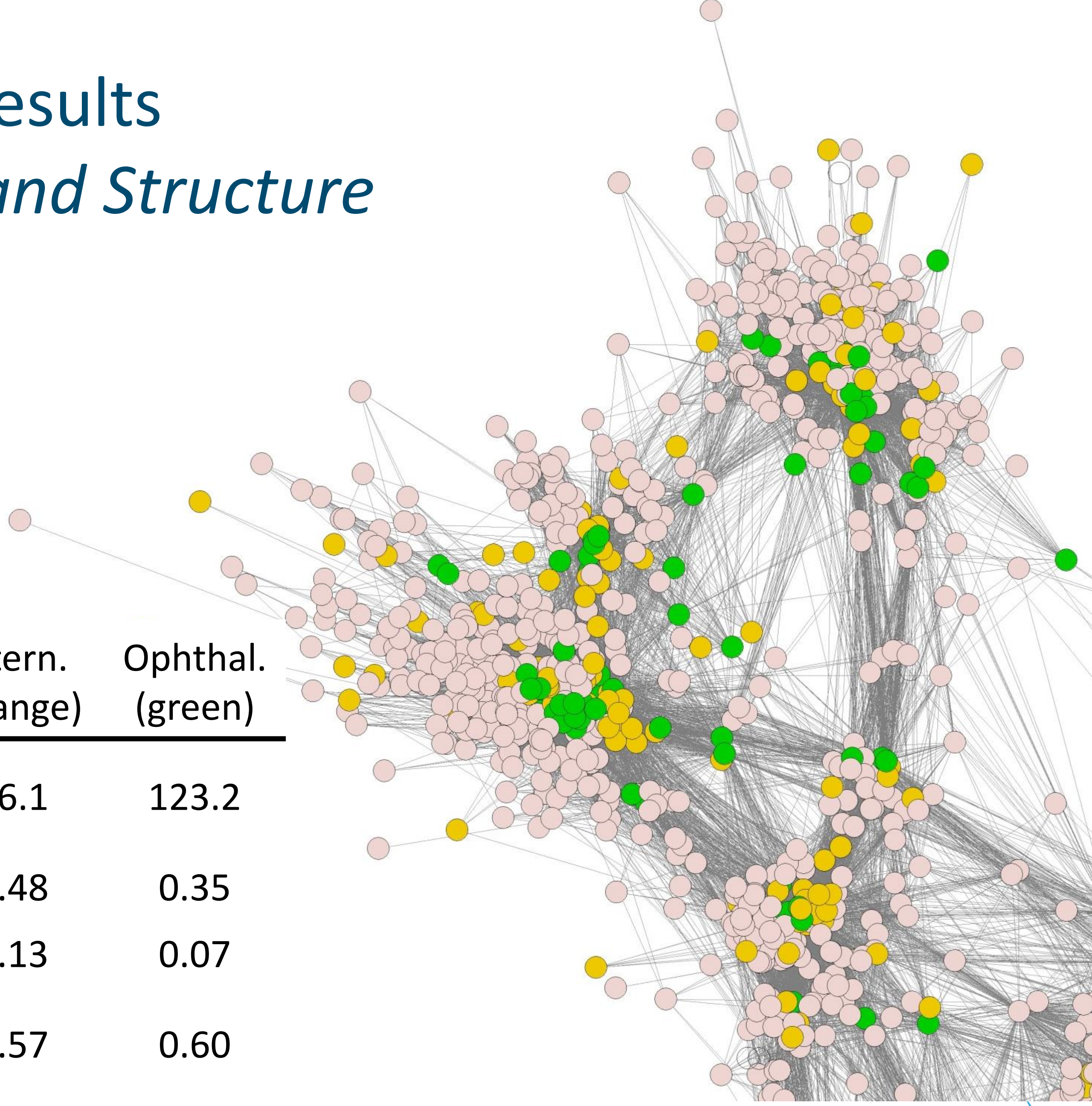
- Included 9260 physicians
  - 79% GP
  - 13% internists
  - 8% ophthalmologists
- Physicians’ age 55
- 65% male
- Network connections
  - 1.874.333 shared patients
  - Forming 237.162 links between them
  - Average 51 connections

(Preliminary) Results

Structure and specialization



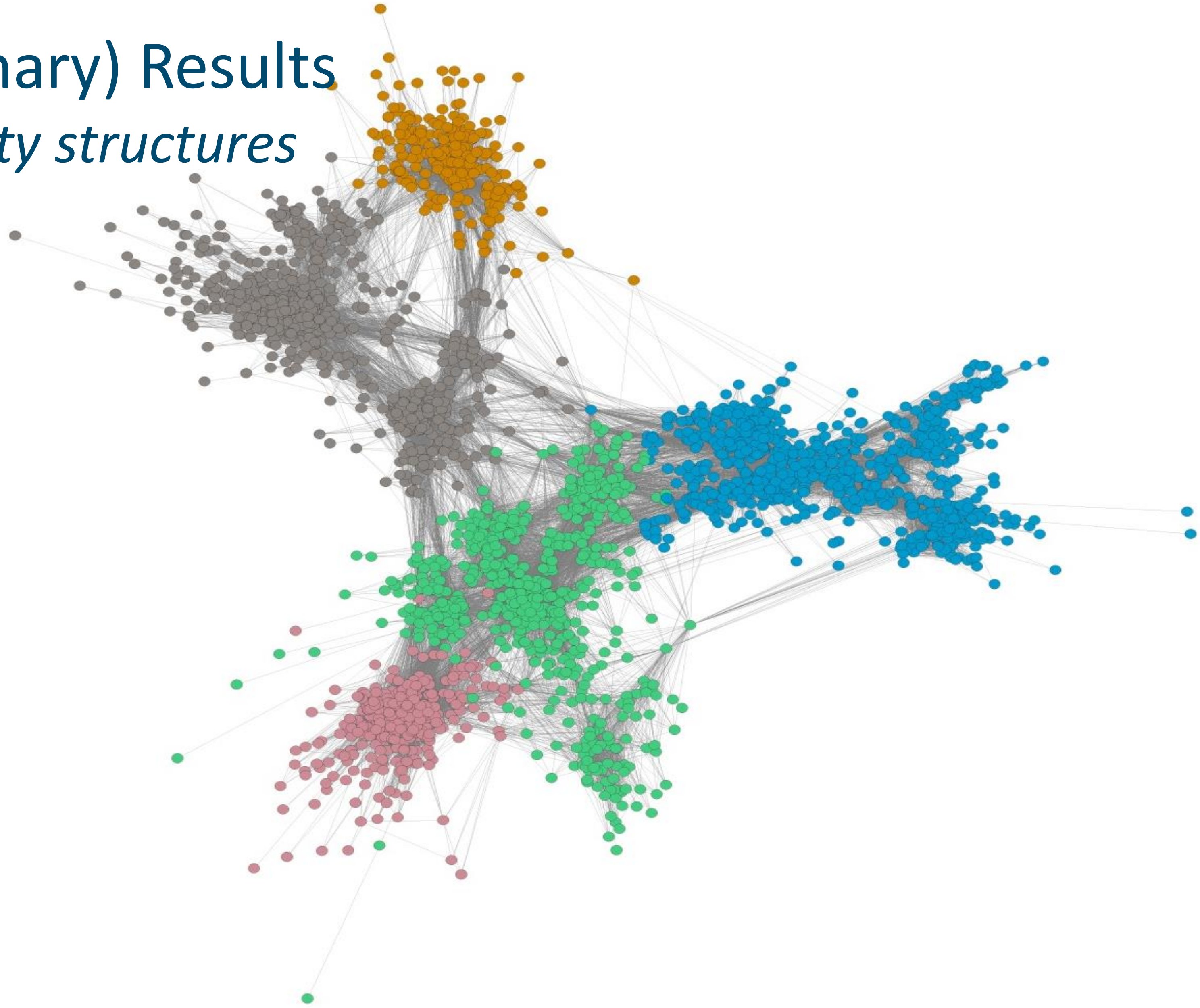
(Preliminary) Results
Specialization and Structure



	GP (pink)	Intern. (orange)	Ophthal. (green)
Number of connections	36.6	96.1	123.2
Density	0.74	0.48	0.35
Constraint	0.23	0.13	0.07
Proportion referrals	0.76	0.57	0.60

(Preliminary) Results

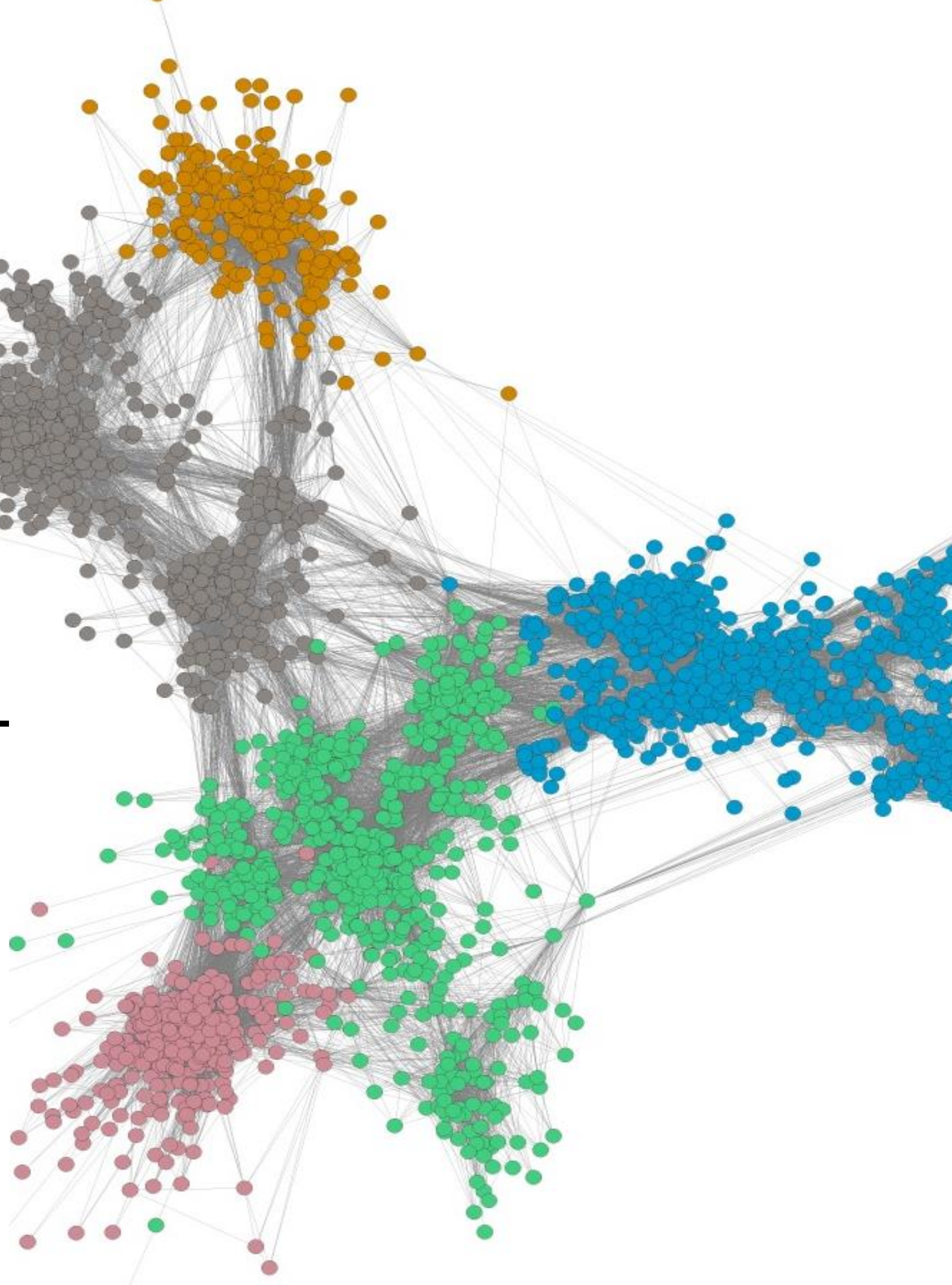
Community structures



(Preliminary) Results

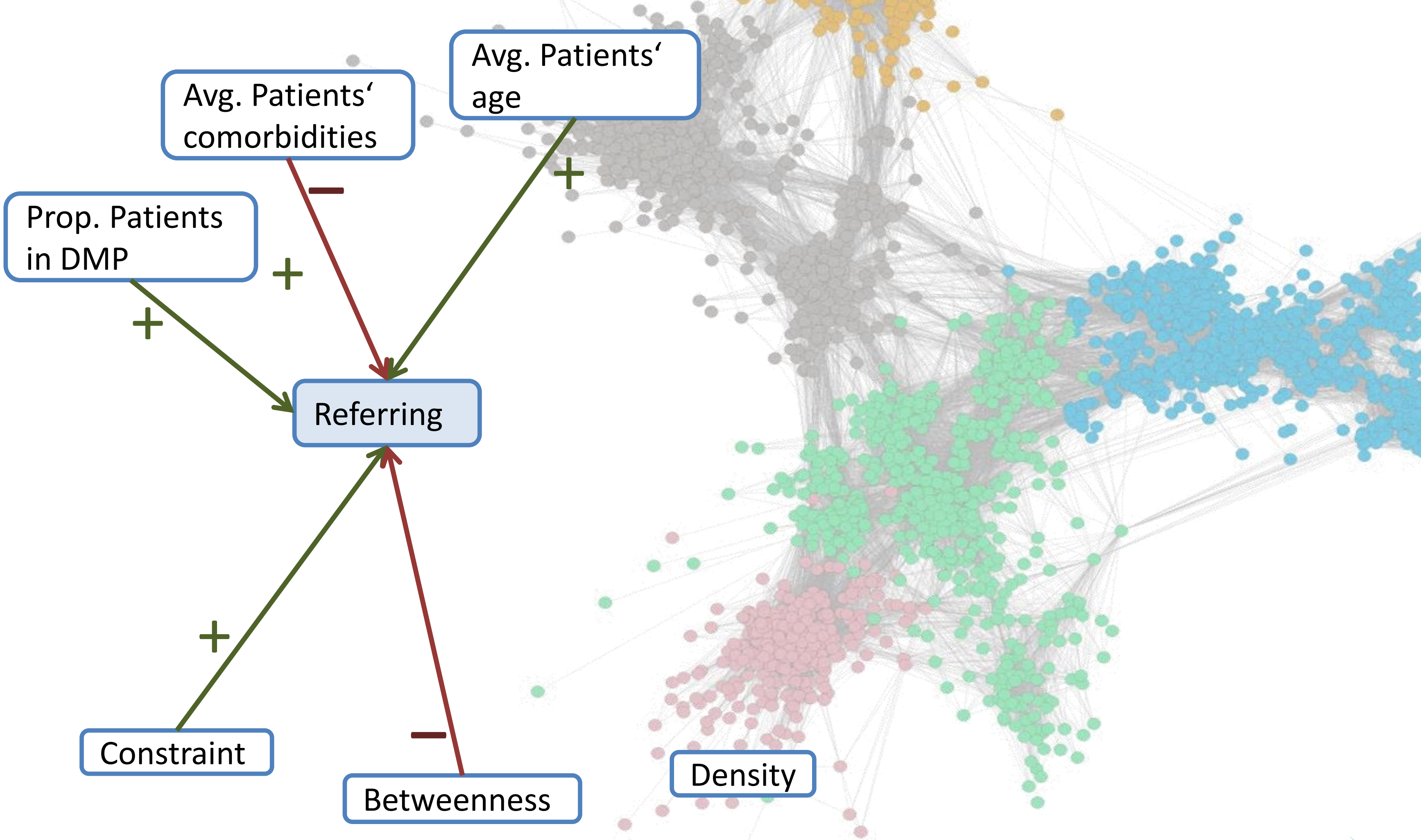
Community structures

	Mean	Min	Max
Size	489	94	952
N connections	50.8	38.5	63.2
Density	0.13	0.04	0.40
Centrality	0.50	0.32	0.96
Prop. GPs	0.79	0.74	0.82
Prop. referrals	0.72	0.62	0.79
Prop. in DMP	0.64	0.54	0.71



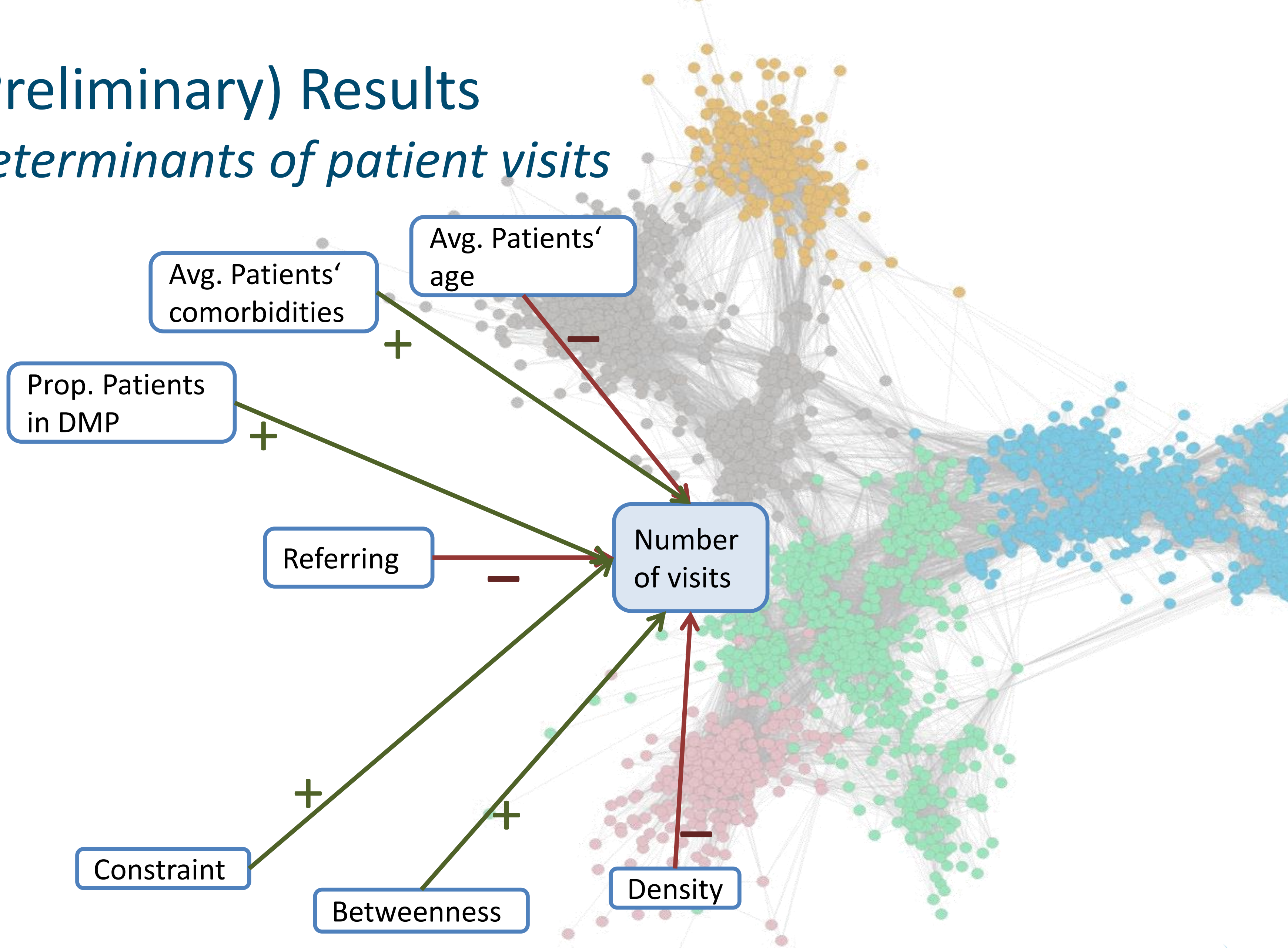
(Preliminary) Results

Determinants of referring



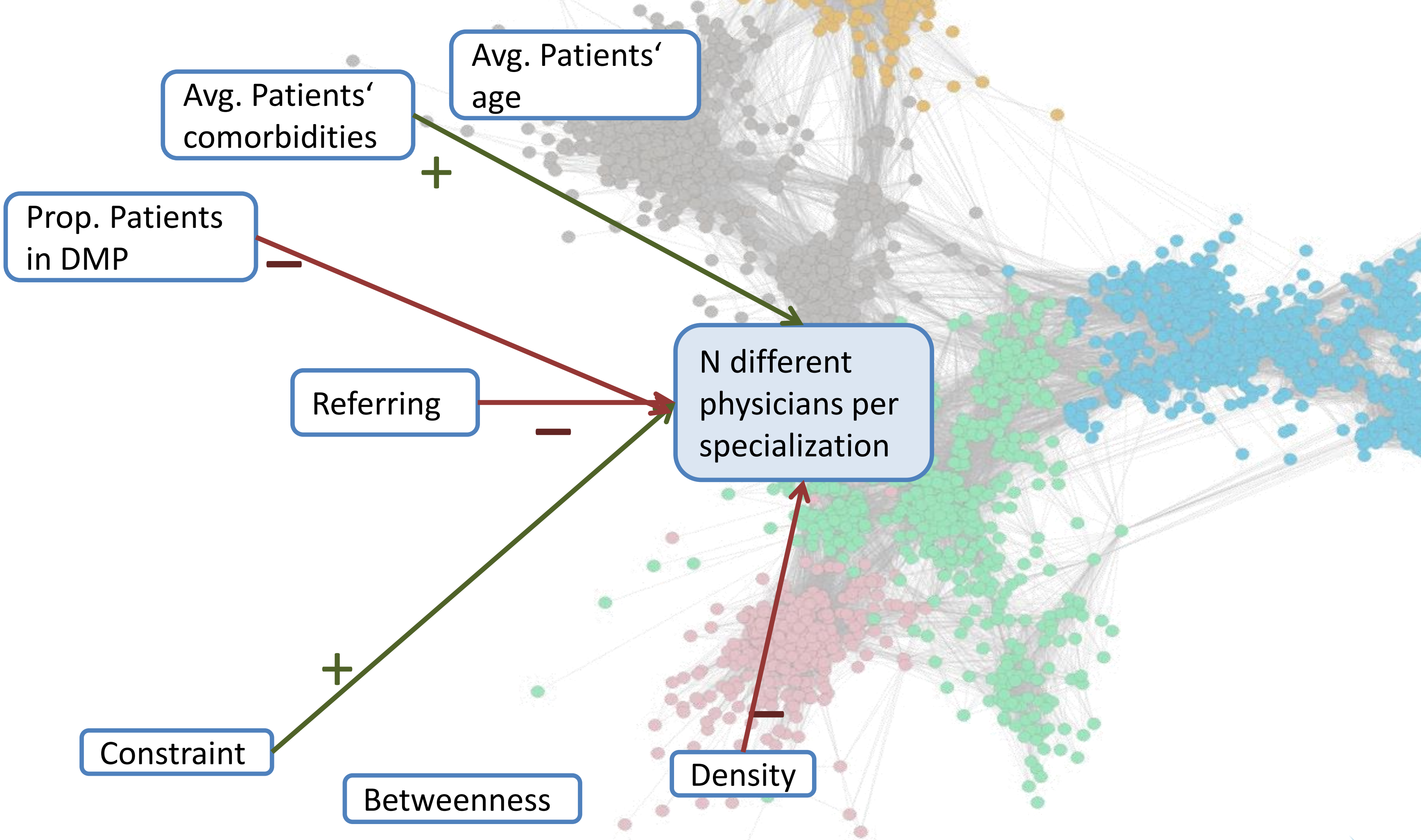
(Preliminary) Results

Determinants of patient visits



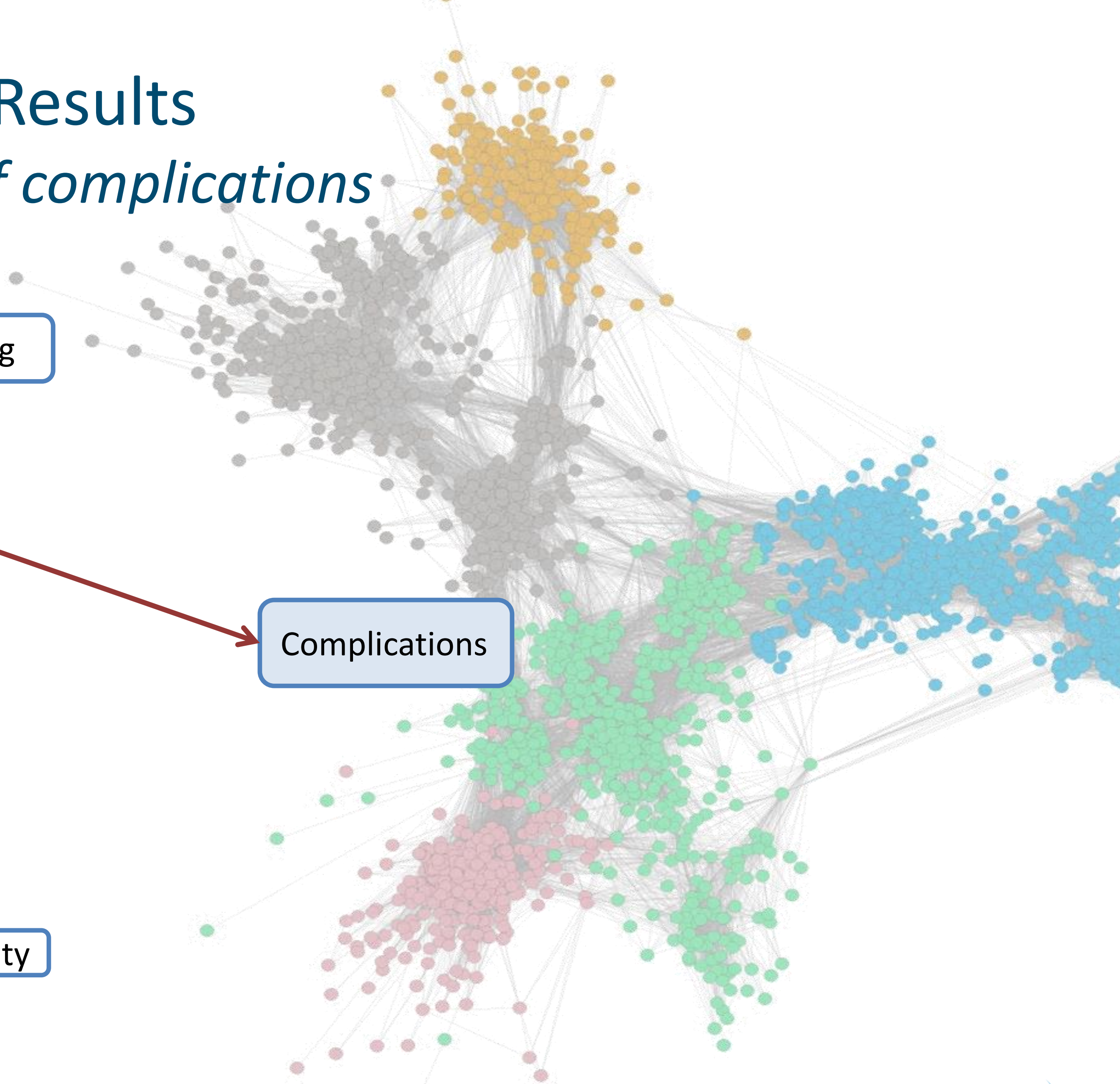
(Preliminary) Results

Determinants of number of phycisians



(Preliminary) Results

Determinants of complications



Referring

Constraint

–

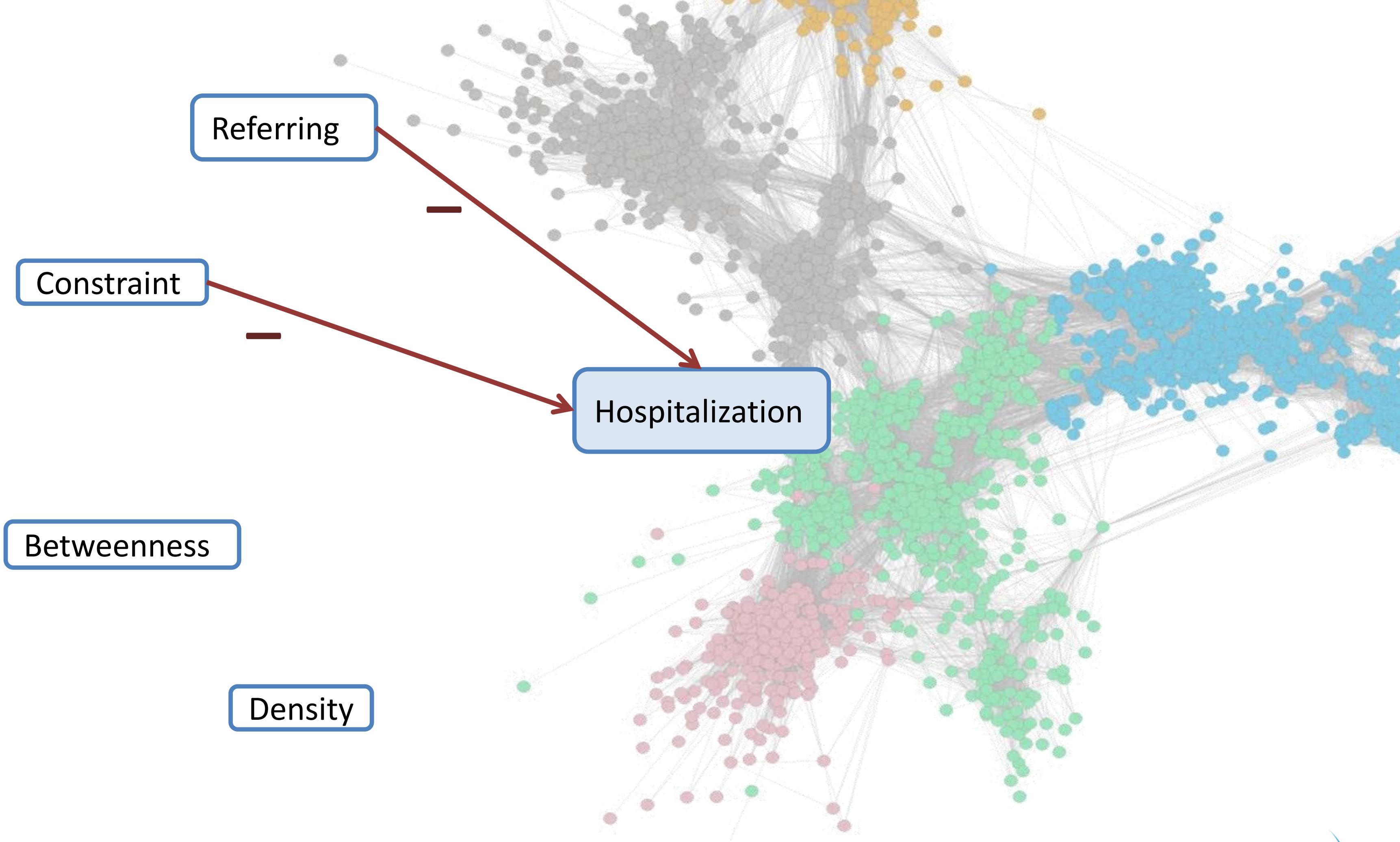
Complications

Betweenness

Density

(Preliminary) Results

Determinants of hospitalization



Conclusion

- Social Network Analysis can capture (variation in) physician collaboration networks
  - Between and within specializations
  - Between Community structures
- Referring
  - Can be distinguished from sharing patients
  - Varies between physicians and community structures
  - Can be linked to better coordination/continuity of care
  - Can be linked to better patient outcomes

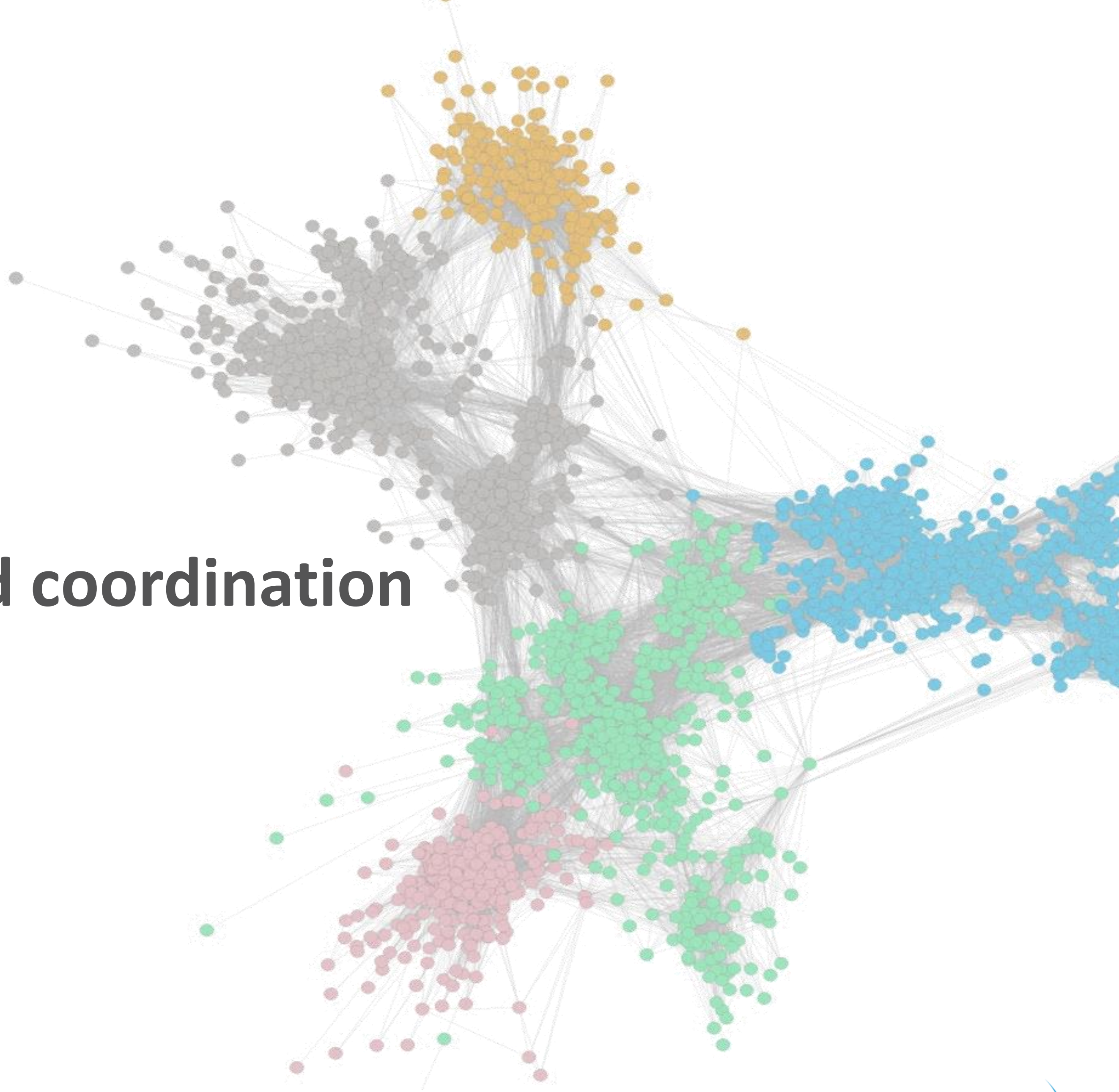
Discussion

- Strengths and limitations
  - Networks based on shared patients
  - Only data from one health insurer
  - Few physician characteristics

- To discuss for future research
  - Theoretical link network measures and outcomes
  - Methodology: strength of connection, sharing and referring
  - Other purposes using Social Network Analysis?

Discussion

Take home



Networks and coordination matter