Evaluation of community public health partnerships: case study of four social networks

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The findings and conclusions in this presentation are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry.

Objectives

- Apply methods and measures of social network analysis for quantitative assessment of interorganizational public health partnership networks

- Find a feasible method for obtaining network data from key players in public health systems

- Identify aspects of interorganizational networks that are relevant to public health system partnership effectiveness

Public Health System
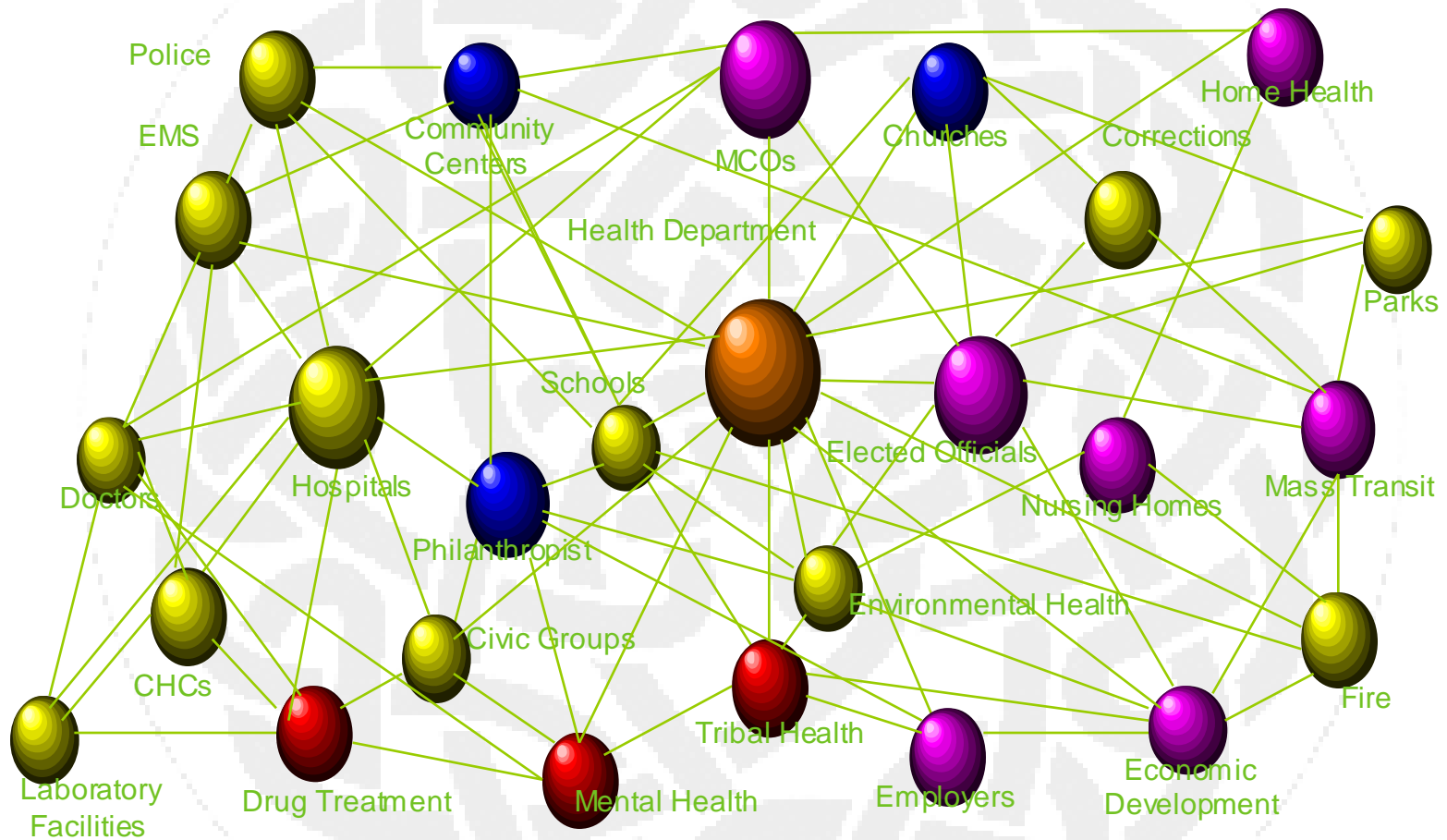
Motivation

- The need for a "systems" approach to public health is emphasized in the recent report from Institute of Medicine (IOM), "The Future of the Public's Health in the 21st Century"
- Need to develop framework for quantitative evaluation of the multiplicity of interactions between public health systems partners
- Intensity of interorganizational and personal partnership relationships within health systems may have positive effects on:
  - performance of public health entities
  - preparedness of public health systems
  - health outcomes
- Public health system is a collection of partnerships
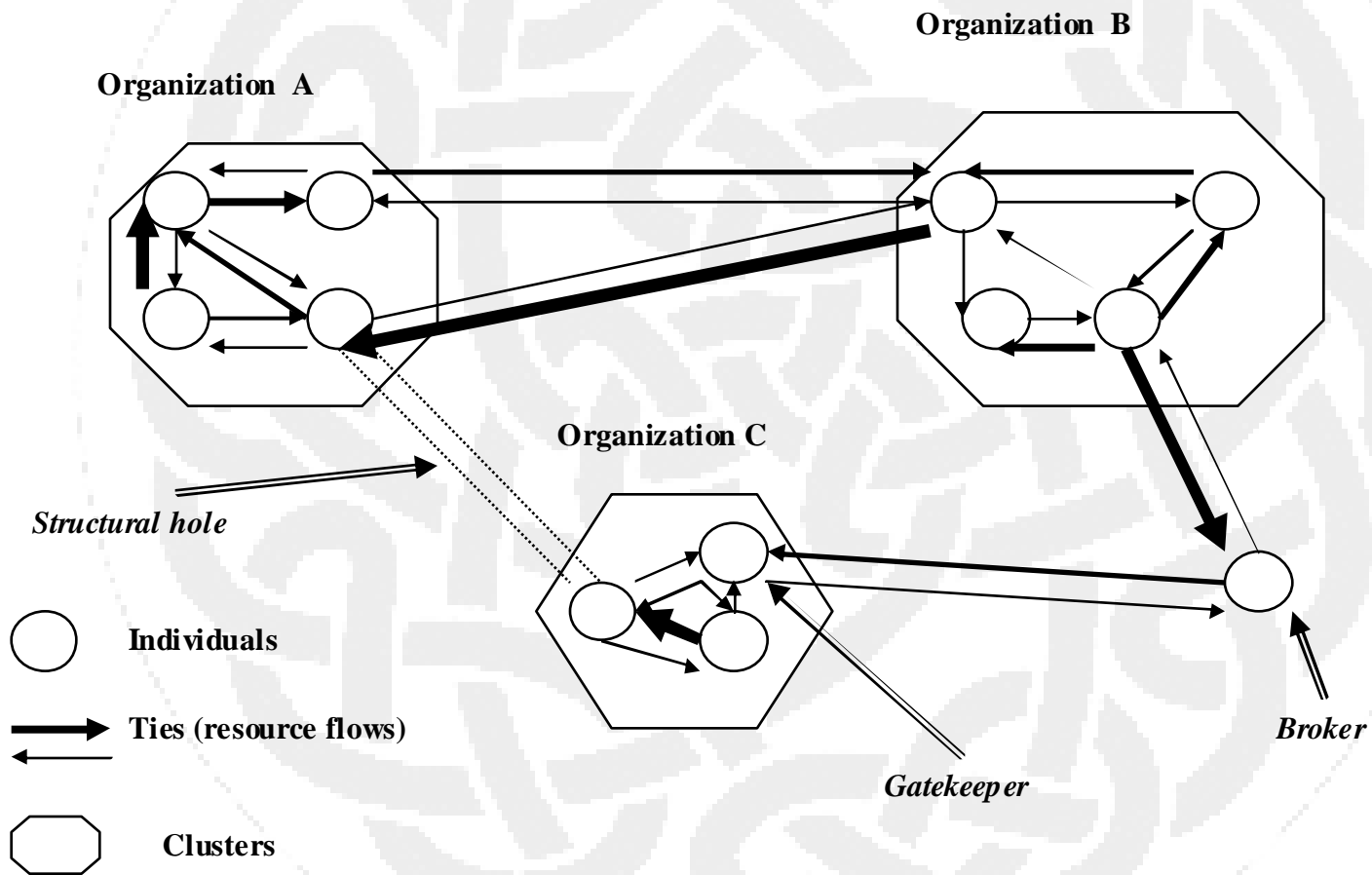- Each partnership can be viewed as social network

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Benefits of Social Network Analysis for Partnerships Evaluation

- Assess partnerships as social networks
- Map existing partnerships
- Identify partnership network characteristics
- Provide metrics for quantitative assessment of partnership networks
- Determine which structures foster success
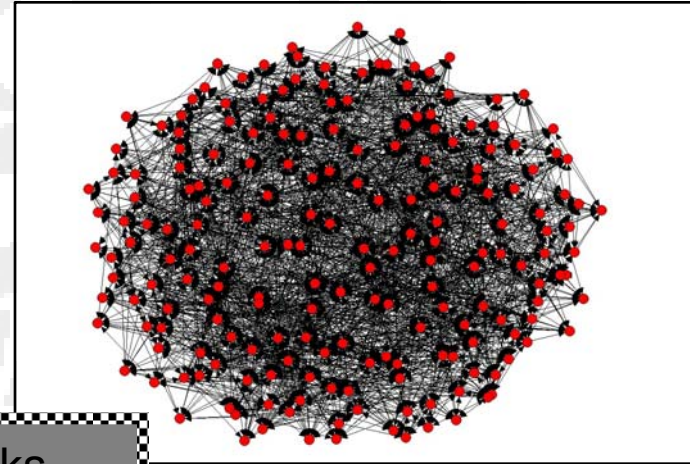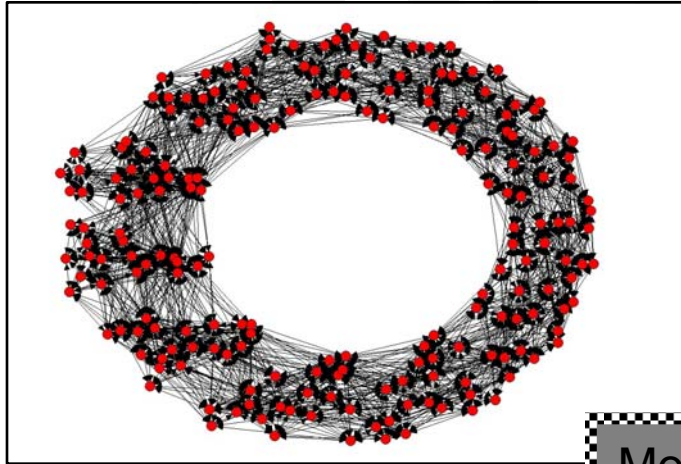- Assist in development of network building strategies

Types and Levels of Social Relations

- **Types of social relations**
  - Dyadic
    - Friendship, coworker, advice
    - Competitive
  - Groupwise
    - Common membership or identity
    - Adversarial memberships or identities
  - Structural
    - Equivalencies, dependencies, linked processes
- **Levels of collectivity**
  - Individuals
  - Groups and organizations
  - Multidimensional systems (collections of individuals and organizations operating within definable boundaries, wherein they contribute or receive resources)

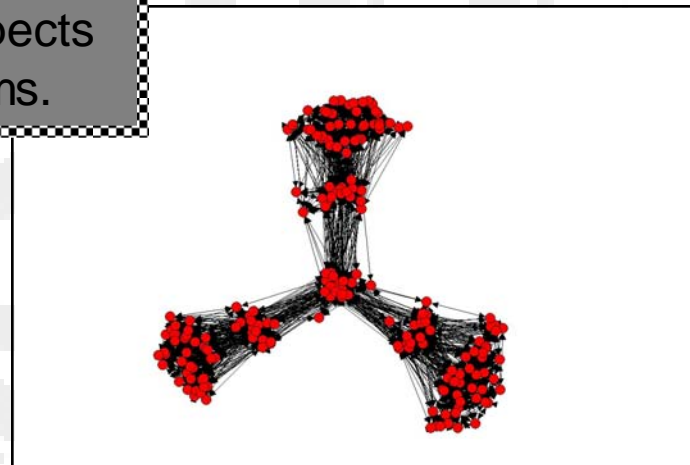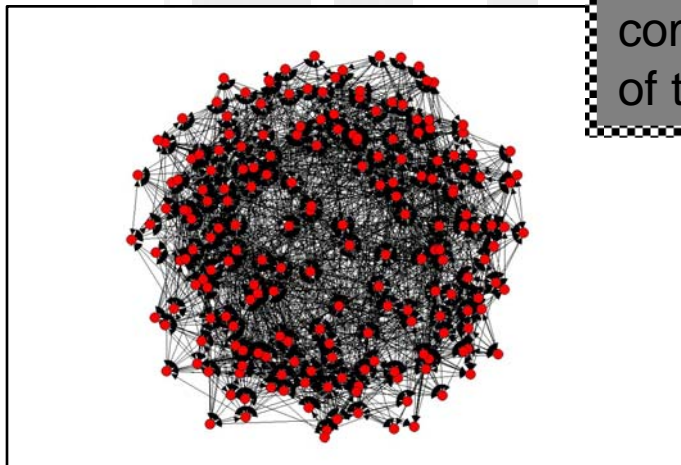# Levels of partnerships: individual and interorganizational

Organization B

Organization A

Organization C

Structural hole

Individuals

Ties (resource flows)

Clusters

Gatekeeper

Broker

General Forms of Networks

Most networks combine aspects of these forms.

Methods

- A combination of qualitative (case study) and quantitative (social network analysis) methods was used to analyze four types of interorganizational networks in Cobb county, Georgia

- We interviewed principal collaborators from: the county board of health, tobacco prevention program, health promotion program for kids and county chamber of commerce about the types and intensities of their partnership relations

- We created graphs of four networks and calculated quantitative measures of partnership network structures used in social network analysis (density, centrality, betweenness)

- We evaluated associations of these structural measures with measures of performance of the county public health system

What interactions are we measuring?

How often does your organization communicate with … on public health related issues?

- No interaction – 0
- Once per year – 1
- Quarterly – 2
- Monthly – 3
- Weekly – 4
- Daily - 5

Software

VISONE

Available for free for academic and research purposes at http://visone.info

The basic network data are usually represented as an *N* x *N* directed matrix for the *N* nodes or actors

	Tobacco Use	American L	Austell Cor	Cobb and [	Cobb and [	Cobb Colla	Cobb Cour	Cobb Cour	Cobb Care	Cobb Unde	Douglas C(	Douglas C(	Georgia All	Georgia/Co	Kennesaw	Mental Hea
Tobacco Use Prevention		3	2	3	5	2	2	1	3	3	3	3	2	2	2
American Lung Associ	3		1	2	3	1	1		1	1	1	1	5	2	1	1
Austell Community Tas	2	1		1	3	3	2	1	1	2	1	1	1	2	1	2
Cobb and Douglas Am	3	2	1		3	1	2	1	1	1	2	2	3	2	2	1
Cobb and Douglas Boa	5	3	2	2		2	3	2	3	3	3	2	3	2	2	2
Cobb Collaborative	2	1	3	1	3		2	1	1	1			1	3	3	3
Cobb County School S	2	1	2	2	3	3		1	2	3		1		4	3	3
Cobb County Safe and	1				1	2	1			2				2	2	1
Cobb Care Kids Coaliti	3		2		5	1	3			2				2	1	
Cobb Underage Drinki	3		2		3	2	3	2	3					3	2	3
Douglas CORE (comm	3			2	3							3	2	2		2
Douglas County Schoc	2	1		1	3		1				3		1	3		2
Georgia Alliance for T(	3	5		3	3						2			2		
Georgia/Cobb PTA	2		2		2	1	3	1	3	1	1	2	2		1	
Kennesaw State Unive	2															
Mental Health, Develo[	2		2	1	3	3	3	4	1	3						
Powder Springs Comn	3		1		2	3	2	1	2	2				2	2	1
Wellstar Health Systen	4	3	2	3	3	3	2		5	1	2	2	3	1		3

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Network measures

- Density
- Degree
- Indegree
- Outdegree
- Betweenness
- Closeness
- Centralization

Network measures: Density

- The density measure describes general level of linkage among the actors in the community. This measure compares the number of actual ties in a network to theoretically possible number of relations

- Higher density indicates a greater degree of interaction among the network members in the process of making decisions

Network measures: degree centrality

- Degree centrality measures the number of direct connections a node (organization) has with other nodes (organizations)

- Degree centrality is a general measure of how connected an organization is to others in the network

Network measures: Indegree and Outdegree centrality

- Indegree is a count of the number of ties directed to your organization. Indegree is usually interpreted as a form of popularity, prestige, i.e., a measure of how many other organizations see themselves as partners with your organization

- Outdegree is the number of ties that our organization directs to others. It is a measure of outward social interaction, i.e., a measure of how many other organizations your organization regards as partners

Network measures: Betweenness

- Betweenness is calculated as the number of times an organization in the network stands along the shortest path between two other organizations, with the two organizations holding no connection with one another

- Betweenness is a measure of a 'broker' role in the network. The higher the value of betweenness, the more potential an organization has to control third-party relationships and transfers of information

Network measures: Closeness

- Closeness is defined as the mean geodesic path (i.e the shortest path) between a partner and all other partners reachable from it

- Closeness can be regarded as a measure of how long it will take information to spread from a given partner to others in the network. The higher the value of closeness, the shorter are the paths to the organization relative to other entities in the community

Network measures: Centralization

- Network centralization (or global centrality) measures the degree to which an entire network is focused around a few organizations. A very centralized network is dominated by one or very few partners.

- Centralization scores are calculated for each of centrality measures and represent deviation of centrality scores from the mean. For example, a low closeness centralization score implies low levels of centralized access to information resources. The betweenness centralization score is small if the network does not exhibit much control by a few organizations
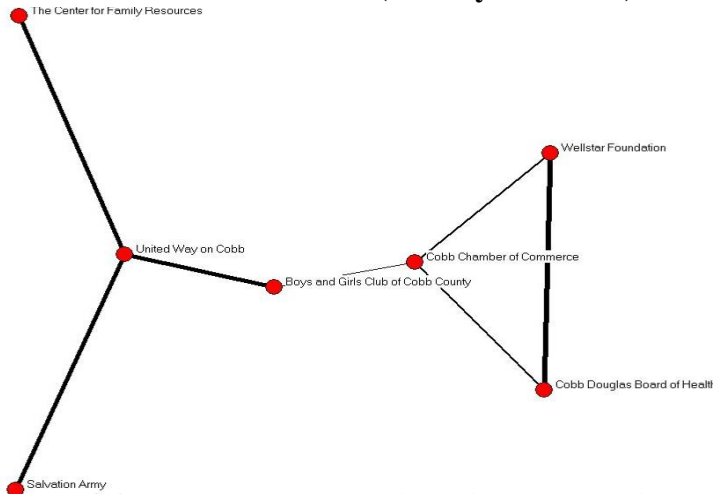
Types of questions that can be answered by using relevant social network measures

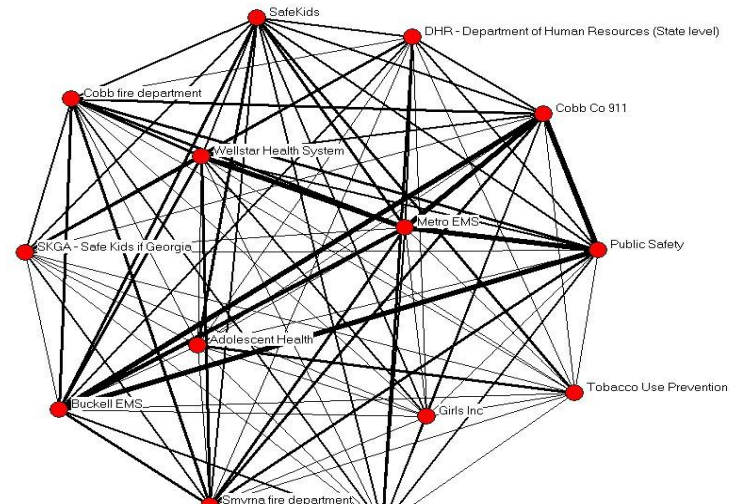| Research questions	Network measure
How well developed/connected is the partnership network?	Density
What is the overall configuration of the network (decentralized vs. centralized)?	Centralization
Which organization is the most powerful in the network (most connected)?	Degree centrality
Which organization everybody wants to work with? (has most inward connections to)	Indegree centrality
Which organization is the most eager to work with other organizations? (has most outward connections)	Outdegree centrality
Which organization is in a position of being a gatekeeper/broker/intermediary?	Betweenness
Which organization provides the shortest path for reaching all network members?	Closeness

Examples of existing networks of different density in Cobb county, GA
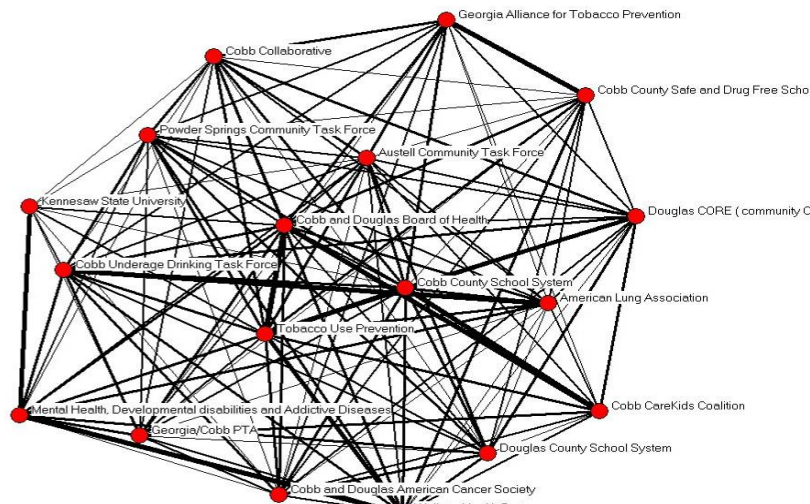
Tobacco Prevention Network (Density – 69.49%)

Safe Kids Network (Density – 85.26%)

Chamber of Commerce Network (Density – 23.81%)
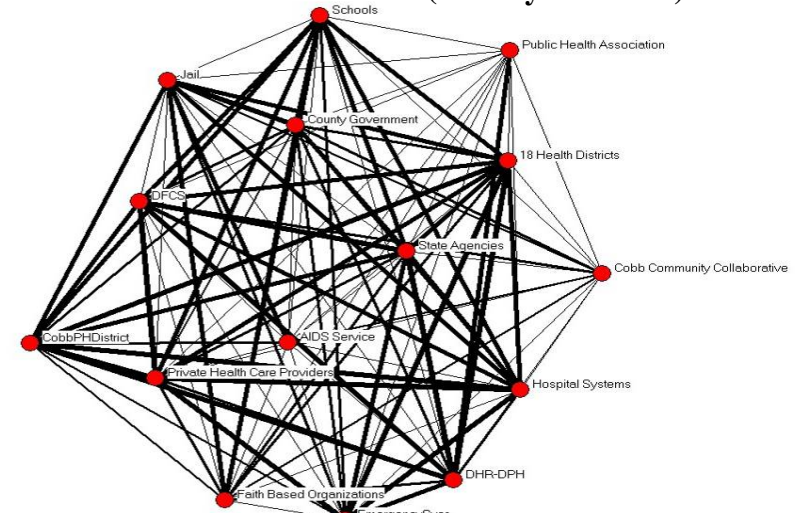
Board of Health Network (Density – 87.14%)

Results of ego-network study: network level

- The density of collaborative networks differs considerably from 22% for Chamber of Commerce to 87% for Board of Health

- The four networks seemed to operate independent of each other. Only weak connections between the four networks are provided through their joint partnerships with insurance providers and hospitals

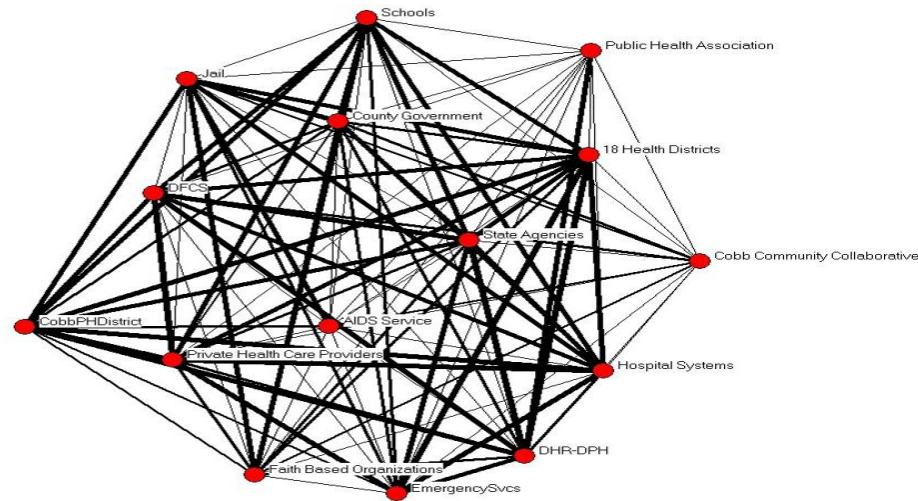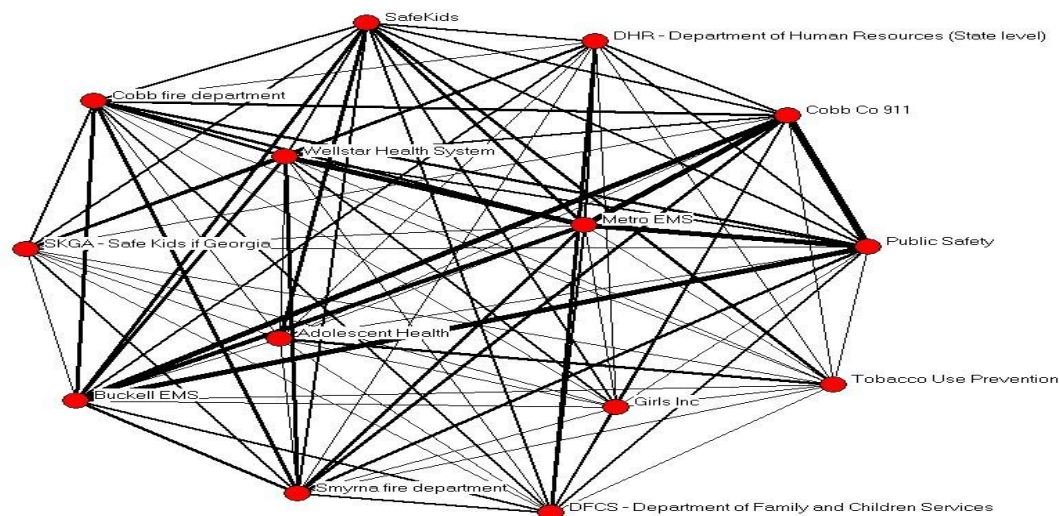| Board of Health Public Health Information Network density 87.14%					
node	degree	indegree	outdegree	betweenness	closeness
Faith Based Organiz	*4.55%*	5.25%	3.84%	10.45%	**8.16%**
DFCS	5.25%	*3.84%*	6.67%	8.62%	6.05%
Emergency Services	5.35%	5.66%	5.05%	8.73%	7.42%
DHR-DPH	5.35%	4.24%	6.46%	4.30%	6.53%
Hospital Systems	5.45%	4.04%	6.87%	6.35%	6.28%
Private Health Care	6.16%	4.85%	7.47%	8.13%	6.05%
Cobb Community Collab	6.26%	8.89%	*3.64%*	6.98%	**8.16%**
Schools	6.26%	6.46%	6.06%	1.45%	6.53%
AIDS Service	6.36%	8.08%	4.65%	9.58%	**8.16%**
State Agencies	6.46%	5.45%	7.47%	**17.85%**	6.53%
County Government	6.77%	6.46%	7.07%	1.41%	5.63%
Public Health Associ	6.97%	8.69%	5.25%	3.79%	7.42%
Jail	7.07%	7.88%	6.26%	3.01%	6.28%
Board of Health	8.18%	7.07%	9.29%	*0.00%*	*3.71%*
18 Health Districts	**13.54%**	**13.13%**	**13.94%**	9.34%	7.10%
minimum	4.55%	3.84%	3.64%	0.00%	3.71%
maximum	13.54%	13.13%	13.94%	17.85%	8.16%
centralization	7.36%	6.93%	7.79%	11.99%	1.60%

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Safe Kids Public Health Information Network density 85.26%					
node	degree	indegree	outdegree	betweenness	closeness
Tobacco Use Preventi	_5.95%_	7.43%	_4.46%_	**20.57%**	**9.98%**
Cobb Co 911	6.13%	7.06%	5.20%	9.96%	8.32%
SKGA - Safe Kids if	6.88%	7.81%	5.95%	18.75%	8.32%
DFCS - Department of	7.43%	7.81%	7.06%	3.75%	7.13%
Public Safety	7.43%	7.06%	7.81%	7.28%	_6.80%_
Cobb fire department	7.62%	7.81%	7.43%	7.95%	_6.80%_
Girls Inc	7.62%	6.32%	8.92%	7.57%	8.81%
Metro EMS	7.62%	_4.83%_	10.41%	6.94%	7.49%
DHR - Department of	7.62%	8.55%	6.69%	2.94%	7.49%
Wellstar Health Syst	8.36%	7.81%	8.92%	3.03%	7.13%
Adolescent Health	8.55%	7.43%	9.67%	4.53%	7.13%
Smyrna fire departme	8.74%	**10.04%**	7.43%	5.01%	7.49%
Buckell EMS	**10.04%**	**10.04%**	**10.04%**	_1.72%_	7.13%
minimum	5.95%	4.83%	4.46%	1.72%	6.80%
maximum	10.04%	10.04%	10.41%	20.57%	9.98%
centralization	2.54%	2.54%	2.94%	13.95%	2.48%

Chamber of Commerce Public Health Information Network density 23.81%					
node	degree	indegree	outdegree	betweenness	closeness
Chamber	_7.35%_	_0.00%_	14.71%	_0.00%_	**35.86%**
H.Board	10.29%	5.88%	14.71%	_0.00%_	5.58%
Wellstar	10.29%	20.59%	_0.00%_	0.00%	_0.00%_
CFamRes	11.76%	11.76%	11.76%	_0.00%_	12.55%
SalArmy	11.76%	11.76%	11.76%	_0.00%_	12.55%
B&GirlsC	13.24%	14.71%	11.76%	27.27%	12.55%
UnitedWay	**35.29%**	**35.29%**	**35.29%**	**72.73%**	20.92%
minimum	7.35%	0.00%	0.00%	0.00%	0.00%
maximum	35.29%	35.29%	35.29%	72.73%	35.86%
centralization	24.51%	24.51%	24.51%	**68.18%**	25.17%
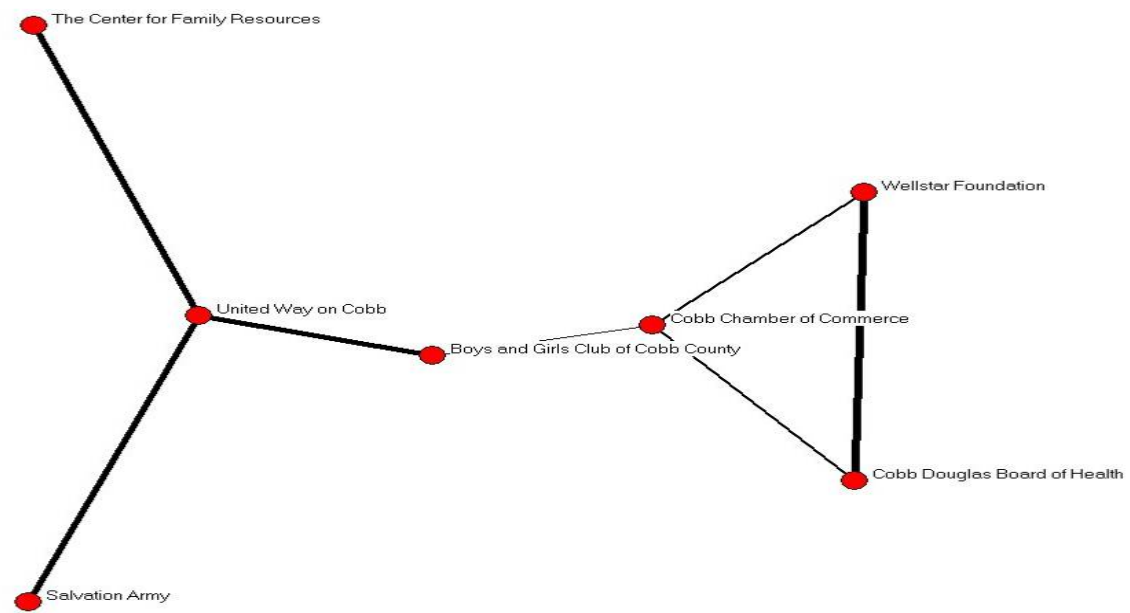
Tobacco Use Prevention Public Health Information Network density 69.49%					
node	degree	indegree	outdegree	betweenness	closeness
KennesawUniv	2.55%	5.10%	0.00%	0.00%	0.00%
SafeDrugFree Schools	3.32%	3.57%	3.06%	13.07%	6.35%
DouglasSchools	3.95%	3.57%	4.34%	3.05%	6.56%
Douglas CORE	3.95%	3.83%	4.08%	0.23%	4.37%
GeorgiaTobaccoPreven	4.97%	5.36%	4.59%	0.23%	3.71%
Powder SpringsTForce	5.23%	5.36%	5.10%	2.45%	6.56%
AmLungAss	5.36%	4.34%	6.38%	12.36%	**8.55%**
AustellTForce	5.74%	5.10%	6.38%	11.91%	**8.55%**
CareKids	5.87%	5.87%	5.87%	2.77%	5.46%
CDouglasAmCancerSoc	5.87%	4.59%	7.14%	**14.62%**	7.87%
UnderageDrinkingTF	6.12%	5.61%	6.63%	3.09%	4.92%
Mental Health	6.25%	6.12%	6.38%	2.68%	5.18%
CobbCollaborative	6.89%	6.38%	7.40%	13.91%	7.29%
Georgia/Cobb PTA	6.89%	8.16%	5.61%	14.14%	7.57%
CobbSchools	7.65%	7.14%	8.16%	2.96%	6.56%
Wellstar	8.93%	8.93%	8.93%	2.52%	5.46%
CDBoardHealth	**10.46%**	**10.97%**	**9.95%**	0.00%	5.04%
minimum	2.55%	3.57%	0.00%	0.00%	0.00%
maximum	10.46%	10.97%	9.95%	14.62%	8.55%
centralization	4.86%	5.40%	4.32%	**9.28%**	*2.84%*

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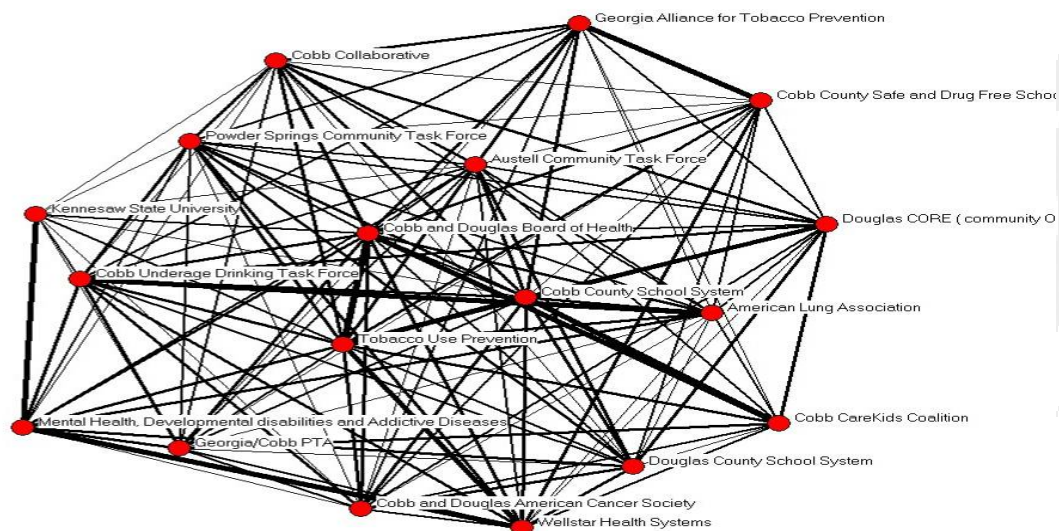
Summary of relevant network measures across 4 networks					
		Networks			
Research questions	Measures	**Tobacco**	**Health Board**	**Safekids**	**Chamber**
How well developed/connected is the partnership network?	Density	high	high	high	low
What is the overall configuration of the network (decentralized vs. centralized)?	Centralization	decentralized	decentralized	decentralized	centralized
Which organization is the most powerful in the network (most connected)?	Degree centrality	Board of Health	Health district	Emergency medical services	United Way
Which organization everybody wants to work with? (has most inward connections to)	Indegree centrality	Board of Health	Health district	Emergency medical services, Fire department	United Way
Which organization is the most eager to work with other organizations? (has most outward connections)	Outdegree centrality	Board of Health	Health district	Emergency medical services	United Way
Which organization is in a position of being a gatekeeper/broker/intermediary?	Betweenness	Cobb American Cancer Society, Cobb PTA, Cobb Collaborative, SafeDrug Free schools, American Lung association	State health agency	Tobacco use prevention, Safe Kids	United Way
Which organization provides the shortest path for reaching all network members?	Closeness	American Lung Association, City of Austell	Faith-based organizations, AIDS coalition, Cobb collaborative	Tobacco use prevention	Chamber of Commerce

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Network centralization and perceived public health system performance

Legend: Average performance score — Betweenness centralization
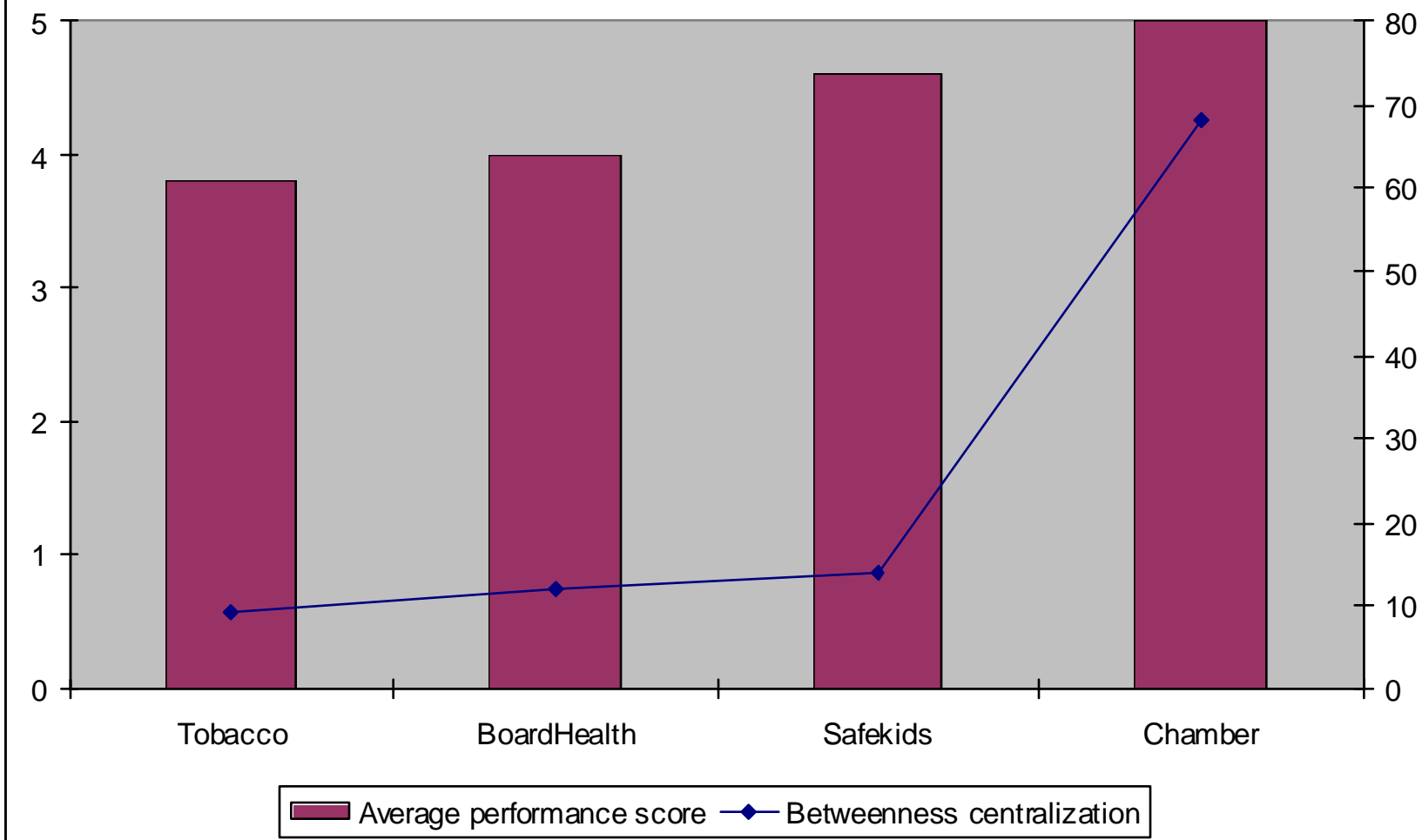
Results of ego-network study: individual organization level

- The following <u>major players</u> <u>(most connected)</u> organizations have been identified for each of 4 networks:
1. Health district (Board of Health Network),
2. Board of Health (Tobacco Prevention Network),
3. EMS (SafeKids Network),
4. United Way (Chamber of Commerce Network).
- United Way and State health agency are identified as <u>brokers</u> in Chamber of Commerce and Board of Health Networks. SafeKids and Tobacco Prevention Networks have multiple brokers
- The <u>most "close" members</u> of network, i.e. the ones that others can be more easily reached through are:
1. Faith–based organizations (Board of Health Network),
2. American Lung Association (Tobacco Prevention Network),
3. Tobacco Prevention Network (SafeKids Network),
4. Chamber of Commerce (Chamber of Commerce Network).
- Positive association between centralization and perceived public health system performance has been observed across 4 networks

Implications for public health practice

- Social network analysis is a useful tool for revealing partnership network configurations and measuring network attributes

- Quantitative framework for evaluation of interorganizational cooperation in public health developed in the study may enable more targeted approach for promoting and evaluating partnerships that may lead to improved community health outcomes

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Thank you for your support

- **Cobb County Board of Health**

- **CDC-Georgia State University Seed Grant Awards in Social and Behavioral Sciences**

Further Resources

General information about network analysis:

International Network for Social Network Analysis
http://www.insna.org/