COMPLEX SYSTEMS AND NETWORK SCIENCE FOR PREVENTION AND CONTROL OF NONCOMMUNICABLE DISEASES

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Interpreting Stakeholder Network Analysis Data

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Overview

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Objective

- Understand how to interpret stakeholder network analysis data

- Network visualisations
- Network metrics

Network survey components

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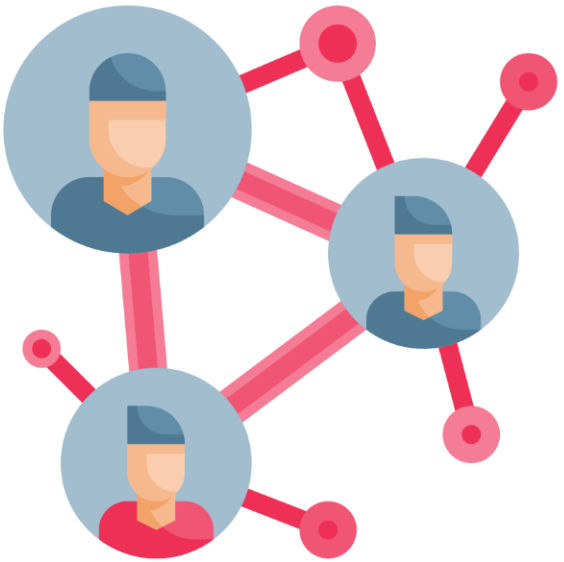
- **Background information:** organisation type, number of employees
- **Participation**: frequency, duration, types of engagement, barriers/facilitators
- **Exchange of information**
- **Collaborations and interactions**
- **Functioning of the network**: facilitation, recruitment, participation



Representation: in

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Nodelist: looks like the survey data

StudyID	Name1	Name2	Name3	Nam
530801	530802	530810	530809	530
530802	530801	530810	530808	530
530804	530811	530824	1	530
530807	530808	1	530809	530
530808	1	530807	530811	530
530809	530811	530804	530824	530
530810	530814	530801	530802	530
530811	530824	530804	1	530
530812	530825	530823	530820	530
530813	530819	530822	530821	530
530814	530820	530810	530823	530
530815	530823	530814	530812	530
530816	530817	530813	530812	530
530817	530820	530813	530822	530
530810	530813	530821	530822	530

Edgelist: allows edge attributes

StudyID	toStudyID
530801	530802
530801	530807
530801	530809
530801	530810
530801	530811
530801	530812
530801	530825
530801	530826
530802	530801
530802	530808
530802	530809
530802	530810
530802	530812
530802	530822
530802	530825
530804	530809
530804	530811

Adjacency matrix: mathematically convenient

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530801 . 1 . 1 . 1 1 1 1 . . . . . . . . . . . 1 1
530802 1 . . . 1 1 1 . 1 . . . . . . . . . 1 . . 1 .
530804 . . . . . 1 . 1 . . . . . . . . . . . 1 . 1
530807 1 1 1 . 1 1 1 1 . . . . . . . . . . . . . 1
530808 . . . 1 . 1 1 1 . . . . . . . . . . . 1 . .
530809 . . 1 . 1 . . 1 . . . . . . . . . . . 1 . 1
530810 1 1 1 . . 1 . 1 1 . 1 . . . . . . . 1 . 1 1
530811 . . 1 1 1 1 1 . . . . . . . . . . . . 1 . 1
530812 1 . . . . 1 1 . . 1 1 1 . . . 1 . . 1 1 1 .
530813 . . . . . . . . . . . . . . . 1 . 1 1 1 . . .
530814 . . . . . . 1 . 1 1 . 1 . . 1 1 1 1 1 . 1 .
530815 . . . . . . . . . 1 1 1 . . . . 1 . 1 1 . 1 .
530816 . . . . . . . . . 1 1 . 1 . 1 1 1 1 1 1 . 1 .
530817 . . . . . . . . . 1 1 1 1 1 . 1 1 . 1 1 . 1 .
530819 . . . . 1 . . 1 . 1 . . . . . . . 1 1 . . . .
530820 . . . . . . . 1 1 1 1 1 . . 1 . . 1 1 1 1 .
530821 . . . . . . . . 1 1 1 . . . 1 1 . 1 1 . 1 .
530822 . . . . . . . . 1 1 1 1 . 1 1 1 1 . 1 . 1 .
530823 . . . . . . . 1 1 . . 1 . . 1 1 . 1 . 1 1 .
530824 . . 1 . . . . . . . . . . . . . 1 . . . . . 1
530825 . . . 1 . . 1 1 1 1 1 1 . . . . . . 1 1 . .
530826 1 1 . 1 . 1 . . . . . . . . . . . . . 1 . .
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Network visualisations

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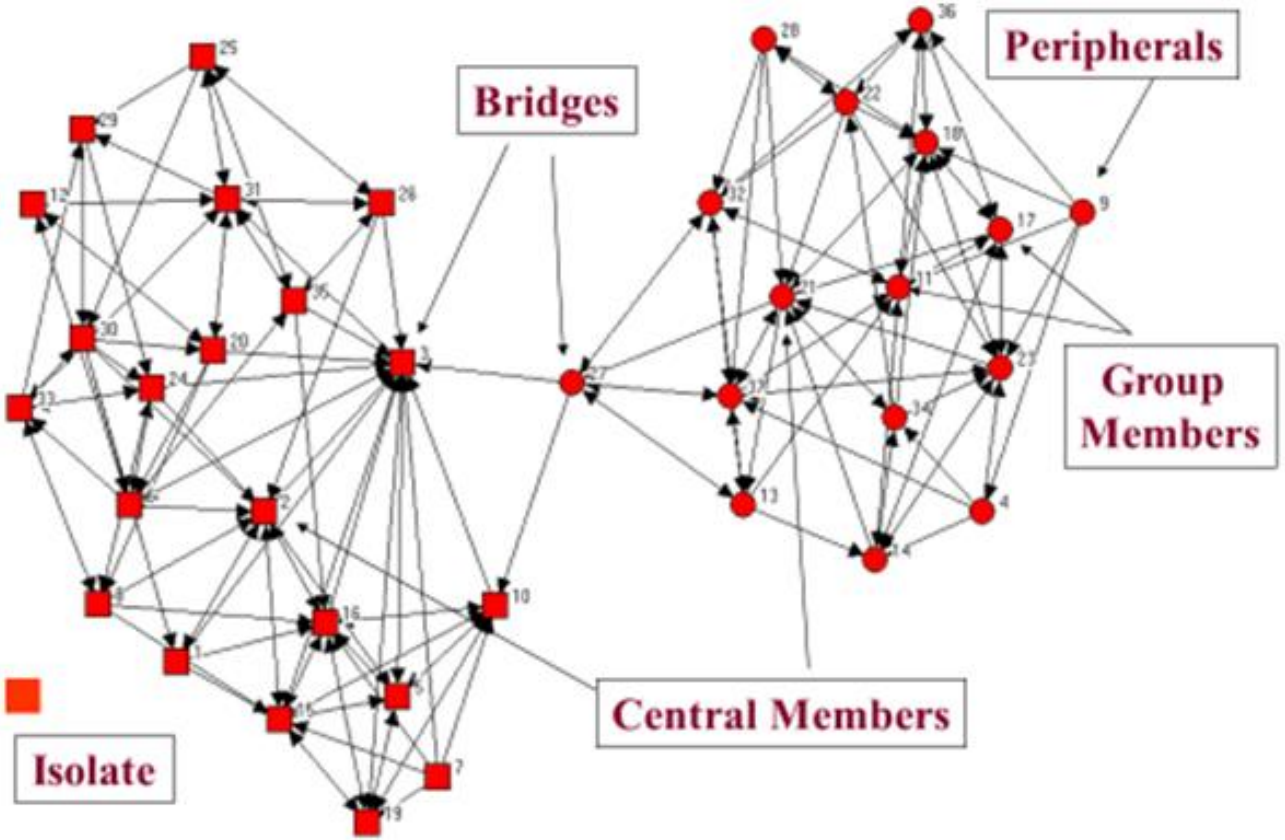
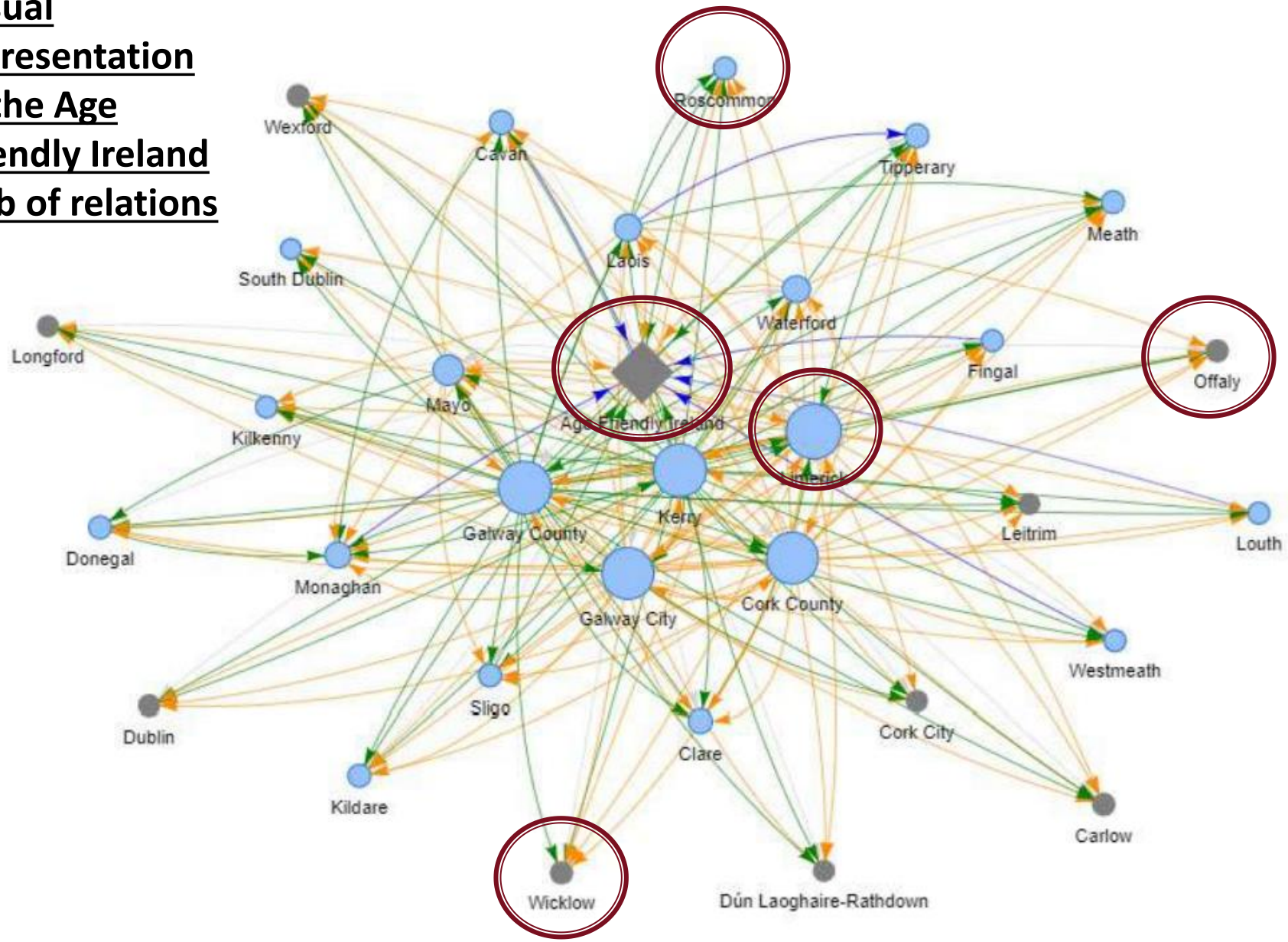


Visual representation of the Age Friendly Ireland web of relations



https://iris.who.int/bitstream/handle/10665/366634/9789240068698-eng.pdf?sequence=1

Terminology

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Annex A. Terminology and theoretical development of SNA

The table below provides definitions of core terminology commonly used in SNA.

Basic definitions	
network	Set of nodes AND set of ties representing entities and one or more relationships between them.
node	Representation of an entity, such as a person, organization or stakeholder involved in Age-friendly Cities and Communities (AFCC) programmes. This is also called a vertex or actor.
tie	Representation of a relationship between a pair of entities, such as collaborations or shared resources between AFCC organizations. This is also called an edge, arc, or link.
directed/undirected	The relationship may be one way (directed) or two way (undirected). As a directed example, Kilkenny could consider Dublin a collaborator, even if Dublin doesn't consider Kilkenny a collaborator.
Node properties	
neighbours	The set of nodes that have a tie with the given node.
degree	The number of ties attached to the given node. An example is the number of organizations that Kilkenny considers to be collaborators.
clustering coefficient	The proportion of potential ties between a node's neighbours that are actual ties. An example is the proportion of pairs of Kilkenny's collaborators who are collaborators with each other.

See Manual

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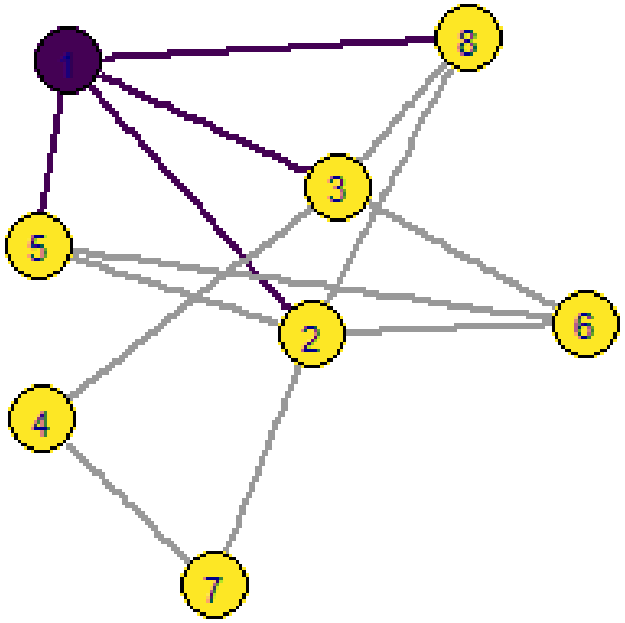
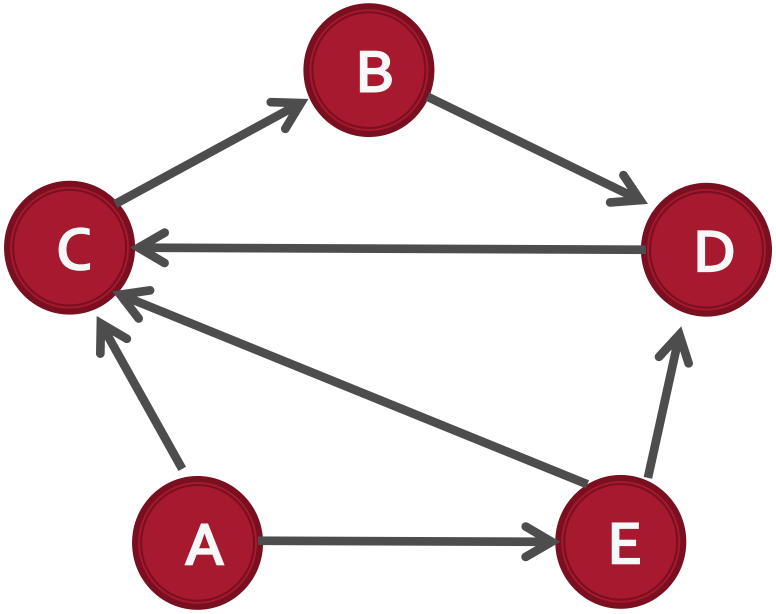
Node level properties

Node property: degree



- Number of edges attached (incident) to node
  - If directed: in-degree and out-degree
- Example: purple node has degree = 4

InDegree / OutDegree

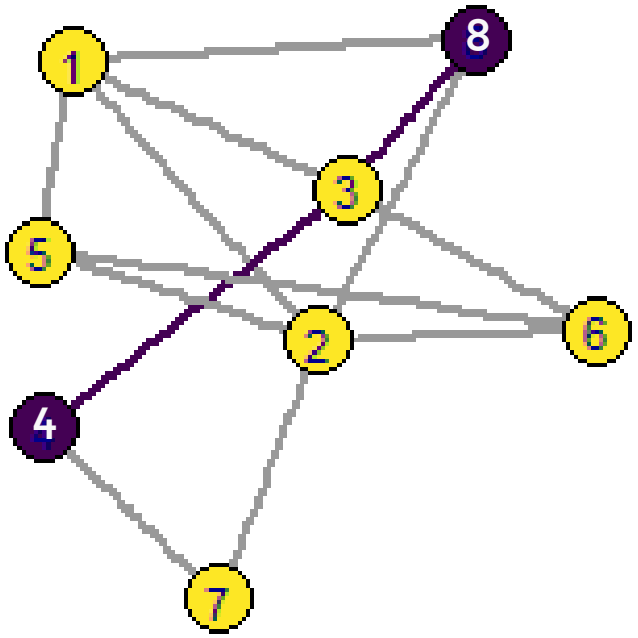


- Directed graph
- Degree = indegree + OutDegree

- Example:
- InDegree for C = 3
- OutDegree for C = 1

Tip: InDegree for C is the number of other nodes with an arrow pointing towards it
OutDegree for C is the number of nodes it has an arrow pointing to

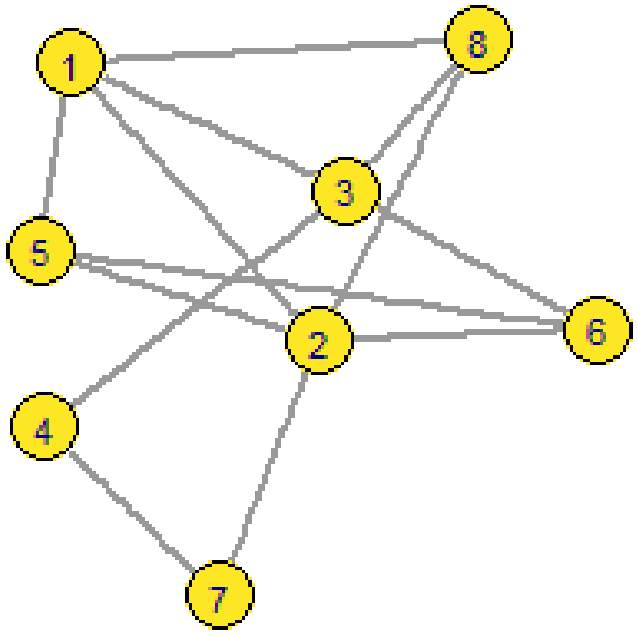
Shortest path (geodesic)



- Shortest path is a node pair property
- Why important: Optimal, most efficient connection between 2 nodes

- [4,8] has Shortest Path of 2
  - shortest path is 2,3,8
  - other paths?
  - 4,7,2,8;
  - 4,3,1,8;
  - 4,3,6,2,1,8;
  - 4,7,2,6,3,1,8; or …

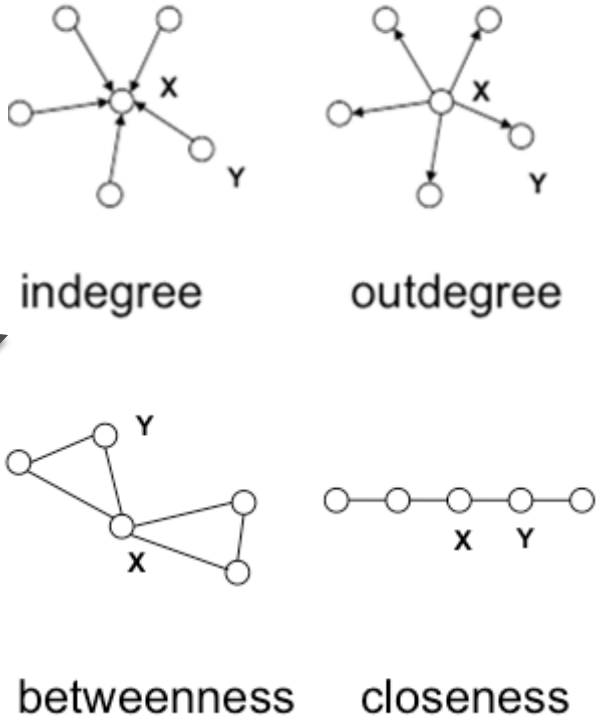
Node property: Betweenness



- Betweenness is the number of shortest paths passing through the node
- Important for flow, communication through a network
  - Node 3 on shortest paths 4,8 and 4,6 and others
  - Node 3 NOT on shortest path 1,7 or 1,8

Centrality

- Centrality is a NODE level attribute
- Concerns each node's influence within a network
  - common measures are degree, betweenness and closeness
  - MANY other measures used
- 'Best' measure depends on meaning of influence
  - eigenvalue (and PageRank) accounts for the influence of the connections as well



Centrality X > centrality Y for all networks shown

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Structural features

Denser regions

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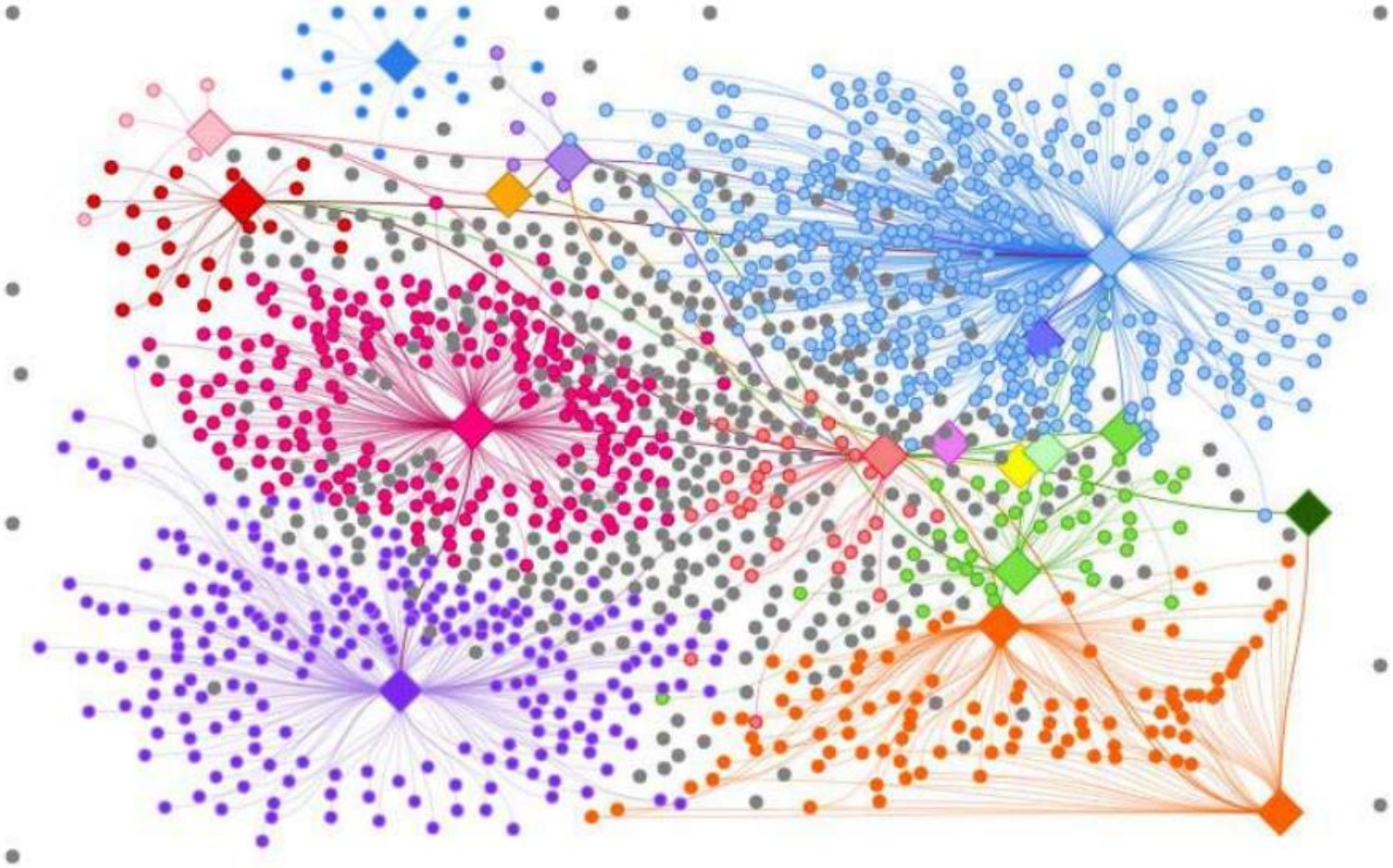
COMMUNITIES

- Subnetworks where high density of edges between members
  - low density elsewhere

HOMOPHILY

- Use some node attribute (eg gender) to describe whether edges are more likely to similar nodes
- Can be interpreted as expected communities

Fig. 10. Visual representation of the GNAFCC web of relations



Dots represent GNAFCC members and diamonds GNAFCC affiliates. Each community (i.e. affiliate and its members) is represented by a unique colour. Affiliates with members in common (e.g. a national and a subnational programme) form one community and are indicated in the same colour. Grey dots represent members not linked to any affiliate. Connections among members and names were omitted to facilitate visualization.

Friendships Among Students in One Classroom (12 year olds)

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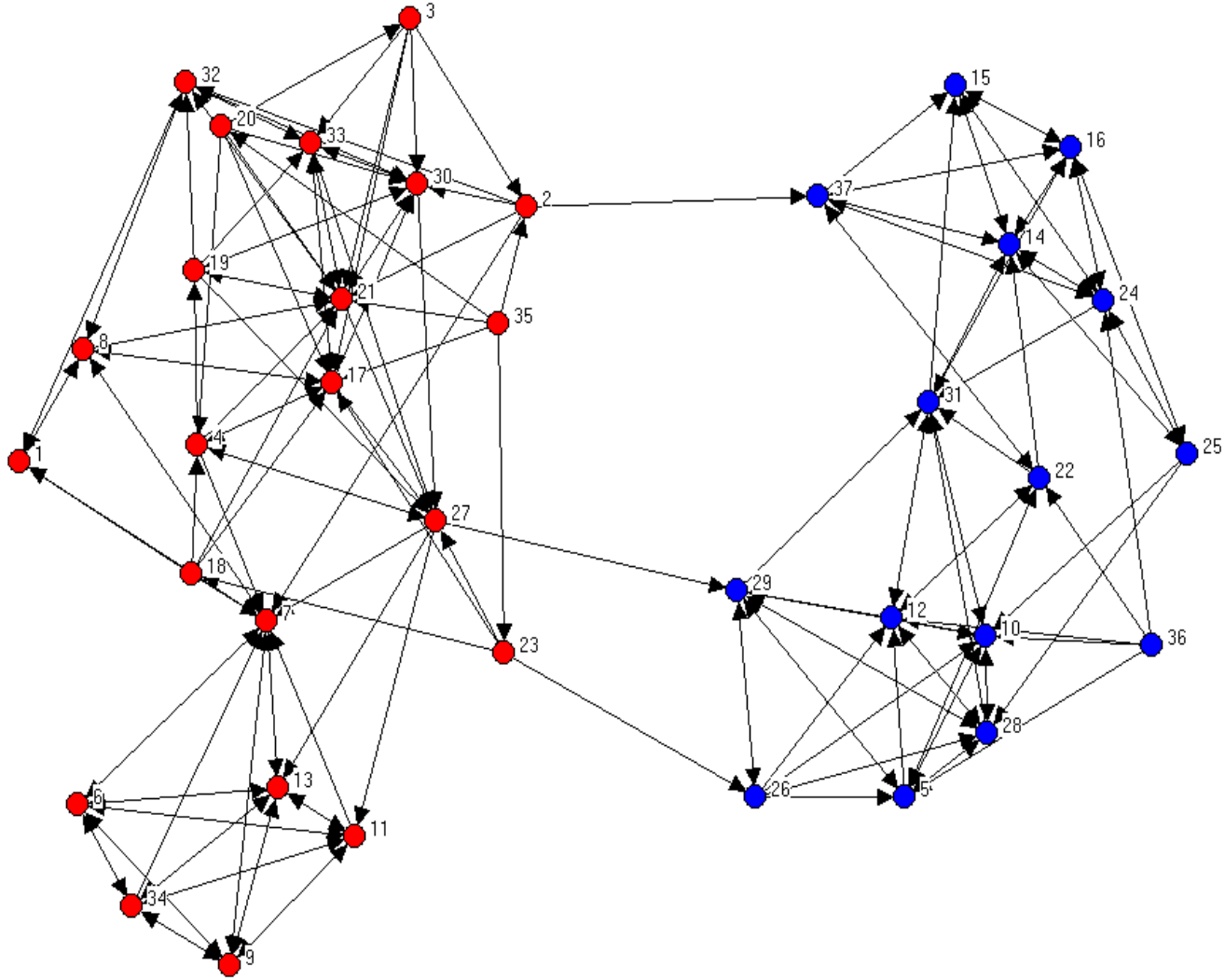
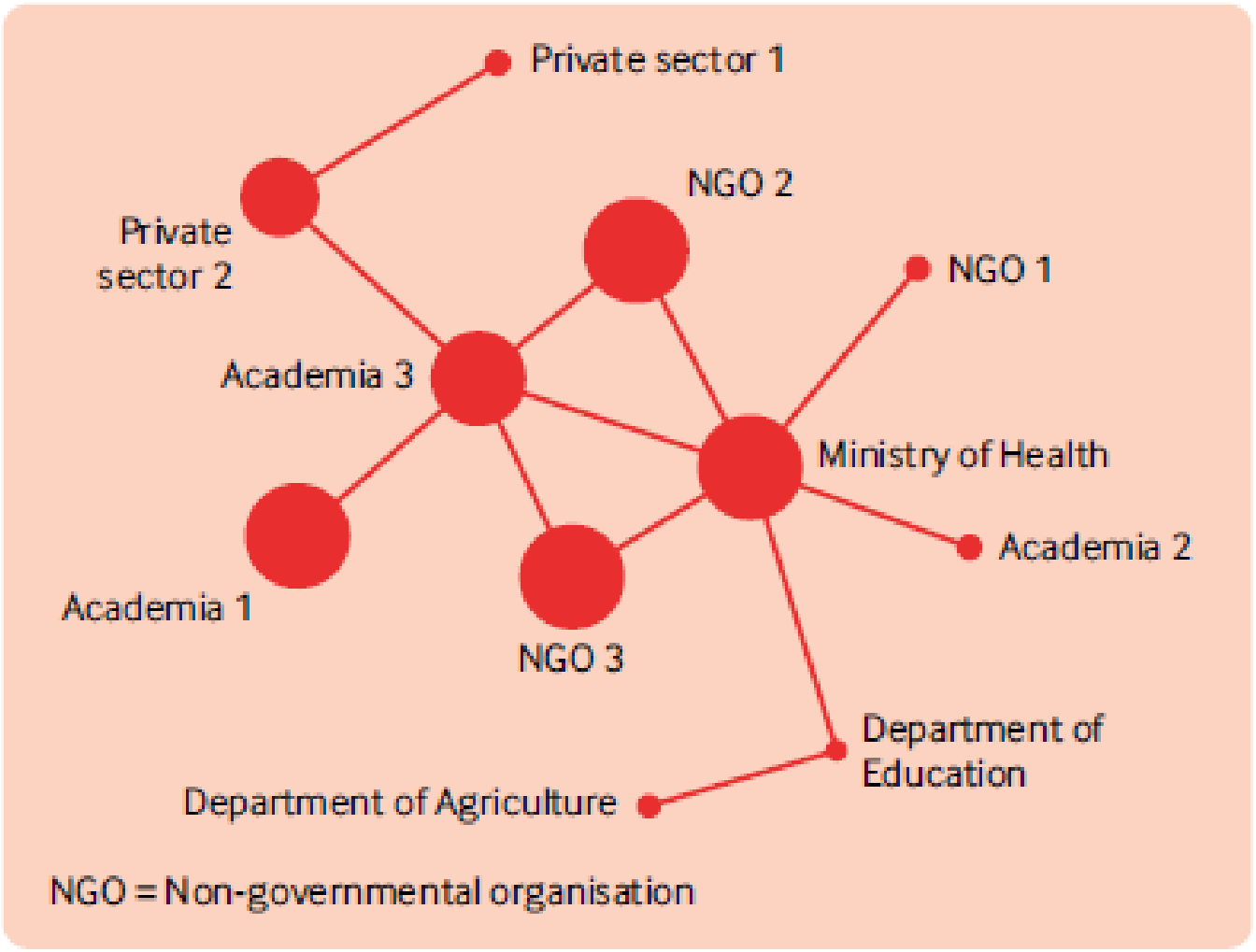


National action plans to tackle NCDs: role of stakeholder network analysis

Network science approaches can enhance global and national coordinated efforts to prevent and manage non-communicable diseases, say **Ruth Hunter and colleagues**

Decent figures highlight the rising global burden of non-com- government and whole of society is necessary to support countries to reduce NCDs.

Operationalising multisectoral partnerships as networks



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https://doi.org/10.1136/bmj.l1871