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ANALYSING FUNDING PATTERNS AND THEIR EVOLUTION FOR TWO MEDICAL RESEARCH TOPICS

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1. Objective

To analyse funding patterns and their evolution in two medical research topics: breast and ovarian cancer.

- How differ co-funding patterns between years 2003 and 2013
- How differ funding patterns depending on the NIH involvement and cross-nation co-funding

2. Data and Method

- Data: *PubMed* database

	Med1 (ovarian cancer)	Med 2 (breast cancer)
Total records	81,937	273,526
Records with founding	14,560 (17.77%)	48,948 (17.9%)
Number of funding agencies	65	91
Funding agencies coincide	63	63
Funding agencies do not coincide	28	2

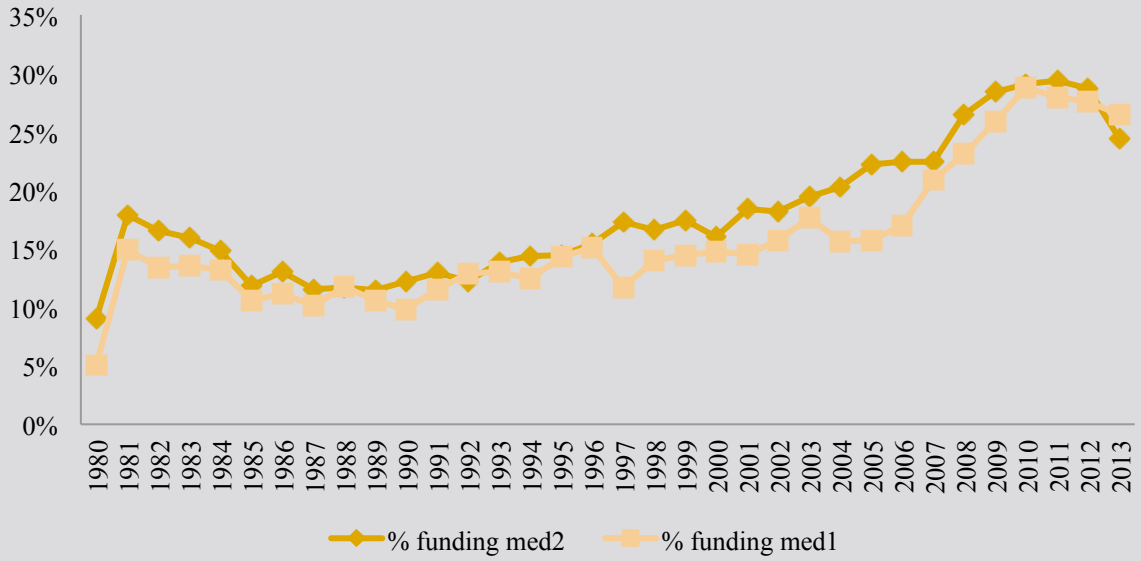


Figure. Percentage of papers which give funding information by year

2. Data and Method

- Cleaning and preparation of data: through the software *VantagePoint* (Porter & Cunningham, 2005)

- Social Network Analysis: with software *Ucinet6* (Suominen, 2014; Swar & Khan, 2014; Kim et al., 2014)

3. Results

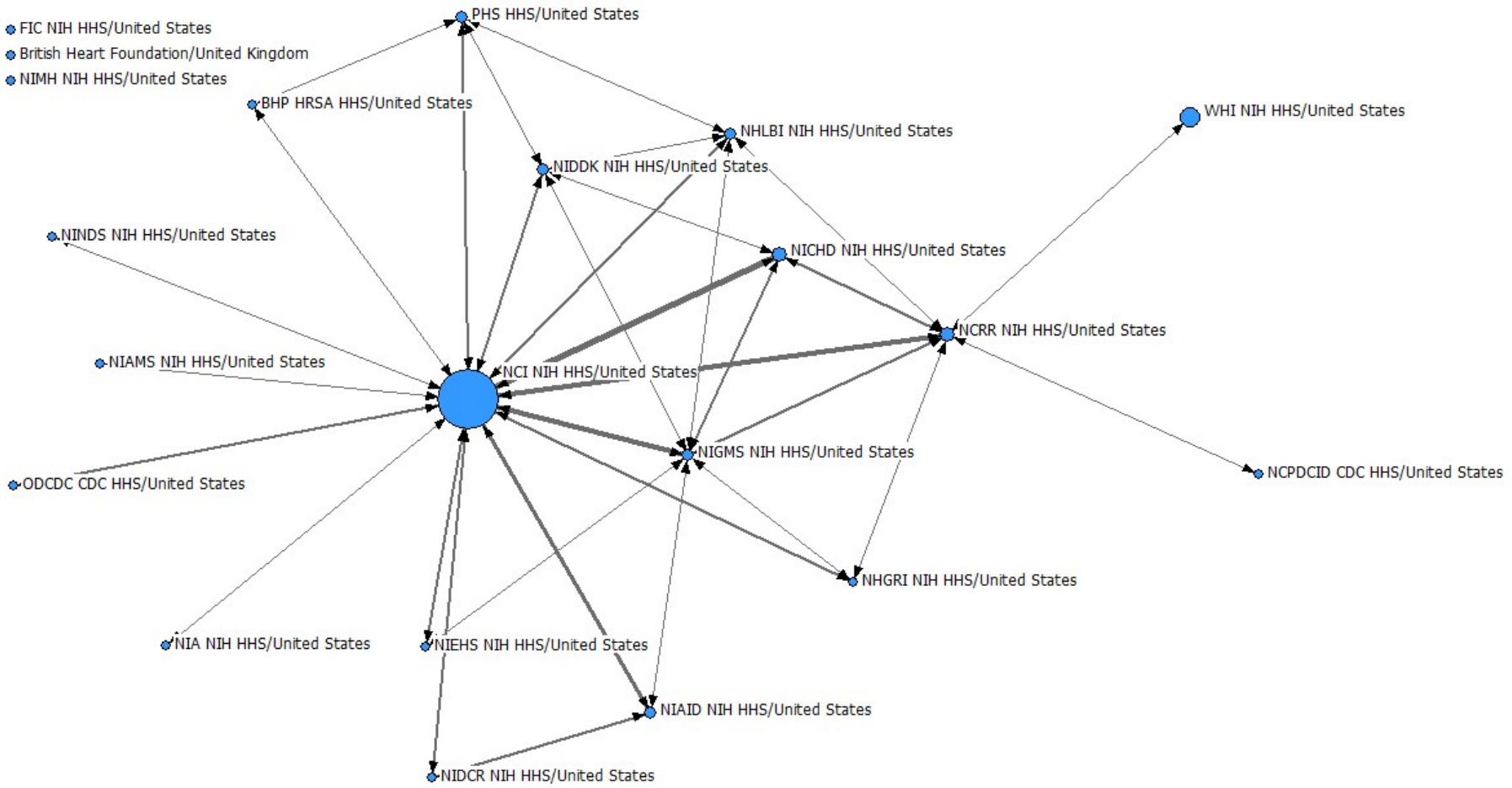
- There is a tendency in the majority of the agencies to appear first in the funding of research about breast cancer.
- The number of agencies that fund research in both topics has increased in the last ten years.

3. Results

- The National Cancer Institute is the most important funding agency for the two medical topics and the two periods analysed.
- The National Centre for Research Resources (NCRR) is important in both topics.
- The National Institute of General Medical Sciences (NIGMS) is represented in ovarian cancer, and the Public Health Service (PHS) emerges in breast cancer.

	Med1 Y2003	Med1 Y2013	Med2 Y2003	Med2 Y2013
Network Density	21.57%	18.5%	16.9%	23.6%
Degree Centrality	NCI NIGMS NCRR	NCI NCRR NIGMS	NCI NCRR	NCI NCRR PHS
Closeness	NCI NIGMS NCRR	NCI NCRR NIGMS	NCI NCRR	NCI NCRR PHS NIGMS
Betweenness	NCI NCRR	NCI NIGMS	NCI NCRR	NCI NIMH NIGMS

3. Results


FIC NIH HHS/United States
British Heart Foundation/United Kingdom
NIMH NIH HHS/United States
PHS HHS/United States
BHP HRSA HHS/United States
NHLBI NIH HHS/United States
WHI NIH HHS/United States
NIDDK NIH HHS/United States
NINDS NIH HHS/United States
NICHD NIH HHS/United States
NCRR NIH HHS/United States
NIAMS NIH HHS/United States
NCI NIH HHS/United States
NIGMS NIH HHS/United States
NCPDCID CDC HHS/United States
ODCDC CDC HHS/United States
NHGRI NIH HHS/United States
NIA NIH HHS/United States
NIEHS NIH HHS/United States
NIAID NIH HHS/United States
NIDCR NIH HHS/United States

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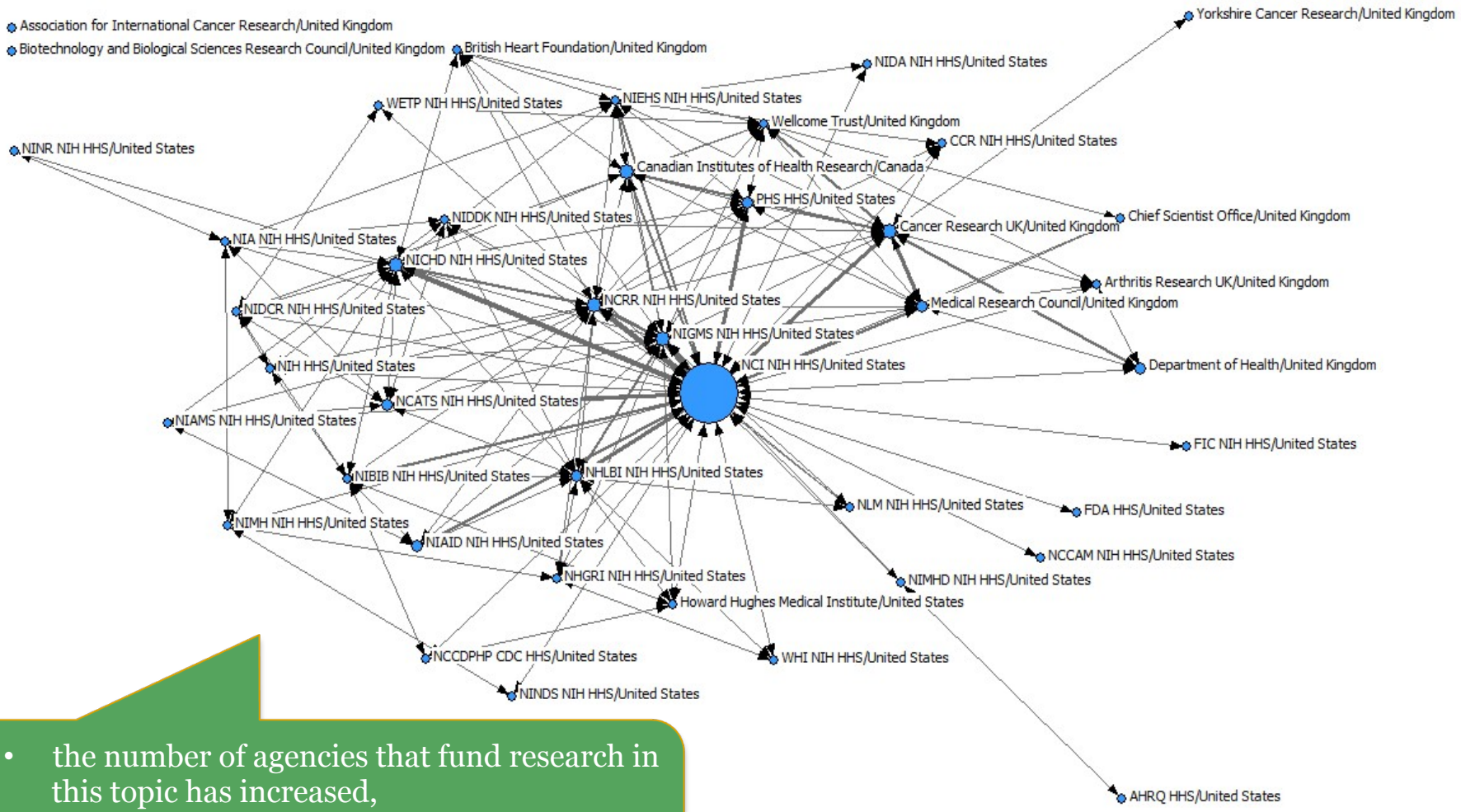
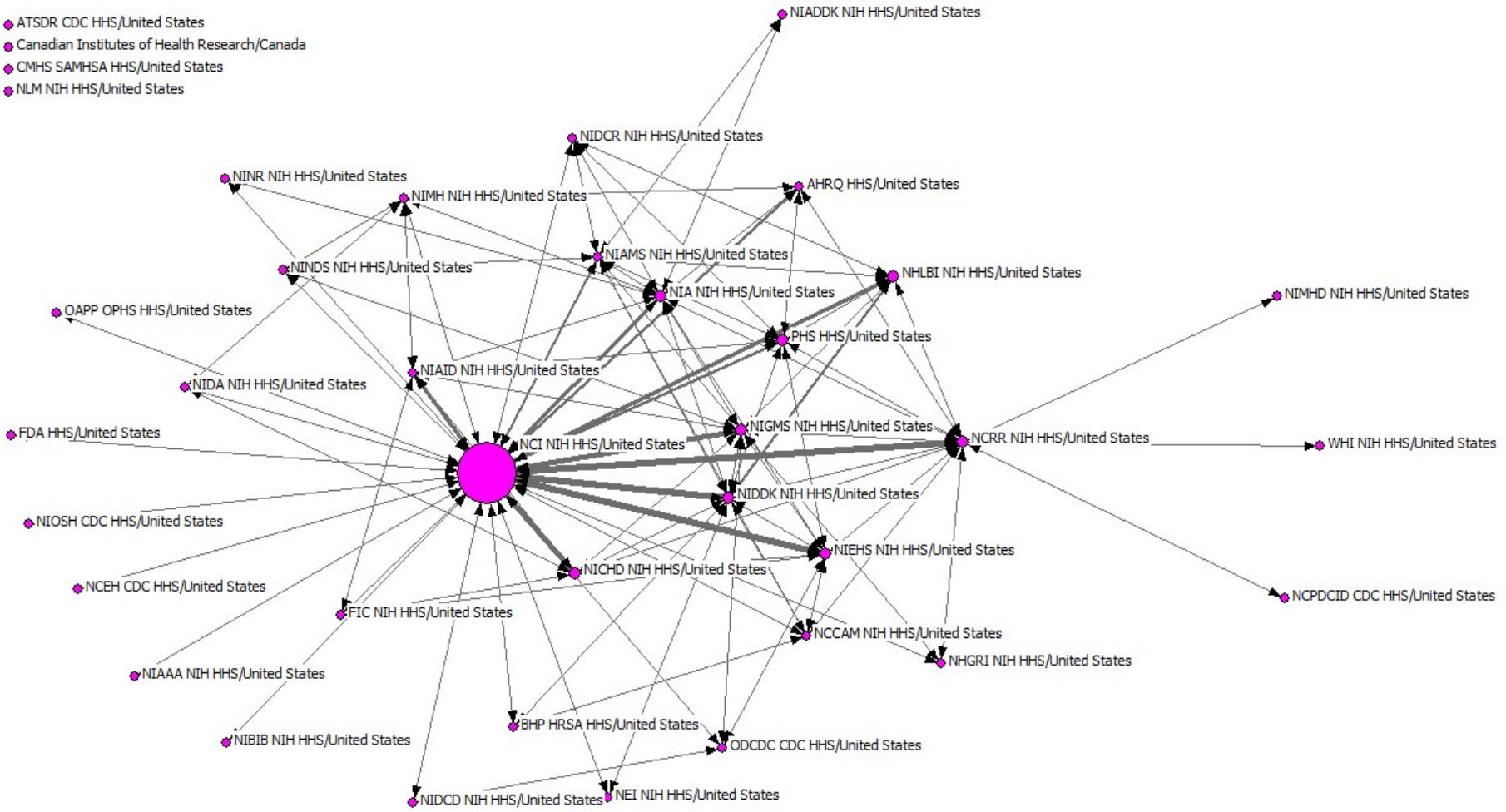


- the number of agencies that fund research in this topic has increased,
- the number of links between agencies has enlarged.

Funding Ovarian cancer, Year 2013

3. Results


ATSDR CDC HHS/United States
Canadian Institutes of Health Research/Canada
CMHS SAMHSA HHS/United States
NLM NIH HHS/United States
NIADDK NIH HHS/United States
NIDCR NIH HHS/United States
NINR NIH HHS/United States
NIMH NIH HHS/United States
AHRQ HHS/United States
NIAMS NIH HHS/United States
NINDS NIH HHS/United States
NHLBI NIH HHS/United States
NIA NIH HHS/United States
NIMHD NIH HHS/United States
OAPP OPHS HHS/United States
PHS HHS/United States
NIAID NIH HHS/United States
NIDA NIH HHS/United States
NIGMS NIH HHS/United States
FDA HHS/United States
NCI NIH HHS/United States
NCRR NIH HHS/United States
WHI NIH HHS/United States
NIDDK NIH HHS/United States
NIOSH CDC HHS/United States
NIEHS NIH HHS/United States
NICHD NIH HHS/United States
NCEH CDC HHS/United States
NCPDCID CDC HHS/United States
FIC NIH HHS/United States
NCCAM NIH HHS/United States
NHGRI NIH HHS/United States
NIAAA NIH HHS/United States
BHP HRSA HHS/United States
NIBIB NIH HHS/United States
ODCDC CDC HHS/United States
NIDCD NIH HHS/United States
NEI NIH HHS/United States

3. Results

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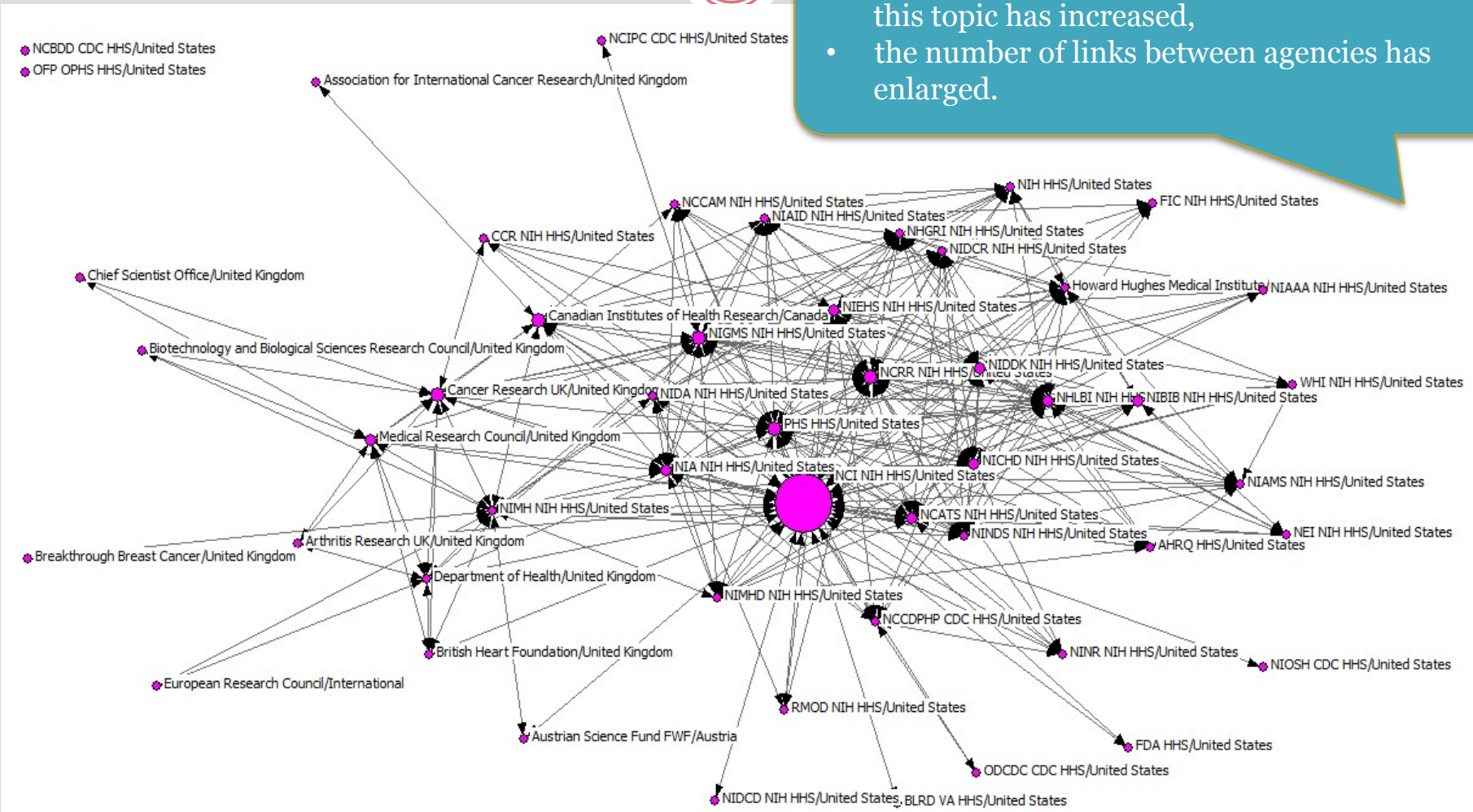

3. Results

- Cliques: each participant in the clique has ties with the rest of nodes which form the clique.
- Med1 Cliques:
  - in 2003 the NCI was involved in every clique, while in 2013 it appears in 35 cliques (92% of cliques).
  - in 2003 all the cliques were formed by United States agencies, while in 2013 we observe that 11 cliques incorporate cross-national co-funding (28.9% of cliques).
  - Nations involved in these 11 cliques are United States, Canada and United Kingdom (the three nations in 4 cliques, United States and United Kingdom in 6 cliques, and United States and Canada in 1 clique).

3. Results

- Med2 Cliques:
  - the importance of the NCI, which appears in 31 cliques in 2003 and in 67 in 2013.
  - in 2003 all the cliques were formed by United States agencies, while in 2013 we observe that 25 cliques incorporate cross-national co-funding (36% of cliques).
  - Nations involved in these 25 cliques are United States, Canada, United Kingdom, Austria and the European Research Council (United States and Canada appear in 12 cliques; United States and United Kingdom in 7 cliques; United States, United Kingdom and Canada in 4 cliques; United States and Austria in 1 clique; United States, United Kingdom and the European Research Council in 1 clique).

3. Results

- Summary of patterns in co-funding research:

	Med1 Y2003	Med1 Y2013	Med2 Y2003	Med2 Y2013
Non co-funding agencies (isolate in network)	3	2	4	2
Cross-agency with NCI (number of cliques)	10/10	35/38	31/32	67/70
Cross-agency without NCI (number of cliques)	0	3	1	3
Cross-national co-funding (number of cliques)	0	11/38 (29%) United States, Canada, United Kingdom	0	25/70 (36%) United States, Canada, United Kingdom, Austria, European Research Council

- In ovarian research prevail cross-national co-funding between the United States and United Kingdom (6 cliques), while in breast research the dominant linkage occurs between United States and Canada (12 cliques).

4. Conclusions

- Co-funding research analysis allows researchers:
  - To detect which are the most important institutions in supporting research in a topic,
  - To show which are the mediator agencies to be contacted when it is difficult to manage a direct link with the funding star, which in our analysis is the NCI.
  - To observe which countries are linked more directly and in a higher rank to the United States depending on the topic. If we were trying to look for a mediator in ovarian cancer, we could find more opportunities in United Kingdom (6 cliques); if the topic were breast cancer, we would find our mediator in Canada (12 cliques).

4. Conclusions

- Difficulties:
  - although *PubMed* database allowed us to download all the data in a fast way, cleaning the acknowledgement data required a lot of time.
  - data included jointly the number of the project granted, the funding agency and other information, so we needed to delete those unnecessary data project by project.
  - Another important difficulty was related to the limitation for working with a high amount of data with *VantagePoint* and Windows, but fortunately we were able to solve it.

Thanks for your attention!

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