

Social Network Determinants of depression.

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Social Networks and Health Informatics Seminar

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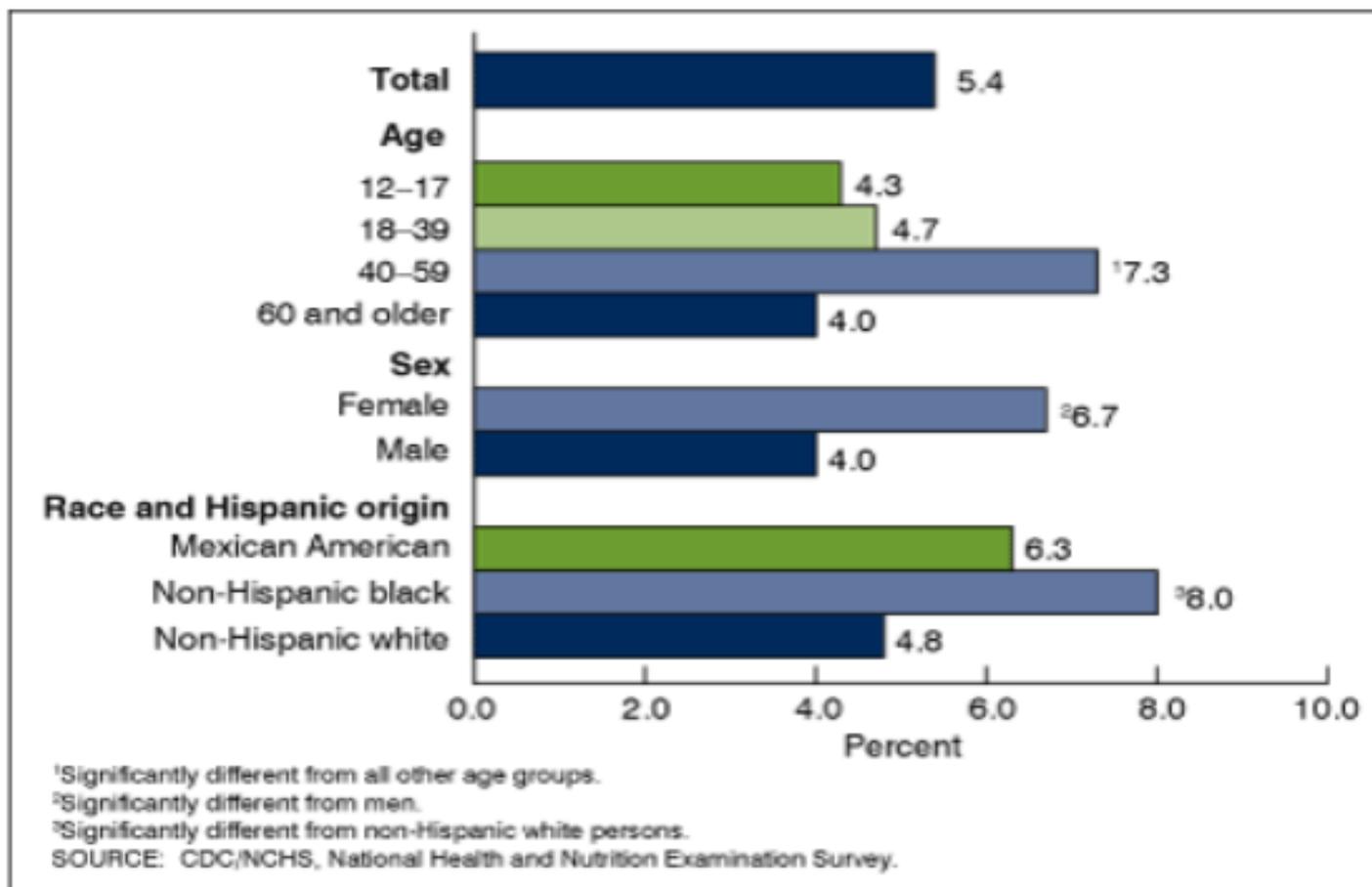
Cost of Depression – is it real?

- **Total of 17 million, only in USA.**
- **“\$86 billion in United States of America in the year 2000”.**
- **Affects one in every 10 American.**

- N.I.H.

Patterns of Depression

Figure 1. Percentage of persons 12 years of age and older with depression by demographic characteristics: United States, 2005–2006



Etiology of Depression

- Causality:- Biological vs. psychological vs. social factors.
- In a social network:- Structural effects vs. influence effects.
- Types of influences in social networks:-
 - Induction:- depression in one person causes depression in others.
 - Homophily:- birds of the same feather, flock together.
 - Confounding:- strong-connections correspond to jointly experiencing contemporary exposures to depression.

Framingham Heart Study (FHS)

- Began in 1948 with the 'Original cohort' (5209);
- In 1971, additional 'Offspring cohort' (5124);
- In 1994, additional 'Omni cohort' (508) and
- In 2002, additional 'Generation-3 cohort' (4095).
 - Cardiovascular study on residents of Massachusetts.
- 12,067 people assessed, roughly every 4 years over a period of 32 years.
- Within all cohorts – (<1%) loss to follow-up because of out-migration (participation rate > 80%).

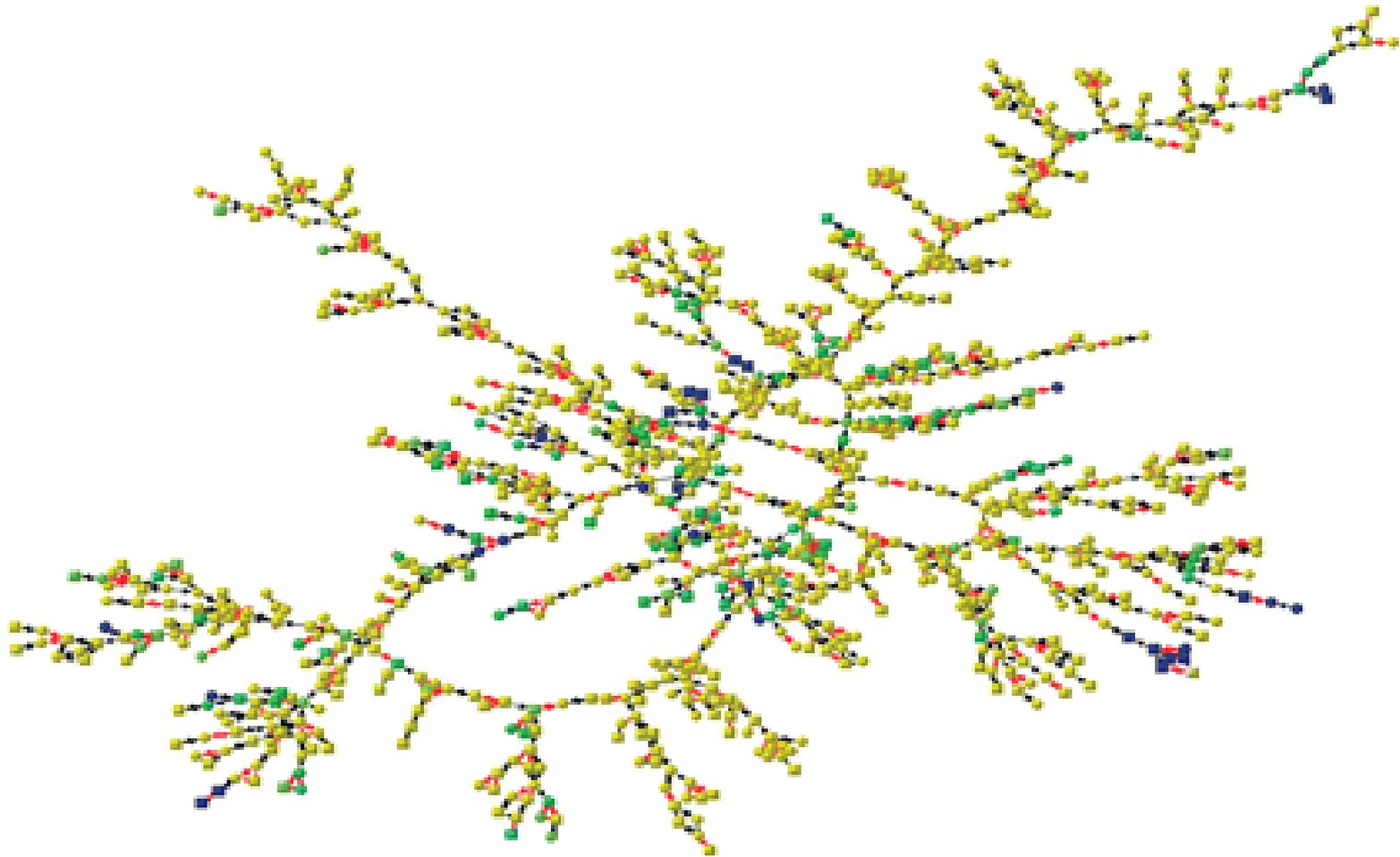
Methodology

- Experiment-type:- Continuous surveillance and serial examinations = longitudinal-research-models.
- Data-types:- Physical exam, laboratory tests, ‘battery-testing’, questionnaire (20-items) and basic demographic information.
- Stakeholders:- “alters” and “ego”.
 - “who is whose neighbor” and
 - “what is the geodesic distance between them”.
- Connectedness:- “ego-perceived”, “alter-perceived” and “mutually-perceived.”

Methodology (cont.)

- Depression is measured using the Center for Epidemiological Studies Depression Scale (CES-D) – good reliability and validity.
 - [cesdscale.pdf](#)
- A 20-item questionnaire:- scoring yields a scale from 0 (least depressed) to 60 (most depressed), with a score of 16 or greater is used to identify depression.

Depression - mapping



Hypothesis

- Depression levels might be dependent on target's position with respect to the entire network (type or direction of social relationship between ego and alter affects the association between the ego and the alter).
- Correlation between CES-D scores of neighbors within a certain level of proximity.
- Women are emotionally more expressive and more effective at communicating emotions in comparison to men.
- Homophily – couples vs. friends.

Results

- Correlation between depressive symptoms and peripheral positions in the network map (periphery targeted remedy).
- Correlation between alters depression, induced by the ego (degrees of separation ≤ 3).
 - 1 DOS – 93%
 - 2 DOS – 43%
 - 3 DOS – 37%
 - 4 DOS – (-2%) : effect disappears.

Each extra connection reduces CES-D score by 0.3 points. [Hypothesis :- more friends = less depressed ?]

Results (cont.)

- A target's social network structure may be affected by depression and/or the structure of the social network may itself affect depression.
 - Symmetric to both incoming and outgoing structural changes.
 - Target's with depression symptoms loose 6% of their social ties on avg. of 4 years.
- 'eigenvector-centrality':- Larger the value, the better connected the 'ego' is to the entire network (it doesn't matter if the connections are direct or indirect ties). What is the significant of being better connected ?

Results (cont.)

- Depression spreads more easily than its absence. What is the significance of this ?
- Types of connectedness determine spread patterns.
 - Mutually-perceived – 359% chance of spread.
- Interesting to Note:- Main results of the experiment remain the same even when dynamic changes to marital status, occupational prestige, et cetera are accounted for.
- Gender role? Female vs. Male... (female – 142%)

Limitations

- CES-D scores are not used as a clinical tool to identify depression.
- Sample of the population for the experiment is somewhat homogenous (doesn't represent many underrepresented minorities or take a global perspective).
- The sample social network created in the experiment contains a lot of physical world ties and fails to integrate digital world ties (such as online interactions between individuals, with a different sense of degrees of separation).
- Homophily driven bias.

Conclusion

- By identifying how structures in a network may affect behavioral patterns at egos and their alters, future policies can be so designed as to maximize impact on specific components of the network.
- ‘Seeding’ – novel experiment that seeks to use well-connected individuals to spread information over a network.
- People are social beings – homophily – their social behaviors are deterministic – so is their mental health.

Future Interest

- Network phenomena appear relevant to the epidemiology of depression... how can we draw parallels from this into the paradigm of computer networks?

Questions ?