

Social Networks and Health





Spreading of depressive symptoms over adolescent friendship networks.

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Background

- Depression affects 350 million people worldwide¹.
- It is characterised by a set of symptoms which could be affected by social networks.
- We explore this possibility using a range of statistical methods.

Data

 National Longitudinal Study of Adolescent Health (Add Health) - health behaviours of United States adolescents in 1994-95 and 1996².

Parametric Inference

Considered total CES-D score and 7 component symptoms - anhedonia, poor appetite, poor concentration, dysphoria, helplessness, tiredness, and worthlessness.
 Worsening: X_t > X_{t-1}, X_{t-1} < Yⁱ_{t-1}, i = 1,...,k

(b)

(d)

or

or



- Includes friendship data friendship network.
- Includes Centre for Epidemiological Studies Depression (CES-D) scale questions - quantised depression score³.

Empirical Data Analysis



$P_{\mathcal{K}} = \infty + \beta \sum_{l=0}^{\infty} \langle l \rangle^{l} (1 - \beta)$

• Improving: $X_t < X_{t-1}, X_{t-1} > Y_{t-1}^i, i = 1, \dots, k$





- Model 1 (a) and (c). Model 2 (b) and (d). Model 3 (a) and (d).
 Model 4 (b) and (c).
- Model parameters inferred from data using maximum likelihood estimation.
 Models were compared using their Akaike Information Criterion.

Parametric Inference - Example Results



Figure 1: (i) and **(ii)** - grid plots of CES-D scores at the first time point (wave I) against the second time point (wave II). **(i)** - coloured by worse off friends. **(ii)** - coloured by better off friends. **(iii)** - Empirical distribution of CES-D score change.

- Empirical data shows an effect from higher and lower scoring friends on the change in CES-D score.
- The score changes appear to follow an exponential distribution.

Parametric Inference - Poor Appetite



Figure 2: Results for Helplessness. Red - model 1. Blue - model 2. Green - model 3. Purple - model 4. Black - observed frequencies. (i) and (ii) depend on worse off friends, (iii) and (iv) on better off friends. Model 1 is preferred for all symptoms except poor appetite.

Figure 3: Results for Poor Appetite dependent on worse off friends. Model to line correspondence is the same as **figure 2**. Unlike with all other symptoms, model 4 is preferred.

Conclusions

- For most symptoms, the emotional state of friends can have both a positive or negative effect on the state of an individual.
- This effect only occurs for smaller numbers of friends.
- These symptoms reflect the total CES-D score.

- Appetite is the only symptom to not follow this pattern.
- Empirical findings suggest that the change in symptoms occurs progressively between time points - more testing is needed.

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go.warwick.ac.uk/complexity/people/students/dtc/students2013/eyre/ email: r.w.eyre@warwick.ac.uk [1] World Health Organisation. Depression - Fact Sheet No. 369. 2014. URL: http://www.who.int/mediacentre/factsheets/fs369/en/.
 [2] E. Whitsel, J. Hussey, J. Tabor, P. Entzel, K. Harris, C. Halpern, and J. Udry. The National Longitudinal Study of Adolescent Health: Research Design. 2009. URL: http://www.cpc.unc.edu/projects/addhealth/design.

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