The Social Symbiome Framework: Linking *Genes-to-Global* Cultures in Public Health Using Network Science

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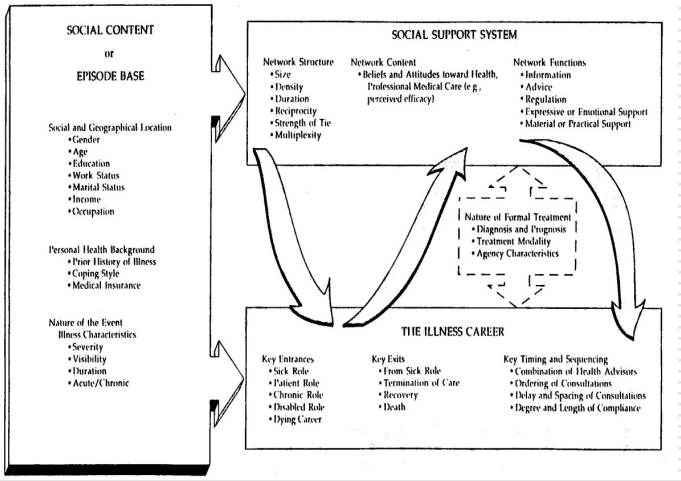
Introduction: Linking Biology and Society

- Human Genome Project
- Obsolescence of Nature-Nurture Debate
- Transdisciplinarity

The Network Episode Model



- Individuals as pragmatic and social
- Explicitly dynamic and event-based
- Focus on the episode, not the choice
- Focus on pathway (*choice, coercion, "muddling"*)
- Interaction in social networks as underlying mechanism

Sources:

Pescosolido, B.A. 1991. "Illness Careers and Network Ties: A Conceptual Model of Utilization and Compliance." Pp. 161-184 in Gary Albrecht and Judith Levy (eds.), *Advances in Medical Sociology*, *Volume 2*. Greenwich, Connecticut: JAI Press.

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Pescosolido, B.A. 2006. "Of Pride and Prejudice: The Role of Sociology and Social Networks In Integrating the Health Sciences." *Journal of Health and Social Behavior* 47 (September):189-208.

Finding #1: Pathways to Care

Percentage of Individuals Reporting Different Accounts of Initial Entry into the Mental Health System, INMHS, 1990-1994 (n=109)

Story Theme	N	%
Choice	50	45.9
Coercion	25	22.9
"Muddling through"	34	31.2

Source: Pescosolido, B.A., C. Brooks-Gardner and K.M. Lubell. 1998. "How People Get Into Mental Health Services: Stories of Choice, Coercion and 'Muddling Through' From 'First-Timers.'" *Social Science and Medicine* 46(2): 275-286.

Finding #2: Social Networks Shape Pathways to Care, But Not in Isolation to Biological Systems

- Social networks interact with type of symptom to shape pathway to care
- Larger social networks are more potent for individuals with bipolar disorder
  - Significantly associated with a coercive pathway to the mental health system

Finding #4 & #5: Network Effects in Historical Context

- Geographical context delimits the ability of religions to form a "community of support"
- Religious "hubs"
- Judaism → Overall protective effect but "small"
  Large effect in Northeast; reversed in South
- Catholicism → Overall protective effect is "solid"
  Similar reversal in the South
- Evangelical Protestantism → Some protective effects
  Reverse in Northeast

Source: Pescosolido, B.A. 1990. "The Social Context of Religious Integration and Suicide: Pursuing the Network Explanation." *The Sociological Quarterly* 31:337-57.

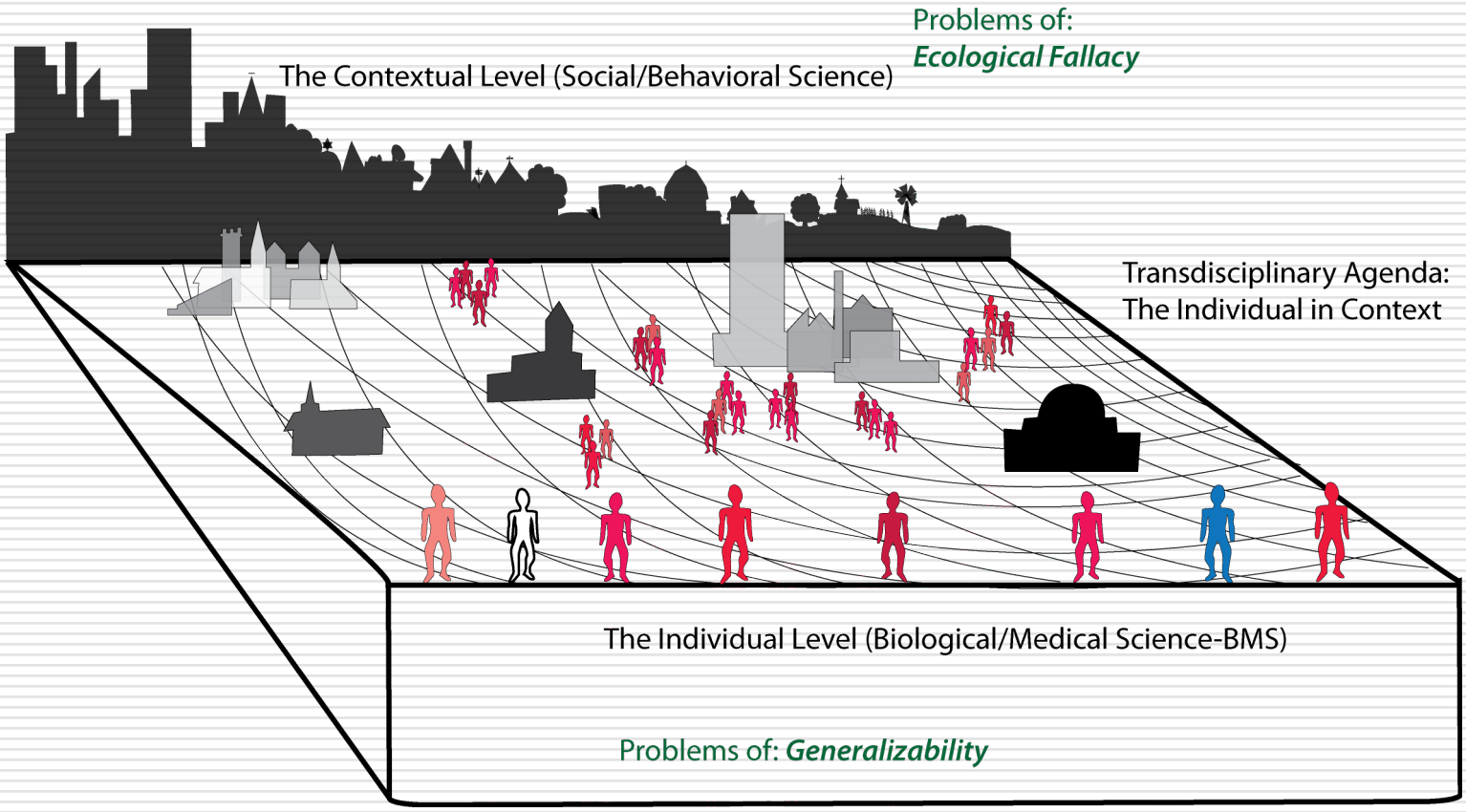
Finding #5: Support Groups, PTSD and Outcomes for Veterans

- Social interaction with network of other Vietnam vets *reduces* stress reaction in cosmopolitan metro areas but *increases* it in medium size cities and rural areas
- Because combat is exogenous to current setting, not "drift" or "selection" confound

Source: Kadushin, C. 1983. "Mental health and the interpersonal environment: a reexamination of some effects of social structure on mental health." *American Sociological Review* 48(2):188-198.

Illustrating the Fundamental Dilemma

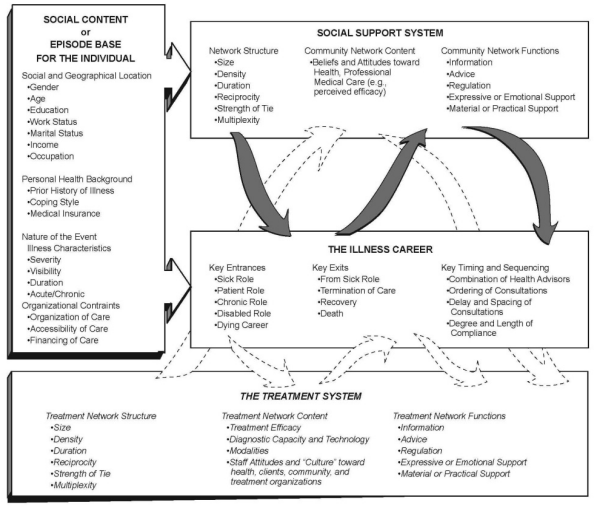
Example: Religion and Suicide

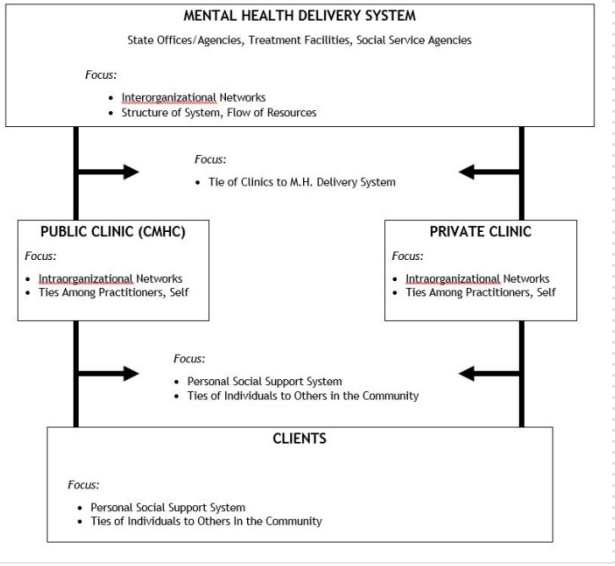


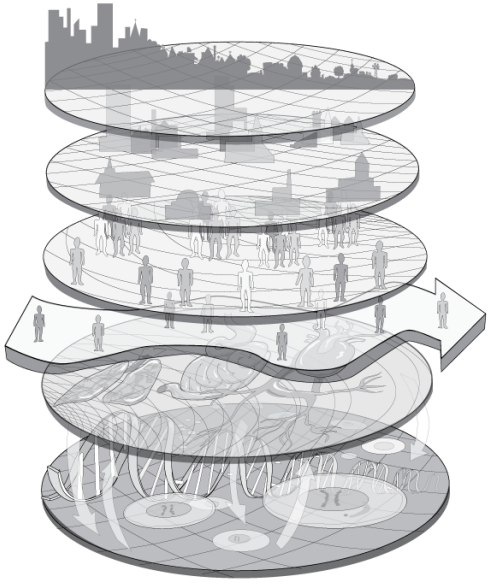
Source: Adapted from: *Social Networks and Health*, Levy and Pescosolido, 2002

NEM Morphing

Multi-level approach (*individual, personal network, treatment organizations, service systems)*







Sources:

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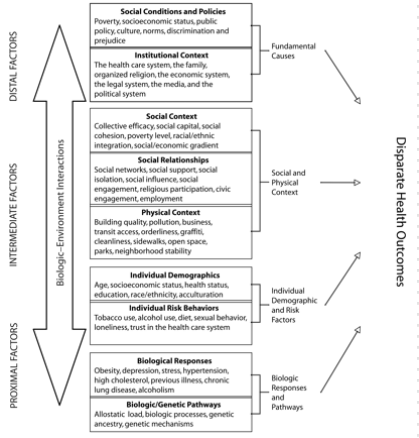
Pescosolido, B.A. 1996. "Bringing the 'Community' into Utilization Models: How Social Networks Link Individuals to Changing Systems of Care." pp. 171-197 in *Research in the Sociology of Health Care*, Vol. 13A, J. Kronenfeld, ed. JAI Press.

No Shortage of Conceptualizations



Warnecke, R., A. Oh, N. Breen, et al. 2008. "Approaching health disparities from a population perspective: The National Institutes of Health Centers for Population Health and Health Disparities." *AJPH* 98(9): 1608-1615.

Bronfenbrenner's Bioecological Model, representation from "A Thematic Perspective to Lifespan Development," Solmonson, L., C. Mullener, & D. Eckstein. http://www.shsu.edu/~lls014/Chapter%20Two/Bronfenbrenners%20Bioecological%20Model.html

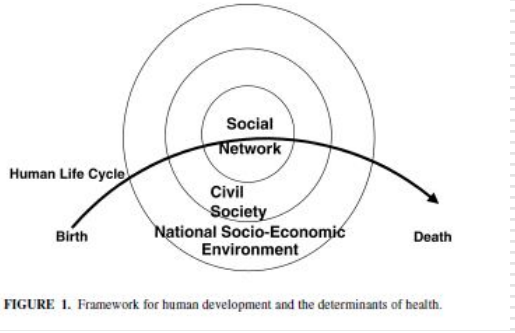
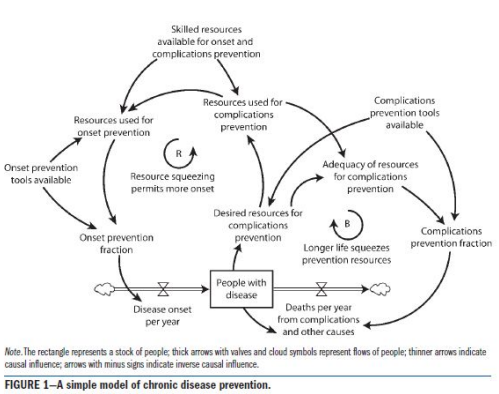


FIGURE 1. Framework for human development and the determinants of health.

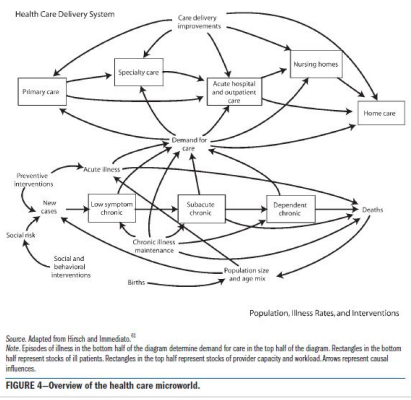
Hertzman, C. 1999. "The biological embedding of early experience and its effects on health in adulthood." *Annals of the New York Academy of Sciences* 896:85-95.



Note. The rectangle represents a stock of people; thick arrows with valves and cloud symbols represent flows of people; thinner arrows indicate causal influence; arrows with minus signs indicate inverse causal influence.

FIGURE 1–A simple model of chronic disease prevention.

Homer, J. & G. Hirsch. 2006. "System dynamics modeling for public health: Background & opportunities." *American Journal of Public Health* 96:452-58.



Source. Adapted from Hirsch and Immediato.[6]

Note. Episodes of illness in the bottom half of the diagram determine demand for care in the top half of the diagram. Rectangles in the bottom half represent stocks of ill patients. Rectangles in the top half represent stocks of provider capacity and workload. Arrows represent causal influences.

FIGURE 4—Overview of the health care microworld.

Homer, J. & G. Hirsch. 2006. "System dynamics modeling for public health: Background & opportunities." *American Journal of Public Health* 96:452-58.

Requirements for Connecting Models

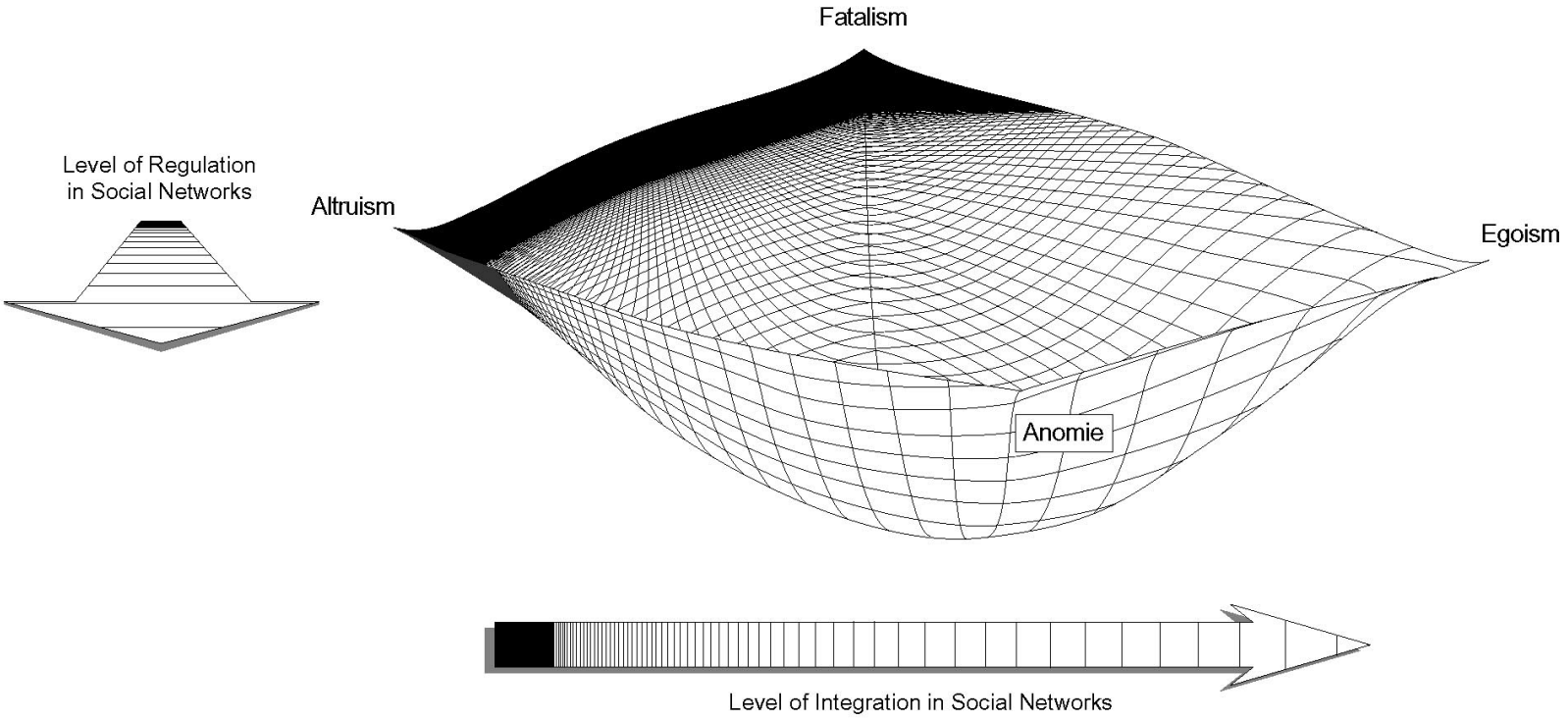
- Consider and articulate the full set of contextual levels that have a documented role in past empirical research
- Offer an underlying mechanism or "engine of action" that connects levels, is dynamic, and allows for a way to narrow down focal research questions (NRC 2006, IOM 2006)
- Employ a metaphor and analytic language familiar to both social and natural science that can facilitate synergy
- Understand the need for and use the full range of methodological tools proven useful in the social and natural sciences
- Provide a tangible way to intervene from treatment to activism to policy

Source: Pescosolido, B.A. "Organizing the Sociological Landscape for the Next Decades of Health and Health Care Research: The Network Episode Model III-R as Cartographic Subfield Guide." Pp. 39-66 in B.A. Pescosolido, J.K. Martin, J.D. McLeod, and A. Rogers (eds.). 2011.***The Handbook of the Sociology of Health, Illness & Healing: Blueprint for the 21st Century***. New York, NY: Springer.

One Key: Social Network Perspective or Networks & Complex Science

- Complexity theory → large-scale, *interacting units*
- Relationships are "fundamental mediators of human adaptations"
- Networks are the "active ingredients of environmental influences" – *Neurons to Neighborhoods*
- Puts human face on issues of access, barriers, intervention, and points of direct intervention by conceptualizing these as actions of individuals
- Introduces a way to connect to "the rest"

The Network & Complex Systems Foundation: Durkheim Translated



Sources: Pescosolido, B.A. 1994. "Bringing Durkheim into the 21st Century: A Network Approach to Unresolved Issues in the Sociology of Suicide." In *Emile Durkheim Le Suicide: One Hundred Years Later*, ed. By D. Lester. The Charles Press.

Goldsmith, S.K., T.C. Pellmar, A.M. Kleinman, & W.E. Bunney. 2002. *Reducing Suicide: A National Imperative.* Institute of Medicine. Bethesda, MD: National Academies Press.

Tripartite Base and Goal

- Biological foundations
- Biological Embedding
  - Hertzman 1999
- Social embeddedness
  - Granovetter 1985

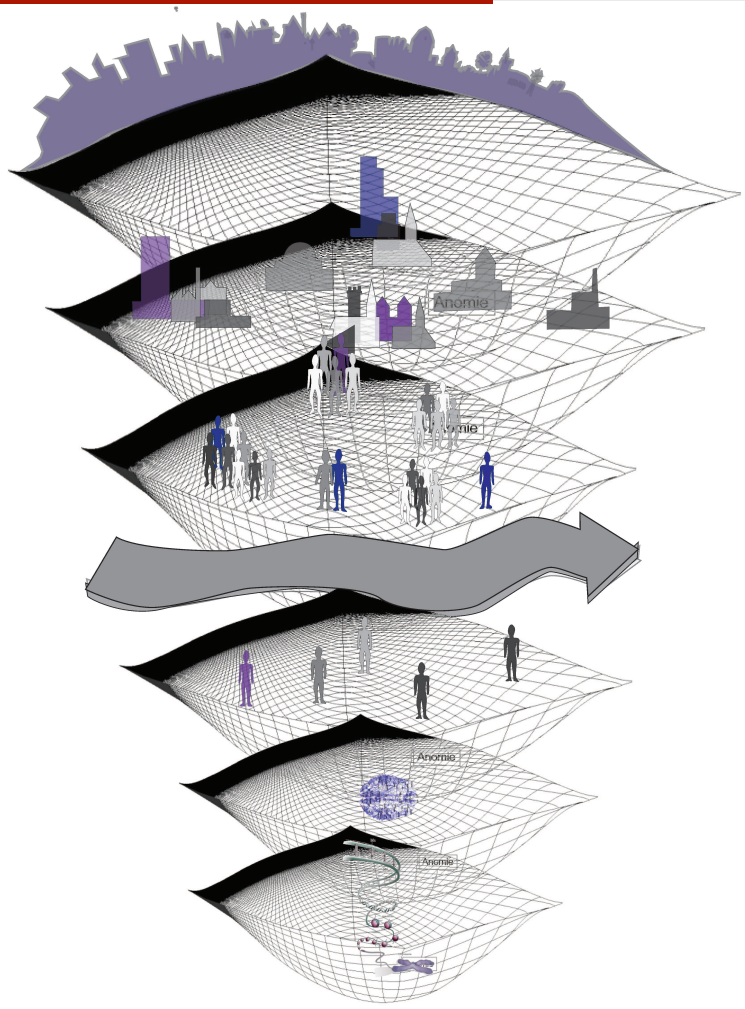
Simmel 1922: "…society arises from the individual and the individual arises out of association."

The Social Symbiome

- It is the convergence or clash among network systems that drives the onset and response to problems such as suicide, mental illness, and substance abuse
- Health, health behavior, illness behavior, and health care outcomes are shaped by six systems
  - Three individual / internal systems embedded in three external systems
  - These shape the dynamic health, illness, and treatment and recovery careers of individuals

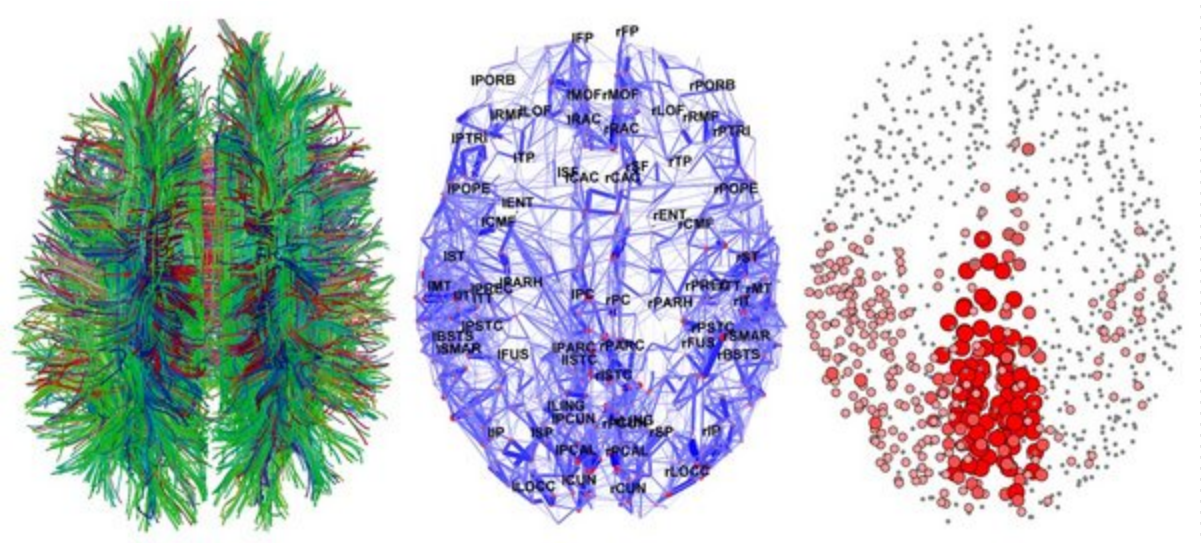
Source: Pescosolido, B.A., S. Olafsdottir, O. Sporns, B.L. Perry, et al. Forthcoming. "The Social Symbiome Framework: Linking *Genes-to-Global* Cultures in Public Health Using Network Science." Forthcoming in *The Handbook of Applied Systems Science*, Z.P. Neal, ed. Routledge.

The Social Symbiome

Community		Global / Local / Virtual
Organizations		Civic Organization Social Service System Treatment Systems
Personal Networks		Friends, Kin
Life Course		Health & Human Development
Individuals		Identity Social Location
Organ Systems		Connectome
Molecular		Genome Epigenome

The Bottom Layers?

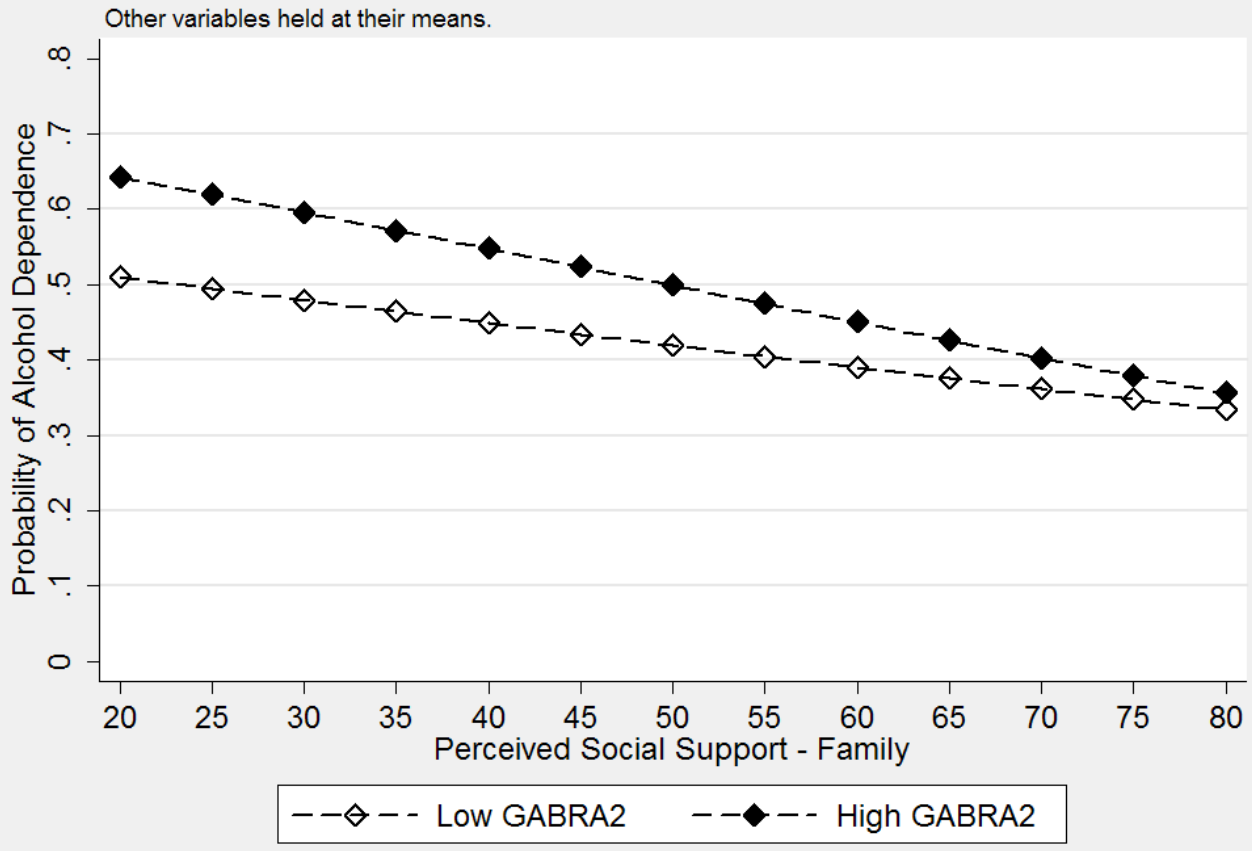
The Connectome at Multiple Scales: These scales can be roughly categorized as microscale, mesoscale, and macroscale…any unified map will likely rely on "probabilistic" representations of connectivity data.



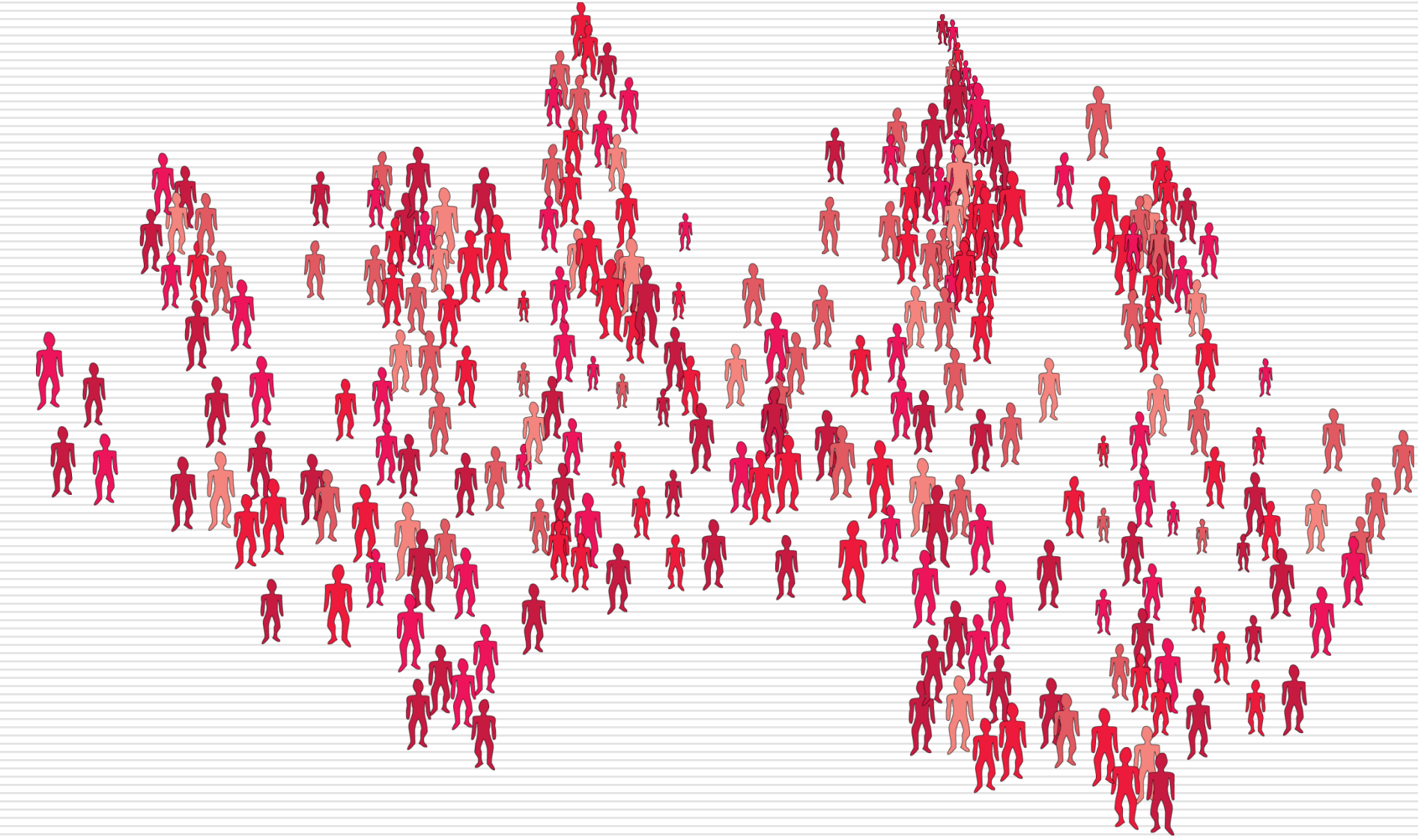
Sources: Sporns, Olaf; Tononi, Giulio; Kötter, Rolf (2005). "The Human Connectome: A Structural Description of the Human Brain". *PLoS Computational Biology* 1(4): e42.

Wallace, M.T. 2004. "A revised view of sensory cortical parcellation." *Proceedings of the National Academy of Sciences* 101: 2167–72.

Finding #8: Network Ties Change Genetic Effects



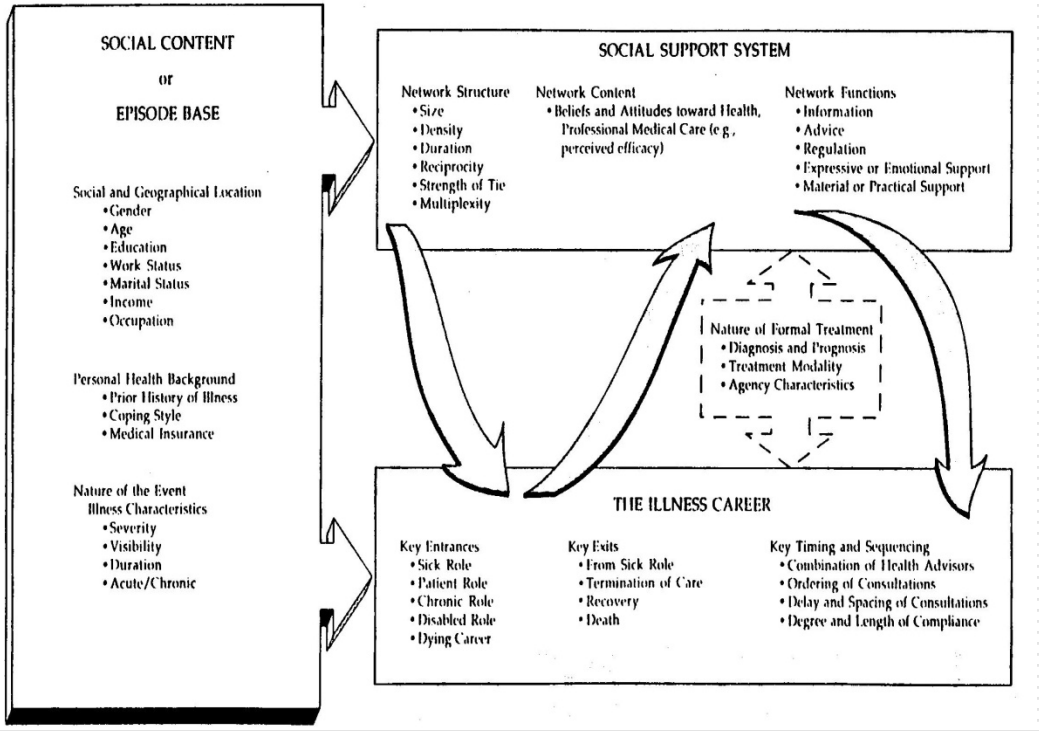
Source: Pescosolido, B.A., B.L. Perry, J.L. Long, J.K. Martin, J.I. Nurnberger, V. Hesselbrock. 2008. "Under the Influence of Genetics: How Transdisciplinarity Leads Us to Rethink Social Pathways to Illness," *American Journal of Sociology* 114(Suppl.): S171-S201.



NCMHSR

Network-Episode Model – Phase I

- Health care utilization
- Dynamic "illness career", "patterns" & "pathways"
- Rational choice subsumed as one option in a social influence process



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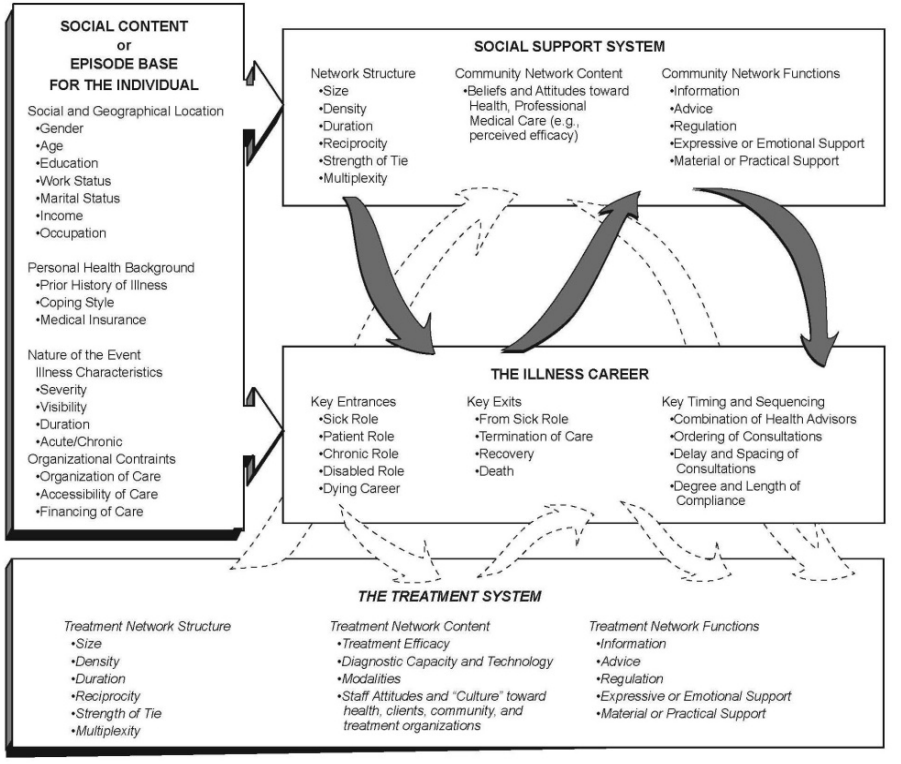
Network-Episode Model – Phase II

- Elaboration of dynamics of treatment, organizational, and policy choice
- "Outside," "Inside" Network

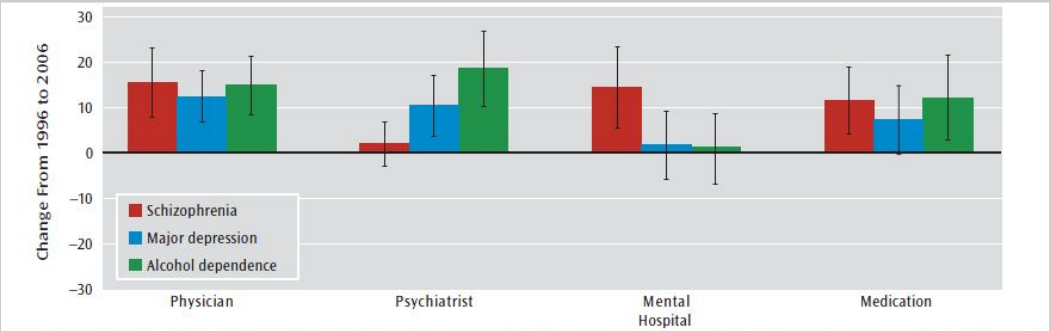


Sources:

B.A. Pescosolido & C.A. Boyer. 1999. "How Do People Come to Use Mental Health Services? Current Knowledge and Changing Perspectives," Pp. 392-411 in A.V. Horwitz and T.L. Scheid, eds., *A Handbook for the Study of Mental Health: Social Contexts, Theories, and Systems*. New York: Cambridge University Press.

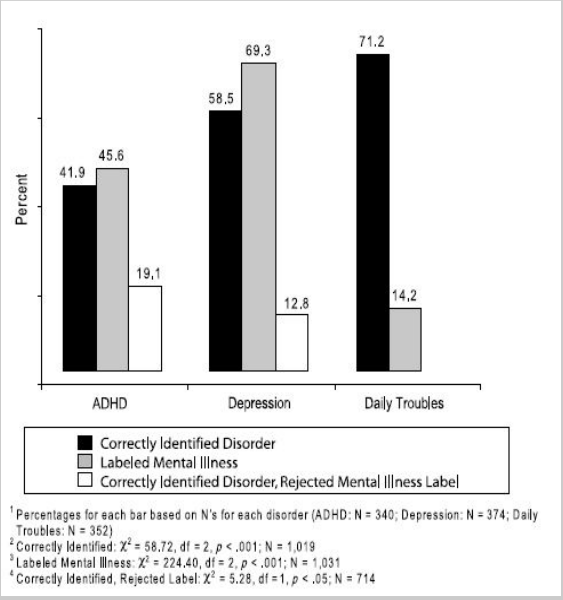
B.A. Pescosolido, & C.A. Boyer. 2010. "Understanding the Context and Dynamic Social Processes of Mental Health Treatment," Pp. 420-438 in A.V. Horwitz & T.L. Scheid, eds., *Handbook for the Study of Mental Health: Social Contexts, Theories, and Systems, 2nd Ed.* New York: Cambridge Univ. Press.

Finding #2: Community Ties Shape The Response to Mental Illness



[a] Graphs indicate the discrete change in the predicted probability for a given outcome with respect to year (multiplied by 100), calculated with controls held at their means for the combined sample. Data are from the mental health modules of the 1996 and 2006 General Social Surveys and are weighted. Tic marks indicate 95% confidence intervals.

Adjusted Survey Year Differences in Treatment Endorsement, by Vignette Condition, 1996 and 2006 GSS. Source: Pescosolido et al. 2010. "'A Disease Like Any Other'? A Decade of Change in Public Reactions to Schizophrenia, Depression, and Alcohol Dependence." *AJP* 167(11): 1321-1330.



[1] Percentages for each bar based on N's for each disorder (ADHD: N = 340; Depression: N = 374; Daily Troubles: N = 352)
[2] Correctly Identified: $X^2 = 58.72$, df = 2, $p < .001$; N = 1,019
[3] Labeled Mental Illness: $X^2 = 224.40$, df = 2, $p < .001$; N = 1,031
[4] Correctly Identified, Rejected Label: $X^2 = 5.28$, df = 1, $p < .05$; N = 714

Percentage of respondents correctly identifying the situation and applying mental illness label, by vignette types, National Stigma Study-Children. Source: Pescosolido et al. 2008. "Public Knowledge and Assessment of Child Mental Health Problems: Findings From the National Stigma Study-Children." *JAACAP* 47(3): 339-349.