



OBSSR Conference Held on Complex Systems, Health Disparities & Population Health: Building Bridges

March 10, 2014

On February 24-25, the National Institutes of Health (NIH) Office of Behavioral and Social Sciences Research (OBSSR) held a two-day national meeting of the Network on Inequality, Complexity and Health (NICH). NICH is housed at the University of Michigan and brings together nineteen scholars from a broad set of disciplines to explore the use of Complex Systems modeling techniques in advancing the understanding of how to improve population health and eliminate health disparities. Accordingly, the NIH meeting was designed to address bridging the application of system sciences methodologies to population health and health disparities. According to OBSSR's Stephane Philogene, project officer for NICH, meeting participants included individuals from 20 countries as well as 39 states within the U.S.

The level of interest, Philogene pointed out in his welcoming remarks, "bodes well for the utility and growing application of systems science methodologies to policy resistant health challenges, but more specifically for application of these tools and methods to population health and health disparities research." Philogene shared that the vision for the meeting was part of the OBSSR's second strategic plan under the leadership of then-OBSSR director David B. Abrams. That vision, as articulated in the strategic plan, "was to bring together the biomedical, behavioral, social, and public health science research communities to work more collaboratively to solve the most pressing population health challenges faced by our society." To realize this vision, Philogene reported that OBSSR developed a series of initiatives to:

- (1) Facilitate collaborative research across the full range of disciplines and stakeholders;
- (2) Simulate systems thinking and modeling approaches to research that integrates multiple levels of analysis; and
- (3) Work with NIH institutes and centers to identify key problems in population health where scientists, practitioners, and decision makers can work together to accelerate the translation, implementation, dissemination, and adoption of behavioral and social science research findings.

One of the persistent, policy resistant and pressing dilemmas in the U.S. that seemed to demand new ways of looking at it is the problem of health disparities, Philogene emphasized.

Led by George Kaplan, University of Michigan, NICH was funded for five years after submitting an unsolicited proposal for a new interdisciplinary research network. The two-day NIH meeting was to reflect on some of the specific projects initiated, consider what has been accomplished, and what remains as challenges going forward for the unique cadre of scholars and the network that makes up NICH, Philogene explained.

The Future of Systems Science

On day two, Patricia Mabry, OBSSR, ([slide presentation](#)) shared OBSSR's current directions: (1) supporting the next generation of methods and measures; (2) enhancing health and lengthening life in populations; and (3) training the next generation of research investigators.

Mabry explained that "systems science" refers to a family of methodologies, including systems science methodologies; enables the study of complex problems; represents the complexities of a problem in a tractable form by simplifying it while retaining the salient characteristics; addresses the "big picture" of a complex problem as well as the components that make up the system; and complements traditional linear, reductionist methods. According to Mabry, modeling and simulation characterize much if not most of the system science methodologies.

Why is OBSSR investing in systems science? As Mabry explained, health problems are complex, especially in context and there is a need to employ methods to match. She also noted that behavioral and social science research (BSSR) investigators are becoming aware of these methods and are seeking training. At the same time, OBSSR wants to aid investigators in using systems science methods to address important health problems.

She pointed out that systems science includes a range of methods, including but limited to: agent-base modeling, microsimulation, system dynamics modeling, network analysis (including social network analysis), discrete event simulation, markov modeling, many operations research and engineering methods, and a variety of other modeling and simulation approaches.

Systems science methods are designed to capture dynamic behavior of the system (change over time); bidirectional relationships (feedback loops); nonlinear relationships (threshold behavior, worse-before better); and time-delayed effects. Systems science, Mabry explained, can help detect unintended consequences, emergent properties (individual behavior leads to aggregate outcome), and gaps in existing knowledge. Sensitivity analysis can tell us how important they are, she added. Systems science can also enable virtual experimentation and generate hypotheses for empirical testing.

Systems science methodologies include: computational/mathematical modeling; agent-base modeling; dynamic modeling, including System Dynamics; and network analysis, Mabry explained, noting that it is also referred to as complexity science, complex adaptive systems, and non-linear dynamics.

Providing a historical perspective to put systems science in context, Mabry provided several examples of systems science supported by the NIH: Cancer Intervention and Surveillance Modeling Network (CISNET), funded by the National Cancer Institute; Models of Infectious Disease Agents Study (MIDAS), supported by the National Institute of General Medical Sciences; and Initiative on the Study and Implementation of Systems (ISIS), supported by the National Cancer Institute. She also cited the Centers for Disease Control and Prevention's support of the Prevention Impacts Simulation Model (PRISM) and the 2007 University of Michigan Complex Systems conference. Mabry further highlighted the March 2006 special issue of the *American Journal of Public Health*.

She also pointed out OBSSR's investments in systems science, including the support of the 2007 Symposia on Systems Science and Health; the BSSR-Systems Science Listserv (2007); and the Institute on Systems Science and Health, a weeklong training and cross-disciplinary cohesions. The Office also



developed funding opportunities, including: *Using Systems Science to Understand and Improve Population Health* (PAR-08-224); *Social Network Analysis and Health* (PAR-10-10-145/146); and *Systems Science and Health in the Behavioral and Social Sciences* (PAR-11-314/315). For an in-depth description of OBSSR activities in systems science, Mabry directed meeting participants to see Mabry and Kaplan in *Health and Behavior* (October 2013).

The future of systems science, according to Mabry, includes Big Data, mHealth (mobile technologies as they are applied to understand and improve health), and dissemination and implementation research (i.e. tobacco, obesity, workforce). It also involves identifying data for primary data collection. She noted the need for more longitudinal data on social networks. Health disparities, Mabry emphasized, is “ripe for systems science,” citing such factors as the “intergenerational transmission of disadvantage,” geographical aspects of health disparities, *Gene x Environment* interactions, and the creation of decision tools for vulnerable populations.

The agenda for the meeting along with speakers' presentations will be posted [here](#).

