The 2011 System Dynamics Applications Award : Citation for the winner

"Prevention Impacts Simulation Model (PRISM) for Chronic Disease Policymaking"
By Jack Homer, Kristina Wile, Gary Hirsch, Justin Trogdon, Amanda Honeycutt, Bobby Milstein, Diane Orenstein, and Lawton Cooper

This year, we take great pleasure in presenting the Society's third "Applications Award." In addition to myself, Jim Lyneis, the awards committee consists of Brad Morrison, Mark Paich, Eric Wolstenholme, and Erich Zahn. As many of you will remember, our prior two award winners have been in the "business" world – Mark Paich, Nick Pudar and team for the General Motors OnStar work, and Ken Cooper and Greg Lee for Fluor Corporation's project Change Impact System.

This year's winner is in a different field – public health. Nevertheless, as we will see, the work clearly meets the standards set forth for the Society's Applications award: system dynamics modelling that leads to specific actions which yield demonstrable improvement in the performance of the system. In particular, the model developed by this year's winners has been used to identify the most effective and economical strategies to prevent and manage chronic disease. They have had a number of successful implementations of this work, which have led to measurable public health benefits.

It gives me great pleasure to announce and introduce this year's award winners, for the work broadly titled: "Prevention Impacts Simulation Model (PRISM) for Chronic Disease Policymaking", the winners are Jack Homer, Kristina Wile, Gary Hirsch, Justin Trogdon, Amanda Honeycutt, Bobby Milstein, Diane Orenstein, and Lawton Cooper.

In this award-winning work, the authors developed and used as system dynamics model to address a number of important public health problems. In the United States, at least 70% of deaths each year are from chronic diseases (heart disease, cancer, and stroke alone accounting for more than 50%), and their direct and indirect costs are more than 1 trillion dollars per year. Governmental health agencies are in a position to promote strategies to prevent and manage chronic disease, but identifying the most effective and economical strategies is often difficult. The difficulty comes in part from uncertainty about the immediate, proximal effects of interventions, but more importantly from uncertainty about their more delayed and distal effects. Some analytic models exist to estimate intervention effects, but most do not recognize the important interactions among different risk factors nor do they adequately model long term versus short term impacts. The conventional "silo" approach to analysis results in fragmented and difficult-to-compare estimates of intervention effects.

To help health agencies better plan and evaluate interventions, the CDC (since 2007), along with the NHLBI (since 2009), funded the creation of the Prevention Impacts Simulation Model (PRISM). PRISM is a relatively large system dynamics model (over 1,500 input elements and 4,000 output elements) that is used to simulate trajectories for health and cost outcomes for the entire U.S. population (disaggregated by 6 gender-age groups) from 1990 to 2040, and has also been applied to represent other national and local populations. Interventions are in several broad areas: medical care (14 separate interventions), smoking (5), nutrition and weight loss (8), physical activity (4), emotional distress (2), and particulate air pollution (1). These interventions act through a range of channels such as access, price, promotion, and regulation. The diseases and conditions modeled in detail include heart disease, stroke, diabetes, hypertension, high cholesterol, and obesity, and the model also accounts for cancers and

respiratory diseases related to smoking, obesity, poor nutrition, and physical inactivity. The model reports summary measures of mortality and years of life lost as well as the consequent medical and productivity costs of the chronic diseases and conditions modeled.

Local and federal health officials have used PRISM throughout its development, and its applications continue to grow in number and variety. A freely accessible version of the model, called PRISM Online, will allow diverse stakeholders to create and compare intervention scenarios of their own design.

Several peer-reviewed journal publications have come out of the PRISM project already and more are in the publication pipeline. The following three are the most informative publications to date (PRISM core team members in bold):

Homer J, Milstein B, Wile K, Trogdon J, Huang P, Labarthe D, **Orenstein D**. (2010) Simulating and Evaluating Local Interventions to Improve Cardiovascular Health. *Preventing Chronic Disease* 7(1), January 2010. Available at: http://www.cdc.gov/pcd/issues/2010/jan/08_0231.htm. [discusses results from U.S. version of PRISM]

Homer J, Milstein B, Wile K, Pratibhu P, Farris R, **Orenstein D**. (2008) Modeling the Local Dynamics of Cardiovascular Health: Risk Factors, Context, and Capacity. *Preventing Chronic Disease* 5(2), April 2008. Available at: http://www.cdc.gov/pcd/issues/2008/apr/07_0230.htm. [discusses PRISM general framework and background]

Hirsch G, Homer J, Evans E, Zielinski A. (2010) A System Dynamics Model for Planning Cardiovascular Disease Interventions. *American Journal of Public Health* 100(4):616-622. [discusses El Paso County, Colorado version of PRISM]

This work also demonstrates how a team from different organizations and with different skills can work together to effectively address a complex problem:

Jack Homer is a former faculty member at the University of Southern California and a full-time consultant to private and public organizations since 1989. His many articles on system dynamics applications and methodology are frequently cited. His health-related modeling applications have dealt with national and local health reform, urban health disparities, chronic diseases, hospital-acquired infections, obesity, HIV/AIDS, antibiotic resistance, hospital surge capacity, cocaine prevalence, eating disorders, new medical technologies, and other topics. These works have been done with many organizations, among them the Centers for Disease Control and Prevention, the National Institutes of Health, the Veterans Health Administration, the National Alliance of State and Territorial AIDS Directors, and the New Zealand Ministry of Health. In 1997, Dr. Homer received the SD Society's prestigious Jay W. Forrester Award. He has an MS in statistics from Stanford University and a PhD in management from MIT.

Kristina Wile is a facilitator and analyst in the areas of systems thinking, system dynamics and organizational learning. She is a founding partner of the Systems Thinking Collaborative, a networked organization that provides consulting, facilitation, simulation modeling and coaching in systems thinking and related disciplines. She has seventeen years of experience helping communities and organizations in many public and private sectors to understand the feedback forces driving their performance, and to develop systemic strategies. She received her master's degree in system dynamics and operations at the MIT Sloan School of Management in 1994.

Prior to her graduate work, she worked seven years as an electronics and system engineer developing and managing the development of industrial and commercial products.

Gary Hirsch has over 40 years of experience in applying SD to a wide variety of health care problems including chronic illness, disasters and infectious disease outbreaks, illegal drug use, oral health and dental care, health reform, manpower requirements planning, and the design of improved delivery systems. He has published papers on this work in several journals. His recent work has focused on chronic illnesses such as diabetes and cardiovascular disease. He is also President of the MetroWest Free Medical Program, an organization that provides primary health care to uninsured people in the area west of Boston. Mr. Hirsch has SB and SM degrees from the Sloan School of Management at MIT with concentrations in SD and Public Sector Management.

Justin Trogdon is a health economist at RTI International. His current research includes program evaluation and cost-effectiveness studies; methods for estimating the cost of disease with applications in obesity, tobacco, cancer, and other chronic disease; and the impact of social networks on obesity. He has managed projects in these topic areas for the Centers for Disease Control and Prevention, National Association of Chronic Disease Directors, and American Heart Association. He has published in *Circulation, Health Affairs, Journal of Health Economics, Health Economics, Health Services Research, American Journal of Public Health, Medical Care, International Economic Review,* and *Journal of Labor Economics.* Before joining RTI, Dr. Trogdon was an assistant professor at the School of Economics at the University of Adelaide, Australia, and he worked at the Duke University Center for Health Policy, Law and Management.

Amanda Honeycutt is a senior economist at RTI International and associate director of RTI's Public Health Economics Program. Her research focuses on evaluating and applying alternative approaches for quantifying burden of illness; estimating the cost and cost-effectiveness of prevention and treatment interventions; and assessing and applying alternative approaches for estimating program or intervention effectiveness using secondary data, including fixed effects and instrumental variables methodologies. She has led studies to assess the cost-of-illness for chronic conditions and the cost-effectiveness of intervention programs designed to prevent or manage illness. She has also conducted economic analyses for a number of public health program areas, including immunization, developmental disabilities, blood lead screening, diabetes, chronic kidney disease, heart disease, early childhood intervention, obesity, and HIV/AIDS. Dr. Honeycutt has a PhD in economics from the University of Maryland.

Bobby Milstein supports and studies innovations to improve health and health equity. With an educational background that combines cultural anthropology, behavioral science, and systems science, he specializes in strategies to achieve large-scale institutional change. He currently leads the Hygeia Dynamics Policy Studio and directs multiple health system change initiatives for the Fannie E. Rippel Foundation. He is also a visiting scholar at the MIT Sloan School of Management. Previously, Dr. Milstein served for 20 years at the Centers for Disease Control and Prevention, where he founded the Syndemics Prevention Network, chaired the agency's Behavioral and Social Science Working Group, and was the principal architect of CDC's framework for program evaluation. He also led more than a dozen dynamic modeling projects at CDC related to chronic disease, environmental health, reproductive health, emergency preparedness, and health system improvement.

Diane Orenstein is a Behavior Scientist in the Applied Research and Evaluation Branch, Division for Heart Disease and Stroke Prevention, Centers for Disease Control and Prevention. Her work provides leadership in developing evidence-based tools designed to help states,

communities, and policymakers understand and strategically plan and evaluate interventions and policies, and estimate the economic burden of chronic diseases. Dr. Orenstein has been the CDC lead on the PRISM project since its inception. Also, she has led a team of economists and epidemiologists over the last several years to create the Chronic Disease Cost Calculator for state-specific estimates of the treated prevalence, per-person costs, and total Medicaid, Medicare, and all-payer costs for 10 different chronic diseases. Dr. Orenstein has presented her research findings at numerous national meetings and in professional journals.

Lawton Cooper is a Medical Officer in the Division of Cardiovascular Sciences of the National Heart, Lung, and Blood Institute at the National Institutes of Health. His research interests include clinical trial methodology, heart failure disease management and transitional care, exercise therapy for heart failure and other cardiovascular disease, cardiovascular risk stratification and predictive modeling in acute and chronic care settings, and reducing delay time for treatment of acute coronary syndrome. Dr. Cooper has published in major medical journals including the *New England Journal of Medicine*, *JAMA*, *Lancet*, and *Circulation* and has made numerous presentations at national research meetings. He has been a major collaborator on several large multi-center NHLBI-funded clinical trials. He has received a number of NIH awards, including one in 2010 for his "innovation, creativity, and responsiveness in enhancing the comparative effectiveness research portfolio at the NHLBI."

Please join me in congratulating the PRISM team on this fine work.

James M Lyneis
Chair, System Dynamics Society Applications Awards Committee