## Session

**Novel Use of Agent-Based Modeling for Evaluating Childhood Obesity Interventions (in collaboration with the Applied Public Health Statistics Section)**

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*APHA 2016 Annual Meeting & Expo (Oct. 29 - Nov. 2, 2016)*

## Abstract

**How Can Agent-Based Modeling Help Us Address Childhood Obesity?**

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Introduction: Since 2005, many different initiatives have been implemented in Los Angeles County to address rising rates of childhood obesity. There is a need to understand which of these interventions were the most effective. However, evaluating their impact is challenging, because the pathways leading from intervention activities to child adiposity outcomes are not direct but rather flow through a dynamic, interacting system of behaviors and environments at the child, family, neighborhood and societal levels. Furthermore, various different interventions could reinforce or interfere with each other. To evaluate the effectiveness of the obesity-related initiatives, we need to incorporate this complexity into our study methods. Conventional statistical modeling is not well-suited to capture this complexity. Methods: The NIH-funded Early Childhood Obesity Systems Science Study applies a systems science approach, specifically agent-based modeling (ABM), to evaluate the obesity-related initiatives in Los Angeles County. ABM involves computer simulations in which agents such as children and families interact with and are influenced by changes in policy, programs and the food or physical environment. Using ABM, we can estimate the likely impact of particular programs and policies. Results: We explain ABM and contrast it with traditional data analysis. We show how ABM can be used to illuminate the likely impact of a program or policy and quantify the combined effects of multiple programs. Discussion: ABM is an innovative tool for simulating intervention effects. It can be used to evaluate efforts to prevent childhood obesity and help planners select interventions with the greatest impact.

Biostatistics, economics Conduct evaluation related to programs, research, and other areas of practice Other professions or practice related to public health Public health or related public policy Public health or related research Systems thinking models (conceptual and theoretical models), applications related to public health

## Abstract

**Examining the impact of changes to the food environment and the WIC food package on adiposity of low-income preschool-aged children through agent-based modeling**

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introduction: The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides nutrition education and healthy food vouchers to nearly 500,000 low-income enrollees in Los Angeles

County (LAC). In 2009, changes to the WIC food package included the introduction of a cash value voucher (CVV) specifically for purchasing fruits and vegetables. We sought to investigate a hypothetical impact of changes in the CVV's dollar value on adiposity among LAC WIC-enrolled preschool-aged children. However, we were concerned that traditional statistical models would not capture the dynamic relationship between hypothetical changes in the CVV, subsequent changes in the retail food environment (RFE), and adiposity. Consequently, we used agent-based modeling (ABM) to investigate the impact of changes to the CVV and the RFE on early childhood adiposity. methods: We developed an ABM that regards WIC enrollees, the RFE, and the CVV as a dynamic, interacting system linked to child adiposity. We fit multilevel, longitudinal models to anthropometric data collected from LAC WIC-enrolled children ages 2-5 years in 2008-2014 to estimate parameter values for the ABM. We conceptualized changes to the RFE and the CVV's value as interventions applied within this system. Using the ABM, we simulated interventions to assess their impact on adiposity. results: We will run the ABM in real time to present estimates of the impact on child adiposity. discussion: Understanding intervention effectiveness within a dynamic environment is essential. Our study leverages traditional statistical modeling and ABM to investigate the impact of hypothetical changes to the CVV on child adiposity.

Biostatistics, economics Chronic disease management and prevention Environmental health sciences Epidemiology Public health or related public policy Public health or related research

## Abstract

**An agent-based model to estimate the impact of increasing affordable housing on obesity risk in early childhood**

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Introduction: Unaffordable housing (i.e., spending > 30% of income on housing costs) is an emerging risk factor for early childhood obesity. With 41 million households in the United States living in unaffordable housing, determining the potential impact of increasing affordable housing on obesity early in life can be beneficial. Methods: We created an agent-based model (ABM) of unaffordable housing and obesity among low-income preschool-aged (2-5 years) children participating in the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) in Los Angeles County. We considered child's diet and sedentary behavior, and mother's mental health as key mechanisms by which unaffordable housing could influence child's weight, all within the context of the family's home and neighborhood environment. ABM allows for the interactions of these mechanisms, and is an innovative method for modeling the relationship between unaffordable housing and child obesity. The ABM was validated and calibrated using data from the Los Angeles County WIC Survey, a triennial survey begun in 2005 that is conducted on a random sample of approximately 5,500 WIC families in Los Angeles County. Results: We will present the predicted impact of a hypothetical intervention to provide affordable housing to the WIC population in Los Angeles County on obesity prevalence among WIC preschool-aged children. Discussion: Efforts to decrease childhood obesity in low-income communities must continue to explore the impact of addressing upstream factors such as those that present barriers to parents who have the intent to implement the nutrition knowledge and skills they have received from WIC.

Public health or related public policy Public health or related research Systems thinking models (conceptual and theoretical models), applications related to public health

## Abstract

**Use of complex simulations to inform policy development and program planning in public health: An emerging priority in Los Angeles County**

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Introduction: From the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) to the Nutrition Education and Obesity Prevention (NEOP) project in Los Angeles County (LAC) to First 5 LA's recent evaluation of their obesity prevention portfolio, the need to consider complex interactions and environmental factors which affect health has become a priority for funding agencies and public health departments. We describe emerging efforts to incorporate complex simulations as novel approaches for informing policy development and program planning in LAC. Methods: An internal program data review including Requests for Proposals from funding agencies in LAC was performed to describe the landscape of obesity prevention funding opportunities that required complex simulations to evaluate program effectiveness and the collective impact of clustered public health interventions. This review was augmented by an inventory of policy, systems, and environmental (PSE) change strategies implemented during 2010-2015. Complex simulations that were requested or considered included system dynamics forecasting, discrete event modeling, agent-based modeling, and Monte Carlo implemented g-computation in multilevel models with spill-over effects. Results: From 2013-2015, three major efforts – UCLA's ECOSyS, the NEOP Synthesis Project, and First 5 LA RECO Evaluation – helped shift the local perspective on evaluation to now include the use of complex simulations for examining effects of multiple interventions collectively or forecasting health impact. Discussion: The presentation describes how these efforts helped advance the use of complex simulations for policy development and program planning locally, and discusses implications for addressing scalability and dissemination of these methods to other communities.

Public health or related public policy