**Project title:** Virtual Population for Obesity Prevention (VPOP)

**A one/two sentence summary of the project topic with a hyperlink to more detailed information via the**[**IMAG wiki**](https://www.imagwiki.nibib.nih.gov/content/msm-participants)**:**   
Develop computational simulation models of communities, cities, and regions that allow decision makers (e.g., policy makers, funders, public health officials, school officials, and business professionals) to better understand and address the various systems contributing to obesity and affecting diet, physical activity, and metabolism.

<http://www.globalobesity.org/our-projects/virtual-population-obesity-prevention/index.html>

* + **List of planned actions outlined in Model Credibility plan:**
  + Stakeholder Working Group
  + Sensitivity Analysis
  + Progressive Layered Criterion Validation
  + **Brief description of information gained by each credibility action**
  + See breakdown of face/criterion and convergence and divergence validation below.
  + Each piece of information informs the degree to which the model is reproducing real world interactions, behaviors and outcomes.
  + Sensitivity analysis allows us to account for the uncertainty of data, the natural variation in the data and also test a range of parameters to gain insight into the key drivers in the system. Sensitivity also provides more robust results to better understand how the model applies to different circumstances.
* **CPMS Ten Simple Rules:**

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| **Define the Context** | See face validity listed below |
| **Use Appropriate Data** | See criterion validation listed below |
| **Evaluate Within the Context** | See face validity listed below |
| **List Limitations Explicitly** | See convergence and divergence validity listed below. Limitations listed explicitly for each iteration of VPOP |
| **Use Version Control** | We use the Git version control system to keep a complete history of and track changes to the codebase. |
| **Document Adequately** | All components of face, criterion and convergence/divergence are documented for each iteration of VPOP. |
| **Disseminate Broadly** | We have disseminated model results in multiple manuscripts, published in Health Affairs, AJPM and Obesity. We also have disseminated results via social media (Facebook, Twitter). Results have also been published in the New York Times, USA Today, Forbes. |
| **Get Independent Reviews** | Each iteration of VPOP that has been published has been through the peer-review process. We have also gained feedback from additional stakeholders (i.e. Project Play, Aspen Institute, Health Departments) regarding the relevance and applicability of the model. |
| **Test competing implementations** | See convergence and divergence validation listed below. |
| **Conform to Standards** | Face validity, criterion, and convergence and divergence validation are common and best practices for validating models. |

* + **Description of how the planned activities will lead to a credible model**
  + Face validity involves developing the model in close collaboration with stakeholders who have intimate knowledge of the system to ensure the model is developed appropriately.
  + Criterion Validity reproduces observed trends at multiple levels to ensure the model is producing results we would expect to observe in a real world system.
  + Convergence and Divergence validity compares with other models and calculations to determine the degree to which you model is behaving as expected.
  + **Progress to-date and plans for the next reporting cycle (6 months). What has been achieved since last reporting?**
* Our team has worked with the New York City Health Department to develop a model of New York City, incorporating additional scales and decision frameworks into the model, including how to decide what to eat. We will develop models in contexts outside of the United States and we are continuing to add more specific features into the model including store stocking patterns as well as modeling different communication campaigns. We are committed to enhancing methods for understanding the impact of various obesity prevention approaches and we will continue to use our models to test interventions and policies to inform decision makers throughout the United States.
* We will continue to use these various models to answer questions of interest to local and national stakeholders and decision makers across the U.S.

**Issues/concerns identified as critical or problematic to achieve the standard of credibility set by MSM Consortium.**

N/A

**What other factors, if any, contribute to credibility but cannot be reported within the TSR structure? In requesting this information, we seek to identify credibility activities/issues and appropriate ways to report them at upcoming IMAG/MSM meetings.**

We have organized the model credibility as face validity, criterion validity and convergence and divergence validity and have referenced this organization in the TSR structure.

Face Validity: *Involves developing the model in close collaboration with stakeholders who have intimate knowledge of the system*

Our team currently works with the Baltimore City Health Department, New York City health department, Laureus Sport for Good, Aspen Institute, National Heart Lung and Blood Institute, Girl Scouts of Central Maryland and the Philadelphia Health Department. We regularly discuss model development and results with each partner, to ensure the model is reflecting the system based on their on-the ground understanding of it.

Criterion Validity: *Reproducing observed trends at multiple levels*

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| Sample Factors | Sample Sources |
| Overweight and obesity prevalence | National Health And Nutrition Examination Survey (NHANES)  Youth Risk Behavior Surveillance System (YRBSS)  Parish State of Youth Sports and Physical Activity New Orleans Sport for Development Coalition 2015.  Rivera JÁ. Review Childhood and adolescent overweight and obesity in Latin America: a systematic review. THE LANCET Diabetes & Endocrinology. 2014;2:321-332.  Baltimore City: Demographics and Social Determinants of Health (2005-2009). In: Maryland Department of Health and Mental Hygiene. |
| Proportion of students purchasing unhealthy snacks | NHANES  *Lent MR, Vander Veur S, Mallya G, et al. Corner store purchases made by adults, adolescents and children: items, nutritional characteristics and amount spent. Public Health Nutr* |
| Average distance students regularly walk to store | *How far will people walk to facilities in their local neighbourhoods. AUSTRALIA: WALKING THE 21ST CENTURY, INTERNATIONAL CONFERENCE, 2001, PERTH, WESTERN AUSTRALIA, VOL 3; 2001.*  *Burke M, Brown A. Distances people walk for transport. Road & Transport Research: A Journal of Australian and New Zealand Research and Practice 2007;****16****(3):16* |
| Average daily SSB consumption levels | NHANES |
| Likelihood of individuals using health apps to meet physical activity recommendations | National Cancer Institute’s 2015 Health Information National Trends Survey – HINTS |
| Proportion of population exercising | Behavioral Risk Factor Surveillance System National Survey – BRFSS)  Parish State of Youth Sports and Physical Activity New Orleans Sport for Development Coalition 2015. |
| Time spent in PE class | Gharib H, Galavíz KI, Lee RE, et al. The Influence of Physical Education Lesson Context and Teacher Behaviour on Student Physical Activity in Mexico. 2015;2041:160-164 |

Convergence and Divergence Validity*: Comparing with other models and calculations*

We have adapted the metabolic model from Hall et al(1) and Rhamandad et al(2) and validated using the methods described below:

The Rahmandad model was validated extensively for infants and children using empirical energy requirements and expenditure, weight, fat mass and fat free mass, and basal metabolic rate data from sources including Butte(3), Torun(4), and Ellis, et al(5). Our team followed the same validation process upon implementing the metabolic model, validating our baseline scenario against the energy inputs and growth trajectories reported in Butte et al,before, and also after we made changes to the model. We also compared our results against data from the 2004-2014 National Health and Nutrition Examination Survey (NHANES) and the model-estimated weights were not statistically different from those reported in NHANES.

1. Hall, K.D., et al., *Quantifying the Dynamics of Childhood Growth and Obesity.* Lancet Diabetes and Endocrinology 2013. **1**(2): p. 97-105.
2. Rahmandad H. Human growth and body weight dynamics: an integrative systems model. PLoS ONE. 2014;9(12):e114609.
3. Butte, N.F., et al., *Body composition during the first 2 years of life: an updated reference.* Pediatr Res, 2000. **47**(5): p. 578-85.
4. Torun, B., *Energy requirements of children and adolescents.* Public Health Nutrition, 2005. **8**(7A): p. 968-993.
5. Ellis, K.J., et al., *The reference child and adolescent models of body composition. A contemporary comparison.* Ann N Y Acad Sci, 2000. **904**: p. 374-82.