

Methods to Identify and Integrate Social Determinants of Health into Effective Interventions

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Disclosures

- Relevant Financial Disclosures
 - None

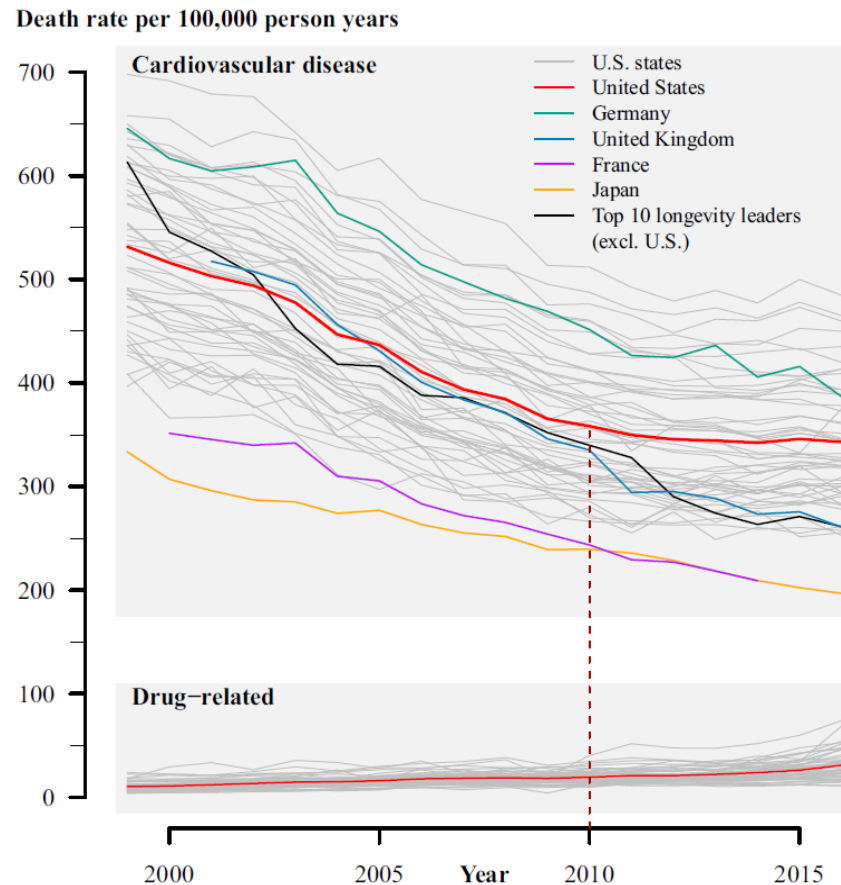
- Non-FDA Approved Uses
 - None

- The views expressed in this presentation are my own and do not necessarily represent the views of the NHLBI; the NIMHD; the National Institutes of Health; or the U.S. Department of Health and Human Services.

US life expectancy stalls due to cardiovascular disease, not drug deaths

Neil K. Mehta^a, Leah R. Abrams^a , and Mikko Myrskylä^{b,c,1} 

^aDepartment of Health Management and Policy, University of Michigan School of Public Health, Ann Arbor, MI 48109; ^bMax Planck Institute for Demographic Research, Rostock 18057, Germany; and ^cCenter for Social Data Science, University of Helsinki, Helsinki 00014, Finland



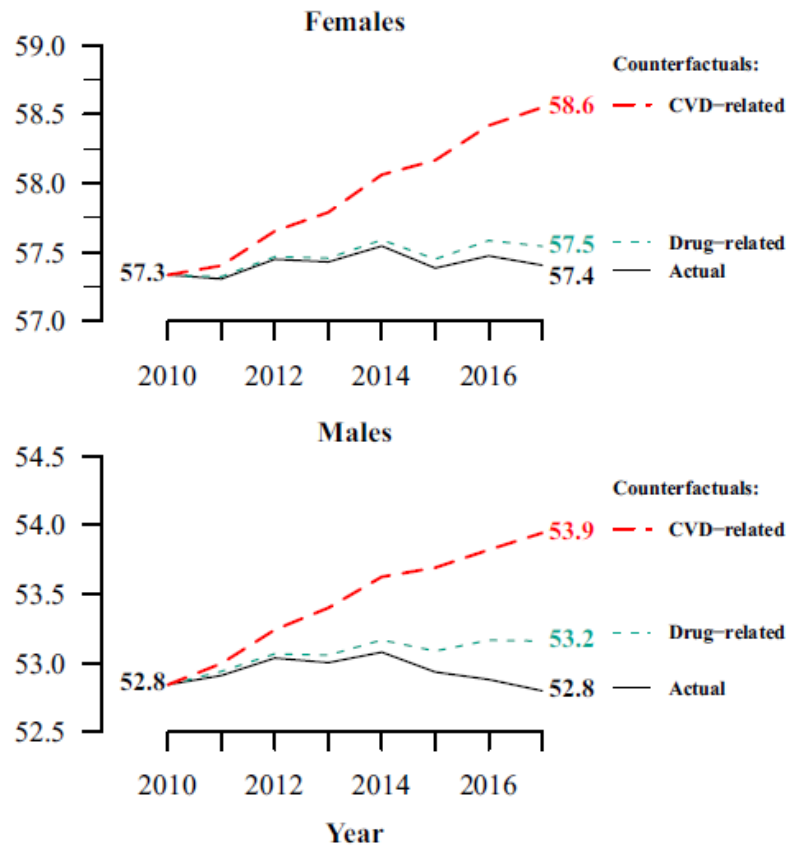
- CVD mortality: 350-550 deaths/100,000 person-years
- Drug-related deaths: 30 deaths/100,000 person-years
- 2016: 30% higher CVD mortality in US compared to 10 high life expectancy countries

Mehta NK et al PNAS 2020

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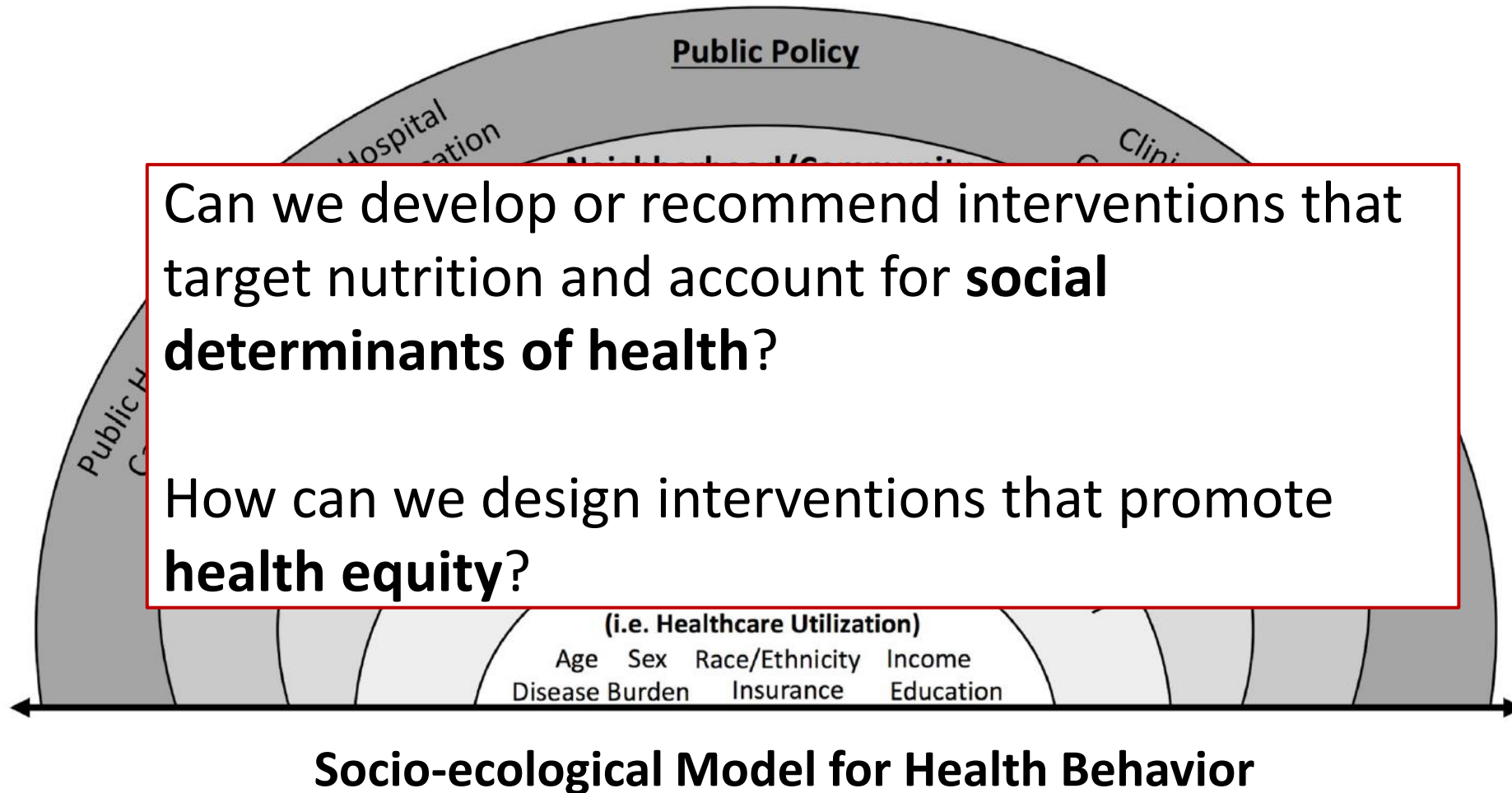


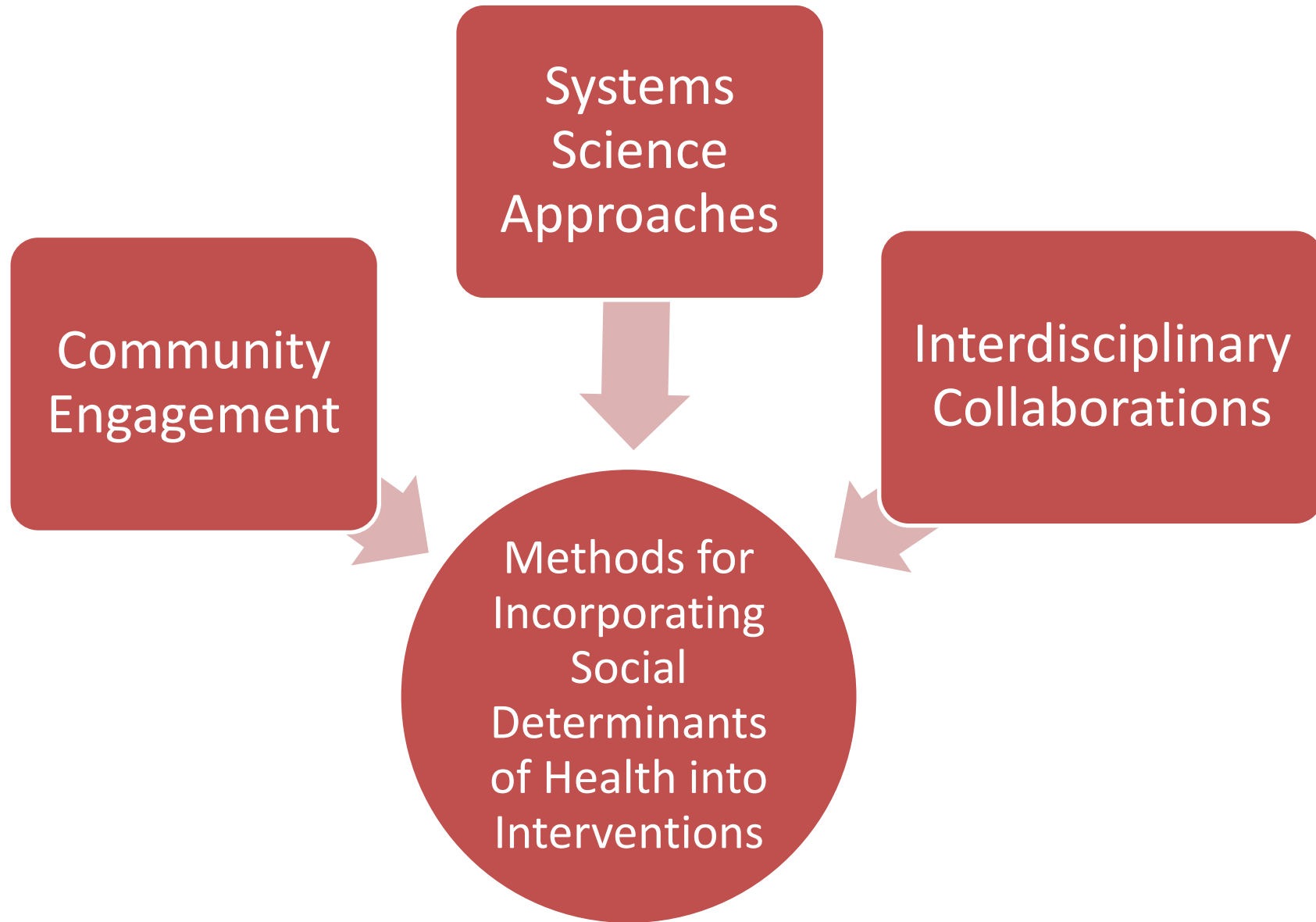
Implications:

- To improve life expectancy trends, need to consider how to reduce CVD mortality again
- Risk factor trends contribute to CVD mortality
 - Obesity
 - Diabetes
 - Hypertension
- Must address **social determinants of health** that contribute to risk factor trends

Mehta NK et al PNAS 2020; Chen Y et al JAMA Cardiology 2019; Harris K et al JAMA 2021

Social Determinants of Health as Key Components of Multi-Level Interventions







Role of Community Engagement in Identifying the Impact of Social Determinants of Health

The Washington DC Cardiovascular Health and Obesity Collaborative (DC CHOC)

- Community advisory board that facilitates community engagement
- Multidisciplinary group of community and academic leaders
- Provide input on project development and design
- Aid in identifying social determinants of health as barriers or facilitators to nutrition-related behaviors





D.C. Community Organizing for Optimal culinary Knowledge Study: An Acceptability and Feasibility Dietary Behavior Study

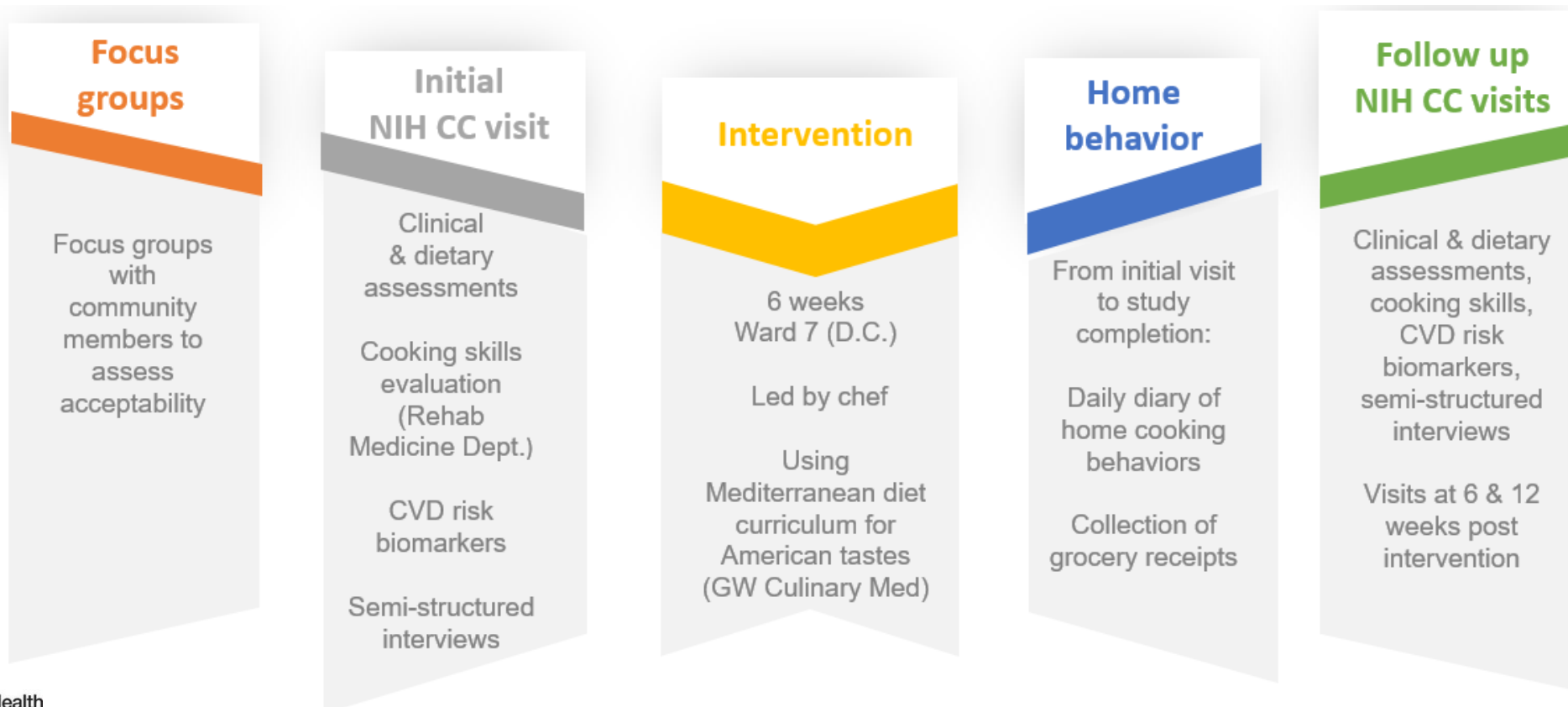
PI: Gwen Wallen, PhD., R.N.

Lead AI: Nicole Farmer, M.D.

20-CC-0036 NCT: [NCT04305431](https://clinicaltrials.gov/ct2/show/study/NCT04305431). Farmer N et al. Pilot and Feasibility Studies 2020

Is it feasible to conduct a cooking behavior intervention within an urban food desert among adults at risk for CVD?
Secondary evaluations: home cooking behavior, clinical biomarkers, anthropometrics, & diet quality

Participant recruitment through D.C. Cardiovascular Health & Obesity Collaborative



Opportunities with Community Engagement

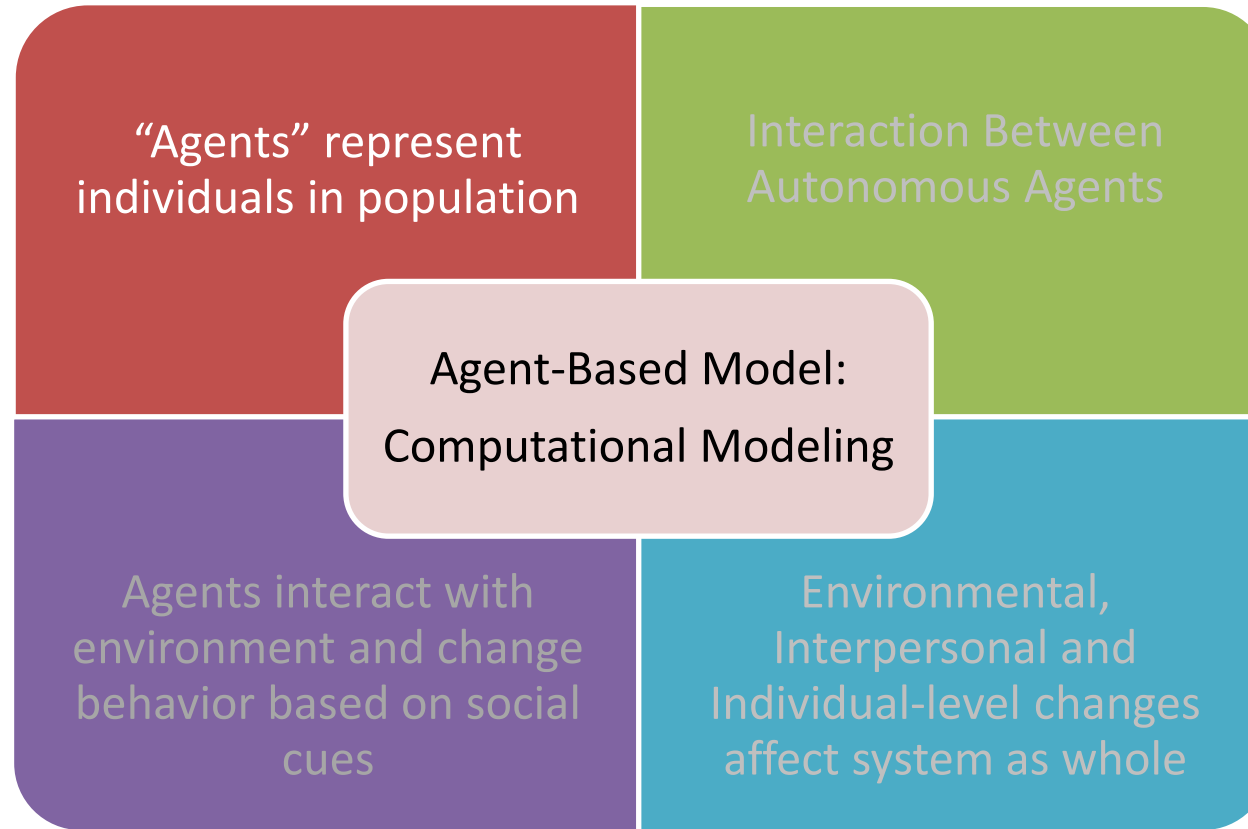
- Gather the qualitative data based on lived experience as part of 'top-down approach' to understanding targets for intervention
- Use of analytic tools like machine learning to identify latent barriers and facilitators to community engagement





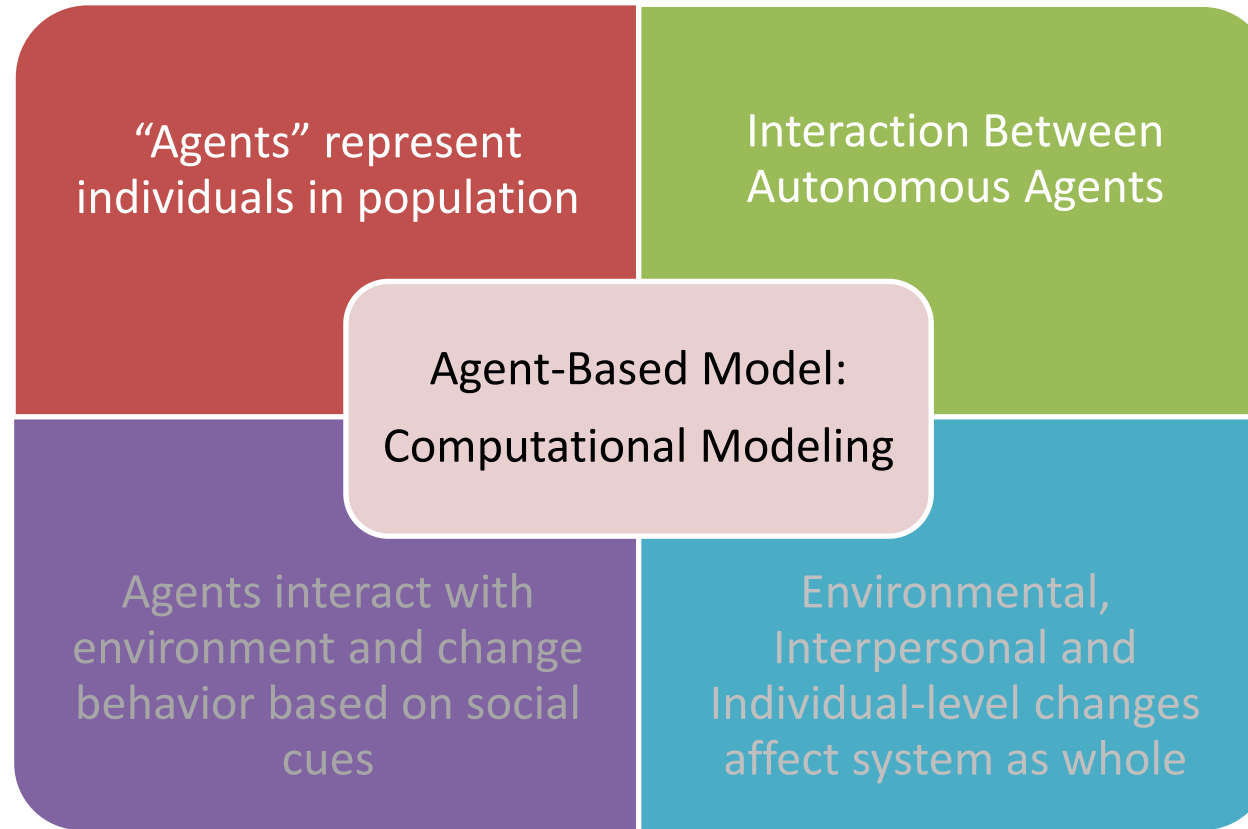
Role of Systems Science Modeling in Identifying the Impact of Social Determinants of Health

Agent-Based Modeling Allows for Simulation of SDoH Effects on Community Members



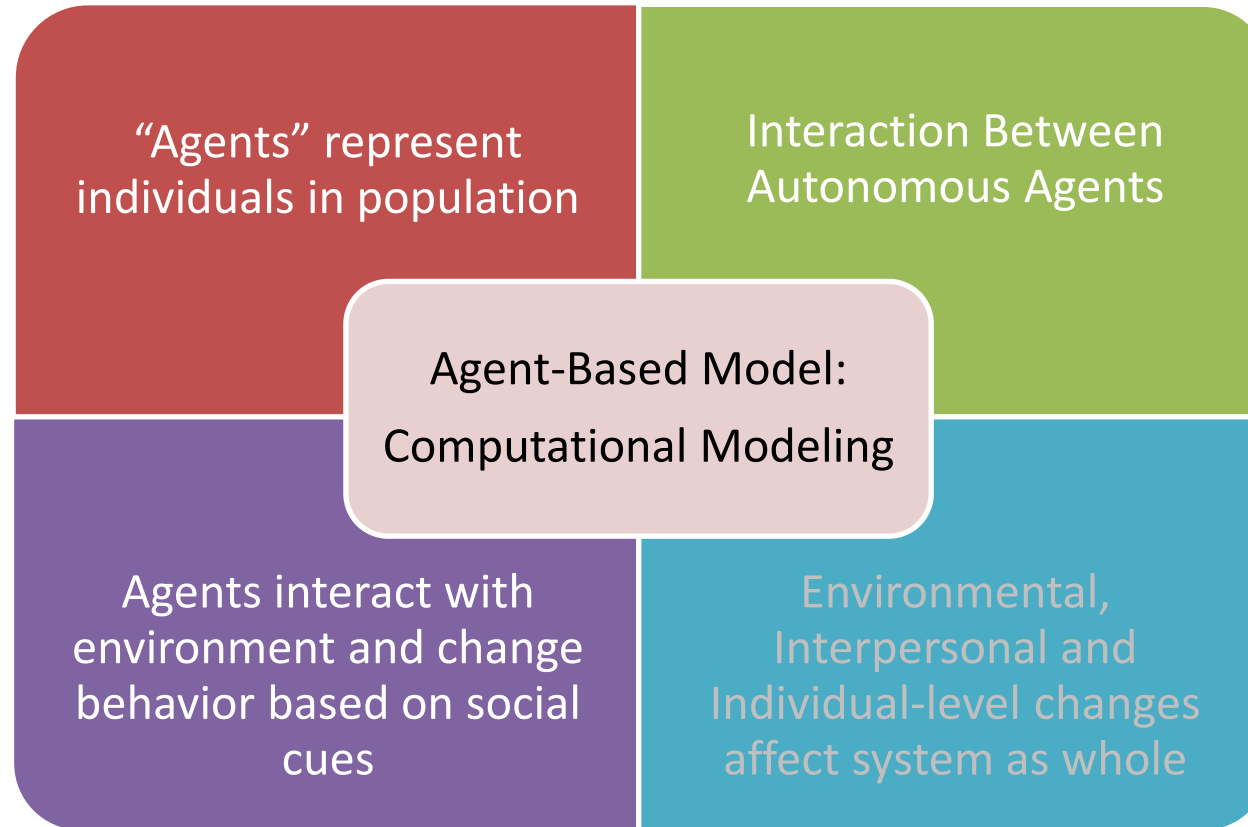
*Hammond RA.
Preventing
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2009
Nianogo R et al,
AJPH 2015*

Agent-Based Modeling Allows for Simulation of SDoH Effects on Community Members



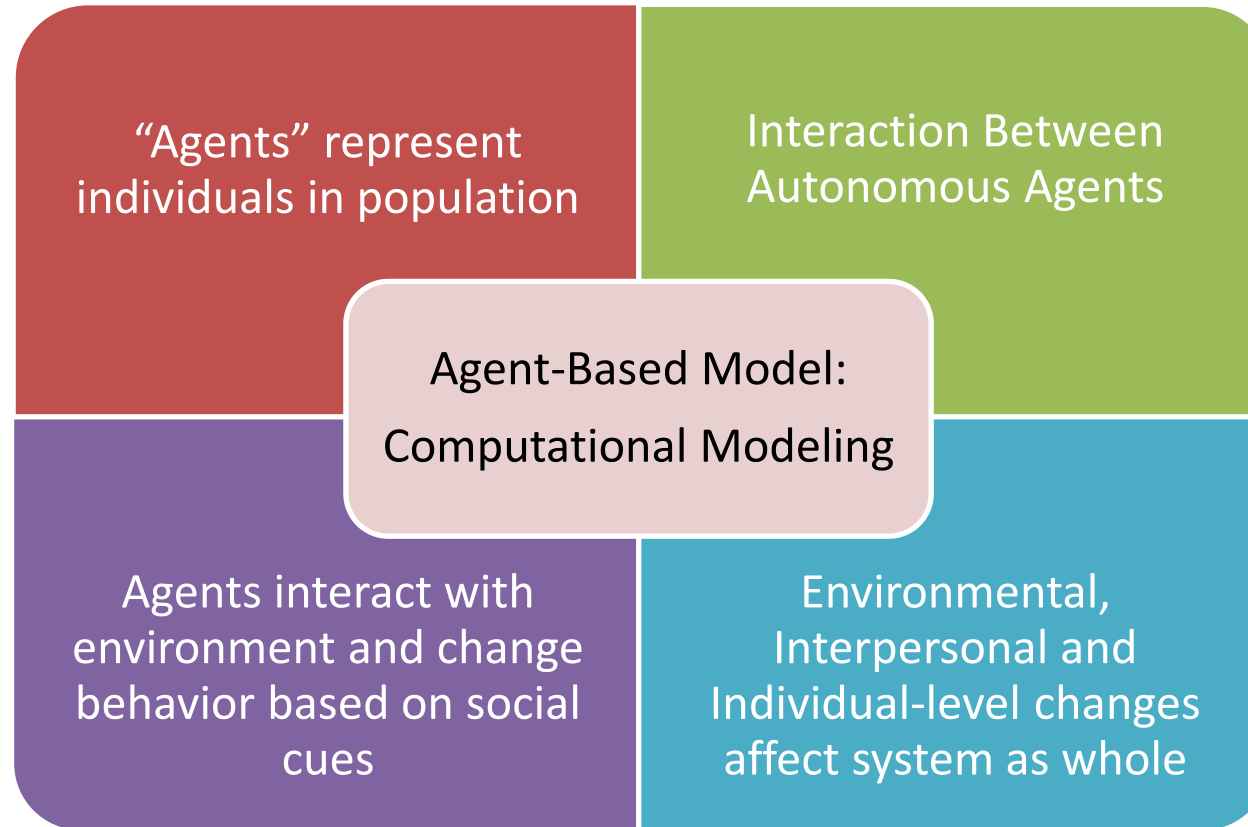
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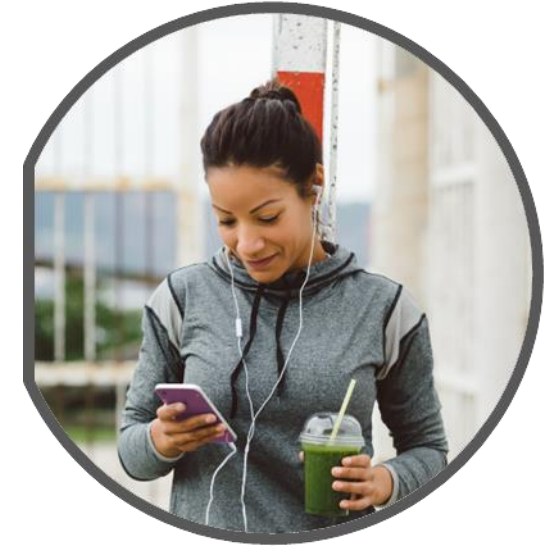
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Systems Science Modeling in Simulation of Multi-level Interventions Tailored to Neighborhood Environment

- Agent-based modeling to test multi-level interventions for African American women in DC:
 - Digital Health Intervention
 - Impact of place-tailored messaging on physical activity (PA)
 - Promotes PA at recreation center classes close to home or work
 - Simulates community-based intervention developed by team



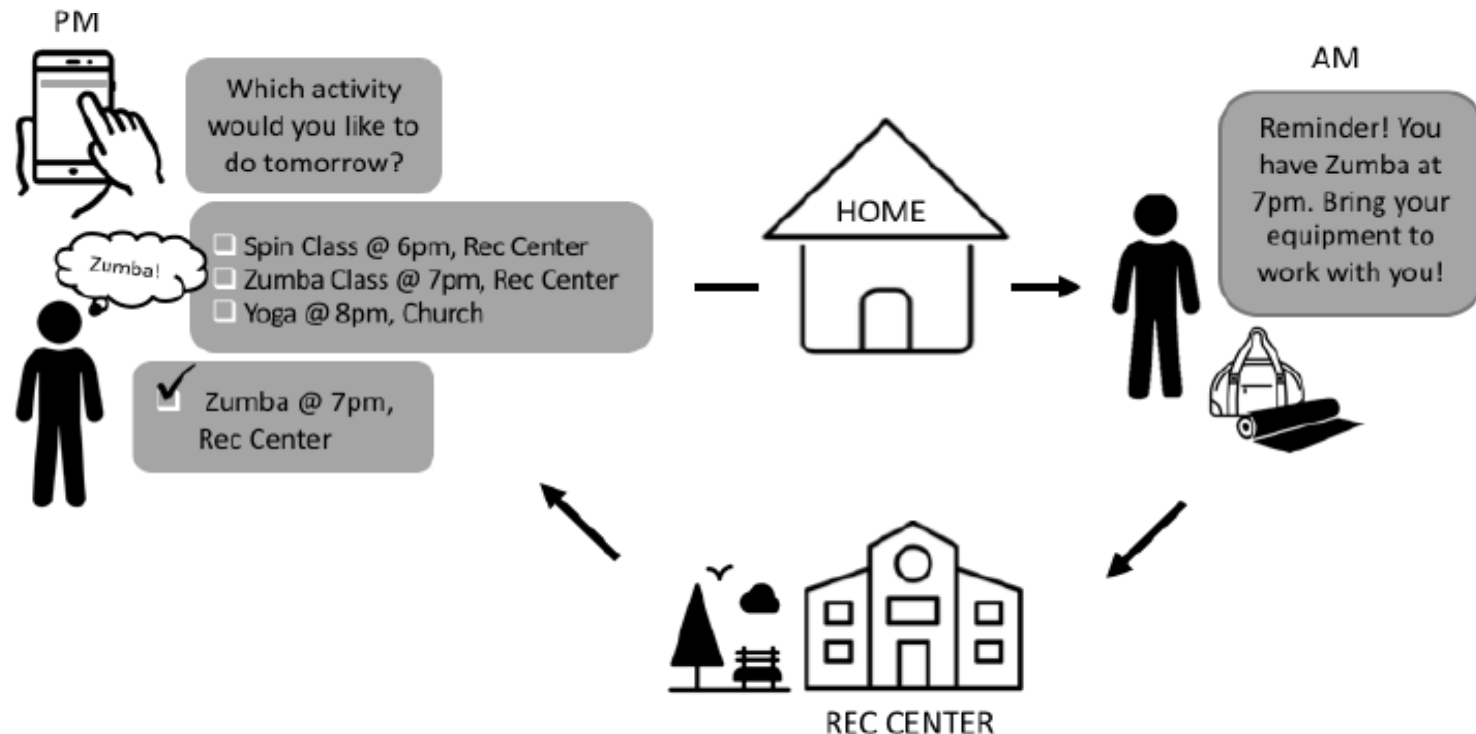
Powell-Wiley TM...Lee B et al. Under Revisions

Diagram of VPOP-DC Agent Based Model for Digital Health PA Intervention

Agent = African American woman aged 18-65 living in Washington DC

Step 1: Can Agent Use a Smart Phone?

Step 2: Agent Receives Notifications through Mobile App



Note: Notifications may be sent in morning or afternoon

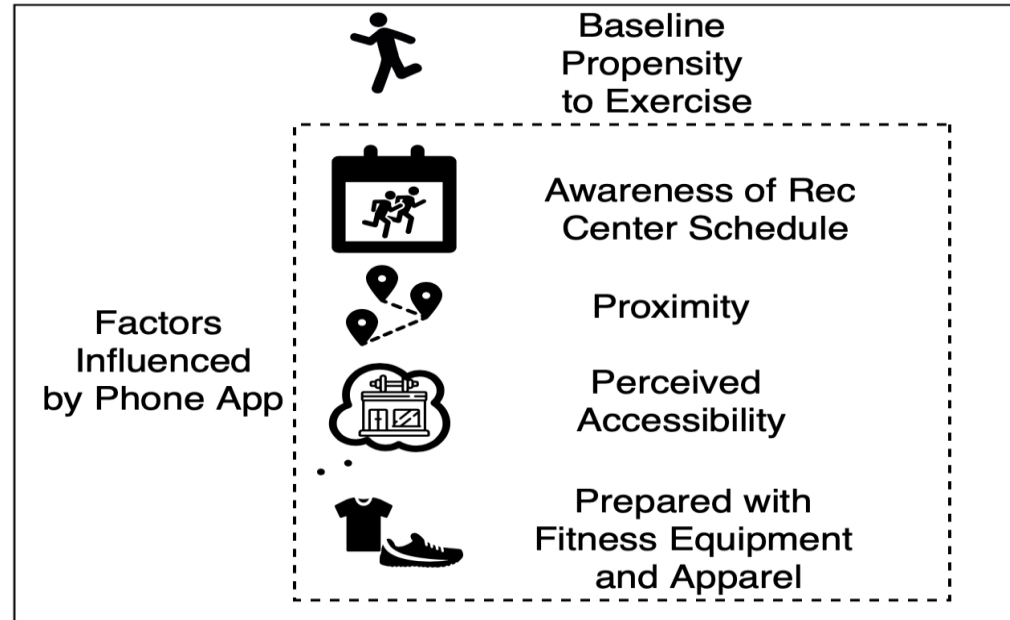
Diagram of VPOP-DC Agent Based Model for Digital Health PA Intervention

Step 3: Agent Makes Decision to Exercise

Baseline Propensity

- Neighborhood Factors
- Chronic Disease
- Weather

Steps 1 and 2



Factors Influencing Probability of Exercise

Decision to Exercise



Attends Fitness Class

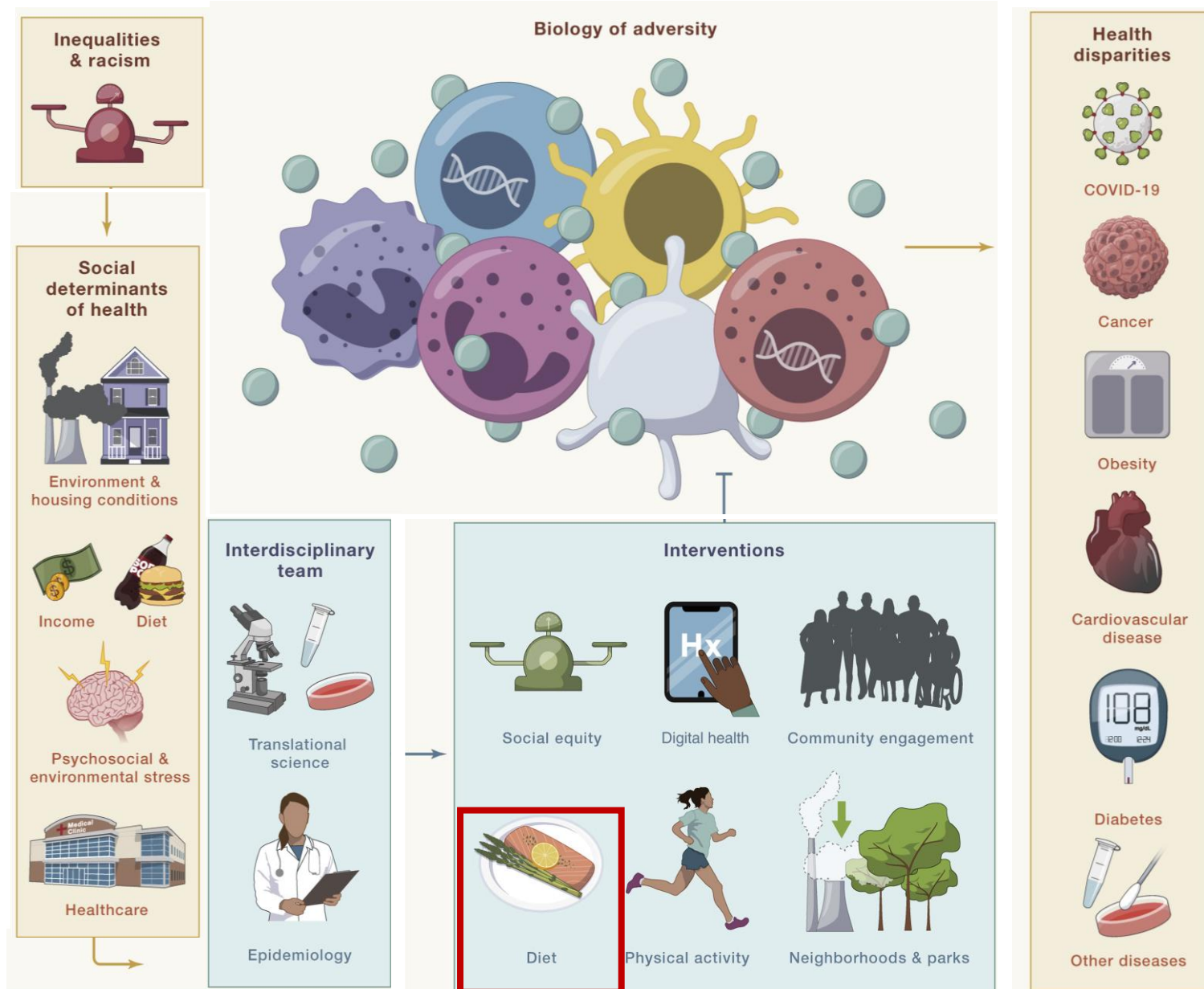
Obesity prevalence based on:

- PA duration for recreation center class
- Caloric expenditure imbedded metabolic model



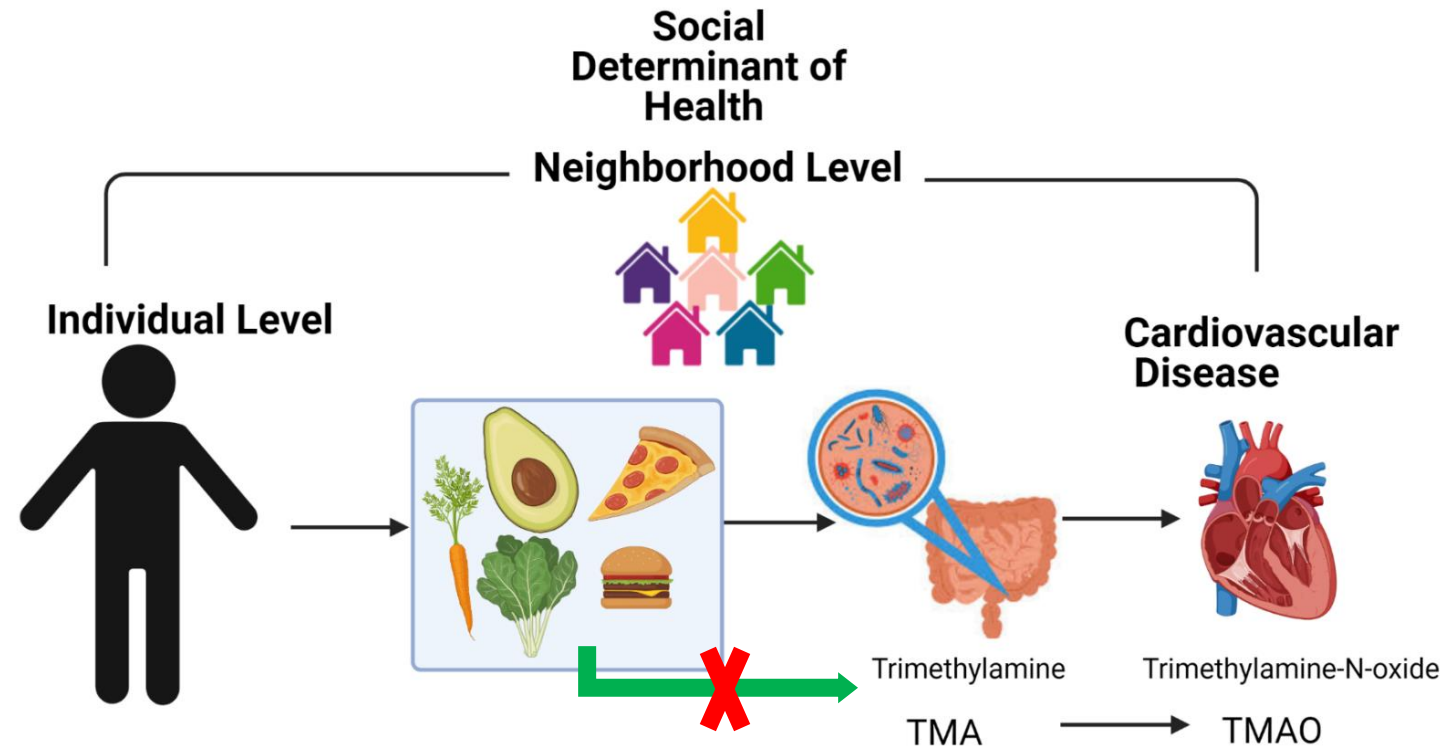
Interdisciplinary Collaborations for Translational Studies of Social Determinants of Health

Interdisciplinary Work on the Biology of Adversity



Diet and Microbial Metabolites in Diet-related Disparities

Targeted Microbial Metabolomics and Neighborhood



Explore the role of neighborhood in microbiome-based risk for CVD

Diet and Microbial Metabolites in Diet-related Disparities

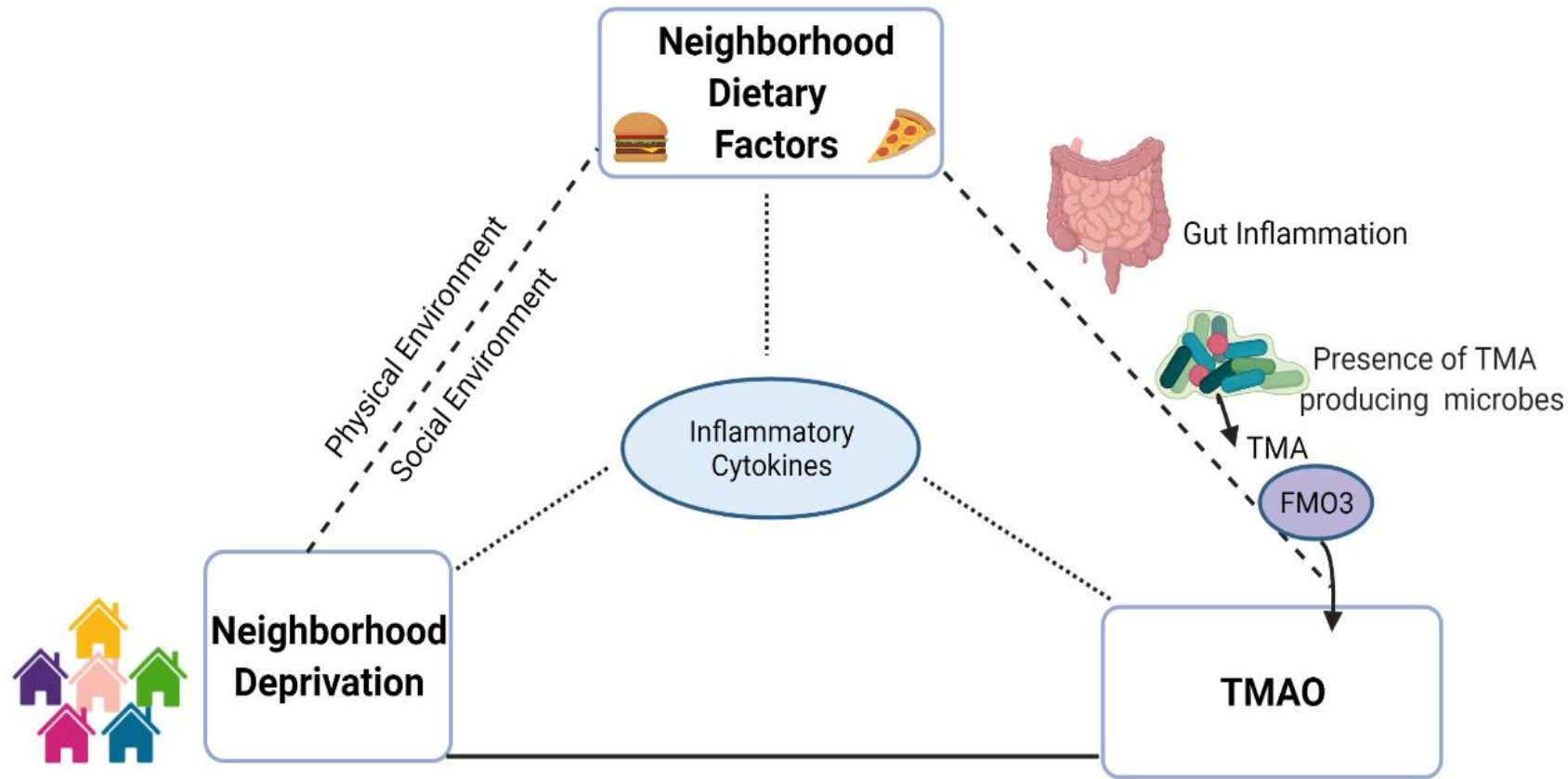


Figure 1. Graphical depiction of hypothesis for neighborhood-diet-inflammatory connection to explain hypothesized differences in trimethylamine-N-oxide levels based on neighborhood deprivation. NDI: neighborhood deprivation index; TMA: trimethylamine; FMO3: flavin monooxygenase isoform 3; TMAO: trimethylamine-N-oxide.

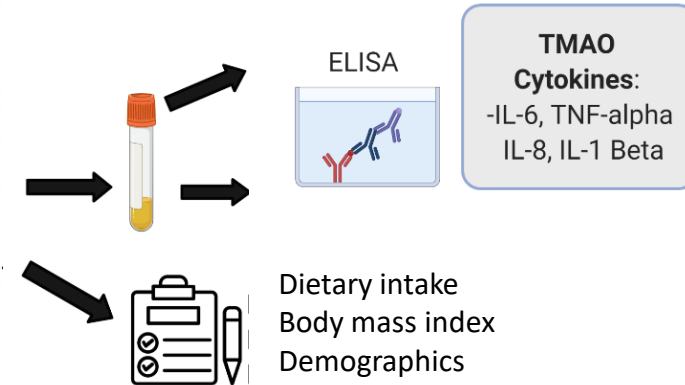
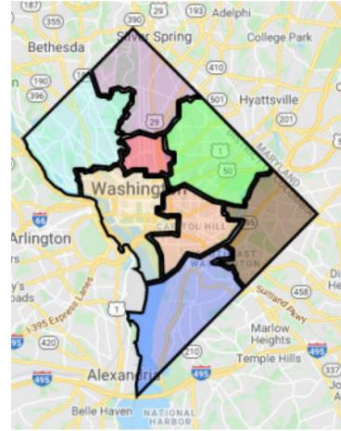
Diet and Microbial Metabolites in Diet-related Disparities

Targeted Microbial Metabolomics and Neighborhood

African-American adults
(n=60) with CVD risk factors

Neighborhood level measure:

- Neighborhood Deprivation Index (NDI)



Key Findings:

- NDI and TMAO levels were positively associated
 - Independent of 10-year CVD risk score and BMI
 - Dependent upon clustering of individuals within a census-tract
- Inflammatory cytokines mediated the relationship between NDI and TMAO
 - **TNF- α** - 60% effect mediated
 - **Interleukin 1- β** – 49% effect mediated

Opportunities for Translational Studies in Social Determinants of Health in Nutrition

- Explore relationships between metabolomic or nutrigenomic markers and social determinants
- Examine impact of dietary interventions on biologic pathways related to social factors





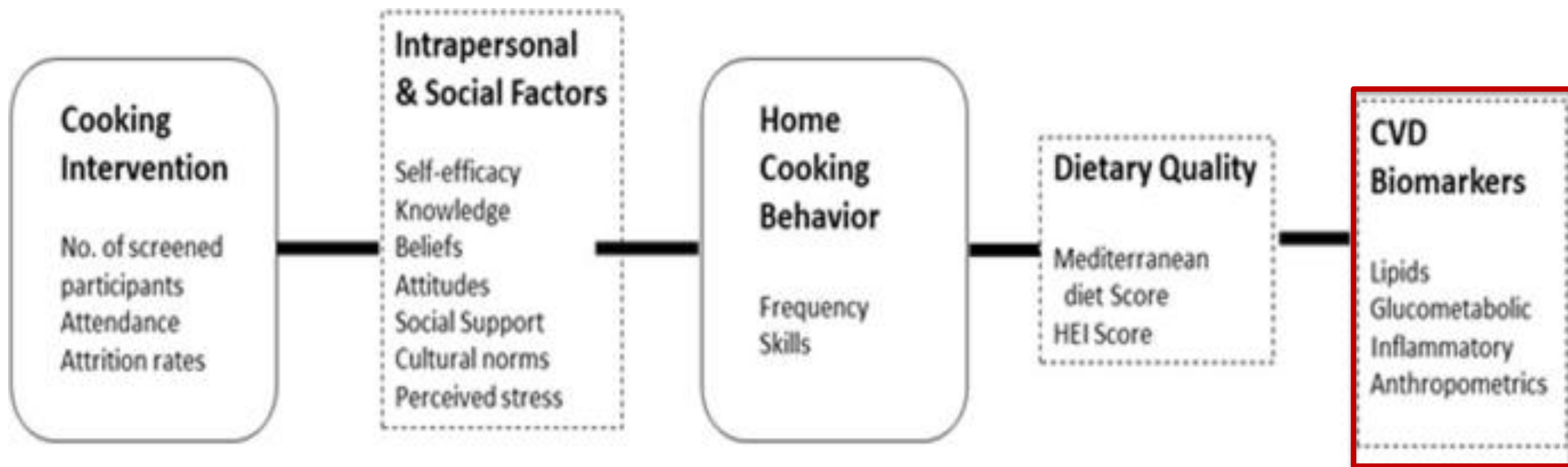
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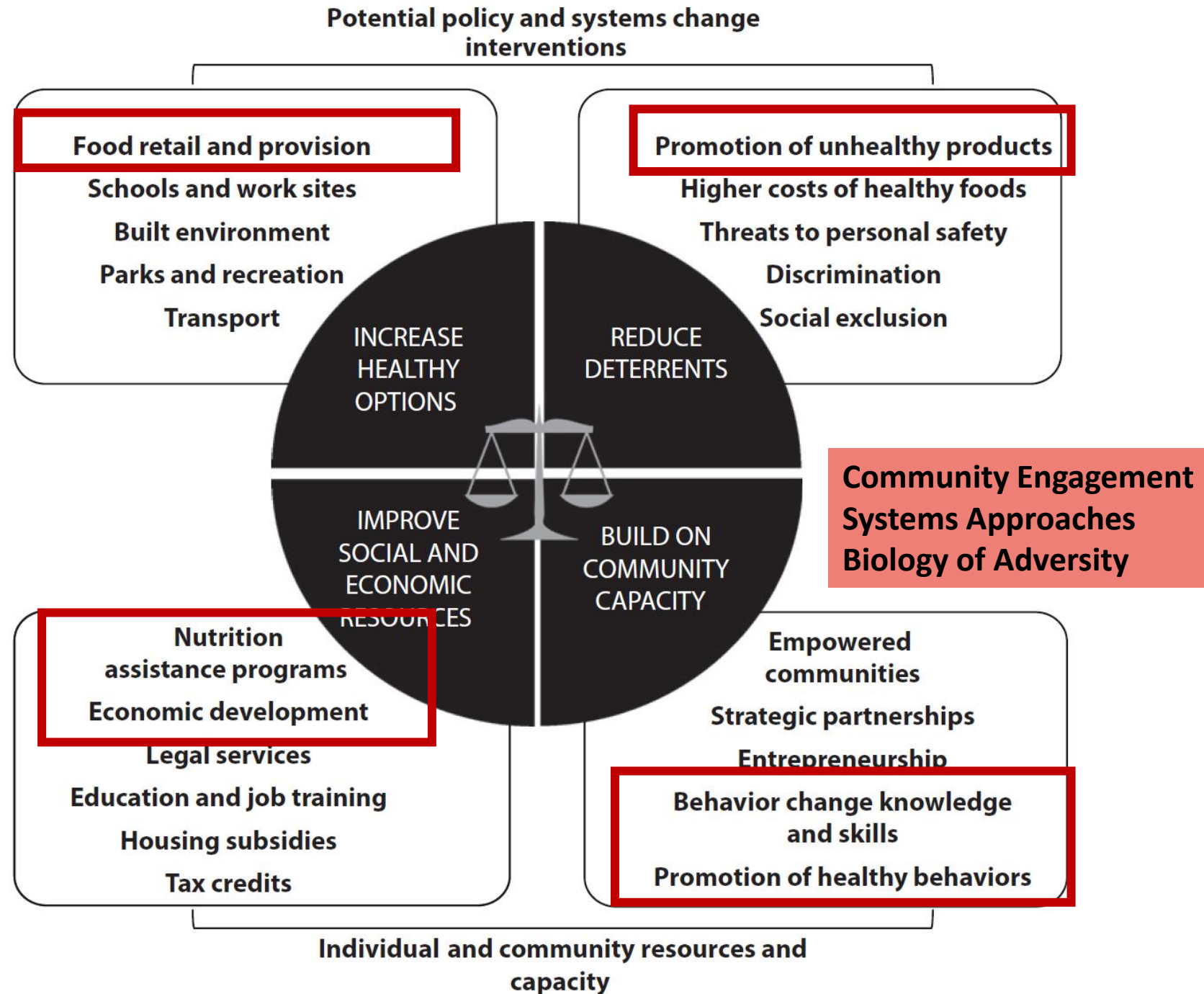


Potential mediators or confounders: demographics, lifestyle behaviors (sleep, physical activity), built environment, self-rated health

Multi-level Approaches for Getting to Health Equity

Kumanyika S. AJPH 2019

Cardiovascular Health Equity as the Ultimate Goal



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- Protocol AIs/Collaborators
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 - George Washington University
 - CUNY School of Public Health
 - University of North Carolina - Chapel Hill
 - UT Southwestern Medical Center
 - University of Washington
- Study Data Collection Volunteers
- Washington, D.C. Faith-based and Civic Organizations

Thank you for your attention



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and Blood Institute

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Simulating the Impact of Crime on African American Women's Physical Activity and Obesity

Tiffany M. Powell-Wiley¹, Michelle S. Wong ^{2,3}, Joel Adu-Brimpong⁴, Shawn T. Brown^{2,5,6}, Daniel L. Hertenstein^{2,5}, Eli Zenkov^{2,5,6}, Marie C. Ferguson^{2,5}, Samantha Thomas⁴, Dana Sampson¹, Chaarushi Ahuja¹, Joshua Rivers¹, and Bruce Y. Lee ^{2,5}

- As exercise propensity increases, crime reductions and increase in PA location accessibility have larger impact
- Policies aimed at reducing obesity by increasing leisure-time PA should take multi-level approach
- Consider targeting crime through urban renewal and policies to improve perceived safety in resource-limited urban communities