Webinar Series
National Nutrition Research Roadmap
2016–2021: Advancing Nutrition Research to Improve and Sustain Health

Webinar 4:
A Few Reminders

CPE Credit

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• To claim credit, please take the post webinar evaluation to be emailed after the webinar.

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Questions & Answers

- Please use the “questions” box on your “Go To Meetings” screen to submit questions to our presenters.

- Please submit your questions at any time during today’s webinar.
Speakers

Bruce Y. Lee, MD, MBA
Associate Professor of International Health
Johns Hopkins Bloomberg School of Public Health

Michele Forman, PhD
Head, Department of Nutrition Science
Purdue University

Mark Denbaly, PhD
Deputy Division Director for Food Economics Data
USDA

Elizabeth Larimore, MS
Agricultural Economist, USDA

Moderator

Marian L. Neuhouser, PhD, RD
Fred Hutchinson Cancer Research Center
President, American Society for Nutrition
Learning Objective

At the end of this program, attendees will be able to:

- Describe research gaps and opportunities related to the application of systems science, design and systems change to effect population level change in eating behaviors, as found in the National Nutrition Research Roadmap.
Use of Modeling To Explore Intervention Impact

Bruce Y. Lee, MD, MBA
Executive Director, Global Obesity Prevention Center (GOPC)
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Content

- Systems, Nutrition, and Obesity
  - VPOP: Virtual Populations for Obesity Prevention (VPOP)
    - Description
    - An example
  - Discussion

www.globalobesity.org
A systems approach to obesity

Bruce Y. Lee, Sarah M. Bartsch, Yeeli Mui, Leila A. Haidari, Marie L. Spiker, Joel Gittelsohn

Published: 03 January 2017

Obesity has become a truly global epidemic, affecting all age groups, all populations, and countries of all income levels. To date, existing policies and interventions have not reversed these trends, suggesting that innovative approaches are needed to transform obesity prevention and control. There are a number of indications that the obesity epidemic is a systems problem, as opposed to a simple problem with a linear cause-and-effect relationship. What may be needed to successfully address obesity is an approach that considers the entire system when making any important decision, observation, or change. A systems approach to obesity prevention and control has many benefits, including the potential to further understand indirect
What is a system?

*Individuals do not exist in isolation; they are all part of many different systems, such as social, political, environment, and economic systems*
Dangers of not using a systems approach

- Missing secondary and tertiary effects
- Unsustainable solutions
- Band-aids rather than solutions
- Unintended consequences
- Expended time, effort, and resources from trial and error

Need for systems science approach
Modeling is the bridge to translation

Modeling can and does occur at different time points along the research path from idea inception to policy implementation.

**Modeling**

- **Need or idea**
  - Considerations for study designs:
    - Data availability
    - Generalizability
    - Granularity

- **Retrospective studies**
  - Data availability
  - Generalizability
  - Granularity

- **Prospective studies**
  - Generalizability
  - Study population
  - Expense
  - Ethical and legal issues

- **Policy and practice**
A systems approach iteratively brings together various disciplines, stakeholders, and methods.
Content

• Systems, Nutrition, and Obesity

• VPOP: Virtual Populations for Obesity Prevention (VPOP)
  • Description
  • An example
  • Discussion

www.globalobesity.org
Content

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Virtual Population Obesity Prevention (VPOP) Labs: “SimCity” for obesity prevention
Representations of all key locations in VPOP use geo-coded data

- workplace
- schools
- physical activity locations (parks, gyms, rec centers)
- households
- food sources
Each person represented by computational agent

Synthetic population built using census data

Each agent has the following characteristics:

• Age
• Gender
• Race/Ethnicity
• Socio-economic status
• Home assignment
• School assignment
• Height
• Weight

Data specific to Baltimore allows the model to truly analyze the systems within Baltimore

www.globalobesity.org
Each agent’s daily schedule

- **Main meal**
- **Snack**
- **Physical activity**

Time of day:
- **Wake up**
- **Breakfast**
  - Home
  - School
  - Skip
- **Travel to school**
  - Walk
  - Car/bus
- **Snack #1**
- **Lunch**
  - School
  - Pack/other
  - Skip
- **Travel from school**
  - Walk
  - Car/bus
- **Snack #2**
- **Physical activity**
  - Moderate / vigorous
- **Dinner**
  - Home
  - Other
- **Snack #3**
- **Sleep**

Repeat for the next day.
Each agent is embedded with a personalized metabolic model

AGENT 241,205
Gender: M
Age: 12
Height: 60
Weight: 95

Metabolic model: Hall et al, 2014

Calories Eaten - Calories Burned = Weight Gain or Loss
Content

• Systems, Nutrition, and Obesity
• VPOP: Virtual Populations for Obesity Prevention (VPOP)
  • Description
  • An example
• Discussion
Modeling The Economic And Health Impact Of Increasing Children’s Physical Activity In The United States

ABSTRACT Increasing physical activity among children is a potentially important public health intervention. Quantifying the economic and health effects of the intervention would help decision makers understand its impact and priority. Using a computational simulation model that we developed to represent all US children ages 8–11 years, we estimated that maintaining the current physical activity levels (only 31.9 percent of children get twenty-five minutes of high-calorie-burning physical activity three times a week) would result each year in a net present value of $1.1 trillion in direct medical costs and $1.7 trillion in lost productivity.
Child’s Play Is Good for All of Us

By GRETCHEN REYNOLDS  MAY 3, 2017

Overweight children are costing America billions according to a new study from Johns Hopkins University. Sean Dowling (@seandowingtv) has more, Buzz60
Economic And Health Impact Of Increasing Children’s Physical Activity In The United States

Average lifetime costs averted by reaching “active to a healthy level” per person, by body mass index (BMI) status.

Bruce Y. Lee et al. Health Aff 2017;36:902-908

www.globalobesity.org
Economic And Health Impact Of Increasing Children’s Physical Activity In The United States

US costs averted annually by increasing levels of children’s participation in physical activity

Bruce Y. Lee et al. Health Aff 2017;36:902-908

www.globalobesity.org
Economic And Health Impact Of Increasing Children’s Physical Activity In The United States

Changes in US costs averted annually among adults by varying the intensity of physical activity

Bruce Y. Lee et al. Health Aff 2017;36:902-908

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Content

• Systems, Nutrition, and Obesity
• VPOP: Virtual Populations for Obesity Prevention (VPOP)
  • Description
  • An example
• GOPC and Discussion
The GOPC is a university-wide Center

The Center includes experts from across Johns Hopkins University

www.globalobesity.org
Systems Science Core Team

Atif Adam, MD  Cameron Avelis, MA  Shawn Brown, PhD  Molly Domino, BA  Saeideh Fallah-Fini, PhD  Marie Ferguson, MSPH  Daniel Hertenstein, BS

Bruce Y. Lee, MD, MBA  Sindiso Nyathi, BA  Mario Solano Gonzalez, BS  Marie Spiker, MSPH  Patrick Wedlock, MSPH  Michelle Wong, BS  Eli Zenkov, BS

www.globalobesity.org  CAL POLY POMONA  PSC  JOHNS HOPKINS GLOBAL OBESITY PREVENTION CENTER
# Recommendations

- Dietary patterns, health, and diseases are linked in a complex system
- Systems approaches have transformed many other fields
- Systems approaches can transform the way we understand and address dietary patterns, health, and diseases
- Systems approaches can allow us to fully harness the increasing amount of available data
- Incorporate systems methodologies such as systems mapping and computational modeling into research and decision making
- Using systems approaches also includes:
  - Convening disciplines not traditionally associated with obesity with those that are
  - Bringing together traditional and non-traditional study methodologies
  - Iterative collaboration with stakeholders
  - More global approaches
Acknowledgements

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- Laureus Sport for Good Foundation
- The Aspen Institute’s Sports & Society Program

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Thank you!

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Contributor
Bruce Y. Lee
I cover the intersection of business, health and public health.
Big Data in Nutrition and How to use it

Michele R Forman

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Purdue University

Objectives

- To examine big data sources in nutrition – with diet, anthropometrics, biochemical information--across the world & nation including:
  - Cohorts, pooled data and meta-analysis
  - Future research
- To learn uses and limitations of the data
Nutritional Epidemiology

Welcome to the FOOD SURVEYS RESEARCH GROUP!

Our mission is to monitor and assess food consumption and related behavior of the U.S. population by conducting surveys and providing the resulting information for food and nutrition-related programs and public policy decisions.

### WHAT WE EAT IN AMERICA

- **Source of data on food and nutrient intakes of Americans**
  - Data Tables
  - Usual Intakes
  - Data Briefs
  - Research Articles

### DIETARY METHODS RESEARCH

- **Topics in collection of dietary recalls**
  - Salt
  - Water
  - Research Articles

### WHAT'S IN THE FOODS YOU EAT SEARCH TOOL

- **Search nutrient content of 13,000 commonly eaten foods**

### FOOD AND NUTRIENT DATABASE FOR DIETARY STUDIES

- **Foods, portions/weights, nutrients for analyzing dietary data**

### AUTOMATED MULTIPLE-PASS METHOD

- **Computerized method to collect 24-hour dietary recalls**
  - Overview
  - Validation Study
  - Research Articles

### MYPYRAMID EQUIVALENTS DATABASE

- **MyPyramid equivalents data for analyzing dietary intakes**

### FOOD INTAKES CONVERTED TO RETAIL COMMODITIES

- **Convert foods consumed in national dietary surveys to retail-level commodities**
  - Data Tables
  - Overview
  - Methodology & Databases

### FSRG LISTSERV

- **Receive announcements about FSRG releases**

### USDA FOOD SURVEYS, 1935 - 1998

- **Documentation, questionnaires, reports, data sets**
NHANES Sampling

- Nationally representative sample of the civilian, non-institutionalized population
- Primary sampling unit = county with units based on state groups with health rankings*
- Stratified cluster sampling with weights to adjust to nationally representative population

*Health rankings of state groups with highest to lowest health levels based on: Death rate, infant mortality rate, % adult smokers or with high blood pressure or overweight & obese or with poor nutrition.
Nutritional Status “cannot be measured by a few simple indexes”

- Clinical physical exam
  - Nutritional status e.g. Ricketts
  - Skin, eye, dental
- Biochemical via blood and urine collection
  - Vitamin A & C, hemoglobin, folate...
- Anthropometrics:
  - Height or length
  - Weight
  - Skinfolds
  - DXA
- Diet:
  - 24 Hr Recalls—In-person & phone
  - FFQ
- Sociological and psychological evaluations
Sources of variation in dietary data

- Intra-individual variation in food consumption by day, nutrient density
- Social desirability
- Seasonality
- Availability and cost of food
- Age
- Sex
- Morbidity
- Education
- Body mass index
- Race/ethnicity
- Eating out

Food Composition: Keeping up with the Jones’ and We’ve come a long way!

1. Essential nutrients – minerals, vitamins, lipids, amino acids
2. Major energy sources – proteins, carbohydrates, fats, alcohol
3. Chemicals formed in cooking
4. Branded foods
5. Dietary supplements

*** No food composition data base is comprehensive
NHANES Web Tutorial for training in use

https://www.cdc.gov/nchs/tutorials/dietary/

Survey sampling statistics: Analysis of Health Surveys, Graubard BI and Korn E, John Wiley and Sons 1999

NHANES Follow-Up Study
Cohort Study with Intent to Pool

- European
- Prospective
- Investigation in
- Cancer
EPIC Cohort Study

- **Aim:** Investigate the relation between nutrition and cancer
- **Who?** 10 European countries with diverse diets and cancer rates
- **When?** 1990
- **Nutrition Data:** FFQ; Food records; Anthropometrics
- **Endpoints:** Vital and health status via postal questionnaires every 3-5 years.
- **Cancer incidence** from annual linkage to cancer registries.
Rules of the Road for Pooling EPIC Study Data

- First rule: Country specific development of dietary tools collecting core food items/questions across countries
- Second rule: Calibrate country specific FFQ with food records and biomarkers
- Third rule: Analyze the data at the country specific level
- Then pool the data
BIG DATA Resources like EPIC

- NCI (PLCO) Prostate, Lung, Colorectal Cancer Trial
- NCI (AARP) American Association of Retired Persons (Cohort) Study
- NCI Agricultural Health (Cohort) Study
BIG DATA Resources with nutrition data not collected with intent to pool

- NCI Cohort Consortium: Pooling study
- CLIC: Childhood Leukemia International Collaboration of case-control studies
‘ALL OF US’ Cohort Study: NIH
Future research

- Volunteers
- To address multiple exposures, markers of and disease states
- What nutrition data might be collected?
  - Anthropometrics: wt/ht; waist circum; BIA
  - Diet: FFQ; 24 hr recalls; Food environment
  - Biochemical: Fecal, blood, urine
Intergenerational Cohort Research: Future Research

- Importance of the triad: mother/partner/offspring in research
- Assess the biosocial pathways using omics, nutrition, environmental data
- Identify vulnerable windows across the life course with potential for intervention
Antenatal Multiple Micronutrient (MM) Supplements: Meta-Analyses of Effects on Birth Outcomes and Infant Survival

Global Summary Estimate: MM vs None, Placebo, Iron or IFA: IronFolicAcid

Basic Finding: Micronutrient Supplements are safe and often beneficial to health
MM vs (Nil, PL, FE or IFA) on Small for Gestational Age: RR = 0.90 (0.83-0.97)

Could there be no effect in Southern Asia?
Haider and Bhutta Cochrane Analysis 2015

MM vs (PL, Fe or IFA) on Preterm Births: RR = 0.96 (0.89-1.03)

Could there only be an effect in Southern Asia?

Keith West: JHU
Know the intent/aim of each study, the advantages and disadvantage of each study design before pooling or a meta-analysis

- Compared to case-control studies, cohort studies are less affected by recall bias.

- Everyone is healthy at the beginning of the cohort study, thus those who develop disease are as likely to participate in the study as those who do not.
Loss to follow up

- If cohort members with poor diets are more likely to drop out

  AND

- Poor diet is associated with higher risk of cancer/other disease

Beneficial effect of diet will be underestimated, because cohort members with poor diets, who will be more likely to develop cancer may drop out
BIG DATA: BIG Challenges

- BIG DATA: What does it offer?
- Challenge: Once a trial or cohort participant always a participant?
- What is the average BMI of participants since 1960’s? 27
- Implications for health research?
Important to capture the distribution: food/nutrient/body mass
Thanks

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National Household Food Acquisition and Purchase Survey (FoodAPS)

Mark Denbaly and Liz Larimore
USDA - Economic Research Service

The information presented here are those of the authors and not those of USDA or the Economic Research Service.

Application of Systems Science, Design, and Systems Change to Effect Population Level Change in Eating Behaviors

Webinar, May 31st, 2017
Table of Contents

• Why FoodAPS?

• Research Questions Enabled by FoodAPS-1

• New Insights Provided by FoodAPS-1 Data

• Plans for the Second Round of FoodAPS
What Drove FoodAPS-1?

- Pursuit of data to enable policy research on consumer food choice behavior by three income classifications and SNAP participation.

- Quantifying the connections to:
  - Household demographics and income
  - Local food environments (price and availability)
  - Access (distances and store choice)
  - Nutrients
  - Food security
  - Dietary and nutrition knowledge
  - SNAP participation
Opportunities for insightful research

Data on SNAP participation, shopping habits and store preferences, household expenditures, and food security provide opportunity for new research.

• Restricted FoodAPS-1 data are being used by 168 external researchers across 61 projects
• Recently released public-use data are fueling more research
• Current FoodAPS research includes:
  ▪ NBER and UKCPR grants
  ▪ Independent external research projects
  ▪ USDA cooperative agreements

See the list on the FoodAPS Research Projects and Publications webpage
FoodAPS-1 Data are Sparking Research in a Variety of Areas

• Food Environment
  – Where do households shop and how do they get there?
  – How do neighborhood characteristics impact food decisions, and nutrition?
  – How does food access impact food security

• Food Prices
  – How do food prices impact healthy food choices?

• Food Away From Home
  – How healthy are the food-away-from-home choices of low-income households?
FoodAPS-1 Data are Sparking Research in a Variety of Areas, continued

- **SNAP**
  - Do SNAP recipients pay the best prices?
  - What foods do new SNAP recipients acquire?
  - Is SNAP like cash for recipients and stores?
- **WIC**
  - Are households less price sensitive when using WIC benefits?
  - How does geography impact WIC participation?
- **Other Food Assistance Programs**
  - How do school meal programs impact what children obtain?
U.S. households are not limited to food stores in their own neighborhoods

Food choices in neighborhoods without supermarkets, even for households without car or other transportation, *not* constrained to lower variety and higher prices of smaller nearby stores.

- Roughly 89% of households do their primary shopping at SM/SC
- Similarly, 89% of SNAP and 88% of non-SNAP low-income households do their primary shopping at a SM/SC
- 9 of 10 food-insecure households (w/ difficulty at some time during the year providing enough food due to lack of resources) primarily shop at SM/SCs

*SM/SC = Supermarkets and Supercenters.

SNAP = Supplemental Nutrition Assistance Program.
Source: USDA, Economic Research Service using data from the National Household Food Acquisition and Purchase Survey, collected April 2012-January 2013, as presented in Ver Ploeg et al., 2015.
Households often bypass the nearest supermarket to obtain groceries

- The average straight-line distance, 2.1 miles
- The average distance to store where household usually shops, 3.8 miles
- This behavior holds even for those who walk, bike, or take public transit

Figure 2. Distance to nearest SNAP-authorized SM/SC and to primary shopping store for selected subgroups

SNAP = Supplemental Nutrition Assistance Program.
WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.
New Insights: SNAP Households Food Shopping Behaviors

Does regional price variation influence the real value of SNAP benefits?

• Bronchetti et al. (2015) findings suggest that 20% to 30% of SNAP households face TFP prices that are high enough to be purchased with their benefits plus 30% of their net income. The proportion increases as the distance increases.

• Basu et al. (2016) find that living in areas with higher cost of living is associated with acquisition of less healthy foods. Authors find that SNAP households are no more likely to live in lower cost of living areas.

• Lyford et al. (2016) find that budgeting plays a crucial role in the affordability of food for individuals receiving SNAP. On average the index of food prices paid by SNAP recipients was 0.09 points lower.

• Chang et al. (2016) find that, while SNAP recipients are better able to employ competent consumer strategies, these strategies are far from ubiquitous.
Planning for FoodAPS-2

• Understand how to improve upon FoodAPS-1
  – Reports evaluating the strengths and limitations of FoodAPS-1
data are available on the FoodAPS Data Quality and Accuracy webpage
• Building infrastructure
  – Conducting ADCM Pilot Test
  – Real time identification of nutrient information
  – Indices of local prices and varieties
  – Area-based local demographic and policy characteristics
• Determining desired content
• Preparing RFP for award in FY17
Development of FoodAPS-2

Aim to refine FoodAPS-1 data collection

• Capture higher quality data, reduce processing time, and lower respondent burden
• Better measures of SNAP participation
• Greater focus on WIC participants and children
• Reduce reclassification of households by accurately collecting information in screener interviews
• Move to year-round data collection
• Links back to agricultural commodity contents of foods
Thank You!

Have ideas and or feedback?
Please contact us: FoodAPS@ers.usda.gov

Need further details and information?
Go to: https://www.ers.usda.gov/foodaps
Questions & Answers

Please submit your questions to via the “questions box” on your screen.
Thank you for joining us!