A Systems Approach to Childhood Obesity Prevention

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Outline

1. What is systems thinking?
2. Applications to obesity
3. Two examples of research and practice
4. Final thoughts and a few useful resources
1. What does it mean to think in systems?
Key Characteristics of Complex Systems

- Heterogeneous
- Each actor and sector in society matters
- Dynamically interactive
- Feedback loops; learning; adaptation
- Emergent phenomena possible
- Tipping
- Non-equilibrium
- Opposite of reductionism (whole is greater than sum of parts)
What is systems thinking?

- Constructing mental models and representing relationships
- 30,000-ft thinking (big-picture, horizontal thinking)
- Systems-as-cause thinking (self-generation phenomena, no “external forces”)
- Dynamic thinking (trajectories v. equilibrium points)
- Operational thinking (stocks and flows)
- Closed-loop thinking (feedbacks)

Source: B. Richmond

What is systems thinking?

- Simulating mental models
- Scientific thinking (simulations, adaptive learning)
- Communicating and diffusing models of complex systems
- Empathic thinking (listening and communicating, responding to feedback on mental models)
- Generic thinking (transcending fields)

Source: B. Richmond
A systems approach focuses on the interconnections across actors, factors and sectors that contribute to childhood obesity.

2. How can systems thinking be applied to childhood obesity?
Applications for Obesity

- Cope with complexities of childhood obesity
- Understand interpersonal, community and intersectoral dynamics – not just traditional risk factors – for generating solutions
- Create virtual laboratories for intervention design and testing sustainable solutions
- Generate new hypotheses and identify gaps in empirical data
- Bring together multiple disciplines & sectors
- Integrate multiple data sources
- Anticipate intended and unintended consequences

Unintended Consequences

- The call for low-fat diets

Graph showing \( UG \) Fat and Sugar Intake Over Time from 1961 to 2006. The graph illustrates the increase in fat intake and sugar intake over time. The data is from the OECD.
The Perils of Unintended Consequences

Developmental Connections

1. Intrauterine Programming
2. Breastfeeding, early food exposure, attachment stage
3. Childcare, habit formation, adiposity rebound
4. Brain maturation, self-management, puberty, health behavior change, increased salience of peer effects & school effects
5. Independence, increasing life stress
6. Pre-conception parental health status, prenatal care

Esposito et al., PCD, 2009
Nader et al., Child Obes, 2012
A Systems Framework of Childhood Obesity with Feedbacks between Individuals and the Environment.

Local, State, and National Policies

A Systems Framework of Childhood Obesity with Feedbacks between Individuals and the Environment.

Physical Environment Support
- Design of Childcare Centers & Schools
- Food Access
- Regional & Urban Planning

Social Environment Support
- Peer & Family Networks
- Institutional Norms
- Culture

Policies related to urban planning, housing, transportation, parks & recreation, food availability, access, financing & marketing, and education.

Regional & Social Environment Support
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Individual Agents of Change
- Care Advocacy
- Centers & Schools
- Food Access
- Urban Planning
- Networks
- Norms
- Culture

Health Care System
- Prevention & Treatment

Individual Agents of Change
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Health Care System
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Policies on media and information, housing (e.g., segregation), industry practices, labor, individual incentives (tax, insurance, etc.).
A Systems Framework of Childhood Obesity with Feedbacks between Individuals and the Environment

Local, State, and National Policies

Physical Environment Support
Design of Childcare Centers & Schools
Food Access
Regional & Urban Planning

Social Environment Support
Peer & Family Networks
Institutional Culture

Interplay between social and physical environment.

Individual Agents of Change
Primary Care Advocacy
Centers & Schools

Health Care System
Prevention & Treatment
Social and physical environments enable and/or constrain family & individual behavior. Individuals also shape their environment. Social and physical environments enable and/or constrain family & individual behavior. Individuals also shape their environment.
A Systems Framework of Childhood Obesity with Feedbacks between Individuals and the Environment

- **Physical Environment Support**: Design of Childcare Centers & Schools, Food Access, Urban Planning
- **Social Environment Support**: Peer & Family, Institutional, Norms, Culture
- **Individual Agents of Change**: Health Care System, Prevention & Treatment

1. Individual empowerment and community mobilization to effect policy change.
2. Health care providers and practices as advocates of social & environmental changes to promote healthy lifestyles.

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1. Design of Childcare Centers & Schools
2. Food Access
3. Urban Planning
4. Peer & Family
5. Institutional
6. Norms
7. Culture
8. Health Care System
9. Prevention & Treatment
Sustainability, Scalability, Reach

- How do we ensure sustained interventions and intervention effects?
- How do we diffuse and scale-up effective interventions? Interventions often only attain cost-effectiveness when they achieve economy of scale.
- How do we ensure different communities all benefit from interventions?

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Table 3: Loss of the Driver

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<tr>
<th>PRIVATE SECTOR</th>
<th>Loss of the Driver</th>
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<tbody>
<tr>
<td>Top-Down, policy interventions in the private sector often come from large industries. Sustainability and scalability are often low, and the reach can be wide as well as the customer base. These interventions do not occur as frequently as public policy interventions since it is challenging to sustain competition from a given industry around public health. Example: healthyWeight/CommHealth (<a href="http://www.healthweigth.Com/marlheureus.com">http://www.healthweigth.Com/marlheureus.com</a>).</td>
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<tr>
<td>Bottom-up, policy interventions in the private sector often come from other health care organizations, such as hospitals and health systems. These organizations are more likely to engage with communities to improve health outcomes. Example: The Alliance for a Healthier Generation (<a href="http://www.healthiergeneration.org/">http://www.healthiergeneration.org/</a>). Blackhear-now for regarding foot wearing to breathe (<a href="http://www.childrensnew.org/index.php/en/advertising/assess">http://www.childrensnew.org/index.php/en/advertising/assess</a>).</td>
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**Behavior Change and Community Health Promotion**

- Top-down, bottom-up: behavior change interventions are more common than top-down policy interventions in the private sector, within or without demonstrating outcomes. With industry backing, sustainability, scalability, and reach are generally relatively strong and are sometimes only a function of business interests rather than public health outcomes. An example of this type of intervention is the Blue Cross Blue Shield/Holder's Community Health program (http://www.holder's.com/holder's/health). A national youth and fitness campaign focused on increasing the wellness of young men by encouraging them to be active for at least 30 minutes a day (http://www.fitfact.org/). |
- Bottom-up, behavior change interventions in the private sector often come from collaborations between organizations and communities. These interventions are more sustainable, scalability, and potentially reach. Example: MEND (http://www.mendprogram.org/). |

Huang et al., *Children's Healthcare*, 2011
Knowledge Transfer Loop

Evidence-Based Practice

Evaluation Modeling

Practice-Based Evidence

External Validity

Internal Validity

Systems Thinking Helps Avoid Common Pitfalls Stemming from Laundry-List Cause-and-Effect Thinking

- Independent effects (from causal factors)
- One-way causality (feedbacks)
- Linearity of effects (dynamically variable over time)
- Instantaneous effects (delays are everywhere)
What Systems Science Is Not

Crystal ball to predict the future

Guessing game of what solutions are for a given problem

Free of theoretical and data considerations

Replacement of existing toolbox

All models are wrong; some are useful. (George Box)

From individual approaches…

5 Foods to never eat:
Cut down a bit of stomach fat every day by never eating these 5 foods.

Health Education
To an environmental and policy focus…

How do we achieve policy adoption and implementation?

If we build it, will they come?
Food deserts in the U.S.

Active communities
New ventures...
How to bring the human factor and the environment together

3. Two Examples of Research and Practice

- How to intervene on both the supply of and demand for health, healthy products, healthy places and healthy policies?
- How to create social movements and shift social norms?
- Can culture be changed or realigned?
Designer Schools: Buckingham, Virginia

Team:
UNMC (T. Huang)
UVA (M. Trowbridge)
VMDO Architects

Gorman et al., Obesity, 2007
Huang et al., Prev Chronic Dis, in press

Supported in Part: UVA Youth-NEX
Institutional dining hall

Old kitchen & servery
School in construction
Cafe

Food Lab
Creating Food Smart Youth

School Garden
Design “Software”

- To optimize the use of design features:
  - Operator's Manual
  - Student-Led Guided Tour (in collaboration with USGBC)
  - Series of Workshops with School & Community Stakeholders
  - Technical Assistance (e.g., Experience Food Project/Chef Tom French)
Latino Health Movement through Youth Advocacy, Social Marketing & Partnerships

Support: RWJF/Active Living Research Nebraska Research Initiative

Initiative Framework

- Designed to develop youth activists to enhance community readiness to address childhood obesity in Omaha’s Latino community.

- Empower families to make healthy choices and create an environment that is conducive to healthy lifestyles.

- It is youth driven and community participatory. Community ownership and sustainability of change are key.
Art and Science

- Marriage of art, media, and science.
  
  [Video Link](http://www.youtube.com/watch?v=YTQcUTSH6E)

- The goal is to catalyze a social movement about Latino health.

  The founding youth advocate cohort designed and developed the logo, brand, and containers for generating a Latino health movement.

SaludableOmaha

[Images of individuals engaged in various activities related to health and well-being]
SaludableOmaha Logic Model

Frerichs et al, 2012

Integrated Model for Generating Social Movement

Frerichs et al, 2012
4. Final Thoughts

- Solution-oriented approach, paradigm shift, convergence of fields
- Systems thinking compels us to ask different questions and come up with non-linear solutions
- Multicomponent ≠ Multilevel ≠ Systems Science
- Important to involve systems thinkers at outset of program design
- Complements traditional toolbox

Blending the individual, social & environmental...
Some Useful Resources

 Donella Meadows: Thinking in Systems: A Primer
 Tarek Hamid: Thinking in Circles about Obesity
 Joy Richmond el al (eds): Tracing Connections: Voices of Systems Thinkers
 Diane Finegood: The complex systems science of obesity. In: John Cawley (ed.): The Oxford Handbook of the Social Science of Obesity