
Solution-Oriented Research

Converging Efforts of Promoting Environmental Sustainability and Obesity Prevention

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Given trends from the last 30 years, the most recent projection estimates that the U.S. prevalence of obesity, not counting the rate of overweight, will reach 51% among adults and 30% among youth by 2030. Total healthcare costs attributable to overweight and obesity will double every decade reaching \$861–\$957 billion a year, or 16%–18% of the total U.S. healthcare expenditure.¹

In light of these dire predictions, a new multilevel research paradigm has recently been proposed to transform efforts to produce effective and sustainable solutions in the long term.² Specifically, a multilevel research paradigm for obesity prevention incorporates six key strategies:

1. framing obesity as a complex systems issue in both the scientific and public spheres,
2. emphasizing cross-level and cross-disciplinary hypotheses at the outset of research,
3. investing in the testing and evaluation of upstream interventions,
4. increasing the capacity to conduct multilevel research and policy translation by building coalitions and training a new generation of multilevel scientists and practitioners,
5. developing and applying systems-science methodologies to the obesity problem, and
6. cultivating a global perspective.

Using this framework, we examine in this commentary how the convergence of efforts for promoting environmental sustainability and obesity prevention can be a perfect marriage that will benefit both causes without competing for limited resources. Reaching across fields can be key to generating sufficient public and political support for solutions that will have a large population-level impact. In light of the need to fundamentally transform the social, physical, and economic landscape of our society, this kind of partnership is more urgently needed than ever.

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Framing Complex Systems Issues

A complex systems problem is defined as a problem with multiple determinants that interact dynamically. The observed problem emerges from the synergy of these varying determinants and cannot be easily attributed to any single one of the factors.³ Both obesity and environmental sustainability are complex systems problems, although public appreciation for such complexity, at least in the area of obesity, remains superficial. Obesity is often blamed on the choices that individuals make regarding food and exercise. However, research has shown that our behaviors are enabled or constrained by environmental forces, whether it be an issue of money, locations of food, proximity to safe places to exercise, exposure to marketing, availability of public transportation, or many other factors in our surroundings that influence our food and physical activity decisions. In other words, it turns out that free will is not so free at all; context matters. A coherent communication strategy at the national level is essential as we capitalize on the public's attention to both issues. By dovetailing obesity prevention efforts on the momentum of the environmental sustainability movement, we can create a communication strategy that will unite, rather than divide, the message that the environment and health are intricately linked.

Cross-Level Hypotheses and Upstream Interventions

Cross-level and cross-disciplinary hypotheses are those that aim to examine how the dynamic interaction of different levels of socio-environmental factors enable and constrain food and physical activity behavior, and further, how these socio-environmental factors influence biological processes to subsequently affect food or physical activity behavior. Increasing evidence suggests that factors such as agricultural and food production, land use, urban design, and transportation design all have an impact on both climate change as well as obesity outcomes. What is not clear, however, is how these socio-environmental factors interact with each other or affect physiological mechanisms to influence our behavior, as well as environmental and health outcomes. Most interventions to date have not resulted in sustained behavior change. For complex public

health problems such as obesity and climate change, top-down policy interventions are likely needed to see an effect at the population-level, as was amply demonstrated in the case of tobacco surtaxes and their large impact on declining smoking prevalence and mortality.⁴

Addressing the next Farm Bill in 2013 may be one common policy goal toward which the environmental sustainability and obesity prevention fields can work together. Agricultural subsidies in the U.S. have led to high volumes of corn production, the majority of which is now used for cattle feed, which in turn has increased beef and dairy production. Grain-fed cattle are high in fat content and are responsible for 18% of total global greenhouse gas emission.⁵ In addition, high-fructose corn syrup, which accounts for approximately 25% of corn use in the U.S., is an omnipresent ingredient in many packaged foods and beverages. Some studies suggest that high-fructose corn syrup results in less satiety than plain sugar, which may increase overall energy intake.⁶ Corn is also used increasingly to generate ethanol as biofuel, which is water- and land-intensive, crowds out other staple grains, drives up commodity prices, risks deforestation, pollutes water and air, and emits nitrous oxide that can exacerbate global warming.⁷⁻¹⁰

The promotion of local organic farming is another policy option that can potentially reduce greenhouse gas emission from food transportation while increasing the availability and accessibility of fresh fruit and vegetables. Efforts exist in parts of the U.S. for community-based organizations to bring local produce to disadvantaged neighborhoods at a low cost. Evaluation of these efforts can demonstrate whether this form of local food-delivery system is sustainable in the long term, changes dietary consumption, and is translatable across diverse communities. At the federal level, the Child Nutrition and WIC Reauthorization Act may be a place where environmentalists and obesity experts can work together to increase the proportion of school food that is locally produced.

Much research funded through Active Living Research suggests that the design of our physical environment plays a significant role in the availability and accessibility of foods and physical activity, and many of these characteristics of the environment play an equally important role in energy use and greenhouse gas output. Segregating residential from commercial zones encourages car use and restricts physical activity and access to healthy foods. Mixed land use is now adopted by many urban redevelopments, but evaluation of these efforts in terms of obesity and health is very limited. The lack of public transportation infrastructure also limits daily physical activity and exacerbates global warming. How the next Transportation Bill will address this issue, in light of rising fuel costs and decreasing revenue for the Department of Transportation, should

be an issue that brings environmentalists and obesity scientists together. Some cities, such as the District of Columbia, are now planning to connect city streets with public bicycles. These are potentially beneficial efforts but need to be evaluated against both environmental and health metrics. And further, the design of living, work, and school space typically has not considered the need for both environmental and obesity prevention goals, yet these are concepts that can be quite harmonious with one another. Smart-growth communities are fast expanding in the U.S., and this is a good time to start evaluating their effect on both environmental sustainability and obesity (www.smartgrowth.org). Novel ideas have also been proposed for school design and architecture and can be tested in communities.¹¹

Capacity Building and Systems Science Training

Collaborating across the environmental sustainability and obesity prevention fields can generate greater public demand and political will to address these issues coherently at the national level. In order to do this, we must begin a dialogue across government agencies at the federal, state, and local levels. Recently, the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD), the National Institute of Environmental Health Sciences (NIEHS), the NIH Office of Behavioral and Social Sciences Research (OBSSR), the National Cancer Institute (NCI), and the CDC came together to begin creating a research agenda that would converge these two fields (Environmental Systems of Public Health, Bethesda MD, September 26, 2008). Efforts will have to be made in the future to help additional federal agencies (e.g., Departments of Transportation, Agriculture, the Interior, Education, and the Environmental Protection Agency, among others) understand that health is not solely the portfolio of the Department of Health and Human Services, but in fact, should be a concern across the government. In addition to government coalitions, both the environmental and obesity fields should invest jointly in public-private partnerships. Finally, it is critical that we train a new generation of public health scientists and practitioners on the science and methodology of complex systems. Increasingly, the use of computational methods is helping us cope with the complexity of data in a systems framework to test and anticipate both intended and unintended consequences of interventions. Federal funding agencies, including the NIH, are investing strategically in these methodologies, and an extension of these methods to consider simultaneously the environmental sustainability issue and obesity can generate tremendous new insight into potentially common solutions to both problems.

Global Perspective

Maintaining a global perspective is critical as we move forward in addressing both environmental sustainability and obesity, not the least because both are worldwide problems and increasingly so. With globalization, many macro-level economic and policy issues such as agricultural subsidies, the marketing and distribution of food, and renewable energy are indeed international issues. Moreover, the fight against tobacco has shown that while smoking has declined in the U.S., it has in fact increased in many developing countries. A similar parallel can occur with the world's food supply if a global view is not taken. With obesity and chronic disease on the rise worldwide, we cannot underestimate the economic impact of global obesity, and many lessons can be learned from experiences in other countries and comparative studies across populations and contexts.

Conclusion

Both the environmental and obesity fields confront complex systems that have multiple biological and socio-ecologic dimensions and share many commonalities for scientific inquiry. Upstream policy interventions such as those addressing the value chain of food and building physical activity into daily lives can benefit both environmental and health goals. In addition, at a time when generating public understanding and support for societal efforts to deal with complex public health problems is critical to engendering political will and action, collaborating to enhance visibility and intellectual and financial capital across environmental and obesity issues seems sensible and just.

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References

1. Wang Y, Beydoun MA, Liang L, Caballero B, Kumanyika SK. Will all Americans become overweight or obese? Estimating the progression and cost of the U.S. obesity epidemic. *Obesity* 2008;16:2323–30.
2. Huang TT, Glass TA. Transforming research strategies for understanding and preventing obesity. *JAMA* 2008;300:1811–3.
3. Mabry PL, Olster DH, Morgan GD, Abrams DB. Interdisciplinarity and systems science to improve population health: a view from the NIH Office of Behavioral and Social Sciences Research. *Am J Prev Med* 2008;35(2S): S211–24.
4. Fichtenberg CM, Glantz SA. Association of the California Tobacco Control Program with declines in cigarette consumption and mortality from heart disease. *N Engl J Med* 2000;343:1772–7.
5. Food and Agriculture Organization. *Livestock's long shadow: environmental issues and options*. Rome: Food and Agriculture Organization, 2006.
6. Teff KL, Elliott SS, Tschöp M, et al. Dietary fructose reduces circulating insulin and leptin, attenuates postprandial suppression of ghrelin, and increases triglycerides in women. *J Clin Endocrinol Metab* 2004;89: 2963–72.
7. Green KP. Ethanol and the environment. *Environ Policy Outlook* 2008;3, July 29.
8. Searchinger T, Heimlich R, Houghton RA, et al. Use of U.S. croplands for biofuels increases greenhouse gases through emissions from land-use change. *Science* 2008;319:1238–40.
9. Crutzen PJ, Mosier AR, Smith KA, Winiwarter W. N₂O release from agro-biofuel production negates global warming reduction by replacing fossil fuels. *Atmos Chem Physics* 2008;8:389–95.
10. Akhtar AZ, Greger M, Fserdowsian H, Frank E. Health professionals' roles in animal agriculture, climate change, and human health. *Am J Prev Med* 2009;36:182–7.
11. Gorman N, Lackney JA, Rollings K, Huang TT. Designer schools: the role of school space and architecture in obesity prevention. *Obesity* 2007;15: 2521–30.