CAN WE IMPROVE NUTRITIONAL HEALTH AT AN AFFORDABLE PRICE?



ABSTRACT

Today's global pandemic of obesity, in both the developed and developing world, is probably the current most significant consequence of an unhealthy diet. Many factors that affect food and physical activity related behaviours are known to contribute to the increasing prevalence of obesity and its co-morbidities. Recognizing that the mix of factors leading to the increasing prevalence of obesity and preventable chronic disease is complex would be a helpful step in the right direction, and a step away from the pervasive notion that there is a simple solution. Complex problems also demand specific types of solutions. By considering this complexity, we can identify and implement strategies to control and reverse the epidemics of obesity, diabetes, cardiovascular disease and many forms of cancer.

RÉSUMÉ

La pandémie d'obésité qui touche à la fois les pays développés et en voie de développement est sans doute la principale conséquence actuelle d'une alimentation malsaine. De nombreux facteurs contribuent à la croissance de l'obésité et de son lot de maladies chroniques évitables au sein de la population. Reconnaître la complexité de ces facteurs serait un pas dans la bonne direction qui nous éloignerait de l'idée tenace qu'il existe une solution simple. En effet, les problèmes complexes demandent des solutions appropriées. En tenant compte de cette complexité, il est possible de définir et mettre en œuvre des stratégies pour maîtriser et renverser l'épidémie d'obésité, du diabète, des maladies cardiovasculaires et de nombreux types de cancer.

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Nutritional health

To address the question "can we improve nutritional health at an affordable price?", we need to work toward understanding the meaning of "nutritional health" and what is meant by a "healthy" food. Drewnowski (2005) recently reviewed the common definitions of foods described as healthy, healthful, nutrient-dense or nutrient-rich. Although many different terms are used to describe energy-rich or nutrient-poor foods – including empty calories, junk food, low nutrient-density, energy dense snack or "bad" foods – there is a remarkable consistency in their meaning. The foods are largely made up of refined grains, added sugars, and visible or added fats. Nutrient rich foods with low-energy density tend to be considered healthy or "good for you," but the specific meaning of healthy food is much less consistent. The category encompasses a large array of items including milk, vegetables, fruits, grains, protein, dairy products, juice, fish, nuts, pretzels, crackers, peanut butter, and olive oil. Unfortunately, unhealthy foods also tend to be cheap, easily accessible, highly profitable, and heavily marketed. One food company has classified these items as "fun for you" foods, as compared to their other products categorized as "better for you" and "good-for-you" (The Hindu Business Line, 2005).

Drewnowski (2005) has proposed the calculation of the naturally nutrient-rich (NNR) score based on 14 key nutrients used in past efforts to define healthy diets. The NNR score is a nutrients-to-calorie ratio which averages percent daily values for these 14 nutrients. Unfortunately, the relationship between energy density and nutrient density indicates that, in general, energy dense foods are also likely to be nutrient-poor. As a result, energy dense, nutrient-poor foods tend to be the least expensive, and nutrient-rich foods – which tend to have a low energy density – are often the most expensive (Drewnowski and Darmon, 2005).

Developing some consensus around an index of the "healthiness" of food has important implications for efforts aimed at increasing the nutritional health of a population. In complex systems, the individual matters and the tasks each individual needs to perform in relation to that system must match their capacity to engage and understand the system (Bar-Yam, 2004). A common and easily understood index of the healthiness of a food could be useful in the development of common messaging among food labels, consumer education materials, and dietary guidance regardless of the source of the message.

Reducing the difficulty of interpreting food messages can only serve to help consumers make the choices they would like to be making. Nutrition survey data suggests that the majority of consumers would like to change their eating habits to improve health, lose weight, decrease their risk of chronic disease, and to become more attractive (National Institute of Nutrition and the Canadian Food Information Council, 2004). However, mixed messages have left the public confused about what to eat (Goldberg, 1992; Wansink, 2006). Confusion stems not only from the complex and evolving nature of nutrition related messages, but also from the fact that various sectors and organizations send messages about nutrition, healthy eating and weight loss for different reasons, using different formats, and with different constraints (Goldberg, 1992; Nestle, 2002). In addition, most Canadians use product labels, magazines and newspapers, friends, relatives and colleagues, as sources of information even though they don't consider them very credible sources, while only half use health associations, family physicians or other health professionals even though they are considered more credible (National Institute of Nutrition and the Canadian Food Information Council, 2004). One manifestation of the pervasiveness and diversity of messages about healthy food seems to be that everyone considers themselves an expert on the topic of obesity despite having the vague sense that they don't know what to eat.

Obesity is a complex systems problem

While it is clear that having a food supply where the most energy dense, nutrient-poor foods are also the cheapest contributes to the "obesogenicity" of the environment, many other factors also contribute to social, cultural, and physical environments that promote and support excess calorie intake and insufficient physical activity (Poston et al., 1999; Swinburn et al., 1999).

The body weight of an individual is a consequence of that individual's food and physical activity related behaviours. An individual's behaviour results from a complex mix of biological and environmental determinants. Overall more than 600 genes, markers, and chromosomal regions have been associated or linked with human obesity phenotypes (Rankinen et al., 2006). Genes have been identified that encode neuropeptides involved in control of appetite, satiety, feeding behaviour, and energy expenditure. In addition to the brain, the pancreas, liver, muscle, and fat tissue all contribute to metabolism and body weight regulation (Schwartz and Porte, 2005). Despite the complexity of biological regulatory mechanisms, it is unlikely that changes to these systems could account for the rapid increases in obesity over the last 20-30 years.

While biology regulates body weight through a complex set of systems, the response of these systems to the social, cultural, and physical environments in which we live, learn, work and play, determine whether an individual or a population are obese (Kumanyika, 2001). Factors proximal to the individual that can influence food and physical activity behaviour include access to healthy food in cafeterias, worksites and lunch boxes, type and length of physical education classes, availability of services supporting active transport – including safe and affordable public transit, sidewalks and bike lanes, showers and changing room facilities at work – and the expectations of our employers, parents, and friends. At the national and international level, factors such as food and agriculture policies, media, and development and globalization of markets, shape the food and physical activity environments.

Given the complexity of the environment and the biology of body weight regulation, it is surprising that we persist in thinking that there is a quick fix to the problem of obesity. In part, this perception is likely due to the increase in media attention (International Food Information Council, 2006) and the tendency of media to reduce the problem to the factor or proposed solution being highlighted. The large and growing weight loss industry also contributes to and is a consequence of the perception that there is a simple solution (Katz, 2005). But these solutions are clearly inadequate and are unable to prevent or reverse the epidemic of obesity in the face of an increasingly obesogenic environment.

Complex problems often engender responses such as despair, belief that the problem is beyond hope, retreat, and an effort to assign blame (Bar-Yam, 2004). In the case of tobacco, demonizing the tobacco companies is thought to have helped in the public health effort to reduce cigarette consumption (Netemeyer et al., 2005). But while many have made comparisons between the fights against tobacco and obesity (Chopra and Darnton-Hill, 2004) it seems unlikely that demonizing food companies will produce the same result. In addition to the complexity of the biology of body weight regulation and the obesogenic environment, there is also a complex set of actors responsible for the fact that our food supply has an excess of heavily marketed, unhealthy, energy-dense, nutrient-poor, cheap food (Schoonover and Muller, 2006). These factors include agricultural policies, trade regulations, commodity markets, value chains, and consumer demand.

Farm to fork solutions

Sometimes complex problems cause people to galvanize their collective efforts and invest significant dollars to tackle the problem (Bar-Yam, 2004). This seems to be the case in Canada, where considerable effort and investment has recently been directed at obesity. Governments at all levels are studying the problem, providing frameworks for action, implementing programs, and supporting research. Health charities and other non-governmental organizations are working together to support research and advocate for policy and program changes. Some are delivering programs that support a healthier environment. The food industry is responding to consumer demand for healthier products and some companies are looking inward at changing corporate policies

Complex problems demand specific types of solutions. Strategies that can be helpful in tackling complex problems include: setting functional goals and directions for improvement, measuring effectiveness in the field, distributing decision-making, action and authority, supporting individual initiative, forming cooperative teams, and creating rules that promote competition with performance feedback at the functional team level (Bar-Yam, 2004).

Setting functional goals and directions for improvement

Within the health sector and across levels of government there has been a significant recent effort to set goals for improved health. At the international level the World Health Organization (2004) has articulated a Global Strategy on Diet, Physical Activity and Health. Its main objectives include reducing the risk factors for noncommunicable diseases, increasing overall awareness and understanding, and "to encourage the development, strengthening and implementation of global, regional, national and community policies and action plans to improve diets and increase physical activity that are sustainable, comprehensive, and actively engage all sectors, including civil society, the private sector and the media" (WHO, 2004).

In Canada, federal, provincial and territorial Ministers of Health committed to improving the health status of Canadians through a collaborative process. This led, in 2005, to the articulation of nine broad goal statements, including that "every person is as healthy as they can be" and "every person receives the support and information they need to make healthy choices" (Health Goals for Canada, 2005). Efforts by the Public Health Agency of Canada to develop an Integrated Pan-Canadian Healthy Living Strategy included more specific goals relevant to obesity including to, "by 2015, increase by 20% the proportion of Canadians who make healthy food choices" (Public Health Agency of Canada, 2005). Across Canada many regional and local governments have set healthy living goals for their populations.

But the environmental changes needed to tackle the epidemic of obesity require the involvement of other sectors including agriculture, transportation, and trade. Outside of the health sector it is generally more difficult to identify efforts to set goals and directions for improvement that will improve public health through support of healthy eating. Although the Food and Agriculture Organization (FAO) of the United Nations acknowledges that obesity is a significant problem, especially in developing countries, it does little to set goals or directions for improvement within agricultural systems. The WHO Regional Office for Europe in collaboration with the Food and Agriculture Organization of the United Nations (FAO) has initiated dialogue on the role of agricultural and trade policies in action against obesity (WHO Regional Office for Europe, 2006). Outside of government, organizations like the Institute for Agriculture and Trade Policy (IATP) have drawn links between agriculture policy and obesity, and call for efforts to emphasize the connection between public health, food, and farm policy (Schoonover and Muller, 2006).

Thus, while we have galvanized our collective interest in tackling the epidemic of obesity through the establishment of health goals at multiple levels of government, we have yet to translate these into functional goals outside of the health sector. Given the complexity of the problem, it is essential that the goal-setting process be extended into other sectors, such as agriculture, transportation, city planning, and public safety, which have important influences on health.

Measuring effectiveness in the field

Without systems for measuring the effectiveness of policies, programs and practices, it is not possible to determine if goals and directions for improvement are met. Clearly, the complexity of the obesity problem demands a wide range of efforts to measure effectiveness, including surveillance systems not only of outcomes such as body weight, body mass, and waist-to-hip ratio, but also of food and physical activity behaviours, of policies and programs, of the quality and quantity of the food supply, and of many other factors such as business practices, food access, and food security. In Canada, national surveillance systems are limited. Height and weight are not measured at regular intervals, and there exists a nearly 35 year gap between surveys that indicated what Canadians were eating. Although national surveillance needs to be improved, considerable data are collected by a range of players at other levels of government, in academia, and in the private sector (CHSPR, 2004). Unfortunately, many of these players have no explicit mandate to support research and researchers have variable access to these sources of data.

To measure the effectiveness of specific interventions requires infrastructure and the capacity for population intervention research and evaluation. Recent efforts to assess the environment for population intervention research in Canada suggest considerable work must be done to accelerate the pace of this type of research (Di Ruggiero et al., 2006). The analysis suggests that a coordinated multi-level approach both within the Canadian Institutes of Health Research (CIHR) and through external partnerships will be needed to build researcher capacity and for the development of tools and data resources. Also called for are improvements in the peer review process, collaboration between the growing number of academic programs in public health, and new models for funding program evaluation.

Despite the need for significant new infrastructure to support the demand for intervention research, CIHR has made progress in recent years by increasing funding to obesity-related intervention research through the Institute of Nutrition, Metabolism and Diabetes' (INMD) strategic focus on obesity and healthy body weight. INMD investments have increased the size of the obesity research community 6-7 fold, and have contributed to a yearly CIHR investment in obesity research reaching nearly $20 million per year in 2005-2006 (Finegood, in press). Through this investment in research and evaluation, CIHR is supporting numerous efforts like the in motion program which assists communities in both setting goals for improvement and for evaluating the effectiveness of their initiatives (Saskatoon Health Region, 2006). INMD has also spearheaded the development of new models for intervention research as illustrated by the Canada on the Move project (Rose and Finegood, 2006). Improving the nutritional health of Canadians requires expansion of current efforts to measure the effectiveness of the policy, program, and practice changes that are undertaken to address the epidemic of obesity.

Distributing decision, action and authority

Within the causal web of factors that influence an individual's food related behaviours are embedded a variety of subsystems that affect food environments including systems that impact food production, transportation, processing, marketing, distribution, and demand. Access and price are also affected by where a person lives and under what circumstances.

Despite the complexity of the systems involved in the food chains that begin on the farm and end at the fork, centralized control can have a significant impact. IATP has drawn a connection between U.S. farm policy and the excess availability of high energy dense foods (Schoonover and Muller, 2006). Farm policy, which supports a few commodities like corn and soybeans and provides little support for the production of fruits and vegetables, has led to large decreases in the cost of soft drinks, fats, oils, sugars and sweets, while driving up the price of fresh fruits and vegetables. Solutions suggested by IATP take into account the complexity of food systems and support the notion that a "healthier food system" is one that distributes decision, action, and authority. IATP recommends supporting local and regional food systems, encouraging school and government procurement policies that favor healthy foods, and keeping small farmers on the land.

Conclusion

Given the rapid rise in co-morbidities associated with obesity, including type 2 diabetes, cardiovascular disease, and some forms of cancer, it is essential that we seek solutions including approaches to improving nutritional health. In Canada, the direct and indirect costs associated with obesity exceed $4.3 billion dollars per year (Katzmarzyk, 2004). With the prediction that one in three children born in 2000 will develop diabetes during their lifespan (Narayan et al., 2003), costs will overwhelm our health care system in the not so distant future. Hence the question "can we improve nutritional health at an affordable price?" needs to be reframed as "can we afford not to act now to improve nutritional health?"

In complex systems, individuals matter. Given the complexity of the systems affecting the food environment, many actions must be taken by individuals at many different levels working in different systems. Among populations the collective actions of individuals determine demand. In homes, schools, and worksites, individuals set the normative food environment based on what they purchase, what they expect of students, and what they make available to employees. In cities and communities, the environment is a function of individuals who work in food distribution and those who set policy, implement transportation systems, design the urban landscape, and collect taxes. In nations and around the world, individuals come together to determine trade policies and to create information systems to which many people have access. With a goal as big and complex as improving nutritional health, everyone must make the decision to help shift societal norms.

References

Bar-Yam, Y. 2005. *Making Things Work: Solving complex problems in a complex world.* United States of America: NECSI - Knowledge Press.

Centre for Health Services and Policy Research (CHSPR). 2004. "Data Data Everywhere: Improving access to population health and health services research data in Canada." Available at: www.chspr.ubc.ca.

Chopra, M. and I. Darnton-Hill. 2004. "Tobacco and obesity epidemics: not so different after all?" *British Medical Journal* 328:1558-60.

Di Ruggiero, E., A. Rose, and K. Gaudreau. 2006. "Canadian Institutes of Health Research Support for Population Health Intervention Research in Canada," unpublished.

Drewnowski, A. 2005. "Concept of a nutritious food: toward a nutrient density score." *American Journal of Clinical Nutrition* 82:721-32.

Drewnowski, A., and N. Darmon. 2005. "The economics of obesity: dietary energy density and energy cost." *American Journal of Clinical Nutrition* 82:265S-273S.

Finegood, D.T. In press. "The Agenda for Obesity Research in Canada." In *Canadian Clinical Practice Guidelines on the Management and Prevention of Obesity in Adults and Children*.

Goldberg, J.P. 1992. "Nutrition and health communication: the message and the media over half a century." *Nutrition Reviews* 50:71-7.

Health Goals for Canada: A Federal, Provincial, and Territorial Commitxment to Canadians. Adopted October 2005. Available at: http://healthycanadians.ca.

Institute of Nutrition, Metabolism, and Diabetes – Canadian Institutes of Health Research (CIHR-INMD). 2006. "Canada on the Move." Information available at: www.canadaonthemove.ca.

International Food Information Council. "Global Trends in Obesity-Related Media Coverage," July 2006. Available at http://ific.org/research/obesitytrends.cfm.

Katz, D.L. 2005. "Competing Dietary Claims for Weight Loss: Finding the Forest Through Truculent Trees." *Annual Review of Public Health* 26:61-88.

Katzmarzyk, P. 2004. "The economic costs associated with physical inactivity and obesity in Canada: an update." *Canadian Journal of Applied Physiology*. 29(1):90-115.

Kumanyika, S.K. 2001 "Minisymposium on Obesity: Overview and Some Strategic Considerations." *Annual Review of Public Health* 22:293-308.

Narayan, K.M., J.P. Boyle, T.J. Thompson, S.W. Sorensen, and D.F. Williamson. 2003. "Lifetime risk for diabetes mellitus in the United States." Journal of the American Medical Association. 290(14):1884-90.

National Institute of Nutrition and the Canadian Food Information Council. 2004. *Tracking Nutrition Trends V*. Available at: www.ccfn.ca/pdfs/TNTV-FINAL.pdf.

Nestle, M. *Food Politics: How the Food Industry Influences Nutrition and Health*. Berkeley and Los Angeles, California: University of California Press, 2002.

Netemeyer, R.G., J.C. Andrews, and S. Burton. 2005 "Effects of anti-smoking advertising-based beliefs on adult smokers' consideration of quitting." *American Journal of Public Health*. 95:1062-6.

Poston II, C., S. Walker, and J.P. Foreyt. 1999. "Obesity is an Environmental Issue." *Atherosclerosis* 146:201-209.

Public Health Agency of Canada, Integrated Pan-Canadian Healthy Living Strategy, 2005. Available at: http://www.phac-aspc.gc.ca/hl-vs-strat/index.html.

Rankinen T., A. Zuberi, Y.C. Chagnon, S.J. Weisnagel, G. Argyropoulos, B. Walts, L. Perusse, and C. Bouchard. 2006. "The human obesity gene map: the 2005 update." *Obesity (Silver Spring)*. 14:529-644.

Rose A. and D. Finegood. 2006. "Postscript: Learning from the experience of developing and running Canada on the Move." *Canadian Journal of Public Health* 97(Suppl. 1):S41-S42.

Saskatoon Regional Health Authority, 2005. "Saskatoon in motion: Five years In The Making 2000-2005." Available at: http://www.in-motion.ca.

Schoonover, H. and M. Muller. 2006. "Food Without Thought: How U.S. Farm Policy Contributes to Obesity." Institute for Agriculture and Trade Policy, Available at http://www.iatp.org/.

Schwartz, M.W. and D. Porte Jr. 2005. "Diabetes, Obesity and the Brain." *Science* 307:375-379.

Swinburn, B., G. Egger, and F. Raza. 1999. "Dissecting Obesogenic Environments: The Development and Application of a Framework for Identifying and Prioritizing Environmental Interventions for Obesity." *Preventive Medicine* 29:563-570.

The Hindu Business Line Internet Edition. 2005. "Nooyi sees a 'Good for you' Pepsi." Available March 31at www.thehindubusinessline.com/.

Wansink, B. and the American Dietetic Association. 2006. "Position of the American Dietetic Association: food and nutrition misinformation." *Journal of the American Dietetic Association*. 106:601-7.

World Health Organization (WHO). 2004. "Global Health Strategy on Diet, Physical Activity and Health." Available on page 43 at http://www.who.int/gb/ebwha/pdf_files/WHA57/A57_R17-en.pdf).

World Health Organization (WHO). Regional Office for Europe. Press release, 17 May 2006. "Health, trade and agriculture sectors must work together against obesity." Available at: http://www.euro.who.int/mediacentre/PR/2006/20060516_1.