Environmental and Societal Factors Affect Food Choice and Physical Activity: Rationale, Influences, and Leverage Points

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Introduction

Dietary and physical activity behaviors that affect health are influenced by a wide variety of forces; changes in these behaviors require interventions and commitment to action at multiple levels.[1,2] Education-based obesity-prevention strategies (e.g., mass-media promotion of healthy foods and promotion of healthy physical activity habits through schools) are viewed as the most useful and the most feasible to implement.[3] Implicit in these strategies is the focus on the individual.[2] Education-based strategies have met with limited long-term success in changing behavior,[4] however, perhaps owing to a general lack of supporting environmental modifications.

There is increasing recognition of the importance of the environment in shaping behavior, yet strategies that focus on changing environmental factors are much less familiar, and may therefore require partnerships with relevant sectors outside traditional health domains. As described in greater detail by Economos et al.,[5] partnerships among researchers, educators, government, and industry have demonstrated success in smoking reduction at the population level. Interventions such as taxation and advertisement regulations have been instrumental in promoting smoking cessation in the United States and are used by agriculture and agribusiness interests to promote specific food consumption patterns. Similar models of collaborations or interventions may be successful in changing food intake and physical activity, and may potentially result in such desirable outcomes as prevention and reduction of obesity.[6] It is important to appreciate the interaction among multiple environmental factors and that complex behavior changes are dependent on different influences at different levels.

In Working Group II, we took on the task of identifying broader contextual, environmental, societal, and policy variables that may improve our understanding of people's eating and physical activity behaviors and may lead to new directions for influencing shifts in behavior. Ecologic models of behavior, and most health promotion models, specify that health behaviors be influenced by biologic, demographic, psychological, social/cultural, environmental, and policy variables. However, the research base that identifies specific important environmental and policy variables is very limited.[1,7–11] Nevertheless, there are several reasons that support the need to identify environmental and policy influences on physical activity and eating behaviors.

The Need to Understand Environmental and Policy Influences

It can be argued that Americans live in an environment that does not favor a balance between physical activity and food intake.[12] It is easy to find and purchase a large variety of foods. Portion sizes have grown larger, in part because consumers value a greater quantity of food for a lower price.[13] This exaggerated availability of palatable and varied food is a constant challenge to people's drive to eat. Our current society is structured so that most people do not need to be physically active during a typical day. For example, land use policies not only facilitate dependence on automobiles, but also hinder alternative modes of transport that demand more physical activity (e.g., walking or cycling).[14] Opportunities for physical activity seem to be disappearing from daily life, whereas more enticements to be physically inactive are introduced through laborsaving devices and an expanding leisure industry whose products often require inactivity. The current environment favors an imbalance between food intake and physical activity, therefore, which can contribute to obesity and chronic diseases.[6]

Environment and policies may affect everyone in the population; even if such environmental influences on behavior are weak, they can influence large segments of the population on a daily basis. Foods served at schools and worksites affect everyone in those settings, and every driver on a given street sees signs for fast food outlets. All residents of a neighborhood are affected by the "walkability" of their surroundings, and international comparisons show that the United States has the least "walkable" cities and the lowest rate of walking as a means of transportation.[15]

Limited adoption of healthful behaviors and poor maintenance of behavioral change, frequently observed in individually based interventions,[4] may be partially explained by a failure to alter environments in which it is difficult to make healthful choices. In addition, environmental supports for healthful eating and physical activity are distributed unevenly throughout the population. Understanding environmental influences may help explain socioeconomic status and cultural differences in health behaviors and health outcomes.[16]

Ecologic models of behavior lead to predictions that efforts to change behavior will be most effective when they are carried out on multiple levels: individual, social and cultural, environmental, and policy.[17,18] Thus, educational interventions that target individuals should be most effective when society provides environments and policies that encourage people to use the knowledge and skills they have learned. Environmental and policy changes should be most effective when combined with programs that motivate and enable people to obtain healthful foods and use opportunities for physical activity.

Developing Hypotheses About Environmental, Societal, and Policy Influences on Physical Activity and Eating Behaviors

Approach

Despite hypotheses that environmental variables are strong influences on physical activity and eating behavior, few studies have investigated these influences. We determined that the next step toward achieving more healthful food intake and activity patterns was to identify specific environmental, societal, and policy variables that are hypothesized to affect physical activity and eating behaviors. A panel of experts from diverse professional fields was assembled to form a working group, consistent with similar models of partnerships that have successfully changed behaviors, as evaluated by Economos et al.[5] We anticipated that there would be many environmental and policy influences, so we began a database that listed the hypothesized influences. The working group constructed the database over a series of three meetings. The technique of knowledge mapping[19] was used to systematically nominate and organize a hierarchy of environmental and societal factors as they affect food and physical activity choices. This was complimented by a review of key literature, as summarized here and in Appendices 1 and 2. A similar approach was recently proposed by Swinburn et al.[20] The working group used knowledge mapping to identify the agencies, institutions, or industries that have the most direct responsibility for each influence. These groups are the leverage or control points because they can be involved in change strategies. Identifying intervention leverage points may also suggest short-term and long-term research and intervention priorities.

Framework

Concurrent with the development of the database, we developed the portion of the framework that dealt with variables outside the individual to complement the portion of the framework developed by Gazdag et al.[21] Three types of environmental and policy influences were conceptualized in a hierarchical fashion: specific behavior settings where people live their lives; primary or proximal leverage points that control behavior settings; and secondary or distal leverage points that have indirect, but still important influences on behavior settings.

The environmental component of the framework begins with the microenvironments or "behavior settings" in which the behavior or lifestyle takes place (Figures 1a and 1b). The behavior or lifestyle was defined as either an eating or physical activity pattern assumed to be related to chronic disease and obesity. Within the physical activity domain, both physical activity and physical inactivity were considered because these two types of behaviors are typically affected by different sets of environmental and household level factors.[7] Because eating, physical

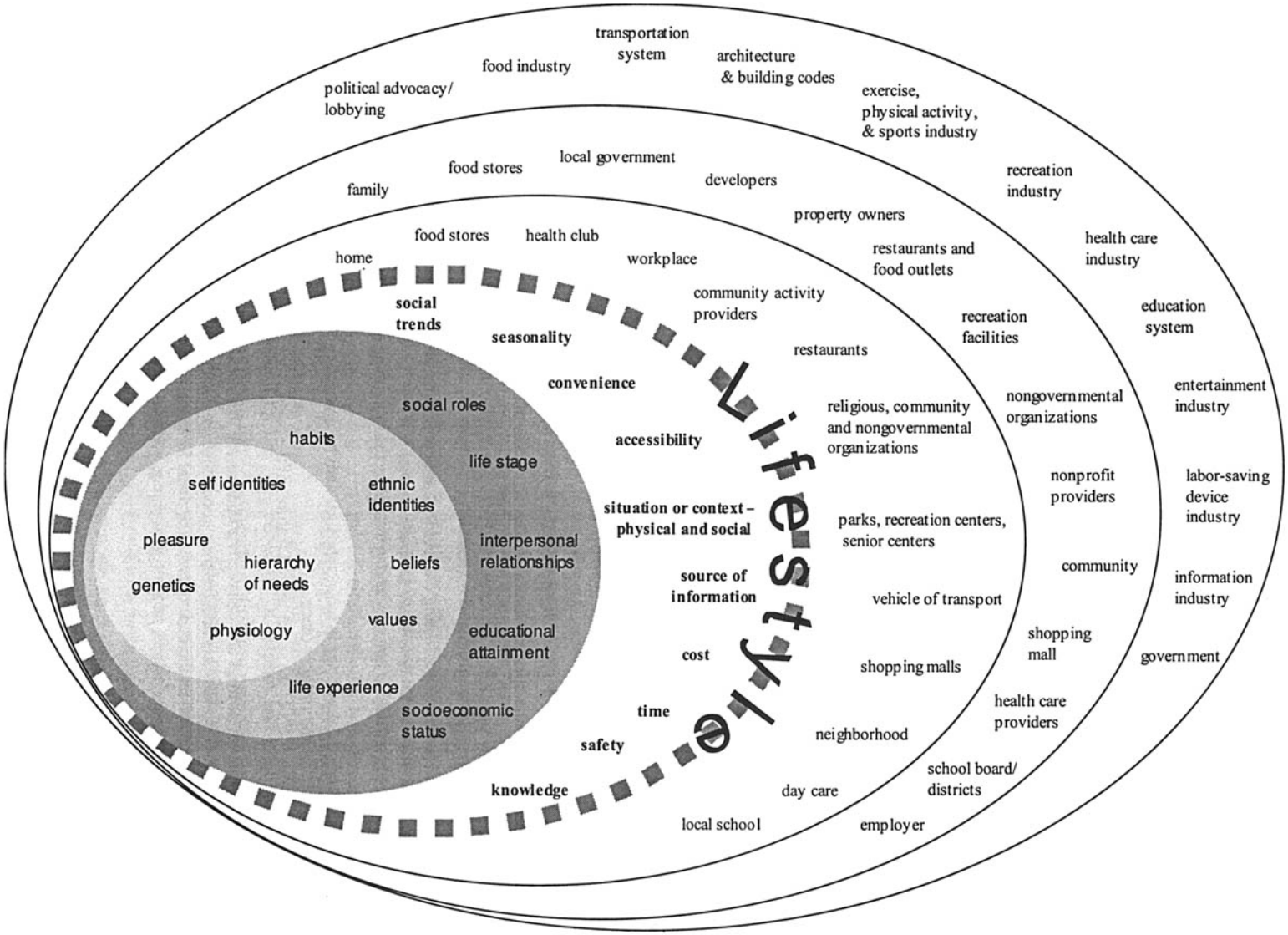

Figure 1a. Framework for determinants of physical activity and eating behavior. See Figure 1b for framework legend and explanation.

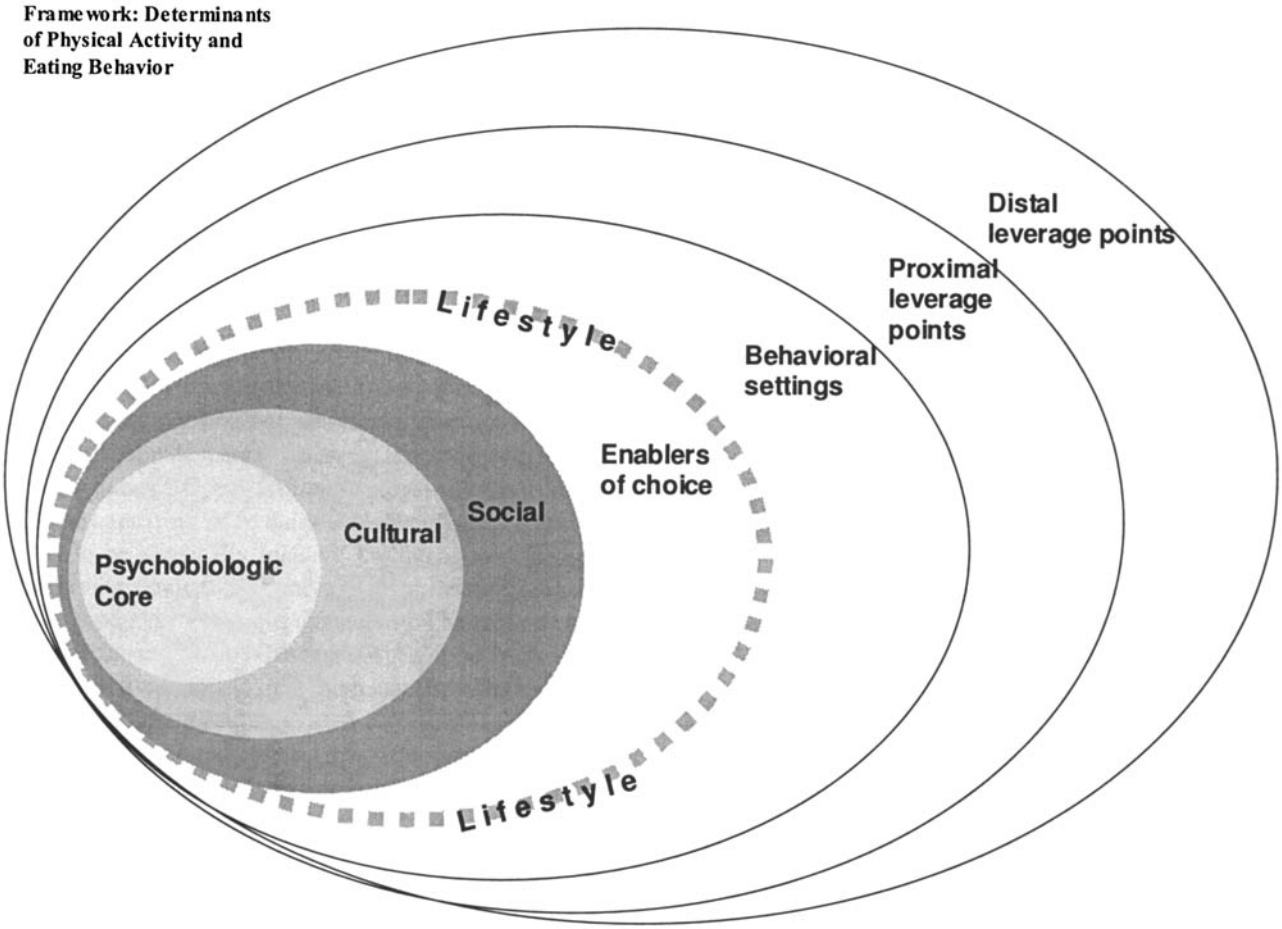

Figure 1b. Layers of the Framework.

Psychobiologic Core: Genetically programmed metabolism and behavior—instinctive behavior, innate values related to survival, which are essentially immutable. Early conditioned behaviors (e.g., positive and negative reinforcement of pleasure, pain, etc.) and experiential learning, physiologic state; these are behavioral and metabolic phenotypes expressed within a given environment. The psychobiologic core also includes current health status.

Cultural: Personal life experienced, "inherited" values and beliefs (e.g., ethnic and cultural identity), self-identity within immediate social/cultural surroundings.

Societal: Roles and relationships, "acquired" values and beliefs, how society views the individual and vice versa, i.e., self-identity within broader social/cultural environment, broader societal values (e.g., social trends). This layer interacts with the cultural layer: how society views you affects how you view yourself.

Enablers of Choice: Most proximal factors affecting choices that are commonly identified as enhancers or barriers to change. These factors tend to be the ones most focused on in order to facilitate change.

Lifestyle: Visible physical activity and eating behavior choices made by the individual, may be a mix of who they are and who they would like to be.

Behavior Settings: Physical and social settings in which physical activity and eating behaviors take place and choices are made—the situational context within which behavior takes place.

Proximal Leverage Points: Controllers of the structure and features of the microenvironment that affect the physical activity and eating behavior choices.

Distal Leverage Points: All behavior settings and macroenvironments are influenced by additional layers of factors, either directly or indirectly (e.g., controllers of the raw materials and finished goods that consumers purchase or are exposed to, along with the laws, policies, economics, politics, etc. that affect the controllers). The distal leverage points also include some multidimensional factors that pervade all levels and that shape attitudes, beliefs, and knowledge, e.g., media.

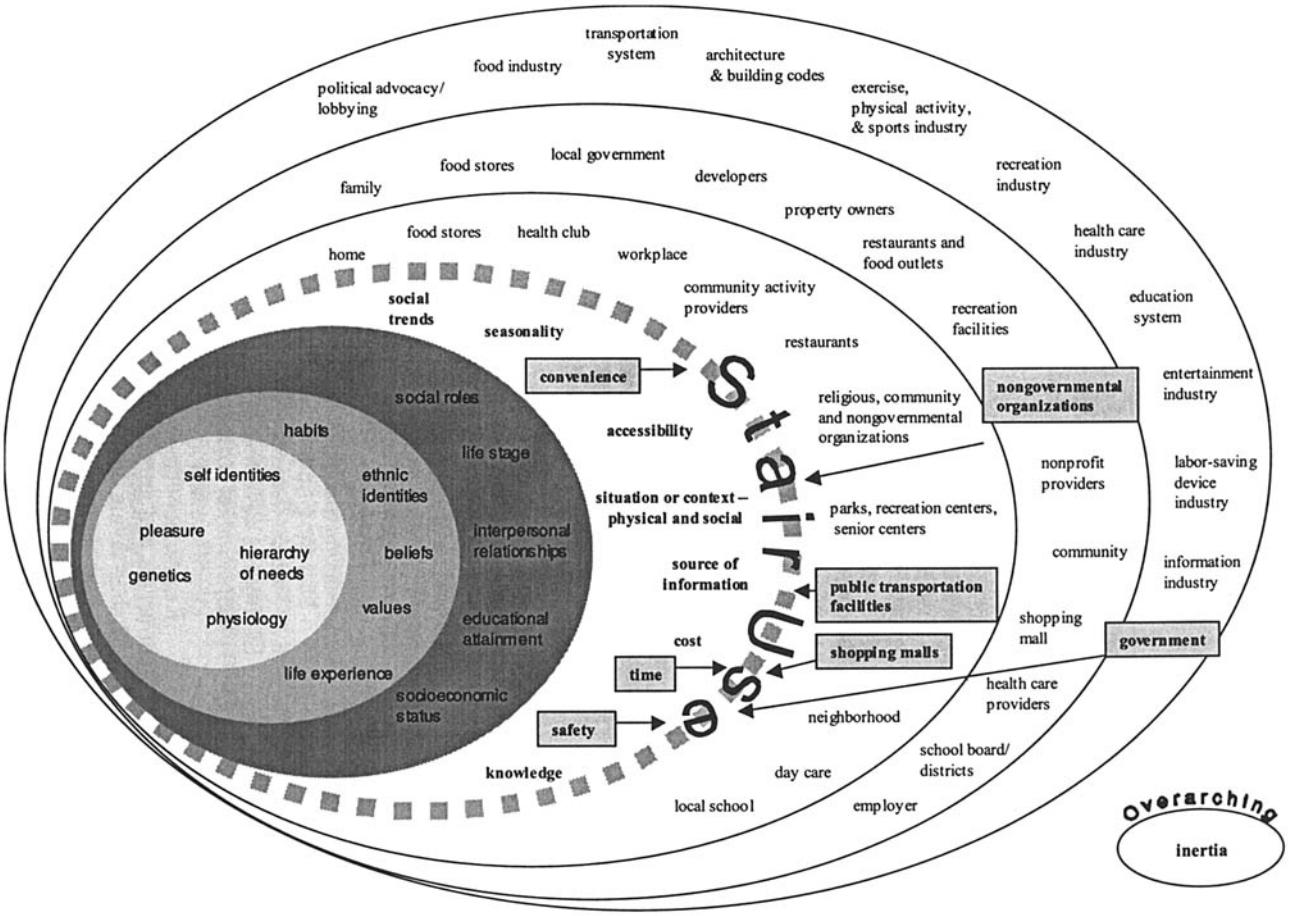

Figure 2. Framework for determinants of stair use in public transportation facilities and shopping malls. See Figure 1b for framework legend and explanation.

activity, and physical inactivity can occur in many settings, 13 types of relevant behavior settings were identified. These behavior settings were then applied to the framework, but should not be considered all-inclusive. When specific intervention examples (Appendix 3) were applied to the framework to demonstrate its utility (Figure 2), some behavior settings were renamed and others were added.

Influences

Each behavior setting can contain many influences. For example, eating in the home may be influenced by the presence of high-calorie snacks or alternative snacks like fruits. Physical activity in the home may be influenced by the presence of exercise equipment, whereas a computer connected to the Internet may influence physical inactivity. The working group was constrained by time and therefore nominated only representative influences. Although the database is large, it is far from complete.

Each influence within a behavior setting was considered the basic unit in the database and selected characteristics of influences were recorded. When this article was written, 122 specific influences had been entered into the database (Table 1). The impact of the influence on eating or physical activity was determined by collective judgment and coded on a 3-point scale (1 = low, 2 = medium, 3 = high). The changeability of the influence also was coded on a 3-point scale (1 = difficult, 2 = medium, 3 = easy). A high changeability score means that it is possible to change the influence in a healthful direction. The product of impact X changeability was considered to be a useful guide regarding influences to target for short-term intervention or research. Green and Kreuter[22] also advocated these concepts of impact and changeability and their role in health promotion planning.

The group rated only a minority of influences on physical activity and eating patterns to have easy changeability; most were considered difficult to change (Table 2). For those influences that were considered difficult to change, such as laborsaving devices in the home and bag lunches taken to school, the impact of successful change was predominantly rated moderate to high. This may indicate that the most meaningful environmental changes will be difficult to achieve. Although these are subjective rat-

Table 1. Database of Hypothesized Environmental Influences on Physical Activity and Nutrition: Sorted by Behavior Setting

Changeability 1 = difficult 2 = moderate 3 = easy	Impact 1 = low 2 = moderate 3 = high	Proximal Leverage Point Within Macroenvironment	Behavior Setting (Microenvironment)	Influence	Behavioral Outcome
2	3	Family	Home	Snacks within household (food purchased)	Nutrition
2	3	Family	Home	Meals within household (food purchased)	Nutrition
1	3	Family	Home	Facilities for food preparation and storage	Nutrition
1	2	Family	Home	Garden	Nutrition
1	2	Family	Home	Garden	Physical activity
2	3	Family	Home	Sedentary stimuli for leisure (TV, computer)	Physical activity
2	1	Family	Home	Active stimuli for leisure (exercise equipment/videos)	Physical activity
1	3	Family	Home	Labor-saving devices	Physical activity
1	3	Family	Home	Presence of young children	Physical activity
1	3	Family	Home	Lawn and play space	Physical activity
2	1	Supermarket/local shops/convenience stores	Food stores	Placement of healthful foods	Nutrition
1	1	Food industry	Food stores	Types of packaging of healthful foods	Nutrition
2	3	Food industry	Food stores	Coupons for processed foods	Nutrition
2	3	Supermarket	Food stores	Small stores in low socioeconomic status areas	Nutrition
1	2	Food industry	Food stores	Perceived cost of healthful food versions	Nutrition
1	2	Supermarket/local shops/convenience stores	Food stores	Food placement targeting children	Nutrition
2	2	Supermarket/local shops/convenience stores	Food stores	Junk food placement	Nutrition
2	2	Supermarket/food industry	Food stores	In-store promotion of foods	Nutrition
1	2	Supermarket/food industry	Food stores	Shelf space for healthful foods	Nutrition
2	3	Food industry/supermarket	Food stores	Portion size/unit packaging	Nutrition
2	2	City government/developers	Neighborhood	Sidewalks (presence and quality)	Physical activity
2	2	City government/developers	Neighborhood	Bike paths	Physical activity
2	1	City government/developers	Neighborhood	Connectivity of streets	Physical activity
2	2	City government/developers	Neighborhood	Mixed land use (residential and commercial)	Physical activity
3	3	City government/developers	Neighborhood	Public recreation facilities	Physical activity
3	2	Recreation industry	Neighborhood	Private recreation facilities	Physical activity
1	2	Entertainment industry	Neighborhood	Inactive recreation facilities (movies/video arcade)	Physical activity
1	3	City government/police	Neighborhood	Crime/perceived safety	Physical activity
1	2	City government	Neighborhood	Traffic	Physical activity
1	2	Municipal/private property owners	Neighborhood	Vending machines	Nutrition
1	3	City government/food industry	Neighborhood	Fast food outlets	Nutrition
2	1	City government	Neighborhood	Farmers markets	Nutrition
2	1	City government/food industry	Neighborhood	Outdoor advertising	Nutrition
1	2	City government/ supermarkets	Neighborhood	Supermarket access	Nutrition
1	2	Convenience stores	Neighborhood	Minimarts	Nutrition
1	2	City government	Neighborhood	Residential density	Physical activity
1	2	City government/architects	Workplace	Stair access and attractiveness	Physical activity
1	3	Employer	Workplace	Labor-saving devices	Physical activity
2	1	Employer	Workplace	Exercise facilities	Physical activity
2	2	Employer	Workplace	Physical activity promotion policy	Physical activity
2	2	Employer	Workplace	Placement of parking lot	Physical activity

Table 1. Database of Hypothesized Environmental Influences on Physical Activity and Nutrition: Sorted by Behavior Setting (continued)

Changeability 1 = difficult 2 = moderate 3 = easy	Impact 1 = low 2 = moderate 3 = high	Proximal Leverage Point Within Macroenvironment	Behavior Setting (Microenvironment)	Influence	Behavioral Outcome
3	1	Employer	Workplace	Bike rack	Physical activity
2	1	Employer	Workplace	Shower availability	Physical activity
1	3	City government/regional government	Workplace	Commuting (including urban design)	Physical activity
3	1	Employer	Workplace	Education (signs) program	Physical activity
3	1	Employer	Workplace	Education (signs) program	Nutrition
2	2	Employer	Workplace	Kitchen facilities	Nutrition
3	1	Employer	Workplace	Drinking water access	Nutrition
3	3	Employer	Workplace	Cafeterias	Nutrition
1	2	Employer	Workplace	Mobile canteens	Nutrition
3	2	Employer	Workplace	Vending machines	Nutrition
2	3	Employer	Workplace	Company eating policies	Nutrition
2	3	School	School	Physical education class availability	Physical activity
2	3	School	School	Physical education class content/training	Physical activity
2	3	School	School	Recess	Physical activity
2	3	School	School	Lunchtime activities	Physical activity
3	3	School	School	After school physical activity	Physical activity
2	2	School	School	Intramural physical activity	Physical activity
2	3	School	School	Recreation facilities (appropriate for climate)	Physical activity
2	3	School	School	Community use of school facilities	Physical activity
1	3	School	School	Commuting to school	Physical activity
2	1	School	School	Parking lots	Physical activity
2	2	School	School	Nutrition education	Nutrition
1	3	School	School	Type A meal[a]	Nutrition
1	2	School	School	Breakfast	Nutrition
2	3	School	School	A la carte meals	Nutrition
1	2	School	School	Offsite eating (high school)	Nutrition
1	3	Family	School	Bag lunches	Nutrition
2	2	School	School	Vending machines	Nutrition
2	2	School	School	Drinking water access	Nutrition
1	2	School	School	Food sales for funds	Nutrition
1	3	School	School	Food service (self supporting)	Nutrition
2	2	School	School	Soda concessions	Nutrition
2	1	School	School	Student stores	Nutrition
1	2	Recreation industry	Health club	Cost	Physical activity
1	2	Recreation industry	Health club	Location/accessibility	Physical activity
2	2	Recreation industry	Health club	Ambiance	Physical activity
2	1	Recreation industry	Health club	Youth programs	Physical activity
2	1	Recreation industry	Health club	Vending machines	Nutrition
3	1	Recreation industry	Health club	Drinking water access	Nutrition
2	1	Recreation industry	Health club	Concessions	Nutrition
1	3	Local government	Public active recreation facilities	Access/location	Physical activity

Table 1. Database of Hypothesized Environmental Influences on Physical Activity and Nutrition: Sorted by Behavior Setting (continued)

Changeability 1 = difficult 2 = moderate 3 = easy	Impact 1 = low 2 = moderate 3 = high	Proximal Leverage Point Within Macroenvironment	Behavior Setting (Microenvironment)	Influence	Behavioral Outcome
1	3	Local government	Public active recreation facilities	Crime/perceived safety	Physical activity
2	2	Local government	Public active recreation facilities	Equipment quality	Physical activity
2	2	Local government	Public active recreation facilities	Variety of uses	Physical activity
3	2	Local government	Public active recreation facilities	Expertise of leaders	Physical activity
3	2	Local government	Public active recreation facilities	Programs	Physical activity
2	1	Local government	Public active recreation facilities	Vending machines	Nutrition
3	1	Local government	Public active recreation facilities	Drinking water access	Nutrition
2	1	Local government	Public active recreation facilities	Concessions	Nutrition
1	2	Nonprofit providers	"Religious, community, and nongovernmental organizations"	YMCA/YWCA/Boys & Girls Clubs	Physical activity
2	2	Organization/ community	"Religious, community, and nongovernmental organizations"	Youth clubs	Physical activity
2	2	Organization/ community	"Religious, community, and nongovernmental organizations"	Youth sports	Physical activity
2	2	Organization/ community	"Religious, community, and nongovernmental organizations"	Adult sports	Physical activity
1	2	Organization/ community	"Religious, community, and nongovernmental organizations"	Sitting at meetings	Physical activity
2	1	Organization/ community	"Religious, community, and nongovernmental organizations"	Activity events for fundraisers	Physical activity
2	1	Organization/ community	"Religious, community, and nongovernmental organizations"	Dances	Physical activity
2	2	Collective group	"Religious, community, and nongovernmental organizations"	Potluck dinners	Nutrition
3	2	Organization/ community	"Religious, community, and nongovernmental organizations"	Food at meetings	Nutrition
2	1	Organization/ community	"Religious, community, and nongovernmental organizations"	Food for charity	Nutrition
2	2	Organization/ community	"Religious, community, and nongovernmental organizations"	Food for fundraisers	Nutrition
2	3	Restaurant industry	Restaurants	Portion size	Nutrition
2	2	Restaurant industry	Restaurants	Limited choices of healthful foods	Nutrition
1	2	Restaurant industry	Restaurants	Prompting for additions	Nutrition
1	2	Restaurant industry	Restaurants	Pricing for combination meals	Nutrition
2	1	Restaurant industry	Restaurants	"Nutrient information, including substitutions"	Nutrition
2	3	Restaurant industry	Restaurants	Food processing/preparation	Nutrition
1	3	Restaurant industry	Restaurants	Incentives for consumption (e.g., toys)	Nutrition
1	3	Restaurant industry	Restaurants	Drive-thru facilities	Physical activity
2	1	Restaurant industry	Restaurants	Playgrounds	Physical activity
1	2	Food industry	Vehicle for transport	Difficulty of eating healthful foods	Nutrition

Table 1. Database of Hypothesized Environmental Influences on Physical Activity and Nutrition: Sorted by Behavior Setting (continued)

Changeability 1 = difficult 2 = moderate 3 = easy	Impact 1 = low 2 = moderate 3 = high	Proximal Leverage Point Within Macroenvironment	Behavior Setting (Microenvironment)	Influence	Behavioral Outcome
1	1	Food industry/restaurants/ convenience stores	Vehicle for transport	Outdoor advertising	Nutrition
1	2	Restaurant industry/convenience stores	Vehicle for transport	Automobile convenience food outlets	Nutrition
2	2	Gas company/food industry	Vehicle for transport	Food at bus/gas/train stations	Nutrition
1	1	Shopping mall	Shopping malls	Food availability	Nutrition
2	1	Shopping mall	Shopping malls	Food variety	Nutrition
2	1	Food outlets/shopping mall	Shopping malls	Food smells	Nutrition
1	1	Shopping mall	Shopping malls	Video arcades	Physical activity
2	2	Shopping mall/collective group	Shopping malls	Mall walking	Physical activity
1	1	Shopping mall	Shopping malls	Parking lot placement	Physical activity
1	1	Shopping mall	Shopping malls	Stairs and escalators	Physical activity
1	1	Shopping mall	Shopping malls	Youth activities	Physical activity

[a] A standard classification used in the USDA school lunch program.

ings, the working group had the perception that influences on physical activity were no less difficult to change than eating habits, but were likely to have more impact once successful change was achieved. The lower impact ranking of influences on eating habits may be the result of bias associated with the working group members' greater collective experience in nutrition research, intervention, and policy compared with that of physical activity. As more empirical evidence becomes available, these ratings of impact and changeability can be modified accordingly.

Leverage Points

To enhance the relevance of this group's efforts to the development of interventions, the working group identified potential leverage points that may be used to change each influence. These leverage points are depicted as the outermost layers of the framework (Figure 1). The proximal leverage point was defined as the immediate controller of a given influence on physical activity or eating patterns within a behavioral setting. Distal leverage points were identified that may have indirect control over a given influence. The distinction between proximal and distal are made relative to the influence. For example, the family is the proximal leverage point for the types of snacks purchased for consumption in the home. The distal leverage points for home snack consumption include grocery stores, the food industry that produces the snacks, multiple government agencies, and advocacy groups. In our database, the grocery store is also listed as a behavioral setting, with the food industry listed as a proximal leverage point for the portion sizes available for purchase (Table 1). A leverage point, therefore, can be defined as proximal to one influence and distal for another.

Table 3 displays nine categories of distal leverage points that the group believed to have significant influence on many specific behavioral influences within multiple behavior settings. The list of leverage points is incomplete but begins the process of identifying industries, organizations, and federal, state, and local government agencies that need to be involved in efforts to improve eating and physical activity behaviors. Because the categories of distal leverage points are very broad, substantial time and effort will be required to identify specific components of the industries and institutions most relevant for influencing nutrition and physical activity. It should also be understood that government, broadly defined, was understood to be a distal leverage point for all influences. Because government influence is so pervasive, it was not always listed, and no effort was made for the current document to identify the levels or agencies of government most related to each influence.

Table 3 also illustrates that some influences on nutrition and physical activity are not easily categorized by behavior settings. Influences like advertising strategies, health news, insurance incentives, reimbursement for pre-

Table 2. Changeability × Impact Ratings of Physical Activity and Eating Pattern Influences

		Number of Influences	
Changeability ×	**Impact**	**Physical Activity**	**Eating Patterns**
easy	high	2	1
	moderate	**3**	2
	low	2	**4**
% of total rated easy to change		12%	11%
moderate	high	7	9
	moderate	**13**	11
	low	9	**12**
% of total rated moderate to change		49%	51%
difficult	high	**10**	6
	moderate	9	**15**
	low	4	3
% of total rated difficult to change		39%	38%
Total influences		**59**	**63**

ventive counseling, research policies, and professional training do not necessarily impinge on people in the places where they engage in eating, physical activity, or sedentary behaviors. These broader environmental and policy variables, nevertheless, may be important influences on behavior.

Overarching Variables

A small number of societal variables were identified as overarching across all behavioral settings and leverage points. Societal variables are seen as the context or background within which all the other variables interact. Societal variables are not likely to be changed in the short term. Overarching societal influences include competition for time, tradeoffs between multiple goals, economic rather than health motivations, and extreme demographic diversity. Societal assumptions that appear to characterize most of American culture include the higher value placed on individual rights versus the common good and the concept that "more is better." A better understanding of such societal variables may help us predict which environmental and policy interventions are most likely to be accepted or resisted by the American population. Demographic characteristics are expected to interact with specific influences such that some influences will be particularly important for various subgroups defined by age, sex, race/ethnicity, socioeconomic status, and geographic region. Because it is not possible to predict how demographics and environmental influences will interact, demographic diversity was considered an overarching societal variable that needs to be considered when planning environmental and policy interventions.

To stimulate discussion, we nominated 10 physical activity influences and 10 nutrition influences that could be considered top priorities for intervention (Table 4). The order of listing of influences reflects the number of times a working group member nominated an individual influence as a priority. Of interest was the observation that the working group members identified priorities in several behavior settings for both behaviors.

Utility of the Framework and Database

The framework and database developed by the working group are intended to contribute to a rational planning process to develop strategies to improve eating and physical activity habits in the population. The framework clearly illustrates the view of the working groups that eating and physical activity behaviors are influenced by a wide variety of internal and external factors, and all should be considered when planning interventions.

The database also suggests that eating patterns and physical activity are influenced by the complex interactions of many variables. We believe this accurately reflects the extent to which unhealthy eating and physical inactivity has become woven throughout our daily lives. We are encouraged to engage in unhealthful behaviors in multiple settings every day, and change will involve the cooperation of many corporations, government agencies, professional groups, and advocacy organizations. Because collective judgment rather than empirical research were used to create the database, the specifics can be argued. We hope such debate stimulates research rather than acrimony. The length of the list of influences and leverage points may create a sense of futility, but that is not the intention. The database helps explain why unhealthful diet and physical activity patterns are so common and resistant to long-term change. It is clear that change in the

Table 3. Hypothesized Environmental Influences on Physical Activity and Nutrition: Sorted by Distal or Indirect Leverage Points

Changeability 1 = difficult 2 = moderate 3 = easy	Impact 1 = low 2 = moderate 3 = high	Distal Leverage Point Within National/ Global Environment	Proximal Leverage Point Within Macroenvironment	Influence	Behavioral Outcome
1	3	Information environment	Food industry/media/ Federal Trade Commission	Food advertising	Nutrition
1	2	Information environment	Entertainment industry	Body image/what people eat on TV (cultural representation of food)	Nutrition
1	2	Information environment	Entertainment industry	Body image/what people do on TV and in sports (cultural representation of physical activity)	Physical activity
2	2	Information environment	Local/state/federal government/ public interest groups	Health education (social marketing)	Nutrition
2	2	Information environment	Local/state/federal government/ public interest groups	Health education (social marketing)	Physical activity
1	3	Information environment	Media/scientific community	Health news	Nutrition
1	3	Information environment	Media/scientific community	Health news	Physical activity
1	2	Information environment	Diet industry	Diet ads	Nutrition
1	2	Information environment	Recreation industry	Physical activity ads	Physical activity
1	2	Information environment	Dietary supplement industry	Dietary supplement ads	Nutrition
1	3	Entertainment/computer industries	Entertainment industry/ computer industry	TV/video	Physical activity
1	3	Entertainment/computer industries	Entertainment industry/ computer industry	Movies	Physical activity
1	3	Entertainment/computer industries	Entertainment industry/ computer industry	Internet	Physical activity
1	3	Entertainment/computer industries	Entertainment industry	Spectator sports	Physical activity
1	3	Entertainment/computer industries	Entertainment industry/ computer industry	Video games	Physical activity
1	3	Transportation industry	Local/state/federal government/ public interest groups	Mass transit	Physical activity
1	3	Transportation industry	Local/state/federal government/ public interest groups	Road infrastructure	Physical activity
1	3	Transportation industry	Local/state/federal government/ public interest groups	Automobile use	Physical activity
1	3	Transportation industry	Local/state/federal government/ public interest groups	Bike/walking infrastructure	Physical activity
1	3	Health care industry	University accreditation	Medical school training	Nutrition
1	3	Health care industry	University accreditation	Medical school training	Physical activity
2	3	Health care industry	Government/insurance companies	Reimbursement policies	Nutrition
2	3	Health care industry	Government/insurance companies	Reimbursement policies	Physical activity
1	3	Health care industry	Insurance companies/ employers (leverage)	Insurance incentives	Nutrition
1	3	Health care industry	Insurance companies/ employers (leverage)	Insurance incentives	Physical activity

Table 3. Hypothesized Environmental Influences on Physical Activity and Nutrition: Sorted by Distal or Indirect Leverage Points (continued)

Changeability 1 = difficult 2 = moderate 3 = easy	Impact 1 = low 2 = moderate 3 = high	Distal Leverage Point Within National/ Global Environment	Proximal Leverage Point Within Macroenvironment	Influence	Behavioral Outcome
2	3	Health care industry organizations	Government/private research	Research on health care costs	Nutrition
2	3	Health care industry organizations	Government/private research	Research on health care costs	Physical activity
1	3	Health care industry	Pharmaceutical industry	Pharmaceutical dominance	Nutrition
1	3	Health care industry	Pharmaceutical industry	Pharmaceutical dominance	Physical activity
2	3	Health care industry	Numerous	Lack of prevention orientation (HEDIS)	Nutrition
2	3	Health care industry	Numerous	Lack of prevention orientation (HEDIS)	Physical activity
1	2	Architecture/building codes	Architects	Access/attractiveness of elevators	Physical activity
2	2	Architecture/building codes	Architects	Access/attractiveness of stairs	Physical activity
3	4	Architecture/building codes	Building managers	Signs promoting stair use	Physical activity
1	1	Architecture/building codes	Architects	Parking lot placement	Physical activity
2	2	Architecture/building codes	Landscape architects	Walking paths on grounds	Physical activity
2	2	Exercise, physical activity, and sports industries	Exercise, physical activity, and sports industries	Ads appeal to limited audience (e.g., vigorous exercise)	Physical activity
2	1	Exercise, physical activity, and sports industries	Exercise, physical activity, and sports industries/ community organizations	Sponsor sports, not physical activity events	Physical activity
2	2	Exercise, physical activity, and sports industries	Exercise, physical activity, and sports industries	Limited education about adherence	Physical activity
1	3	Multiple "labor-saving device" industries	Multiple "labor-saving device" industries	Labor-saving devices at work and home	Nutrition
1	3	Multiple "labor-saving device" industries	Multiple "labor-saving device" industries	Labor-saving devices at work and home	Physical activity
1	3	Multiple "labor-saving device" industries	Multiple "labor-saving device" industries	Increasing use of computers	Physical activity
1	3	Multiple "labor-saving device" industries	Multiple "labor-saving device" industries	Multiple electronic entertainment media	Physical activity
1	2	Multiple "labor-saving device" industries	Internet industry	Ads and incentives to use the Internet	Physical activity
2	1	Exercise equipment manufacturers	Exercise equipment industries	Exercise machines	Physical activity
2	2	Multiple "labor-saving device" industries	Electronic industries	Portable audio equipment (to increase physical activity enjoyment)	Physical activity
1	3	Food industry	Food industry	Food technology that increases variety and decreases price of processed foods	Nutrition
3	2	Multiple "labor-saving device" industries	Internet industry/ health organizations	Internet for health information and guidance	Nutrition

Table 3. Hypothesized Environmental Influences on Physical Activity and Nutrition: Sorted by Distal or Indirect Leverage Points (continued)

Changeability 1 = difficult 2 = moderate 3 = easy	Impact 1 = low 2 = moderate 3 = high	Distal Leverage Point Within National/ Global Environment	Proximal Leverage Point Within Macroenvironment	Influence	Behavioral Outcome
2	2	Education system	Professional organizations/authors and industries	Professional training	Nutrition
2	2	Education system	Professional organizations/authors and industries	Professional training	Physical activity
2	2	Education system	Professional organizations/authors and industries	School system	Nutrition
2	3	Education system	Professional organizations/authors and industries	School system	Physical activity
2	1	Education system	Professional organizations/authors and industries	Health education curriculum	Nutrition
2	1	Education system	Professional organizations/authors and industries	Health education curriculum	Physical activity
1	2	Education system	Professional organizations/ and industries	Research to practice lag/gap government	Nutrition
1	2	Education system	Professional organizations/ and industries	Research to practice lag/gap government	Physical activity
2	2	Political advocacy/lobbying organizations (relevant to change strategies)	Professional organizations/ news media	Influence of public opinion	Nutrition and physical activity
2	1	Political advocacy/lobbying organizations (relevant to change strategies)	Influence of government	Numerous	Nutrition and physical activity
2	2	Political advocacy/lobbying organizations (relevant to change strategies)	Influence of regulatory bodies	Numerous	Nutrition and physical activity
2	1	Political advocacy/lobbying organizations (relevant to change strategies)	Legislation	Numerous	Nutrition and physical activity
2	1	Political advocacy/lobbying organizations (relevant to change strategies)	Health organizations	Programs and reimbursement related to preventive counseling	Nutrition and physical activity
2	1	Political advocacy/lobbying organizations (relevant to change strategies)	Scientific/professional organizations	Numerous	Nutrition and physical activity
2	2	Political advocacy/lobbying organizations (relevant to change strategies)	Unions	Numerous	Nutrition and physical activity
2	1	Political advocacy/lobbying organizations (relevant to change strategies)	Political parties	Numerous	Nutrition and physical activity

Table 3. Hypothesized Environmental Influences on Physical Activity and Nutrition: Sorted by Distal or Indirect Leverage Points (continued)

Changeability 1 = difficult 2 = moderate 3 = easy	Impact 1 = low 2 = moderate 3 = high	Distal Leverage Point Within National/ Global Environment	Proximal Leverage Point Within Macroenvironment	Influence	Behavioral Outcome
2	1	Political advocacy/lobbying organizations (relevant to change strategies)	Religious groups	Numerous	Nutrition and physical activity
2	1	Political advocacy/lobbying organizations (relevant to change strategies)	Other affinity groups (e.g., Urban League)	Numerous	Nutrition and physical activity

healthy direction will not be easy; it will require a sustained commitment from many sectors of society.

The database may be useful in conceptualizing change strategies. Frequently named agencies, institutions, and industries can be recruited into coalitions. Coalitions are needed to create the multidimensional interventions suggested by the framework. Coalitions have an added benefit of allaying the burden involved in interventions. The bringing together of health professionals, scientists from various disciplines, industry representatives, government officials, and advocacy organizations to work for the common good of improving nutrition and physical activity may be more effective than one group demanding changes from another. A challenge of forming such coalitions is that people from some sectors of society may see themselves as unrelated to the problem or the solution. Studies show aspects of community design influence walking and cycling for transportation, for example, but transportation engineers, architects, developers, and city councils do not often think their decisions about transportation and urban design affect physical activity.

A limitation of the framework and database is that they do not give specific guidance about how to form effective coalitions, how to motivate participating organizations to undertake recommended changes, how much changes will cost, how long changes will take, and how or when such changes might affect particular individuals or population subgroups. The database can help researchers and practitioners determine priorities for their own work, however, and the impact and changeability ratings are offered to help people get started in generating data. The listing of hypothesized influences is seen as a step forward because lack of a conceptual framework of environmental influences has been identified as one factor inhibiting work in this area.

At this early point in research on environmental and policy influences on physical activity and nutrition, all types of research are needed. It is particularly important to develop measures of the proposed environmental and policy variables so that research can be conducted. Observational studies that examine associations between environmental variables and behavior can test hypotheses. Qualitative studies of policy formation in relevant industries and government agencies could be useful, as could laboratory studies of proposed policy changes. Public opinion studies could assess public acceptance of various environmental and policy changes and evaluation of the costs attached to each. Case studies that evaluate ongoing environmental and policy changes would help build the database and provide an opportunity for collaboration between practitioners and researchers. As a preliminary step, it may be useful to further develop the existing database through expert opinion. Researchers and practitioners are encouraged to examine the database to

Table 4. Top Influences on Physical Activity and Eating Patterns Nominated by Working Group II

Proximal Leverage Point	Behavioral Setting	Influence
A. Influences on Physical Activity		
City government and developers	Neighborhood	Public recreation facilities
School board	School	Community use of school facilities
Employer	Workplace	Physical activity promotion policy
School board	School	After school physical activity programs
School board	School	Physical education class availability
Organizations and community	Religious, community, and nongovernment organizations	Youth sports
City government and developers	Neighborhood	"Walkable" communities
School board	School	Physical education class content and training
City government and police	Neighborhood	Crime and perceived safety
Family	Home	Sedentary stimuli for leisure
B. Influences on Nutrition		
Restaurant industry	Restaurants	Portion size
Family	Home	Purchase of snacks within household
Employer	Workplace	Cafeteria
School board	School	Food service (self-supporting)
School board	School, workplace, neighborhood, recreation centers	Vending machines
Family	Home	Purchase of meals within household
School	School	A la carte meals
School	School	Type A meals[a]
City government and food industry	Neighborhood	Fast food outlets
Food industry and supermarket	Food stores	Portion size and unit packaging
Employer	Workplace	Company eating policy

[a] A standard classification used in the USDA school lunch program.

determine how it can inform their efforts to improve the health of the population.

Conclusion

Modern society has evolved into complex environments that appear to support unhealthful patterns of eating and physical activity. These environments have developed over decades and even centuries, and we are just beginning to understand their negative effects on health. Given the large number of proposed influences, and the corresponding large number of stakeholders, it is not likely that important changes will be made quickly. It does not appear that the general public is clamoring for change in the types of environmental and policy factors discussed in this paper, and public support will be needed for extensive change. Thus, research is needed to document the extent of environmental influence and how they affect different individuals. Those findings should determine the priority placed on efforts to improve environmental supports for healthful eating and physical activity. There is also a need to tailor interventions in the face of increasing demographic diversity. In the meantime, informed hypotheses and common sense can guide practitioners to create and advocate for favorable environmental and policy changes. Consistent with ecologic models of behavior, population-wide improvements in eating and physical activity behaviors are most likely to result from interventions that change as many levels of the framework as possible, including intrapersonal, social, cultural, environmental, and policy levels.

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Appendix 1

Additional Resources

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