Work Group IV: Future Directions for Measures of the Food and Physical Activity Environments

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Abstract: Much progress has been made in the past 5 to 10 years in measuring and understanding the impact of the food and physical activity environments on behavioral outcomes. Nevertheless, this research is in its infancy. A work group was convened to identify current evidence gaps and barriers in food and physical activity environments and policy research measures, and develop recommendations to guide future directions for measurement and methodologic research efforts. A nominal group process was used to determine six priority areas for food and physical activity environments and policy measures to move the field forward by 2015, including: (1) identify relevant factors in the food and physical activity environments to measure, including those most amenable to change; (2) improve understanding of mechanisms for relationships between the environment and physical activity, diet, and obesity; (3) develop simplified measures that are sensitive to change, valid for different population groups and settings, and responsive to changing trends; (4) evaluate natural experiments to improve understanding of food and physical activity environments and their impact on behaviors and weight; (5) establish surveillance systems to predict and track change over time; and (6) develop standards for adopting effective health-promoting changes to the food and physical activity environments. The recommendations emanating from the work group highlight actions required to advance policy-relevant research related to food and physical activity environments.
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Introduction

Changes to the food and physical activity environments together with policy approaches may be the most effective strategies for creating population-wide improvements in diet and physical activity.[1] Although research on food and physical activity environments and policies is a relatively new field of study, evidence is accumulating that physical environments and policies are related to food intake, physical activity, sedentariness, and obesity. To further advance progress in environmental and policy research, several measurement and methodologic issues need to be addressed. The 2007 Measures of the Food and Built Environments workshop, sponsored by the NIH and the Robert Wood Johnson Foundation, included four work groups that deliberated on various aspects of these issues.[2] Work Group IV was asked to identify gaps and barriers in the evidence to date, and develop recommendations for future directions related to food and physical activity environments and policy measures. The discussions and recommendations of this work group, summarized here, highlight actions required to advance policy-relevant research related to food and physical activity environments.

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Process

A nominal group process[3] was used to determine the top priority areas for food and physical activity environments and policy measures. The workshop began with an individual visioning activity with participants thinking about the question: *Where do we need to be by 2015 with regard to measuring the food and physical activity environments and related policies?* Ideas were then solicited in a group format and recorded on large poster paper by the facilitator. After the ideas were consolidated, participants voted to determine the priority areas for future directions. Group participants then discussed the barriers and challenges for each priority area and developed recommendations. Overall, 24 ar-

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eas were identified, although several were overlapping. The top six priority areas were to:

1. develop and/or identify existing **standards** for adopting effective health-promoting changes to the food and physical activity environments (10 votes);
2. evaluate **natural experiments** (i.e., environmental or policy changes) to improve understanding of food and physical activity environments and their impact on behaviors and weight (9 votes);
3. improve understanding of **mechanisms** for relationships among the environment, physical activity, eating behaviors, and obesity (6 votes);
4. identify relevant **factors** in the food and physical activity environments to measure, including those most amenable to change (5 votes);
5. develop and/or identify simplified **measures** that are sensitive to change, valid for different population groups and settings, and responsive to changing trends (5 votes); and
6. establish and/or refine **surveillance** systems to predict and track change over time (5 votes).

These top six areas were then re-ordered to follow a logical sequence: factors (identified); mechanisms (understood); measures (developed); natural experiments (evaluated); surveillance (established); and standards (developed). Each was then discussed and recommendations made.

The work group identified and discussed other priority areas for future directions for food and physical activity environments and policy measures. Priority areas that ranked high but did not score in the top six areas (i.e., voted as important by three or more members on the working group) included:

- simplify and use currently available measures;
- identify all relevant factors in the environment, beyond the traditional measures of the food and physical activity environments, which would include achieving a better understanding of the cultural and social environments and how to measure these other factors well; expand capacity to do transdisciplinary research related to measures, which would include creating a positive, sustainable environment to foster this type of research;
- increase efforts to integrate physical activity, dietary, and sedentary behavior intervention research to establish more collaboration between these disciplines on measures development; and
- conduct more qualitative research among disadvantaged communities.

One common cross-cutting theme that emerged from the group discussion was the importance of emphasizing research on food and physical activity environments and policy measures among diverse groups and populations. These include racial and ethnic minority populations, different age groups, and geographic locations. Measures on the food and physical activity environments cannot entail a *one size fits all* approach.

Priorities and Recommendations

Below are the work group's priorities for where the field needs to be by 2015, and recommendations to help achieve each priority. Many of the priorities and recommendations below are interrelated and complementary.

Priority #1: Identify Relevant Factors in the Food and Physical Activity Environments to Measure, Including Those Most Amenable to Change

Environmental and policy factors play a role in determining both nutrition and physical activity behaviors. These factors operate by determining the access, availability, quality, and consumption of foods and beverages and levels of physical activity.[1,4] A better understanding of these factors and how environments can be modified and policies created are essential for reducing obesity and other diet- and activity-related chronic diseases. Yet, the empirical evidence on environmental and policy factors is relatively scant, especially for the food environment. In addition, little research has been conducted assessing which aspects of the food and physical activity environments are most influential in affecting diet and physical activity outcomes. Moreover, evidence is lacking about the most feasible and effective environmental changes and policies to implement in order to improve healthy eating and physical activity.

The study of environmental and policy influences on food and physical activity behaviors is a relatively new science, and the systematic development of conceptual models and theory is still in its infancy.[5–7] Ecologic models emphasize the multilevel linkages and relationships among these factors and are well suited to guide environmental and policy research and intervention efforts. However, Ball and colleagues[5] note the lack of strong and well-conceptualized theoretical models for testing the interactions among personal, social, and environmental factors. As discussed below, understanding the mechanisms and causal pathways by which specific environmental influences may interact with individual factors to influence health behaviors is a major limitation, as well as formidable challenge, of work in this field to date. The field is hampered by a lack of validated and reliable measures to assess relevant environmental and policy factors.[8,9] The work group discussed these barriers and challenges and made the following recommendations.

Recommendations

- Social–ecologic and multilevel approaches (e.g., social, physical, economic, and policy contexts) are well suited for understanding food and physical activity environments and developing interventions and policies. These approaches should be used in future research.
- New theories and conceptual models should be developed, and/or existing theories or models expanded or refined to help identify and assess relevant factors and their amenability to change.
- Transdisciplinary research approaches should be strengthened and expanded using a number of mechanisms, including:
  - transdisciplinary training through university or college graduate programs;
  - collaborative research teams;
  - establishing appropriate ad hoc study sections to evaluate and review transdisciplinary research; and
  - changing university reward systems (e.g., promotion/tenure codes) to favor and value transdisciplinary research.

Priority #2: Improve the Understanding of Mechanisms for Relationships Between the Environment, Physical Activity, Diet, and Obesity

Although recent studies have pointed to the role of the overall environment in influencing physical activity, diet, and obesity, our understanding of the mechanisms by which the environment affects behavior and obesity outcomes is still limited,[5,8] and work is only starting in many of these areas.[4] Building on work conducted in Priority 1 to identify the influential factors, research to understand how policy, economics, socio-cultural factors, and physical features of the environment exert their effects on health behaviors and obesity is essential for the development of future interventions that can produce effective and sustainable benefits.

A number of barriers preclude an understanding of these mechanisms. First, as noted above, theoretical development is insufficient,[5] and few insights exist into the mechanisms relevant for different behaviors (e.g., walking for transport, walking for recreation, food choices). Second, measures of both perceived and objective environments need to be further developed and better differentiated. Compared with perceived measures, objective measures of the environment are more difficult to collect and have received much less attention. Relationships between these two types of measures of the environment need to be better understood. Third, mechanistic studies are needed to determine mediating pathways linking the environment to behaviors and health outcomes, as well as to factors that moderate the impact of the environment. For example: How does the provision and use of public transportation affect the choice to walk? How does perception of crime differentially affect the willingness to walk for women versus men? Do factors work equally across various populations or contexts? Fourth, little understanding exists of the relative influence of different facets of the environment and other factors on key behavioral outcomes.

To address some of these barriers, new methodologic developments are necessary. For instance, tools are needed to capture exposures at varying geographic scales[10] and to measure their time-space interaction: How long are individuals exposed to varying "doses" of healthy and unhealthy environments at varying scales during their daily life and what is their cumulative effect. In order to do this, efficient and portable equipment such as GPS is needed, as well as new platforms to handle the increasingly complex data sets produced. Finally, innovative statistical and computational methodologies are needed to simultaneously quantify complex, multiple pathways between the environment and physical activity, diet, and obesity.

Recommendations

- Work groups should be developed to conceptualize and develop theoretical frameworks that capture environments in greater depth and that hypothesize potential pathways and mediating effects on food and physical activity environments.
- Mechanistic studies are needed that involve:
  - mixed methodology (e.g., qualitative and quantitative approaches);
  - interventions related to changes in the environment, including evaluations of natural experiments;
  - secondary analysis of existing observational and intervention data; and
  - development and application of new methodologies for the analysis and design of multilevel studies.
- Research frameworks should be developed to form effective community partnerships (e.g., academic–community) in order to help render mechanistic studies more feasible, valid, and meaningful.

Priority #3: Develop Simplified Measures That Are Sensitive to Change, Valid for Different Population Groups and Settings, and Responsive to Changing Trends

Despite a surge of interest in investigating the role of environmental and policy factors in determining diet and physical activity behaviors, instruments to measure and assess environmental factors and policy change remain underdeveloped and have not been evaluated for validity, reliability and utility in diverse population

groups and settings. Many tools are developed on an ad hoc basis and depend on the needs of specific times, populations, and places. Further, environmental exposures often are measured at different scales and are not behavior-specific.[7] These measurement issues lead to inconsistencies in the evidence base. For example, differing methods to assess exposures may lead to varying effect estimates for the same hypothesized exposures. This leads to problems of interpretation for both researchers and policymakers and inhibits the development of targeted environmental and policy interventions. Improvement in the science of exposure assessment is central to the generation of a consistent and reliable evidence base that allows a thorough understanding of how specific features of policy outputs and the environment affect specific aspects of diet and physical activity.

For developing a common set of measures and standards/protocols, it is crucial to identify the spatial unit of measurement (e.g., individual, neighborhood, school administrative area), and to determine how and what to sample (e.g., random samples of schools from the entire city and measuring the environmental conditions within the schools' administrative area, random samples of individuals, and taking measures around their homes). Due to the need for disaggregated, fine-grained measures for health behaviors and outcomes, traditional census-based or administrative-boundary–based aggregated measures may not be sufficient. Therefore, it appears necessary to determine sampling strategies and the corresponding unit of measurements, because population-level assessments may not be not feasible.

Several barriers stand in the way of improving measurement. First, consensus and knowledge are lacking about what kinds of measures of the environment and policy are required. Should they be objective, perceived, or a combination? How should they be operationalized and mapped onto existing behavioral surveillance systems? Second, little consensus exists about the scale at which environmental exposures should be measured, and whether the scale should vary for different environmental exposures, behaviors, and population groups.[7] Third, current knowledge about variations in the impact of environmental exposures within specific populations (e.g., ethnic/racial groups, children/adults/older adults) and settings (e.g., schools, homes) is limited. Fourth, as previously mentioned, new technologies such as GIS, satellite imagery, GPS, and mobile telephone technology have not yet been sufficiently harnessed to track and measure exposures through space and time. Fifth, federal and state sources of routine environmental data that could be used to construct environmental exposure measures often are unavailable, or are inconsistently collected and are of varying degrees of quality. Sixth, scientists have vested interests in the further development of their own methodologies, which can limit innovation by others. And finally, the development and validation of robust survey instruments is a time-consuming and expensive process with limited opportunities for funding.

Recommendations

- A common core of measures should be developed and disseminated. Funding for this type of research should be made available through grants or exploratory research grant mechanisms that provide enough support and resources for high quality research.
- An electronic repository of field-tested, reliable, and validated measurement tools should be developed with full supporting documentation that can be freely accessed online.
- Federal, state, and local sources of policy, environmental, and geographic data on the food and physical activity environments should be collected after a consistent protocol is developed, adopted, and made freely available.

Priority #4: Evaluate Natural Experiments to Improve the Understanding of Food and Physical Activity Environments and the Impact on Behaviors and Weight

Knowledge about the effect of environmental and policy factors on nutrition and physical activity consists largely of evidence generated from cross-sectional studies.[10,11] Researchers and policymakers alike have demanded better evidence for the existence of causal environmental agents that influence these behaviors. Evaluations of natural experiments have been proposed as a way of populating a sparse evidence base both in terms of investigating the environmental determinants of diet and physical activity behaviors and of identifying effective environmental interventions and polices. The evaluation of a natural experiment usually takes the form of an observational study in which the researcher cannot control or withhold the allocation of an intervention to particular areas or populations, but in which natural or pre-determined variation in allocation occurs.[11] When a policy or environmental intervention is implemented in practice, it provides an opportunity to evaluate a natural experiment and observe changes that occur in a population group. Such interventions might take the form of implementing policies and practices designed specifically to alter the food or physical activity environment or activities. The primary aim may not be to reduce obesity levels, but it is plausible that the reform may affect diet and physical activity behavior and therefore is important to study. Evaluations of natural experiments related to food and physical activity environments are rare.[7,12,13]

Numerous challenges exist in using natural experiments in public health research. First, evaluations of natural experiments are often poorly designed, with numerous threats to validity, including inadequate sample sizes and insufficient community controls. Second, natural experiments may be implemented with short lead times, and most research funding agencies do not have procedures in place to undertake rapid appraisals of research proposals. Similarly, the unpredictable nature of natural experiments means that, often, insufficient time is available to put well-designed evaluations in place. Third, few best-practice models of evaluation have been developed that use experimental or quasi-experimental designs. And finally, the inability to define optimal environments makes identifying appropriate natural experiments an inexact science, particularly with regard to the selection of controls. A further priority is to learn from people and places that are healthier than would be expected given existing socio-environmental conditions. Understanding this resilience might help us discover unknown protective individual and environmental factors that promote good health despite exposure to adverse environments.

Recommendations

- Funding bodies should develop rapid review mechanisms to facilitate timely funding of evaluations of natural experiments.
- Public and private sector agencies should identify, in collaboration with researchers, appropriate natural experiments for evaluation and best-practice models of evaluation.
- Procedures and processes should be developed to train a cadre of researchers in the evaluation of the impact of environmental interventions and policies on obesity-related behaviors. For example, this could occur through continuing education or professional development efforts as well as formal coursework in graduate school programs.

Priority #5: Establish Surveillance Systems to Predict and Track Change over Time

Policies, food and physical activity environments, and individual behavior patterns change over time. Research has documented important health and environmental impacts of these environments from cross-sectional studies.[14,15] However, only limited evidence has been obtained on how changes in environments over time relate to changes in health-related behaviors.[16,17] Surveillance systems can provide useful data on food and physical activity environments and also can develop mechanisms to monitor and track the data over time. Such a system could gather dynamic policy-relevant information, such as transportation investment and land-development decisions,[10] or decisions about the availability of supermarkets in low-income communities. The lack of such information stymies research and the ability to apply research to practice. Physical activity environment variables known to predict health outcomes used in research (e.g., street connectivity) can be used to prioritize transportation investments and land-use actions that promote active living and healthy eating. Neighborhood food environment variables can be used to assess the availability and quality of food in local food stores. A consistent set of policy measures of the food and physical activity environments tracked over time would provide researchers the ability to cross-validate their work and practitioners the capacity to have evidence-based strategies to retrofit and build communities to promote health.

Currently, few consistently adopted standards exist for data collection or for measuring food and physical activity environments. Similarly, few protocols have been established to monitor how environments change over time. For example, transportation networks, census, parcel land use, and food environment data are collected using different methods and uniquely coded in different places. Thus, the establishment of appropriate surveillance systems is hampered by a lack of agreement on the appropriate measures to monitor, the protocols to be employed to operationalize such measures, and the temporal and spatial scales at which phenomena should be measured. An additional constraint is limited access to required data (for example, on the physical activity environment), particularly taking into account the level of spatial resolution required to link it with setting-specific behavioral data.

Recommendations

- Strong advocates for a surveillance system to predict and track change should be cultivated at different levels—grassroots and higher—who can champion and encourage such a system.
- The research community should engage in the *Healthy People 2010*[18] process (the national health promotion and disease prevention initiative) and lobby to include healthy community indicators as part of its system of monitoring and surveillance.
- Any surveillance system should start with what we already know (proof of concept) and should be flexible enough so new information can be added. As part of the proof of concept phase, successful models used by other countries should be examined.
- States and Metropolitan Statistical Area (MSA) regions in the U.S. should be identified and supported to serve as pilot sites for developing a surveillance system.
- Performance monitoring systems should become tools to monitor compliance between proposed growth and development activities and health outcomes.
- Cross-pollination of expertise in health and planning departments should be encouraged.

Priority #6: Develop Standards for Adopting Effective Health-Promoting Changes to the Food and Physical Activity Environments

As the evidence base develops and the case for modifying environments becomes compelling, policymakers and practitioners increasingly look to the research community for guidance about what and how to implement environmental modifications. For example, to increase physical activity in the population, questions about the environment arise: *Are changes required in density, mixed use and street connectivity, and if so, by how much? Will this requirement vary for different population groups (e.g., young children, adolescents, older adults, income levels) or in different locations (e.g., near shopping centers or schools)? If so, what is required?* To facilitate successful change, standards for change will be required. A standard is *a degree or level of requirement, excellence, or attainment.*[19]

As has been highlighted in previous priorities, despite potential promise, a number of barriers have been identified that stand in the way of achieving this priority. First, the evidence upon which to base standards relevant to different behaviors, settings, and potentially, different subgroups is thin. Second, before proceeding to developing standards, measures of the food and physical activity environments must be critically reviewed to better explain whether inconsistencies in the literature to date relate to measurement error or differential impacts of the food or physical activity environment on different subgroups or cultural groups. Third, data are lacking to identify and assess environmental factors associated with specific behaviors (e.g., diet, food choices, sedentariness and physical activity) in specific settings (e.g., schools, workplaces). Fourth, lack of meaningful thresholds for environmental and policy measures is an important barrier. A better understanding is needed of environmental and policy change thresholds to be achieved in order to bring about behavioral change. Fifth, evaluation of natural experiments and baseline surveillance are required to assess how amenable to change these factors are over time, and by how much.

Recommendations

- Quality standards should be developed for the collection of geographic and environmental data and measures and survey tools.
- Funders should support a series of projects that undertake pooled analyses of existing studies with common measures or meta-analyses of published data.
- A review and evaluation of existing standards should be conducted to assess their impact on health outcomes, including any unintended consequences.
- Existing standards producing negative health or health behavior outcomes should be modified and a periodic review commissioned.

Conclusion

Much progress has been made in the past 5 to 10 years to better measure and understand the impact of the food and physical activity environments on behavioral outcomes. Nevertheless, this research is in its infancy. To help the field realize its full potential, continued investment is needed in research, scholars, and field development, with a view to developing a coherent evidence base and consensus statements about measures and standards. Given the complexity involved in measuring and understanding the impact of the food and physical activity environments on behavioral outcomes, transdisciplinary research teams working across disciplines to achieve these recommendations are needed. The priorities and recommendations developed by this work group are interrelated and complementary. If fully implemented, it is hoped that within the next few years the field will be in a position to recommend the implementation of a number of high-impact and effective policy and environmental interventions that will have a continued positive effect on future populations.

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