Obesity-Related Policy/Environmental Interventions

A Systematic Review of Economic Analyses

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Context: Policy and environmental changes to support and encourage individual-level nutrition and physical activity behavior are underway in many parts of the U.S. and around the world at national, state, and local levels. Yet, to the authors' knowledge, no summary of the cost-benefit or cost-effectiveness studies of obesity-related policy/environmental interventions exists.

Evidence acquisition: The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement guidelines were followed to identify, screen, and describe the protocols used in this systematic review. In 2014, a unique search was conducted of titles and abstracts in MEDLINE, EconLit, SCOPUS, and Web of Science databases that were published from January 2002 through January 2014 in English-language, peer-reviewed journals. The search terms described obesity, physical activity, and diet in combination with economic evaluation.

Evidence synthesis: In 2014 and 2015, the results were analyzed. A total of 27 studies met the inclusion criteria, of which 26 described separate interventions. Of the 27 included studies, eight focused on the community and built environment, seven assessed nutrition-related changes, nine reported on the school environment; and three evaluated social marketing and media interventions. The vast majority of included studies reported beneficial economic outcomes of the interventions.

Conclusions: Given the large and growing literature on the health and behavioral outcomes of policy and environmental interventions, the relatively low number of located benefit-cost and cost-effectiveness economic assessments appears to indicate a prime opportunity for the research community to address.

Context

High rates of obesity in the U.S.¹ are a grave public health concern given the association between high BMI and increased risk of numerous adverse health outcomes, such as increased risk of cardiovascular disease, Type 2 diabetes, and certain forms of cancer.^{2–6} In turn, these health outcomes can lead to significantly increased economic costs related to health care, reduced productivity, and increased disability rates.^{7–9}

Policy and environmental changes to support and encourage individual-level nutrition and physical activity behavior are underway in many parts of the U.S. and around the world at national, state, and local levels, including: changes to food environments; transportation systems, urban planning, and parks and recreation; information environments; youth settings, such as childcare and schools; and healthcare and clinical settings. Examples of those policy and environmental changes include increasing access to healthy food in underserved areas, supporting complete streets initiatives and mixed use zoning, menu labeling and media campaigns, and changing school food and physical education requirements.^{10–16}

Cost-benefit and cost-effectiveness assessments of obesity-related policy/environmental interventions can play a critical role by helping policymakers assess options to support and improve nutrition and physical activity behavior, particularly in resource-constrained environments. At the federal level, cost-benefit and cost-effectiveness analyses are the primary tools used to justify changes in existing policies and creation of new regulations by showing whether benefits from a proposed action outweigh the costs and whether the proposed action is the most efficient option.¹⁷ Federal agencies are also encouraged to make use of evidence-based

strategies and cost-effectiveness data to improve resource allocation. Findings from such evaluations have informed the development of policy and other interventions to reduce tobacco and alcohol use and to enhance road safety.^{18–20} Many studies and reviews have been published on the direct (e.g., health care) and indirect (e.g., absenteeism) costs of obesity.^{7–9,21–24} There is also a large literature on health and behavioral outcomes associated with policy and environmental interventions,^{11–13} and one review assessed cost of illness and cost effectiveness of childhood obesity interventions,²⁵ but to the authors’ knowledge no summary of the cost-benefit or cost-effectiveness studies of obesity-related policy/environmental interventions for youth and the general population exists. The present study seeks to fill that gap.

Economic evaluations have been particularly informative for the development and implementation of policy and environmental interventions to reduce tobacco use. Based on the experiences with comprehensive state tobacco programs which have been demonstrated to be highly cost effective,²⁶ CDC has developed and refined recommendations for “best practices” for these programs.²⁷

A note on terminology: Cost-benefit (also referred to as benefit-cost) analysis is an attempt to identify the societal costs and benefits over time that are associated with a course of action, assign monetary values to those costs and benefits, and determine the net costs/benefits in monetary terms in today’s dollars, that is, the net present value.²⁸ By contrast, cost-effectiveness analysis (also sometimes called cost-utility analysis) assesses relative costs and effects of two or more different options, and often expresses those outcomes in terms of quality- or disability-adjusted life-years (QALYs or DALYs) or healthy years equivalents (HYEs) in an attempt to

account for gains in quality of life.²⁸ In recent years, the quality-adjusted life-year has become the preferred measure given that it reflects the benefits of both reductions in morbidity and mortality in a way that is more consistent with economic theory. In addition, the incremental cost-effectiveness ratio (ICER) expressed as incremental time discounted dollar costs per discounted quality-adjusted life-year gained, is used for comparisons of alternative policies, and compared against standard benchmarks to determine if the policy is cost effective.

Applying cost-benefit and cost-effectiveness methodology to the assessment of obesity-related policy and environmental interventions can be challenging, primarily because of the time horizon over which the costs and benefits of a policy or environmental change accrue. An intervention may result in direct effects (such as behavior modification), which in turn may have effects over a longer time horizon (such as reduced risk for chronic disease). There is a long and complex pathway from diet and activity changes to improvements in life expectancy and quality. Often only the direct effects and some subset of indirect effects (e.g., BMI changes) are observed over the duration of the typical study from which parameters for economic assessments are extracted. Some parameters are estimated from carefully designed studies, others are derived from the published literature (frequently using best available, but imperfect measures), and some parameter values are chosen by assumption. Nevertheless, results from these economic assessment studies may provide helpful input to decision makers.

Evidence Acquisition

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement guidelines were followed to identify, screen, and describe the protocols used in this systematic

review.²⁹ A unique search of titles and abstracts in MEDLINE, EconLit, SCOPUS, and Web of Science databases that were published from January 2002 through January 2014 was conducted. Additional studies as references in related reviews were also included. The search was limited to English-language articles that were published in peer-reviewed journals. The search terms, which describe obesity, physical activity, and diet in combination with economic evaluation, were cross-searched using the following algorithm: (*obes**, *weight*, *BMI*, *bariatric*, *physical activity*, *exercise*, *diet*, *nutrition*, *food*) AND (*cost analysis*, *cost effective**, *cost utility*, *cost benefit*, *economic analys*s*, *economic evaluation*).

After duplicates were removed, the titles and abstracts of the search results were screened by two authors (SS and RM) to determine their eligibility (Figure 1). Studies were eligible for inclusion in this review if they reported results from a cost-benefit or cost-effectiveness assessment of a policy or environmental intervention related to diet, physical activity, or obesity that was implemented or implementable by policymakers, and that was also a major component of the published article. All studies selected for inclusion, and a randomly selected subset of excluded studies was reviewed by all co-authors. All studies that met the inclusion criteria, regardless of the sample size, were included.

Excluded were studies that focused on: diet or physical activity outside the context of energy balance/obesity; chronic diseases or conditions related to energy balance/obesity, such as Type 2 diabetes; cost estimation (e.g., costs of health care related to obesity); surgical or pharmacologic therapies; commentaries, reviews, or editorials; and articles that reported only pilot data or descriptions of the design of a study. Finally, articles assessing economic evaluations of an

intervention that was not a policy or environmental change—for example, individual or group weight loss counseling interventions—were also excluded.

Relevant study characteristics were abstracted for 270 studies, including study design, intervention design, setting and population, and economic analysis methods, each of which was independently reviewed and verified by at least two authors. To ensure consistency, the abstraction process was conducted through an electronic form with definitions for each variable. Summary statistics and tables were prepared from the resulting data. The 270 abstracted studies were then assessed for eligibility.

Evidence Synthesis

As shown in Appendix Table 1, a total of 27 studies^{30–56} met the inclusion criteria, of which 26 described separate interventions; two articles^{53,54} presented results on the same intervention. Of the 27 included studies, eight studies^{34,37–39,43,51,53,54} focused on the community and built environment; seven studies^{30,31,33,36,48–50} assessed on nutrition-related policy/education changes, of which five studies^{31,33,36,48,50} analyzed state implementations of the U.S. Expanded Food and Nutrition Education Program (EFNEP); nine studies^{32,41,42,44–46,52,55,56} focused on school environments; and three studies^{35,40,47} evaluated social marketing and media interventions.

Most (15 of 27) studies^{32,34,35,37–39,41–43,46,51,53–56} analyzed policy or environmental changes at the local level, six studies^{31,33,36,47,48,50} at the state level, and seven studies^{30,40,44–46,49,52} at the national level. Note that the number of studies does not sum to 27 as one study analyzed an intervention at more than one level of government.⁴⁶

Twelve studies^{34,35,37–39,43–45,47,51,53,54} analyzed interventions intended to improve physical activity behavior, nine studies^{30,31,33,36,40,48–50,52} focused on improving diet, and six studies^{32,41,42,46,55,56} assessed interventions addressing both diet and activity. Additionally, 11 studies^{32,40–42,44–47,52,55,56} focused on policy and environmental interventions targeting youth; the rest of the studies focused on the general population or adults.

With regard to reported results and economic assessment methods used, all but two studies^{44,45} found that the interventions they assessed were economically beneficial. Fourteen of the studies^{30,34,35,40–42,44–47,49,52,53,55} assessed an intervention's cost effectiveness, nine studies^{31,33,38,39,43,48,50,51,54} conducted cost-benefit analysis, and four studies^{32,36,37,56} assessed both the cost effectiveness and the cost benefit of an intervention.

Included studies varied considerably by the design of the policy or environmental intervention being assessed for economic effects. Most (14 of 27) papers^{31,33–37,41,43,46,48,50,52,53,54} were economic assessments of policy or environmental changes using quasi-experimental designs usually natural experiments, that is, policy or environmental changes outside the direct control of researchers. Nine studies^{30,38,39,40,44,45,47,49,51} used secondary data analysis to determine their economic assessments. Four studies^{32,42,55,56} assessed economic results of RCTs, and two studies^{40,49} assessed effects of hypothetical policy interventions. Nine studies^{30,35,37,40,44–46,51,49} used simulation modeling techniques in their economic assessments.

Discussion

Perhaps the most striking finding from the review presented here is the relative paucity of studies located conducting cost-benefit or cost-effectiveness assessments of obesity-related policy and environmental interventions in the published literature. Given the large and growing literature on the health and behavioral outcomes of those interventions, the relative lack of associated economic assessments is surprising and represents a prime opportunity for researchers to address.

Another key finding from this present analysis is that the vast majority of included studies reported beneficial economic outcomes, which may be helpful information for policymakers considering similar interventions. Of course, this finding may also be a product of publication bias. Nevertheless, some studies were published that did not find beneficial effects.

The methodologic designs of the interventions described in studies included in the present review also varied considerably, using RCTs, quasi-experimental designs, primary and secondary data analysis, and simulations, demonstrating the innovation by researchers from a variety of fields to assess the interventions. The variety of methods is not surprising given that policy and environmental changes that may improve population diet or physical activity are rarely under the direct control of researchers.

The papers included in this review take two primary approaches to the assessment of interventions:

1. making the best possible assumptions about the parameters then proceeding with the economic analysis; and

2. taking a narrower view by considering a more restricted time horizon, over which uncertainty is reduced.

Given the uncertainty regarding some key parameters, and the trade-off between exhaustiveness and precision in measurement, it is hard to recommend one approach over the other. Both types of studies are desirable as they add to the body of knowledge about the effectiveness of obesity-related policy in different and complementary ways. A key gap for future studies to address would be the long-run effects of interventions on health. Even medium-term studies on the extent to which any intervention changes persist would provide valuable insights for future economic analyses.

At least in the U.S., challenges often exist to increased collaboration between public health researchers and economists, in spite of the many potential benefits to research and practice. For instance, unlike public health researchers, many or most economists in traditional schools of economics are funded by “hard money,” that is, these positions are salaried and do not require grant or outside funding, and multiple authorship of papers is often frowned upon in traditional economic circles. Additionally, economists often communicate in a language that is difficult, at best, for non-economists to understand. Another difference may be that public health researchers tend to design studies to assess health outcomes whereas economists are more likely to design studies that assess economic efficiency.

Increasing collaboration between public health researchers and economists would likely benefit the research community broadly and yield valuable information for decision makers at federal,

state, and local levels. Some suggestions for public health researchers to increase collaboration with economists include:

1. approaching economics colleagues in their initial stages of research study planning and development, rather than (sometimes much) later in the process when critical economic data may be hard or impossible to collect;
2. highlighting the potential for broad impact of study findings with their economics colleagues;
3. approaching health economists in schools of public health as potential collaborators; and
4. offering economic training in schools of public health, in order to better understand the language and foundational concepts of their economics colleagues.

Limitations

This review is limited in several ways. First, the search criteria used in the present review may not have located all of the relevant studies. Second, the located studies may be the result of publication bias against null findings. Third, because the rise in childhood obesity is relatively recent, only now is its impact on morbidity and mortality in later life beginning to be seen. As such, it is difficult to know precisely the costs and benefits associated with interventions to address childhood obesity.

Conclusions

Despite these limitations, the review presented here appears to fill an important gap in the literature. For many policymakers and decision makers, economic assessments of the

interventions under consideration to improve nutrition, physical activity, and obesity may be informative when considering options to pursue.

In addition to public health practitioners, there appears to be a growing interest among many non-traditional public health partners in incorporating health-related concerns into future plans. Cost-benefit and cost-effectiveness assessments of both health and related outcomes would be helpful additional considerations for these audiences, and help guide future interventions to improve the health and well-being of all Americans.

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List of Figures

Figure 1. Flowchart of search, screening and selection process.