Accelerating Evidence Reviews and Broadening Evidence Standards to Identify Effective, Promising, and Emerging Policy and Environmental Strategies for Prevention of Childhood Obesity

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Abstract

The childhood obesity epidemic has stimulated the emergence of many policy and environmental strategies to increase healthy eating and active living, with relatively few research recommendations identifying the most effective and generalizable strategies. Yet, local, state, and national decision makers have an urgent need to take action, particularly with respect to lower-income and racial and ethnic populations at greatest risk. With the surge of promising and emerging policy and environmental strategies, this review provides a framework, criteria, and process modeled from existing expert classification systems to assess the strength of evidence for these strategies. Likewise, this review highlights evidence gaps and ways to increase the types and amount of evidence available to inform policy and environmental strategies. These priorities include documenting independent and interdependent effects, determining applicability to different populations and settings, assessing implementation fidelity and feasibility, identifying cumulative benefits and costs, ascertaining impacts on health equity, and tracking sustainability.

INTRODUCTION

The scope of the childhood obesity epidemic in the United States and its serious health and economic consequences have added urgency to the need for intervention strategies with the greatest potential to close the daily energy gap (i.e., surplus of energy intake over energy expenditure above the level required for healthy growth and development) responsible for the nation's rising childhood obesity levels (31, 32, 34). Meeting this need requires identifying and spreading the most effective, feasible, and sustainable intervention strategies; evaluating promising strategies; and locating emerging strategies, particularly among lower-income and racial and ethnic populations, where obesity rates are highest and rising fastest (32, 34, 41). In consideration of previous public health successes (e.g., tobacco use, risky drinking), policy and environmental interventions are essential for changing behaviors and social norms at the population level (31, 62).

Yet, decision makers (e.g., policy makers, practitioners, community leaders) at the local, state, and national levels have limited access to information about policy and environmental drivers of childhood obesity and its reversal (31, 40). The Institute of Medicine (IOM) identifies the need for better guidance to support well-reasoned actions to create child-friendly, health-promoting communities; this guidance is dependent on a meaningful evidence base (34). At one end of the evidence spectrum, rigorous scientific research and systematic review systems [e.g., the Guide to Community Preventive Services (the Community Guide), Cochrane Reviews] (4, 29) have generated a small number of evidence-based recommendations for policy and environmental approaches to increase physical activity in communities (28, 36), with insufficient evidence for physical activity or nutrition strategies in schools (11). At the other end of the spectrum are a growing number of interventions that have not yet been systematically evaluated or reviewed for their actual or potential efficacy. Across the spectrum, limited evidence is reported for several key decision-making factors, such as population demand for or exposure to policy or environmental changes; policy adoption, implementation, or enforcement; and feasibility for scale-up and spread of intervention strategies across populations and settings (5, 9, 27, 39, 52).

Many interventions are already under way, driven by local cross-sector collaborations or supported by national community demonstration projects [e.g., Centers for Disease Control and Prevention's (CDC) Communities Putting Prevention to Work, Robert Wood Johnson Foundation's (RWJF) Healthy Kids, Healthy Communities program, Y-USA's Healthier Communities Initiatives] (12, 59, 71), typically receiving funding from an array of public and private sources. As indicated by the IOM, the growing imbalance between the availability of a small number of research-tested interventions and a much larger number of promising, but relatively untested practice-based interventions draws attention to the need to help decision makers understand, judge, and use the best available evidence and the best possible evidence (31–34).

This article describes a novel, ongoing review system developed to meet this need by identifying policy and environmental strategies ready for systematic evidence reviews and/or application, as well as emerging and promising strategies worthy of further investigation. The system is designed to assess evidence and identify gaps quickly and to stimulate new thinking about the evaluation, research, and systematic reviews needed to identify what works and what might work in the arena of policy and environmental strategies to prevent childhood obesity. Capitalizing on an efficient review process, it encourages movement from opportunistic evaluations of on-the-ground innovations to rigorous, controlled efficacy and effectiveness studies. Likewise, it serves to identify the evidence necessary to inform policy and practice meaningfully and to clarify the major evidence gaps and evaluation shortcomings (e.g., design, outcome measurement) as well as strategies to address these gaps.

Childhood obesity: a BMI at or above the 95th percentile for children of the same age and sex

Intervention: one or more prevention strategies designed and organized to improve health and behavioral outcomes among individuals or populations

Energy gap: surplus of energy intake over energy expenditure above levels required for healthy growth and development

Policy intervention: a new or altered course of action influencing or determining decisions, laws, rules, or regulations governing health or related health behaviors

Environmental intervention: a new or altered physical, social, economic, or communication environment influencing health or related health behaviors

Evidence: the available body of facts or information indicating whether a belief or proposition is true or valid

The review system was designed to include policy and environmental strategies affecting diet and/or activity levels, energy balance, and weight status, especially overweight and obesity, among youth aged 3 through 18 years, with a special focus on children in lower-income and racial or ethnic populations at greatest risk for childhood obesity (e.g., African American, Latino, American Indian). It classifies policy and environmental strategies implemented at multiple levels (national, state, community, organizational) to improve children's food- and physical activity–related environments ranging, for example, from national policies affecting food pricing, to community policies affecting youth access to healthy foods and safe places to walk, bike, and play (e.g., streetscapes, parks, playgrounds), and to school and preschool food, beverage, and physical-activity policies and environments.

Two primary aims guided development of this review system. The first was to accelerate the discovery and application of replicable, evidence-based policy and environmental strategies for childhood obesity prevention. The second was to assess a full continuum of evidence for policy and environmental strategies, using a wide range of quality indicators (e.g., study design, evaluation methods, intervention effects on behavior and health outcomes, intervention reach, adoption, implementation). In turn, the system was also intended to stimulate further research and evaluation to strengthen the evidence for emerging, promising, and effective policy and environmental strategies, including the identification of quality indicators to judge internal and external validity and to guide decision making and implementation.

To support these goals, the review team developed a practical framework, criteria, and processes to classify intervention strategies and their associated quality and extent of evidence. The review system addressed these goals in four ways: first, by collecting and assessing the strength and quality of evidence currently reported for a wide range of policy and environmental strategies at the same time; second, by identifying strategies with sufficient evidence to merit systematic review by leading national and international evidence-review panels, such as the CDC Task Force on Community Preventive Services; third, by proposing the development and adoption of broader evidence review standards for use by policy and decision makers; and fourth, by summarizing key evidence gaps and methodological shortcomings to be addressed in future evaluation, dissemination, and diffusion efforts.

Several methods and tools were created to support the review system, including (*a*) an overarching conceptual framework, (*b*) a four-level evidence typology, (*c*) a novel evidence review cycle broader than typical search and review methods, (*d*) a detailed inventory and abstraction process guided by multiple quality indicators and review criteria, and (*e*) standardized methods for accelerating evidence review and analysis using intervention strategy summaries. Each of these five components is described in the subsequent sections.

Sedentary behavior: low-intensity behaviors associated with an increased reliance on technology and labor-saving devices

REVIEW SYSTEM DEVELOPMENT AND IMPLEMENTATION

Conceptual Framework: Identifying the Universe of Potential Intervention Strategies

The review system was guided by an overarching conceptual framework that outlines how policies and environments can act alone and in concert to influence physical activity, sedentary behavior, and diet; childhood overweight and obesity; energy balance; and quality of life for children, adolescents, and their families and communities (see **Figure 1**) (7). The framework depicts a range of policy and environmental interventions with potential to modify social norms and attitudes, behaviors, and health across multiple socioecological levels (i.e., national, state, local, organizational, and household) (3, 19, 46).

Specific policy and environmental strategies were classified to further structure and organize the search and inventory processes.

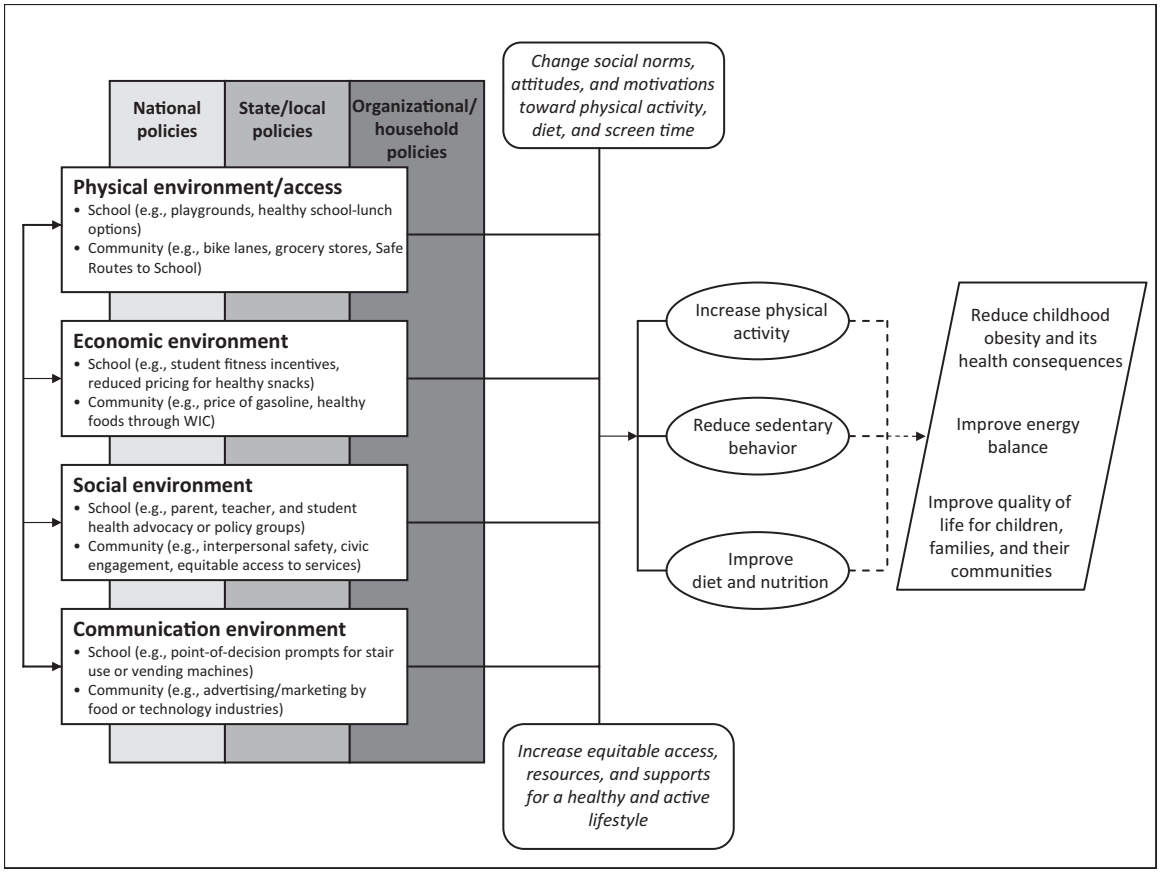

Figure 1

Conceptual framework to identify policy and environmental strategies.

For instance, changes to the physical environment included enhanced access to new or improved facilities (e.g., food vendors, sidewalks, school playgrounds), amenities (e.g., benches, streetlights, kitchen equipment), and cultural or artistic enhancements (e.g., statues, fountains, murals). Changes to the social, economic, and communication environments included increasing equitable access to resources and services (e.g., electronic benefit transfer payment systems at farmers' markets, free access to recreation facilities); strategic, positive media, and events (e.g., campaigns, signage, festivals); and incorporation of existing or new social networks (e.g., neighborhood watch groups, parents or community volunteers supporting Walking School Buses). Policy changes included laws, regulations, ordinances, organizational policies, resolutions, formal and informal rules, institutional practices or guidelines, advocacy and agenda-setting, policy development, funding and resource allocation, policy enforcement, or policy implementation. Policy changes designed to increase benefits to underserved and marginalized populations by requiring a commitment to equitable implementation and enforcement of a policy or altering existing policies to eliminate disparities were also included. These policy and environmental strategies are consistent with the concepts and language used by other review groups (14, 32, 55, 60).

Interventions focused solely on programmatic or promotional strategies without policy or environmental change components were not

included in the taxonomy or in the evidence review. The focus on policy and environment strategies was designed to address the signficant evidence gap related to organization-, community-, and system-level interventions for childhood obesity prevention, to minimize duplication of existing reviews of individual- and interpersonal-level interventions, and to identify evidence standards appropriate to understanding the impact and effectiveness of these strategies.

Evidence Typology: Broadening Evidence Standards for Policy and Environmental Strategies

To reflect the full continuum of evidence for varied policy and environmental strategies for childhood obesity prevention, four levels of evidence (i.e., "effective", first and second tier; "promising"; and "emerging") were identified to assess intervention design, implementation, and applicability (reach, adoption, fidelity, sustainability) and evaluation design, methods, and findings (internal and external validity). The initial iterations of the evidence typology were informed by evidence rating systems employed by other national and international models, including the Agency for Healthcare Research and Quality, the Community Guide, the National Institute for Health and Clinical Excellence, the National Institutes of Health (NIH)'s Research Tested Intervention Programs, the International Obesity Task Force, the White House Office of Management and Budget, and the RE-AIM framework (Reach, Effectiveness, Adoption, Implementation, and Maintenance) (4, 25, 49, 69, 65). An early, simplified version of the evidence typology was presented in a previous *Annual Review of Public Health* article (6).

These authoritative review systems excel at applying established research criteria (e.g., quality of study design and execution) to evaluate intervention efficacy and effectiveness (4). Yet, current evidence review systems often face limitations in using these criteria to evaluate the quality of evidence for population-level policy and environmental interventions because they are typically tested using quasi-experimental, time-series, or observational designs, rather than the randomized, controlled trials commonly used to evaluate individual-level interventions (4, 9, 34).

Other challenges faced by current, systematic reviews include the length of time required to identify, review, and evaluate the quality of evidence for a health topic and its associated intervention strategies (often 1–2 years); use of academic expert review panel qualifications that have the effect of limiting or precluding policy, practice, and community representatives; lack of a common organizing theory; and a resulting overemphasis on evidence related to internal validity—evaluation design, methods, and efficacy—as compared with external validity—intervention design, implementation, and applicability (e.g., 1, 24, 34, 52). Although a few attempts have been made to conduct rapid systematic reviews (10, 23, 68), to date, most articles have highlighted the complexity of the area of endeavor, rather than the methods needed to conduct expedited reviews (68). These challenges frequently result in the delayed identification and implementation of promising interventions, and to the exclusion of information essential to intervention uptake, replication, and spread (26).

Some recent efforts have suggested several criteria for assessing the internal validity of policy and environmental strategies. For instance, comparative effectiveness may be evaluated according to the median effect size on primary outcomes, adverse impacts on quality of life or other outcomes, and differential impact across population subgroups (27, 35); population impact may correspond to the likely efficacy of an intervention (65); and methodological rigor may be judged through sources of bias and transferability to different interventions and contexts (22). Some of these investigators also recommended cost-effectiveness criteria in addition to other outcome efficacy criteria [e.g., change in body mass index (BMI)] (39).

Likewise, supplemental criteria for evidence reviews of policy and environmental strategies have been proposed. For example, reach may

Center TRT: Center of Excellence for Training and Research Translation

refer to the range and breadth of participants, representativeness of participants, participation rates, adoption of policies by different communities, representativeness of those affected by the policy, or the proportion of relevant settings in which the policy or program is instituted (27, 35, 39, 47, 65). Adoption may include uptake by individuals in the relevant settings or representativeness of governing bodies that pass a policy (35, 65). Implementation may be characterized in a number of ways, such as program logic, theory, consistency with related public health approaches, uptake, utility, feasibility, accuracy, training, adaptation, or adequacy of policy enforcement (22, 35, 39, 47). Maintenanceor sustainability may be described as institutionalization or modification of policies or target populations reached over time (35, 39). In addition, population health and immigrant population health may refer to the use of multidimensional approaches or upstream strategies, recruitment of specific populations, or attention to food/activity customs (22).

Another method to expand the evidence review process is exploratory evaluation (i.e., evaluability assessment), involving preevaluation activities for emerging policy and environmental strategies conducted to maximize the chances that subsequent evaluation efforts produce useful information (70). As recently summarized by Trevisan (67) and Leviton and colleagues (42), exploratory evaluation is designed to remedy several common problems in assembling evidence from program and policy evaluations, including perceived usefulness of evaluation by policy makers, disagreements among stakeholders about an intervention's readiness for evaluation, the underlying logic for an intervention being unclear or unrealistic (e.g., how particular strategies will achieve desired results), evaluation costs being prohibitive, and an unwillingness among relevant decision makers to make changes on the basis of evaluation findings.

Based on these advances in the field, subsequent iterations of the evidence typology included a wider array of criteria, as shown in **Table 1**. The resulting inclusion criteria represented at each level of evidence most closely align with approaches and products from four national and international review systems: the Community Guide (72), Project GUIA (Guide for Useful Interventions for Activity) (30), the Center TRT (Center of Excellence for Training and Research Translation) (16), and the CDC-RWJF Early Assessment Initiative (20). These systems reflect greater specificity in the criteria for abstracting evidence than do the other systems. The cross-cutting evidence standards in **Table 1** may help mitigate reliance on variable subjective expert judgments about the quality or strength of evidence for intervention efficacy and effectiveness. In turn, the less subjective nature of these criteria and evidence standards may help to alleviate challenges in comparing effects of different interventions and translating and disseminating review results.

Spanning multiple levels and types of evidence, this typology encompasses interventions identified by authoritative, state-of-the-art evidence reviews (i.e., systematic reviews, syntheses, meta-analyses) and scientific research and evaluation publications and reports as well as minimally tested and/or practice-tested innovations in the field. The four levels of evidence are described below and in **Table 1** using a simplified profile for each level of evidence. This profile reflects the indicators and inclusion criteria used to classify levels of evidence (including information to be abstracted from intervention and evaluation evidence resources, and explicit classification decision rules). The indicators and criteria and application of the decision rules were reviewed by the expert advisory groups to help develop and refine this rating system. The levels of evidence are as follows:

1. Effective (first-tier) strategies include those identified in published systematic reviews, syntheses, or meta-analyses as producing significant, positive health or behavioral outcomes, and intermediate policy, environmental, or economic impacts on the basis of a structured review of published high-quality, peer-reviewed studies and evaluation reports (28, 36);

2. Effective (second-tier) strategies include those demonstrated in published high-quality, peer-reviewed studies and evaluation reports to produce significant positive health or behavioral outcomes, and policy, environment, or economic impacts;
3. Promising strategies include those based on evidence from published or unpublished evaluation studies or exploratory evaluations showing meaningful, plausible positive health or behavioral outcomes, and policy, environment, or economic impacts; and
4. Emerging strategies include newly implemented, untested innovations, with some face validity, suggesting that strategies may be strong candidates for exploratory evaluation.

These criteria were developed and refined for more than two years through ongoing literature reviews, guidance from expert advisors, and tests for applicability of the criteria to the evidence resources (available on request from the authors). Evidence resources include formal publications and reports as well as other informal information sources describing the intervention and/or its evaluation. As illustrated in **Table 1**, each of the inclusion criteria is shown as "required" (i.e., information must be reported and assessed for the intervention to be included in the corresponding level of evidence), "desired" (i.e., information reported is assessed for the intervention to be included in the corresponding level of evidence, yet information not reported does not preclude inclusion of the intervention), or "possible" (i.e., information reported is assessed to accumulate evidence, yet the information is not used to determine inclusion or exclusion of the intervention).

Review Cycle: Moving from Evidence Discovery to Dissemination

The multilevel, multicomponent approach to this systematic review process was designed to assess policy and environmental strategies to prevent childhood obesity and to promote healthy eating and active living among youth aged 3–18 years, especially those in lower-income and racial and ethnic populations at highest risk for childhood obesity. At one end of the continuum, the review process intended to capture relatively new, untested strategies arising in the field (emerging or promising strategies) and, at the other end, strategies with high-quality evaluation and a track record of demonstrated efficacy and effectiveness (effective, first- and second-tier strategies). As such, the review cycle outlined in **Figure 2** illustrates a trajectory from discovery of policy and environmental strategies to prioritization and application of effective strategies in the field. The pathway through this review cycle informed the systematic process of tracking the accumulating evidence for policy and environmental strategies and determining next steps for testing, validating, or applying them.

Moreover, the review cycle illustrates the step-by-step inventory, abstraction, and analysis processes (input) and summary implications (output) for ongoing research and evaluation efforts, as well as the application of intervention strategies in the field. Working from the bottom up, emerging intervention strategies are those suitable for pilot testing or exploratory evaluation (42). For example, emerging intervention strategies included policy changes such as taxes on sugar-sweetened beverages or joint-use agreements to make school playgrounds available for community use after school hours (18, 50, 51). Although these innovations have not been systematically evaluated for their impact on diet, physical activity, or obesity outcomes, their potential population impact and relative low cost have indicated their suitability for immediate pilot testing and exploratory evaluation.

Promising intervention strategies are those recommended for more extensive evaluation or feasibility studies. The second-tier effective intervention strategies are those judged ready for evaluation in large, diverse populations and settings or for systematic review. At the top of the continuum, the first-tier effective intervention

Healthy eating (behavior): dietary behaviors following the types and amounts of foods, nutrients, and calories recommended in the Dietary Guidelines for Americans

Active living (behavior): physical-activity behaviors meeting recommended levels of moderate and vigorous activity accumulated throughout the day

Table 1 Evidence typology for classification of policy and environmental intervention strategies[a]

Indicators	Inclusion criteria	Effective		Promising	Emerging
		First-tier authoritative, rigorous systematic review (2+ studies)	Second-tier high-quality study with peer review (1+ studies)	Published or unpublished evaluation study or report	Practice summary, analogy to related health topic, or untested innovation
Evaluation or research design	Experimental, quasi-experimental, prospective cross-sectional studies and natural experiments	Required	Required	Possible	Possible
	Design using quantitative or qualitative data	Required	Required	Required	Possible
Quality of execution and internal validity (sampling, power, IVs, DVs, effects, subgroup differences, attrition)	Samples include children, families, or communities	Required	Required	Required	Possible
	Samples include racial/ethnic or lower-income populations	Desired	Desired	Desired	Possible
	Summative evidence for obesity/physical activity/nutrition/screen time	Required	Required	Possible	Possible
	Summative evidence for environmental or policy changes or impacts	Required	Required	Required	Possible
	Summative evidence for cost-effectiveness	Desired	Desired	Desired	Possible
	Internal validity	Required	Required	Desired	Possible
Reach (external validity, scalability, exposure, or participation)	Intervention application to/responses from children, families, or communities	Required	Required	Required	Required
	Intervention application to/responses from racial/ethnic or lower-income populations	Required	Required	Required	Required
	Duration of intervention exposure or participation	Desired	Desired	Desired	Possible
	Capacity to impact large populations	Desired	Desired	Desired	Possible
	Impact on racial/ethnic or lower-income populations	Desired	Desired	Desired	Possible
	No harm to populations or subpopulations	Required	Required	Required	Required
Adoption (resources, support, opposition)	Intervention complexity, intensity, duration	Desired	Desired	Desired	Possible
	Intervention costs, personnel, leadership, training	Desired	Desired	Desired	Possible
	Policy/practice relevance, timeliness, compatibility	Desired	Desired	Desired	Possible
	Political, social, and economic climate	Desired	Desired	Desired	Possible

Implementation (formative and process evaluation)	Intervention description (goals, protocols, tools)	Required	Required	Required	Required	Required
	Use of logic model/ theory/constructs	Desired	Desired	Desired	Desired	Possible
	Community inclusion (assessment, planning, implementation, evaluation)	Desired	Desired	Desired	Desired	Possible
	Implementation fidelity/quality assurance	Desired	Desired	Desired	Desired	Possible
	Replication, adaptation, customization	Desired	Desired	Desired	Desired	Possible
Sustainability	New funding/support/resources leveraged	Desired	Desired	Desired	Desired	Possible
	Plans (community, leadership transition, training)	Desired	Desired	Desired	Desired	Possible
	Dedicated enforcement/maintenance authority (agency, committee)	Desired	Desired	Desired	Desired	Possible

[a]Abbreviations: DV, dependent variable; IV, independent variable.

strategies are those showing sufficient evidence of internal and external validity and are, therefore, deemed ready for widespread dissemination and adoption. The review cycle has been a useful tool for illustrating how the evidence typology can inform priorities for further evaluation, systematic review, or implementation of a range of policy and environmental strategies for childhood obesity prevention.

Search and Abstraction: Methods to Collect and Synthesize Evidence

With more than 2,000 evidence resources collected from February 2009 to April 2010, the review team has abstracted 588 articles related to 104 nutrition-related interventions, 270 physical activity–related interventions (including screen time), and 24 interventions addressing both nutrition and physical activity. For several of these interventions, multiple evidence resources were abstracted (e.g., outcomes evaluation, process evaluation). Reviewed nutrition-related interventions reflected 13 discrete healthy-eating policy and environmental strategies from a total of 155 strategies (e.g., child care food and beverage policies—a discrete strategy—may include a number of more specific strategies related to nutrition standards for meals, snacks, or beverages). Similarly, reviewed physical activity–related interventions included 12 discrete active-living policy and environmental strategies from a total of 410 strategies. Yet, school wellness policies count for healthy-eating and active-living strategies, leaving a total of 24 childhood obesity–related policy and environmental strategies (see **Table 2** for a list of the nutrition and physical-activity strategies and **Figure 3** for a flow diagram illustrating the progression through search and abstraction).

The evidence resources reviewed and abstracted were limited to those published between January 2000 and May 2009 in the English language or translated to the English language. Sources used to identify these evidence resources included systematic reviews (e.g., the Community Guide, Cochrane

Table 2 Policy and environmental interventions to reduce childhood obesity[a]

Intervention strategy description	Number of intervention strategies[c]
Menu labeling: Nutrition information provided at the point of purchase for foods/beverages obtained in food retail settings (e.g., fast food/other restaurants, school cafeterias, street kiosks)	8
School food and beverage policies: Nutrition standards to limit access to unhealthy foods/beverages or increase access to healthy foods/beverages (e.g., meals, snacks, vending)	35
Provision of free or subscription fruits and vegetables at school: Distribution of fruits and vegetables to students for free or for a small paid subscription (e.g., lunch, breaks, class)	11
Provision of free drinking water at school: Increased access to fresh, potable water in schools to reduce students' sugar-sweetened beverage consumption	3
Child care food/beverage policies: Nutrition standards to limit access to unhealthy foods/beverages or increase access to healthier choices in preschool, day care, and after-school care	7
Food pricing (schools and community): Changing food prices to increase sale and consumption of healthy foods/beverages and to reduce sale and consumption of unhealthy choices	14
Neighborhood availability of restaurants: New/redeveloped restaurants to increase access, sale, and consumption of healthy foods/beverages and reduce unhealthy choices	9
Neighborhood availability of food stores: New/redeveloped food stores to increase access, sale, and consumption of healthy foods/beverages and reduce unhealthy choices	13
Neighborhood availability of food stores + restaurants: New/redeveloped restaurants and food stores (see previous)	7
School and community gardens/greenhouses: Increased access to gardens/greenhouses and promotion of fruit and vegetable consumption through gardening activities	9
Point-of-purchase prompts for healthy eating: Cues for healthy eating through product and shelf labeling, prompts, and/or other signage to specify healthy food choices	4
Government nutrition assistance programs: Reimbursement to food vendors to increase sale and consumption of healthy foods/beverages and to reduce sale and consumption of unhealthy choices among qualifying lower-income individuals and families (e.g., WIC, SNAP)	11
School wellness policies: Comprehensive school policies to address healthy eating, physical activity, and/or BMI assessment to reduce childhood obesity	24
School physical activity policies and environments:[b] Physical activity standards to increase time spent in structured or unstructured play, sports, or recreation (e.g., physical education, recess, breaks, class) and increased access to facilities and equipment (e.g., playgrounds, fields, courts) to support structured or unstructured play, sports, or recreation	48
Child care physical activity policies: Physical activity standards to increase time spent in structured or unstructured play, sports, or recreation in preschool, day care, and after-school care	8
Safe routes to school: Increased access to safe, convenient, and fun opportunities to bicycle or walk to and from school (e.g., traffic safety, sidewalks or bike lanes, Walking School Bus)	6
Neighborhood availability of parks, playgrounds, trails, and recreation centers:[b] Increased access to facilities that support play, sports, or recreation	77
Neighborhood safety (interpersonal): Increased neighborhood safety (e.g., reduced crime rates, reduced physical/social disorder, increased perceptions of safety)	56
Neighborhood safety (traffic): Increased traffic safety (e.g., increased traffic calming, reduced speed limits, increased street crossing aids, increased street buffers for sidewalks)	34
Point-of-decision prompts for physical activity:[b] Increased signage for information/navigation/motivation in schools or communities to encourage active choices	3
Community design:[b] Improved community design (e.g., land use, proximity between commercial and residential destinations) to support active choices (e.g., transportation, recreation)	74

(*Continued*)

Table 2 (*Continued*)

Intervention strategy description	Number of intervention strategies[c]
Street design:[b] Improved pedestrian-, bicycle-, or transit-oriented design (e.g., reduced building setbacks, increased transit shelters, increased street furniture) to support active choices	38
Transportation policies:[b] Improved transportation design standards (e.g., Complete Streets) and incorporation of multimodal choices into planning products (e.g., Transit Master Plan)	41
Screen time: Decreased access to sedentary activities (e.g., reduced television/computer/video game time, television turn-off devices, increased active video games) in schools or child care settings	1

[a]Abbreviations: BMI, body mass index; SNAP, Supplemental Nutrition Assistance Program; WIC, Women, Infants, and Children program

[b]Intervention strategies are represented in both first-tier and second-tier effective reviews.

[c]Total number of intervention strategies within and across interventions.

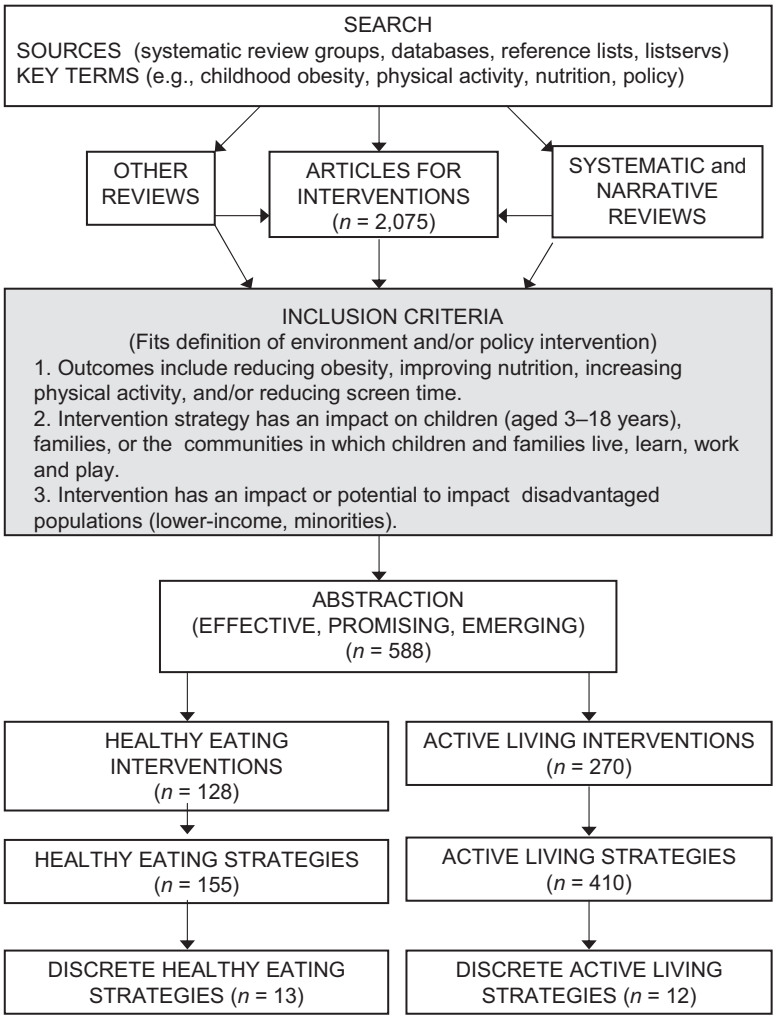

Figure 3

Process for searching and abstracting intervention strategies.

Review), meta-analyses, narrative reviews, peer-reviewed studies, and key word searches on PubMed, Ovid, and other peer-reviewed literature databases and Web-based resources. Other sources included reference lists from research summaries and peer-reviewed articles, international literature sources in the English language or those translated into the English language, and references from expert advisors not uncovered through the other searches. Key words for nutrition, physical activity, and obesity were selected, and key words for special populations and settings enhanced the searches. The key words, reference lists, and related search information are available online (**http://www.transtria.com**).

From this search process, the array of evidence resources varied from existing systematic and narrative reviews, peer-reviewed studies, and evaluation reports published in peer-reviewed journals to "gray" or "fugitive literature" (44) that may come from unpublished dissertations/theses, research syntheses, policy briefs, Web-based summaries, papers and posters presented at professional meetings, printed resources, and program summaries of community demonstration projects or other comprehensive intervention approaches. The gray literature in the inventory has been used to supplement information abstracted from the peer-reviewed publications noted above.

The criteria used to qualify a resource for inclusion were that (*a*) the intervention fit the definition of policy or environmental strategies; (*b*) the intervention directly or indirectly addressed childhood obesity prevention, as well as improvements in healthy eating, active living, and/or energy balance; (*c*) the intervention had the perceived potential to influence children and adolescents aged 3–18 years, their families, and the communities in which they live, learn, and play; and (*d*) the intervention had the perceived potential to benefit lower-income and racial and ethnic populations or to circumvent or mitigate common inequities or barriers. Resources focusing on elderly populations or workplace settings were excluded because of their uncertain relevance to children. Moving forward, policy scans and agenda-setting or advocacy initiatives have been identified as additional potential qualifying sources.

Next, the research team characterized interventions on the basis of criteria used to judge intervention design, implementation, and applicability (reach, adoption, fidelity, sustainability), on the one hand, and evaluation design, methods, and findings (internal and external validity) on the other hand. As illustrated in **Table 1**, this included internal validity, efficacy and effectiveness, external validity, adoptability, feasibility, sustainability, and capacity to maximize contextual conditions (e.g., community readiness, social determinants of health) (26). From the evidence resources likely to meet criteria for first-tier effective, second-tier effective, and promising policy and environmental strategies, the review team abstracted the available intervention and evaluation information according to the indicators and inclusion criteria outlined in the evidence typology (see **Table 1**).

By definition, the evidence for first-tier effective policy and environmental strategies had already been subjected to well-defined search, abstraction, and review processes (72). Individual interventions from these expert reviews were included in the abstraction to ensure that the review system was complete.

From the 41 systematic and narrative reviews initially abstracted and analyzed between October 2008 and January 2009, only six intervention strategies met the inclusion criteria and thus were included in the final summary for first-tier effective intervention strategies: community-scale urban design and land use policies and practices, street-scale urban design and land use policies and practices, increased access to places to be physically active combined with information outreach, point-of-decision prompts to encourage use of stairs, transportation and travel policies and practices, and school-based physical education policies (28, 36). Each is described in the Community Guide and detailed abstraction tables are available online (**http://www.transtria.com**).

The abstraction guide for reviewing evidence resources to inform second-tier effective,

promising, and emerging policy and environmental strategies drew on the criteria from **Table 1** and adapted criteria from the four nationally and internationally recognized expert review systems noted previously (15, 16, 20, 30, 72). The abstraction guide captured intervention and evaluation information regarding populations, sampling, settings, partnerships, design, methods, implementation, execution, results, and maintenance. To accelerate the abstraction timeline (i.e., expert systematic reviews can often take from six months to several years to complete and address one topic at a time), this modified approach was designed to speed up information extraction by trained research assistants as opposed to established experts in the field. Therefore, the abstraction protocol was concrete and specific, minimizing, to the degree possible, subjective interpretation of the information and variability in recording the information, among abstractors. The review team then performed quality-assurance checks prior to additional review by expert advisors. This expert review was expedited by the distillation of information described in the next section.

Abstraction was conducted by two research assistants for each intervention to ensure high inter-rater reliability. Discrepancies between the two abstractors were addressed with the entire review team to develop consensus on abstraction methods and enhance training of assistants. Through systematic tracking of minutes from the review team and advisory group meetings, suggestions for improvements to the process and identification of challenges have been documented to improve the search, inventory, and abstraction process.

Analysis and Synthesis: Expediting Expert Review Through Intervention Strategy Summaries

On the basis of the abstraction process, intervention strategy summaries were created for each policy and environmental strategy to summarize findings for individual interventions and across all interventions within discrete intervention strategies. Core elements of these intervention strategy summaries include background on the policy or environmental strategy (i.e., strategy description; effective, promising, or emerging rating; evidence gaps; political implications; and additional context), an impact table summarizing the evidence criteria for the strategy (e.g., effectiveness, reach, implementation, sustainability), and intervention tables summarizing the evidence for each intervention (e.g., intervention components, study design, outcomes). These intervention strategy summaries are packaged with additional background information about the purpose of the review; the review methods, process, and analysis procedures; and other context from the evidence resources cutting across policy and environmental strategies (e.g., challenges with measures of healthy eating or active living; how social, economic, and environmental conditions mediate, confound, or moderate these strategies).

Once created, each intervention strategy summary is reviewed by expert advisors, composed of a three-person team of a researcher, a practitioner, and a policy expert. In concert with these advisory groups, the review team developed rating categories to assess the effectiveness and potential impact of each policy and environmental strategy when adequate information was reported. Three overall ratings for effectiveness, population impact, and high-risk population impact are described below.

The effectiveness rating was created to capture study design, intervention duration, and outcomes affected and their corresponding effect size or percent change (see **Table 3**). Study design is a qualitative indicator of the type of study. Intervention duration is a rating of the length of time for implementation, such as the time from policy development to policy adoption or the time from environmental design and planning to allocation of funding and build-out of a physical facility. Outcomes affected is a qualitative indicator of the behavioral or health outcomes assessed in the study. Outcome measures are recorded and prioritized on the basis of the quality of assessment measures (e.g.,

Table 3 Effectiveness, population impact, and high-risk population impact rating systems[a]

Rating system	Criteria	Categorization[b]	Operationalization
Effectiveness	Study design	Evaluation study	Intervention evaluation study with an experimental (includes natural), quasi-experimental, or prospective cross-sectional design
		Association study	Cross-sectional study linking policy or environmental changes to health or behavioral outcomes
		Descriptive study	Intervention or evaluation descriptive study using quantitative or qualitative evaluation methods
	Intervention duration	High	Greater than or equal to 12 months
		Medium	6–12 months
		Low	Less than or equal to 6 months
	Outcomes affected	Not rated	Documentation of behavioral and health outcomes (e.g., BMI, diet, physical activity), prioritized based on measurement quality (e.g., physiological measures, self-report or observed measures)
	Effect size or percent change	Net positive	Majority of effects, key effects (e.g., obesity, BMI), or size of effects suggest positive change
		Neutral	Equal positive and negative effects or no effects reported
		Net negative	Majority of effects, key effects (e.g., obesity, BMI), or size of effects suggest negative change
	Effectiveness	Effective	Intervention evaluation × duration (high/medium) × effect size (net positive)
		Somewhat effective	Association × duration (high/medium/low) × effect size (net positive) OR intervention evaluation × duration (low) × effect size (net positive)
		Not effective	Any intervention evaluation or association scoring net negative on effect size
Population impact	Effectiveness	Same as above	Same as above
	Participation/ potential exposure[c]	High	Higher and longer than average participation rates (percentage of population and time) OR Entire target population (assuming full-scale implementation or enforcement) has frequent exposure
		Low	Lower- and shorter-than-average participation rates (percentage of population and time) OR Entire target population (assuming full-scale implementation or enforcement) has periodic exposure OR portion of the target population has frequent or periodic exposure
	Representativeness[c]	High	No significant differences between the evaluation sample and the intervention population OR greater representation of high-risk populations in the evaluation due to oversampling
		Low	Significant differences between the evaluation sample and the intervention population
	Potential population reach[c]	High	Participation/potential exposure (high) AND representativeness (high)
		Low	Participation/potential exposure (high or low)

(*Continued*)

Table 3 (*Continued*)

Rating system	Criteria	Categorization[b]	Operationalization
	Intervention components[c]	High	Multiple intervention strategies—"multi-component interventions"
		Low	A single intervention strategy, with or without multiple approaches—"complex interventions"
	Feasibility[c]	High	Minimal simple intervention activities with little specialized expertise and few resources required
		Low	Larger number of intervention activities requiring more specialized expertise and resources
	Implementation complexity[c]	High	Intervention components (high or low) AND feasibility (low) OR intervention components (high) AND feasibility (high or low)
		Low	Intervention components (low) AND feasibility (high)
	Population impact[c]	High impact	Effective × potential population reach (high) AND any other combination of criteria ratings
		Low impact	Effective or somewhat effective AND any other combination of criteria ratings
		No impact	Not effective AND any other combination of criteria ratings

[a]Abbreviations: BMI, body mass index.
[b]If information is not available for any of the criteria, it is rated as not reported.
[c]If no intervention was implemented it is rated as not applicable.

highest priority are objective physiological measures as opposed to self-reported height and weight). Effect size or percent change is a rating of the net effect of the intervention on the outcomes, with ratings provided for total population and subpopulations separately.

The population impact rating was developed to assess effectiveness in the context of potential population reach and implementation complexity (see **Table 3**). Potential population reach refers to participation or potential exposure as well as representativeness of the participants or those exposed. Participation or potential exposure is a rating of the percent of the intervention population influenced or potentially influenced by the intervention, and the ratings are provided for total population and subpopulations separately. Participation is assessed for interventions that identify a total number of eligible individuals and the duration of their participation, typically in a specified setting (e.g., school wellness policies target all children in the school).

When participation was not reported, potential exposure was estimated on the basis of the size of the target population potentially exposed to the policy or environmental change and the frequency of exposure (e.g., daily or weekly versus periodically). For example, increased access (e.g., more availability, less cost) to healthy foods and beverages and reduced access to unhealthy (energy-dense, low-nutrient) products in community grocery stores have the potential to impact children's food and beverage consumption at home many days of the week, whereas these same changes in restaurants may be more periodic. Potential exposure is more likely to be assessed or reported for larger-scale policy or environmental changes (e.g., menu labeling policy, Complete Streets policy), where investigators cannot identify the total number of eligible individuals. Representativeness is a rating of the degree to which the evaluation sample corresponds to the intervention participants or the population exposed to the intervention.

Implementation complexity represents a composite of the number of intervention components and the feasibility of implementation. Intervention components are a rating of the number of distinct multicomponent and complex intervention components implemented in the intervention. Multicomponent interventions have two or more distinct intervention strategies with the expectation that they will work together additively or synergistically to improve outcomes, and complex interventions have two or more intervention approaches not inherently distinct from one another (modeled from current work of the Community Guide) (61). For example, a tax designated for city parks and recreation improvements is a multicomponent intervention when the funds are used to support new park, playground, or trail facilities, increased safety and security measures, and maintenance of the grounds and facilities. When the tax is restricted to new park development, it is a complex intervention because there are multiple approaches embedded in one strategy (e.g., tax as a policy change, park construction as an environmental change, and promotion to increase awareness of the new park).

Feasibility is a rating of the ease of intervention implementation, including the number and type of intervention activities as well as the level of expertise and amount of resources required. For example, a school yard initiative to support the allocation of school district funds toward the development and maintenance of recreation spaces in schools may not be feasible in many schools or districts, given start-up costs for build-out, the expertise required to design and construct the recreation spaces, and the competing demands for use of school district funds (21). In contrast, a joint-use agreement for a school and a community to share recreational facilities and equipment may be highly feasible, particularly given that model policies have already been developed (50, 51).

The high-risk population impact rating is calculated using the same information extracted and summarized for the population impact rating with a couple of important exceptions: (*a*) potential high-risk population reach is substituted for potential population reach, and it is calculated using high-risk population, which is substituted for participation or exposure; and (*b*) high-risk population is a rating of the proportion of the intervention population (i.e., those participating or potentially exposed) from racial and ethnic or lower-income populations. **Table 4** illustrates application of the impact table to two intervention strategies with four sample studies.

Expert Input: Assuring the Evidence Review and Summary Complements the Field

Because advances in public health science often rely on transdisciplinary and cross-sector perspectives (64), the review team intentionally sought out key disciplines to inform prevention of childhood obesity. Therefore, development of the review system and products occurred with considerable expert input and feedback from more than 40 international, national, state, or local advisors, bringing together diverse expertise and perspectives of researchers, evaluators, practitioners, and policy or decision makers from many disciplines (e.g., public health, urban planning, economics, advocacy). These advisors formed three national advisory groups, including the following:

- A general working group was drawn from the growing field of childhood obesity prevention, including representatives from research programs, community demonstration projects, and policy or advocacy initiatives (13, 20, 46–48, 66);
- A research advisory group made up of research experts from academic and research institutions, professional societies, and government health agencies was charged with assuring the scientific integrity of the review process; and
- A policy and practice advisory group of experts working in the field was charged with assuring the applicability of the review process and findings to policy and practice efforts.

Table 4 Application of the effectiveness, population impact and high-risk population impact rating schemes[a]

Strategy: Neighborhood availability of food stores								
Example interventions	**Study design**	**Intervention duration**	**Effectiveness**	**Potential population reach**	**Potential high-risk population reach**	**Implementation complexity**	**Population impact**	**High-risk population impact**
Powell et al. (2007) (54)	Association	Insufficient information	Positive association—total population Positive association—African Americans	Insufficient information	Insufficient information	Insufficient information	Insufficient information	Insufficient information
Morland et al. (2006) (48)	Association	Insufficient information	Positive association	Insufficient information	Insufficient information	Insufficient information	Insufficient information	Insufficient information
Strategy: School food and beverage policies								
Example interventions	**Study design**	**Intervention duration**	**Effectiveness**	**Potential population reach**	**Potential high-risk population reach**	**Implementation complexity**	**Population impact**	**High-risk population impact**
Perry et al. (2004) (53)	Intervention evaluation	High	Effective	Insufficient information	Insufficient information	High	Insufficient information	Insufficient information
Bartholomew & Jowers (2006) (2)	Intervention evaluation	Medium	Effective	Insufficient information	Insufficient information	Low	Insufficient information	Insufficient information

[a]Refer to **Table 3** for operationalization of the items presented in the columns of this table.

CHALLENGES AND OPPORTUNITIES

Intervention strategy: a plan of action designed to achieve a particular intervention goal or objective

A number of factors presented challenges to planning and conducting this comprehensive review, starting with how policy and environmental interventions are defined in the literature. For instance, definitions of policy and environmental changes to address healthy eating, active living, and/or obesity prevention are described differently depending on the population, setting, or context (e.g., standards for children's healthy eating and diet may incorporate some or all the following: calories, fat, sodium, sugar, or other nutrients), and intervention strategies can be broad or narrow in scope (e.g., street design guidelines may be operationalized as widened sidewalks, the addition of bike lanes and traffic calming measures, or the application of crosswalk striping). These variations in the scope of policy and environmental changes make it difficult to use standard definitions for comparison across studies. To address these challenges, the authors adopted a relatively broad definition of policy and environmental strategies to capture the full range of interventions in the field. Furthermore, the intervention strategy summaries, as products of the review, call attention to the nuances in the intervention strategy definitions for each of the policy and environmental strategies. The field would benefit from the creation of a standard taxonomy of policy and environmental strategies for multilevel, youth-focused healthy-eating, active-living, and obesity-prevention interventions taking place in a variety of settings.

Another challenge is assessing the independent or interdependent effectiveness of specific intervention strategies embedded in multicomponent interventions as well as the overall impact of these comprehensive interventions. The nature of policy and environmental strategies requires the capacity not only to delineate the many moving parts but also to extract the underlying relationships between these moving parts, and even to determine the minimal intervention components required for effectiveness. The review included multicomponent interventions; however, the intervention strategy summaries are judicious in inferring causality or attributing intervention effects to specific policy and environmental changes. Similarly, identifying and tracking unintended consequences and mediating, modifying, or confounding factors associated with policy and environmental strategies pose additional challenges to understanding the array of implications for community change.

Unfortunately, only a handful of studies have examined the effects of policy and environmental strategies in varied populations and community settings, especially among the nation's highest-risk groups. And, despite the fact that there are now a few widely accepted standards for measuring and comparing reach across intervention strategies (e.g., percent and representativeness of populations participating in the intervention or evaluation), these definitions do not necessarily translate to populations impacted by policy and environmental strategies because it may be more appropriate to understand exposure than participation. The lack of well-defined standards of evidence for defining adoption and implementation hindered cross-intervention comparisons on these key attributes.

Similarly, few studies report economic inputs (e.g., direct and indirect costs, resources leveraged) or outcomes (e.g., cost-effectiveness) or track unintended consequences (e.g., potential harms, added benefits) as well as mediating, modifying, or confounding factors associated with policy and environmental strategies. These issues are ripe for future research.

Another significant challenge for this project was procuring evidence about promising and emerging strategies. On the one hand, finding evaluation data on these interventions is a challenge. For emerging strategies, exploratory evaluation has proven valuable to uncover and prioritize interventions for more extensive evaluation (42). On the other hand, many of these interventions are adopted in the field without clear operationalization unless the strategies are guided by a larger initiative or community demonstration project. Likewise,

policy and environmental strategies often encompass a range of activities from agenda-setting and advocacy efforts to policy development, implementation, and enforcement; these strategies take root in and involve various sectors and disciplines (e.g., housing, transportation, planning, economic development, environmental regulations, landscape architecture, land use, agriculture), in which their approaches may have less direct or immediate effects on diet, physical activity, sedentary behavior, and obesity. The Internet further contributes to this challenge because the range of interventions changes on a frequent basis when new approaches are posted on Web sites.

Many benefits from expert participation have propelled this effort forward, including collective learning from the existing policy, practice, and research efforts in the field (e.g., investigators also participated in advisory groups for related efforts); shared methods and protocols for evidence review (e.g., the Community Guide, University of North Carolina Center TRT) (4, 15, 16, 72); a host of evidence sources from different disciplines and sectors; potential drivers of and barriers to summarizing and translating evidence for different audiences; and, most importantly, increased momentum and dissemination from expert buy-in throughout the unfolding process (e.g., presentations at national meetings, paper to the IOM Food and Nutrition Board). Conversely, several challenges related to expert input have required more time than anticipated for review and elaboration on each step in the process as well as struggles to find common language for describing levels of evidence and their associated indicators and criteria.

These limitations present challenges for dissemination in the growing, but still relatively new, body of evidence for policy and environmental approaches to childhood obesity prevention. One challenge will be to contextualize the recommendations made as a result of this review in a way that is meaningful to a wide range of audiences in research, evaluation, policy, and practice settings. For example, the feasibility of implementing certain complex, higher-impact interventions at the local level may be low, given funding and resource constraints. As such, dissemination products may require tailored approaches to maintain relevance and usefulness for each audience (e.g., policy briefs, Web sites). Yet, even a succinct list of policy and environmental strategies does not guarantee that they are used, so new ways of communicating with decision and policy makers (63) and recognition that policy windows can open and close quickly (38) necessarily make this process part science and part art (5).

IMPLICATIONS FOR THE FIELD

This review system is a work in progress. It represents an accelerated, systematic process for collecting, reviewing, and summarizing evidence to classify interventions along a continuum of evidence quality and consistency and, in turn, to advance priorities for research, policy, and practice. The first set of expert-reviewed ratings for first- and second-tier effective, promising, and emerging strategies along with recommendations for further research in each category will be reported on the Transtria Web site (**http://www.transtria.com**). Ideally, a comprehensive review to update these ratings and recommendations should be repeated at least annually as the field grows, consistent with the kind of approach recommended by the IOM's (2010) latest report "Bridging the Evidence Gap in Obesity Prevention" for accelerating the discovery and dissemination of those strategies with the greatest potential for population impact (34).

The proposed four-level evidence typology reflects an expanded paradigm for evidence-based intervention strategies inclusive of traditional criteria (e.g., adequacy of study design, quality of execution) and expanded criteria based on the RE-AIM framework (25, 35) for assessing the strategy's capacity to impact diverse populations and settings (reach), demonstrate timeliness and relevance to complex systems and environments (adoption), maximize existing resources and complement related

efforts (implementation), and gain momentum over time (maintenance).

It also includes a way to prospect for and evaluate emerging and promising strategies and points to evidence gaps at each level of the typology (i.e., emerging, promising, and first- and second-tier effective strategies). Without a focused review and trajectory, many promising intervention strategies may have languished in the field unnoticed and unexamined, and many emerging, untested strategies may have spread throughout the field, based on appeal or ease of implementation, potentially siphoning off resources that could otherwise be allocated for proven, effective strategies.

Several drawbacks limit the value of existing evidence to inform practice and policy change. These include a general lack of information about

1. The pathways from policy and environmental changes to behavioral and health outcomes, particularly for multicomponent and complex interventions;
2. The policy-making process itself, including the drivers and barriers to adoption of evidence-based interventions at the organizational, local, state, and national levels (9);
3. Characteristics most likely to affect intervention efficacy, scalability, and dissemination (e.g., financial constraints; feasibility of replication; and the funding, partners, community support, political support, staff, skills, resources, and protocols required to implement the intervention);
4. Contextual conditions (e.g., economic climate, social determinants, community capacity) serving to support or hinder intervention design, planning, implementation, and sustainability;
5. The specific populations reached by the policy or environmental changes and those represented in the evaluation studies, as well as the social or cultural relevance of the intervention for these populations;
6. Standard outcome measures (e.g., minimum effect size, lowest percent increase/decrease) to assess changes in population-level physical activity, food and beverage consumption, and rates of overweight and obesity, as well as non-obesity-related outcomes (e.g., academic performance, community safety, air quality) (32);
7. Measures of policy and environmental changes (8, 17, 37, 43, 45);
8. Attrition, differential attrition, and maintenance of intervention effects in evaluation samples or subsamples; and
9. The likelihood of sustainability, including necessary enforcement, resources for maintenance of environments, or other ongoing support and funding.

These limitations should be addressed in conducting and reporting future studies to maximize applicability to different populations and settings, opportunities to assess implementation fidelity, detection of independent or interdependent intervention effects, identification of the cumulative benefits or costs of the intervention, impacts on health equity, and intervention sustainability.

NEXT STEPS AND CONCLUSION

The authors continue to work with advisors to determine ways to incorporate these findings and recommendations into the review process and to identify approaches for translating and disseminating effective, promising, and emerging policy and environmental interventions to local, state, and national policy makers and practitioners.

Over the next year, the review process and findings described in this paper will be used to

- Inform existing research and evaluation priorities, including those of foundations and other funders;
- Create interactive online tools to share findings and research and dissemination recommendations across communities and audiences; and
- Draw on the broad advisory network to gain insight into new opportunities for

strengthening and annually updating and reporting on this review process.

Anticipated modifications to this systematic, annual review process may include

- Ongoing development of review criteria associated with reach, adoption, implementation, and sustainability;
- Systematic approaches for reviewing multicomponent interventions as a whole rather than simply the individual intervention strategy components;
- Greater emphasis on tracking social benefits and economic returns of childhood obesity-prevention strategies for policy and decision makers (e.g., increased academic performance, reduced spending on health care); and
- Guidelines for tailoring evidence-based interventions for different audiences on the basis of their assets and needs.

Finally, this review provides an opportunity to reflect on the current practices for documentation, collection, reporting, and review of evidence, which has been identified as a topic of high priority (34). Although the focus of this review has centered on the childhood obesity epidemic, the principles described can translate to other health or related topics, particularly those exhibiting a sense of urgency and an underdeveloped evidence base. Likewise, information from this review provides sensible considerations for future funding initiatives, research and evaluation priorities, and field-building efforts by identifying the types of policy and environmental strategies that can maximize resource investments.

SUMMARY POINTS

1. The scope of the childhood obesity epidemic in the United States and its serious health and economic consequences have added urgency to the need for intervention strategies with the greatest potential to close the daily energy gap responsible for the nation's rising childhood obesity levels.
2. Identification and spread of the most effective, feasible, and sustainable intervention strategies; evaluation of promising strategies; and location of emerging strategies can support local, state, and national decision makers with limited access to information about policy and environmental drivers of childhood obesity and its reversal.
3. An accelerated, systematic process for collecting, reviewing, and summarizing evidence was developed to classify interventions along a continuum of evidence quality and consistency and, in turn, to advance priorities for research, policy, and practice.
4. Development of the review process and products advanced with considerable expert input and feedback from more than 40 international, national, state, or local advisors, bringing together diverse expertise and perspectives of researchers, evaluators, practitioners, and policy or decision makers from many disciplines.
5. To reflect the full continuum of evidence for varied policy and environmental strategies for childhood obesity prevention, four levels of evidence (i.e., "effective" first and second tier; "promising"; and "emerging") were identified to assess intervention design, implementation, and applicability (reach, adoption, fidelity, sustainability) and evaluation design, methods, and findings (internal and external validity).

6. At one end of the evidence continuum is the review process intended to capture relatively new, untested strategies arising in the field (emerging or promising strategies), and at the other end are strategies with high-quality evaluation and a track record of demonstrated efficacy and effectiveness (effective strategies).
7. Intervention strategy summaries for each policy and environmental strategy were developed to summarize findings for each individual intervention and across all interventions within the strategy, including background on the strategy, an impact table summarizing the evidence criteria for the strategy, and intervention tables summarizing the evidence for each intervention.
8. Although the focus of this review has centered on the childhood obesity epidemic, the principles described can translate to other health or related topics, particularly those exhibiting a sense of urgency and an underdeveloped evidence base.

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

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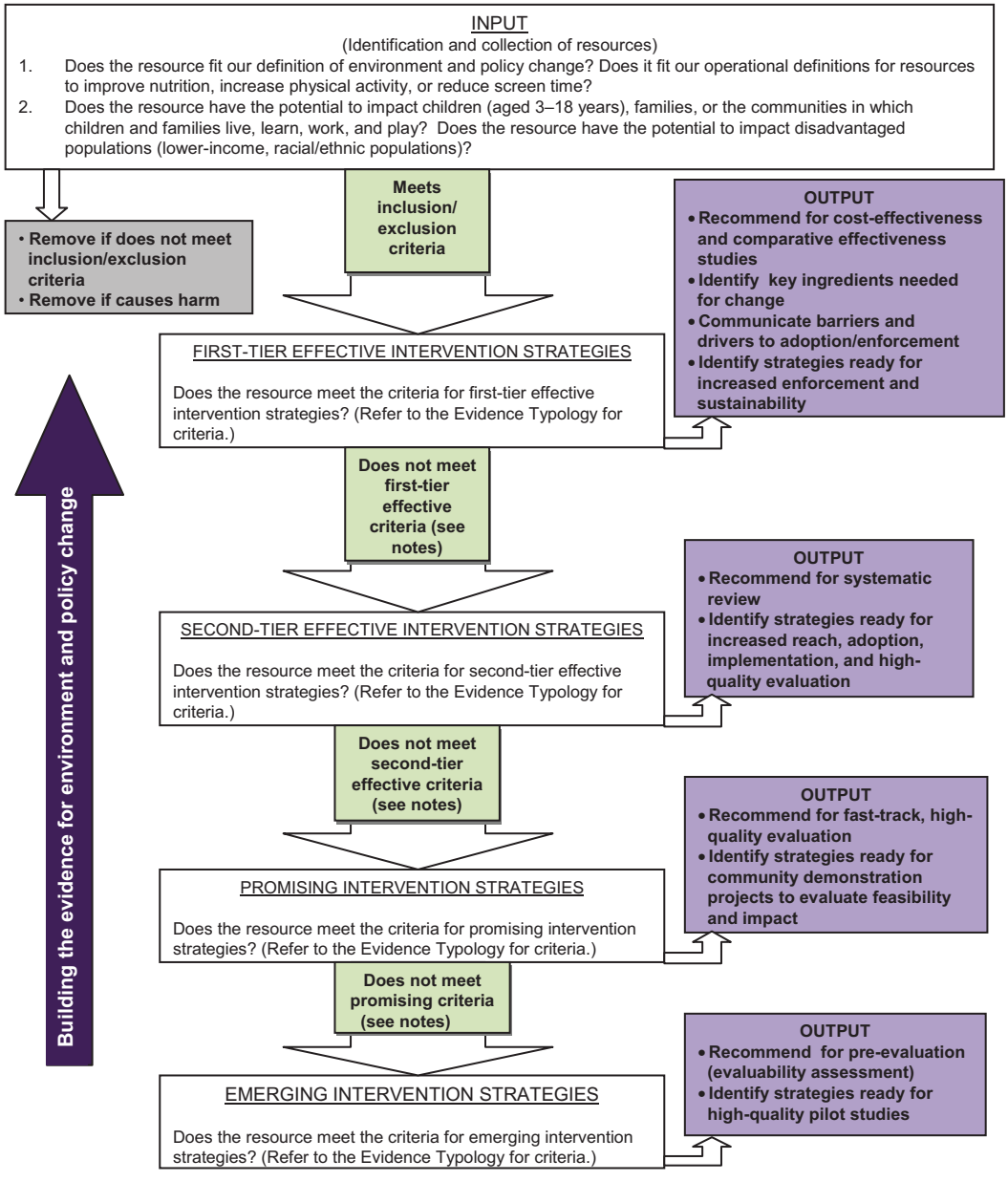

Figure 2

Review cycle: evidence-based policy and environmental change strategies. Notes: "Doesn't meet criteria" may reflect resources that have been reviewed with insufficient evidence as well as those that do not meet the criteria in the Evidence Typology. Based on the evidence gap analysis, these may be recommended for further study to accelerate the identification/recommendation of evidence-based interventions in different populations and settings. Also, environment and policy intervention strategies may be necessary, but not sufficient to create behavior/health change.

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