

Approaches to Measuring the Extent and Impact of Environmental Change in Three California Community-Level Obesity Prevention Initiatives

Despite growing support among public health researchers and practitioners for environmental approaches to obesity prevention, there is a lack of empirical evidence from intervention studies showing a favorable impact of either increased healthy food availability on healthy eating or changes in the built environment on physical activity. It is therefore critical that we carefully evaluate initiatives targeting the community environment to expand the evidence base for environmental interventions.

We describe the approaches used to measure the extent and impact of environmental change in 3 community-level obesity-prevention initiatives in California. We focus on measuring changes in the community environment and assessing the impact of those changes on residents most directly exposed to the interventions. (*Am J Public Health*. 2010;100:2129–2136. doi:10.2105/AJPH.2010.300002)

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THE GROWING SUPPORT

among public health researchers and practitioners for environmental approaches to obesity prevention^{1–5} was confirmed in major consensus reviews by the Centers for Disease Control and Prevention (CDC)⁶ and the Institute of Medicine (IOM).^{7,8} Of the 11 recommended nutrition-related strategies proposed in the CDC review, 5 target the community food environment, in particular, the availability and accessibility of healthier food choices. Those strategies include increasing the availability and affordability of healthier food and beverage choices in public service venues, increasing the geographic availability of supermarkets in underserved areas, providing incentives to food retailers to offer healthier food and beverage choices and to locate in underserved areas, and restricting the availability of less healthy foods and beverages in public service venues. The consensus reviews also recommended a number of environmental approaches to promoting physical activity, in particular, changes to the built environment. Six of the 9 CDC-recommended strategies include improving access to outdoor recreational facilities, enhancing the infrastructure to support bicycling and walking, locating schools within easy walking distance of residential areas, improving access to public transportation, and zoning for mixed-land use

development. The 2005 IOM Committee on Preventing Childhood Obesity created a national action plan that identified several immediate steps to address the obesity epidemic, including improving school food environments, promoting more active physical activity during the school day, expanding access to healthier foods in the marketplace, and expanding and promoting opportunities for physical activity across the community.⁷

The support for environmental approaches reflected in the consensus reviews has been influential in shaping government and foundation initiatives aimed at preventing obesity, including the W.K. Kellogg Foundation's Food and Fitness Initiative,⁹ the Robert Wood Johnson Foundation's Healthy Kids/Healthy Communities initiative,¹⁰ the Department of Health and Human Services Communities Putting Prevention to Work Initiative funded under the American Relief and Reinvestment Act of 2009,¹¹ First Lady Michelle Obama's Let's Move Campaign,¹² and the White House Task Force on Obesity.¹³

Despite the strong support for environmental approaches in the CDC and IOM reports, and in the research literature in general, there is a lack of empirical evidence showing that increasing the availability of healthy food promotes healthier eating or that changing the built environment

increases physical activity. The CDC recommendations were based solely on expert panel ratings of strategies that have been mentioned prominently in the literature. The IOM panel on local government action assembled a wide range of literature and reports in support of their recommendations but did not attempt a systematic meta-analysis of the available intervention studies. The CDC Community Guide,¹⁴ which makes recommendations based on available evidence, has no recommended strategies involving environmental change for either nutrition or obesity. The Community Guide does recommend built environment interventions to promote physical activity, including community-scale and street-scale urban design and land-use policies, and the creation of enhanced access to places for physical activity combined with informational outreach.¹⁵ However, the urban design policy recommendation is based entirely on cross-sectional, observational studies,¹⁶ leaving access to places for physical activity combined with outreach as the only environmental intervention with systematic evidence supporting its effectiveness. Other reviews from the epidemiological¹⁷ and dietetic¹⁸ literature have also found largely cross-sectional studies examining the relationship between the built environment and obesity.

One reason for the lack of evidence is that the field is relatively

new, and results from intervention studies are just now beginning to appear with regularity; in the area of access to healthy food in schools, see Hollar et al.¹⁹ as an example, and in the area of access to healthy foods and physical activity for early elementary school students, see Shape up Somerville.²⁰ However, to our knowledge most environmental intervention studies have been cross-sectional studies that have documented the impact of increasing healthy food availability in neighborhoods (e.g., through healthier corner stores^{21,22}), and the few longitudinal studies we could find showed little or no impact (e.g., newly opened supermarkets in low-income neighborhoods^{23,24}).

The lack of existing evidence about the effectiveness of environmental interventions makes it critical to carefully evaluate the growing number of community initiatives targeting environmental change. We describe the approaches used to measure the extent and impact of changes in the food and physical activity environments in 3 large, multisite, community-level obesity prevention initiatives: The California Endowment's Healthy Eating, Active Communities (HEAC) program, the California Endowment's Central California Regional Obesity Prevention Program (CCROPP), and the Kaiser Permanente Community Health Initiative (CHI). We describe the evaluation methods and discuss the challenges involved in measuring the extent and impact of environmental change.

DESCRIPTIONS OF THE THREE INITIATIVES

The HEAC program and CCROPP are funded by The California Endowment and aim to reduce the prevalence of obesity

and health disparities by increasing access to healthy foods and opportunities for physical activity. CHI is a Kaiser Permanente Community Benefit strategy also designed to improve nutrition and physical activity and to reduce overweight and obesity in selected communities served by Kaiser Permanente. All 3 initiatives are multiyear, comprehensive, community-based initiatives using policy and environmental change strategies to promote healthy eating and active living in low-income and resource-poor communities. The communities in the 3 initiatives range in size from smaller neighborhoods within cities to entire counties. All 3 are working in multiple sectors, including schools, worksites, health care, and neighborhoods. All 3 emphasize community engagement and involvement by using community collaboratives comprising a range of organizations and individuals to guide intervention planning and implementation. More detailed descriptions of the initiatives can be found in companion papers in this issue of the *Journal*.^{25–27}

Table 1 provides a summary of key initiative characteristics, including years of implementation. Because the initiatives are still ongoing, the overall evaluations will not be completed until 2011. There are 6 communities participating in HEAC, 8 in CCROPP, and 3 in CHI in California. The communities range in size from 37 960 in the smallest CHI community to almost 800 000 in the largest CCROPP county. All of the communities are relatively resource poor with substantial ethnic minority populations; in CHI and CCROPP, 30% to 54% of the population is Latino, and the HEAC communities are a diverse mix of African American, Latino, and Asian American families.

All 3 initiatives were informed by a logic modeling process. In HEAC and CCROPP, the logic model and model of change framed the intervention strategies around environments in 5 sectors that would have the greatest impact on food and physical activity behaviors for youths and their families (schools, after school, neighborhoods, health care, and advertising and marketing in local communities). Communities identified local interventions and policy approaches that were most responsive to expressed community needs. CHI communities had a similar degree of latitude in selecting interventions within 4 sectors: schools, worksites, health care, and neighborhoods. A menu of evidence-based interventions by sector was provided, and communities selected at least 1 intervention for each sector.

Table 1 also gives examples of interventions that were implemented in the 3 initiatives, which include a number of strategies described in the CDC and IOM recommendations. The table includes examples of all interventions, including programmatic and policy change interventions. Environmental interventions in HEAC were designed to improve access to healthy foods and opportunities for physical activity in all 5 sectors, and CCROPP was designed more broadly to increase access to healthy foods and safe places to play across the community. Examples of HEAC and CCROPP environmental interventions include improving the healthfulness of school competitive foods, implementing school wellness policies, strengthening the quality of school physical education classes, opening school playgrounds for community use (i.e., joint use), improving neighborhood parks, addressing traffic safety, expanding

farmers markets in rural communities, increasing access to healthy foods in checkout aisles in large chain and neighborhood stores, and limiting expansion of fast-food restaurants. CHI environmental interventions include attempts to increase healthier food choices in corner grocery stores, building walking trails, and changing zoning requirements and master plans to increase neighborhood walkability.

MEASURING ENVIRONMENTAL CHANGES AND THEIR IMPACT

All 3 initiatives employ a logic model approach²⁸ to assess intervention impact.

The logic model describes the intervention's sequence of steps to change the environment as well as the expected long-term behavioral and health impacts on community residents that result from the environmental changes. Indicators are created for each step or stage in the model, including short-term process indicators (e.g., efforts to work with store owners to decrease the number of unhealthy snack foods offered in their stores), intermediate outcome indicators (e.g., pre–post measures of the proportion of unhealthy snacks in store displays), and long-term outcome indicators (e.g., change in the percentage of children living in the neighborhood who ate chips or candy the previous day). Observed changes in long-term outcomes are (tentatively) attributed to the intervention if they are preceded by meaningful changes in the short and intermediate outcomes in a plausible temporal sequence; for example, if observed decreases in unhealthy snack consumption are preceded by significant reductions in unhealthy

TABLE 1—Initiative Summary Descriptions of HEAC, CCROPP, and CHI: The California Endowment and Kaiser Permanente, California

Element	HEAC	CCROPP	CHI
No. of communities	6	8	3
Implementation years	2005–2010	2005–2010	2005–2010
Community size, range	43 224–146 235	123 109–799 407	37 960–52 900
Demographics, % range and race/ethnicity	13%–79% Latino 12%–24% African American 11%–41% Asian	30%–51% Latino	41%–54% Latino
Examples of interventions			
Food/Nutrition environment	Healthier foods and beverages in schools and after school programs	Farmers markets, produce stands	Corner store produce availability
	Healthier offerings in city and county worksites	Acceptance of EBT/WIC at farmers markets	Farmers markets
	Healthier foods in corner stores	Healthier foods in corner stores	Healthier offerings in school cafeterias and worksites
Physical activity environment	Pedestrian safety around schools to encourage walking	Park improvements, increasing access to open space	Walking trails
	Park development and improvement	Safe walking routes	New parks, enhanced park amenities
	Adoption of PE curricula Trained teachers on PE	Opening schools for physical activity programs	
Policy change	Implemented state and local school food and beverage policies	Worksite food and beverage policies	Zoning, land use policies to promote walkability
	Worksite food and beverage policies	Farmers market city ordinances Health language in general plans Zoning ordinance reform	
Programs	Worksite wellness programs	Worksite wellness programs	School, after-school physical activity programs
	After- and before-school physical activity programs	Walking clubs/groups	

Note. CCROPP = Central California Regional Obesity Prevention Program; CHI = Community Health Initiative; HEAC = Healthy Eating, Active Communities; EBT = electronic bank transfer; PE = physical education; WIC = Special Supplemental Program for Women and Infant Children. For each program, the overall approach comprised a community-level approach with a focus on environment and policy change working in multiple sectors, including worksites, health care, schools, and neighborhoods. Community collaboratives are responsible for intervention planning and implementation. Intervention selection for each program was guided by logic models that were developed through a participatory process at the community and regional levels to define sectors, interventions, expected changes, and evidence of change.

snack availability in neighborhood stores.

Table 2 provides a comparison of the data collection and analysis methods used by the 3 initiatives for each stage of the logic model. Comparable approaches are being used to capture short-term or process outcomes, including grantee progress reports and interviews with a range of community stakeholders, to document the efforts made to change the community environment. The evaluations are also taking similar approaches to measuring longer-term population-level outcomes,

including school-based surveys of youths (using the same survey instrument across HEAC and CHI initiatives) combined with fitness assessments and BMI measurement and surveys of adult community residents as part of the evaluation process. All of the population-level measures are being assessed both pre- and post-intervention. The school-based youth surveys were also conducted in a sample of comparison communities.

The differences between the evaluation methods are primarily in the emphasis and approach in

the measurement of intermediate outcomes (i.e., environmental change) and the behavioral impact on those most likely affected by environmental changes. In particular, the HEAC and CCROPP evaluations place a greater emphasis on systematically measuring the extent of environmental change, whereas CHI's evaluations are working more on the intermediate or near-term behavioral impact of those changes. The following sections briefly describe the approach each initiative is taking in these areas.

Measuring the Extent of Environmental Changes

HEAC and CROPP. The HEAC and CCROPP evaluations are using a prospective, longitudinal approach to assess the extent of environmental change in each sector. Tools that use direct observation to take measurements were developed to describe and quantitatively measure changes over time in the availability and types of foods and beverages (healthy and unhealthy), as well as availability of space and equipment for physical activity in various settings, such as schools, after-school programs, parks,

TABLE 2—Evaluation Methods for Environmental Interventions, by Category of Outcome Measure for HEAC, CROPP, and CHI: The California Endowment and Kaiser Permanente, California

Outcome Category	HEAC	CCROPP	CHI
Short-term: process	Grantee surveys and progress reports Stakeholder surveys to assess activities and progress in each sector	Grantee surveys and progress reports Stakeholder surveys with government officials	Progress reporting to document movement toward change Key informant interviews to assess coalition functioning
Intermediate: environmental change	Tailored environmental assessments of food and physical activity environment in schools, worksites, health care organizations, grocery stores, and other neighborhood settings	Observation of physical activity opportunities in public health departments Tracking farmer's market characteristics: foods for sale, signage, EBT/WIC voucher acceptance Tracking physical activity environment in neighborhoods	Verification by observation or progress reporting of specific environmental changes proposed by initiatives
Long-term			
Impact on people most directly exposed to environmental changes	Tracking food and beverage sales in schools, worksites, and health care settings School and after school student physical activity level assessments	Tracking food and beverage sales in public health departments, and farmers markets Community resident focus groups	Calculating "affected reach" ^a
Population-level impact on health behaviors, awareness, and engagement	School-based youth surveys Fitnessgram data analysis ^b Community resident surveys ^c	Community resident survey ^d	School-based youth surveys Fitnessgram data analysis ^b Interactive Voice Response surveys of adults Clinical data (e.g., body mass index) on Kaiser Permanente members only

Note. CCROPP = Central California Regional Obesity Prevention Program; CHI = Community Health Initiative; HEAC = Healthy Eating, Active Communities; EBT = electronic bank transfer; PE = physical education; WIC = Special Supplemental Program for Women and Infant Children.

^aAssessments combine estimates of the number of people exposed with effect sizes from program evaluations or literature review.

^bTo assess student fitness and body mass index.

^cTo assess program awareness and support for environmental changes (e.g., aware of improvements in school food, shop in improved retail outlets).

^dTo assess program awareness and support for environmental changes (e.g., use of farmer's markets, parks, and awareness of CCROPP).

worksites, public health facilities, neighborhood stores, and farmers markets. Focus groups, key informant interviews, and grantee reporting interviews provide additional qualitative detail on the environmental changes and the impact on target communities. Table 3 provides more details on the tools used to capture changes in the community environments in HEAC; CCROPP used a similar approach. These tools were developed from available methodologies in the published literature and in collaboration with program grantees, technical assistance providers, and The California

Endowment. To the extent possible, the tools were tested for observer reliability.²⁹

CHI. The CHI evaluation is tracking the extent of environmental change through site visits and progress reports to document whether the specific changes proposed in the logic models have been implemented. In particular, no attempt is made to make systematic measurements pre- and postintervention in a representative sample of settings (i.e., stores, worksites). The changes are described using a mix of qualitative and quantitative information so that their significance can be assessed (Table 4). For

example, if a corner store had added a produce display where none existed before, the CHI evaluation will document the changes in the variety of produce available and the size of the display.

Measuring the Impact of Environmental Changes on Community Residents

HEAC and CROPP. The potential strength of the impact of the HEAC and CCROPP interventions on long-term health behaviors and obesity rates is determined by triangulating the environmental assessment data with measurements of changes in the number of healthy

and unhealthy food items sold in schools, after-school programs, worksites, and retail environments and, for physical activity, by measuring physical activity spaces and physical activity levels in physical education class, after-school programs, and neighborhood parks. HEAC youth surveys and HEAC and CCROPP community resident surveys provide additional evidence on how the changed environments have had an impact on food purchasing practices, food and beverage choices, park utilization, and other physical activity behaviors, creating a link between observed changes in community

TABLE 3—HEAC Environmental Change Measures: The California Endowment, California

Sector	Methods
Schools	School Physical Activity Environment Assessment—measures resources, equipment, and physical activity opportunities available at schools (n = 19 schools)
	School Beverages and Competitive Foods Environmental Assessment—measures the food environment, policy implementation status, food and beverage marketing, and other environmental factors influencing healthy eating at schools (n = 19 schools)
	PE Activity Levels—assesses physical activity levels during PE classes using SOFIT ³⁹ (n = 19 schools)
	Financial Impact Study—assesses the impact of implementing nutrition standards for a la carte beverages and foods on revenues, expenditures, and net profits from the sales of beverages and foods on campus during the school day (n = 19 schools)
After School	After-School Beverage and Food Environmental Assessment—examines beverage and a la carte food offerings and sales in after-school settings (n = 19 schools)
	After-School Physical Activity Environment Assessment—measures resources, equipment, and physical activity opportunities and programming in after-school programs (n = 19 schools)
	After-School Physical Activity Levels—assesses physical activity levels during physical activity programming using SOFIT (n = 18 schools)
Health Care	Health Care Environmental Assessment—examines beverage and food sales and physical activity opportunities at health care institutions and public health departments (n = 19 health care institutions and public health departments) ³¹
	Health Care Provider Survey—a self-administered survey for direct-service health care providers participating in the HEAC survey; measures changes in how health care providers address obesity prevention and nutrition and physical activity promotion in their clinical practice and to measure these changes over time (n = 248 baseline; n = 173 endpoint). ⁴¹
	Public Health Department Survey—electronic survey of public health department officials measures environmental changes, adoption of obesity prevention plans, intergovernmental coordination, community partnerships, and policy adoption and implementation over time (n = 115 baseline) ⁴²
Neighborhoods	Physical Activity Environmental Assessment—examines the physical activity environment and resources in neighborhoods (n = 12 locations)
	Food and Beverage Environmental Assessment—examines the presence of healthy and unhealthy foods and beverages in retail stores, restaurants, and food advertising and marketing in neighborhoods (n = 12)
	In-Store Food and Beverage Assessment (large store and small store versions)—documents the presence, placement, and advertisement of healthy and unhealthy snack foods and beverages in retail food establishments (n = 7)

Note. HEAC = Healthy Eating Active Communities; PE = physical education; SOFIT = System for Observing Fitness Instruction Time.

environments and individual behavior.

CHI. The CHI evaluation is attempting to systematically quantify the impact of environmental changes on those most directly exposed by using an approach labeled “affected reach.” Affected reach is defined as the number of people affected in a significant way by a program or environmental change. “Significant” is an approximation to “clinical significance” used in the medical literature, i.e., an effect large enough to see clinically

measureable changes in health. Significance varies depending on the outcome measure and is determined through a combination of the existing literature and consultation with experts in a given field. For example, significance for produce consumption interventions may be increasing consumption to the standard of 5 servings of fruits and vegetables per day, or significance may simply mean an increase to a certain amount in a desired behavior, e.g., a 20-minute-per-day level of moderate physical activity.

The specific approach taken in calculating affected reach for an environmental change intervention will depend on (1) whether there is good evidence in the scientific literature or whether we must use program evaluation to estimate impact and (2) whether the outcome can be expressed as an average increase (e.g., in minutes of physical activity) or whether it is the number of people changing their behavior (e.g., decrease in number of children eating unhealthy snacks the previous day). When effect sizes from the

literature are available, they are typically expressed in terms of average impact (e.g., a 0.35 increase in the number of servings of fruits and vegetables eaten by people shopping in a corner grocery store resulting from a 1-meter increase in shelf space²¹). In this case, we compute affected reach by taking the total change in the population (e.g., total increase in the number servings of fruits and vegetables) and calculating the number of people who would be significantly affected (as defined earlier) if the overall change were concentrated among just those individuals. For example, suppose that an increase of 0.5 servings of fruits and vegetables per day is considered clinically significant and we observe an intervention effect of 0.1 servings from a store intervention reaching 1000 shoppers. The total increase in servings of fruits and vegetables resulting from the intervention is $0.1 \times 1000 = 100$ servings per day. That is equivalent to an increase of 0.5 servings per day in 200 shoppers, so 200 is the affected reach for the store intervention. Note that when the effect size is known from the literature, we can estimate the likely affected reach before the intervention is implemented, which may be useful for making decisions about allocating intervention resources.

Where there is limited evidence from the literature on the effect of a behavioral intervention, direct observation can provide a rough estimate of the number of people affected. This is the case for many built environment interventions; for example, one can count the number of users on a newly installed walking trail. Ideally, the observational data will be supplemented by user surveys to see if people are actually increasing the amount of walking they are

doing or are simply changing their walking route to include the trail. Table 4 provides examples of approaches being used to measure affected reach for the CHI interventions.

DISCUSSION

We have described the approaches to measuring the extent and impact of environmental changes in the evaluations of 3 multisite community-level obesity prevention initiatives in California. The initiatives are still underway, and long-term results from the population-level indicators are not yet available. This section discusses some of the challenges and lessons we have learned in evaluating these initiatives that may be useful for other, similar initiatives.

Most of the challenges center around the measurement of the intermediate outcomes: measuring

the extent to which environmental changes have been implemented and their impact on the people most directly exposed. The short-term process outcomes are relatively straightforward and easy to collect, although it can be challenging to collect process data without placing undue burden on the communities. The approaches to measuring long-term population outcomes are also relatively straightforward, at least conceptually, with standard survey-based approaches using pre–post measures incorporated into quasi-experimental designs, where feasible. However, population-level measures are imperfect in capturing the impact of environmental interventions on obesity. Population-level surveys are expensive to conduct,³⁰ and it is difficult to obtain response rates that are representative of the entire population of a community.^{31,32} More

importantly, it is difficult for a single intervention or even a combination of interventions to achieve a measurable population-level impact because most of these interventions are small relative to the array of factors that shape physical activity and dietary behaviors.^{33,34}

If population-level measures cannot provide conclusive evidence about the impact of environmental interventions then we must emphasize the importance of documenting the intermediate outcomes and strengthen the methodology and tools to effectively capture environmental change. These methods will need to include some assessment of the degree to which the environment has changed combined with an assessment of the impact of the changes on those most directly exposed. The HEAC and CRROPP evaluations use a comprehensive

longitudinal approach to capture the extent of environmental change. The challenge of quantifying the degree of environmental change is that the changes are typically complex and multidimensional, even for relatively simple interventions such as changing healthy snack availability in grocery stores.

The HEAC and CCROPP evaluators use audit tools similar to those developed for other initiatives to observe and measure baseline-to-endpoint changes in the store, worksite, and school environments.^{35–39} Measurements of the quality of the change, based on existing school nutrition and physical activity policies and standards, were used to determine potential impact on student health behaviors and outcomes.⁴⁰ The audit tools can measure longitudinal change in specific environmental dimensions (e.g., percentage of items in a store

TABLE 4—CHI Environmental Change Strategies, by Exposed and Affected Reach: Kaiser Permanente, California

Strategy Description	Exposed Reach	Options for Measuring Affected Reach
Food environment strategies		
Organize and develop a certified farmer’s market	100 shoppers/wk	Surveys of shoppers to document increases in fresh produce consumption
Implement a fruit and vegetable community-supported agriculture program that targets low-income residents and is subsidized by full subscribers	100 boxes delivered weekly to individuals and families	Surveys of subscribers to document increases in fresh produce consumption
Implement a healthy menu program in local restaurants	1000 restaurant patrons	Surveys of restaurant owners to document increases in purchases of healthy entrees
Built environment strategies		
Install a lighted walking trail along the canal banks to provide access to safe physical activity	1200 living 0.5 miles from the trail	Observation to capture trail use Surveys of trail users to estimate increases in overall physical activity
Affect the urban planning via city General Plans	10 000 people living in the immediate neighborhood	Pre–post observation of pedestrian traffic in affected areas Intercept surveys of pedestrians to document changes in physical activity
Support open space grant to acquire land for a community park	13 200 living 0.5 miles from the proposed park	Counts of new park users Surveys of users to document changes in physical activity

Note. CHI = Community Health Initiative.

that are “healthy”), but methods have not yet been combined or developed to determine the level and extent of the cumulative effect across environments that is required to tip a neighborhood or a community into supporting healthful behaviors.

The CHI evaluation is focusing on the next step in the logic model: measuring the impact of the environmental changes on those most directly exposed. There are many limitations of the “affected reach” approach to measuring this intermediate impact. As noted in the introduction, the literature on the impact of environmental change interventions is sparse, so evaluators are often forced to rely on less-rigorous program evaluation approaches. In addition, interventions are often small in scale and have limited resources for evaluation, so the evaluations may consist of simply counting the number of walking trail users or the amount of additional produce sold by a corner store without being able to conduct surveys of the users or shoppers to determine whether the observed use or consumption is because of the environmental change or another random factor. Even when surveys can be conducted, the data will often be self-reported and may provide biased estimates of the true underlying behaviors. Finally, even where reliable information is available about effect sizes, the CHI evaluation team’s approach to converting to numbers of people significantly affected is arbitrary when the effect size estimates are for average impact across a population.

Despite these challenges, the CHI, HEAC, and CCROPP evaluations are focusing on the most critical parts of the environmental change logic model. Because population-level outcomes (such as changes in body mass index) are

too far removed from the intervention, the research community must focus its effort on measuring the extent of the environmental changes and the impact on community residents most directly exposed to them. We must continue to develop and refine the quantitative indices of environmental change so that we can make cross-community comparisons over time of the extent of the “dose” or the degree of change taking place. We must also continue to search for ways of establishing a link between the changed environments and measuring the impact on people exposed, perhaps being more flexible about the evaluation designs being used as suggested in the IOM report.⁴³ Future research is needed to understand how to measure the cumulative effect of the environmental changes on a community and its eventual effect on food and physical activity behavior. ■

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This article was accepted September 3, 2010.

Contributors

A. Cheadle, P.M. Schwartz, S. Rauzon, W.L. Beery, and L. Solomon participated in the conceptualization and refinement of the Community Health Initiative (CHI) evaluation methodology reported in the article and in the writing of the CHI sections. S.E. Samuels supervised all

aspects of the Healthy Eating, Active Communities and Central California Regional Obesity Prevention Program studies. L. Craypo managed the design and analysis. S. Yoshida and M. Boyle assisted with the writing and data analysis.

Acknowledgments

The authors acknowledge and thank The California Endowment and Kaiser Permanente for their financial support.

Human Participant Protection

The research was approved by the institutional review boards of Kaiser Permanente, Group Health Cooperative, and the University of California, Berkeley.

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