A Review of Promising Multicomponent Environmental Child Obesity Prevention Intervention Strategies by the Children’s Healthy Living Program

Abstract Childhood obesity has increased rapidly over the last three decades in the U.S. Individual-level interventions targeting healthy eating and physical activity have not significantly impacted clinical measures of obesity in children. Focusing “upstream” on physical, social, cultural, political, and economic environments may be more effective. The purpose of this qualitative review is to analyze published environmental interventions that effectively prevented or reduced obesity in children ages 2–10 years by working within their family, school, and/or community environment to increase physical activity, reduce sedentary behaviors, or improve healthy diet. Through an electronic database search, 590 original articles were identified and 33 were read in full. Using Brennan and co-authors’ (2011) rating system, 18 were rated as effective intervention studies. This analysis showed that interventions targeting multiple environments (e.g., family, school, and community) show promise in reducing childhood obesity. Further research is needed to test interventions targeting multiple environments in different communities and populations.

Introduction Obesity (body mass index [BMI] ≥95th percentile) among children ages 6–11 years in the U.S. has risen from 7% in 1980 to 18% in 2010 (Ogden, Carroll, Kit, & Flegal, 2012). Further, one-third of youth ages 2–19 years are overweight or obese (BMI ≥85th percentile) (Ogden et al., 2012). Children’s overweight prevalence will nearly double by 2030 (Wang, Beydoun, Liang, Caballero, & Kumanyika, 2008).

Excess weight puts children at greater risk for elevated cholesterol, plasma insulin, and systolic blood pressure (Bao, Srinivasan, Wattigney, & Berenson, 1994), which are risk factors for cardiovascular disease (Freedman, Dietz, Srinivasan, & Berenson, 1999) and type 2 diabetes (Narayan, Boyle, Thompson, Sorensen, & Williamson, 2003). Childhood obesity also increases the risk for negative psychosocial consequences, such as discrimination, stigmatization, low self-esteem, and depression (Griffiths, Parsons, & Hill, 2010).

Therefore, it is essential to identify the most effective, feasible, and sustainable interventions. A healthy lifestyle, including healthy eating and physical activity, can lower the risk of obesity (U.S. Department of Health and Human Services [DHHS], 2010). Most children are not meeting the Dietary and Physical Activity Guidelines for Americans (DHHS, 2008; Eaton et al., 2012). Obesity prevention efforts concentrating on individual behaviors, not incorporating environments, may have limited impact on childhood obesity (Summerbell et al., 2005). Recent studies suggest focusing interventions “upstream” on physical, social, cultural, political, and economic determinants of health to produce more significant and sustainable results (Fialkowski et al., 2014). These environments include places where children live, eat, and play, and examples of environmental interventions include increasing fruit and vegetable affordability, instituting school wellness policies, and building playgrounds.

Most childhood obesity reviews have not focused on interventions incorporating the environment as defined above. Story (1999) reviewed school-based prevention programs, while Flodmark and co-authors (2006)
reviewed studies with a control group. Other reviews specifically targeted interventions with obesity prevention as a primary aim (Bautista-Castaño, Doreste, & Serrra-Majem, 2004; Campbell, Waters, O’Meara, Kelly, & Summerbell, 2002) or limiting sedentary behavior (DeMatti, Lemont, & Meurer, 2007). A review by Swanson and co-authors (2011) focused on intergenerational energy balance interventions, while Hardeman and co-authors (2000) included interventions to prevent weight gain.

The purpose of this study is to review effective environmental interventions (in family, school, and community settings) to prevent or reduce childhood obesity. This review was part of the Children’s Healthy Living Program (CHL), a multisite multicomponent early childhood (ages 2–8 years) obesity prevention initiative in the U.S. Affiliated Pacific region. The goal was to identify effective obesity prevention interventions; thus, non-significant or negative studies were excluded. Specifically, the objectives were to review effective, feasible, and sustainable environmental early childhood (2–10 years) obesity prevention interventions, and identify common strategies across successful studies to be included in future evidence-based, early childhood environmental interventions.

Methods

A literature review utilized Google Scholar, Medline, and all EBSCOhost databases of original articles published January 1995–June 2012. Search terms were “childhood,” “obesity prevention,” “physical activity,” and “nutrition.” Each term was searched with “environment.” Inclusion criteria were the intervention targeted home, school, and/or community environments; the article described intervention components like health education or promotion, behavior modification, and/or school health policy; written in English; tracked at least one obesity-related outcome, such as fruit and vegetable, water, or dietary intake, nutrition or health knowledge, physical activity, TV watching, sedentary behavior, BMI, and/or blood pressure; and had a positive intervention effect. Elementary school interventions were included if at least some of the sample was under age 10. Randomized controlled trials were considered the highest evidence quality; however, other study designs (e.g., quasi-experimental) were included if they met inclusion criteria. The included reference lists and existing childhood obesity literature reviews were also hand searched.

The first level of screening focused on relevance of title and abstract. The remaining articles were read in full, applying inclusion criteria. When ambiguity arose, team discussion lead to consensus. Included articles were rated for intervention effectiveness. According to Brennan and co-authors (2011), study design is a qualitative indicator of study type; intervention duration is a rating of implementation length; and effect size or percent change is a rating of the net intervention effect on the outcomes, with ratings provided for total population and subpopulations separately. An “effective” study should produce significant positive health or behavioral outcomes and have policy, environment, or economic implications and be operationalized as Intervention Evaluation x Duration (high/medium) x Effect Size (net positive).

For “effective” articles, common evidence-based strategies were identified if they were a critical component of at least three reviewed interventions. Each article was also categorized according to the environmental level targeted—family, preschool/school, and/or community environment. As preschool/school policy and training are necessary to change the environment, these subcategories were included under the preschool/school environment.

Results

Of the 590 articles identified, 557 were excluded (502 excluded based on title/abstract and 55 based on inclusion criteria). The remaining 33 articles were read in full. Of these, 18 were rated as effective based on Brennan and co-authors’ (2011) framework (see Figure 1), were abstracted (Table 1), and subsequently divided into one of the three environmental intervention categories: family (n = 4), preschool/school (n = 12), and community (n = 5). Three of these targeted more than one environment (Figure 1) and were double counted across categories.

Review of Effective Interventions

Family Environment

Four studies addressed the family environment. Bright Start (Story et al., 2012), the Pediatric Overweight Prevention through a Parent Training Program (PT) (Slusser et al., 2012), and the Kiel Obesity Prevention Study (KOPS) (Müller, Asbeck, Mast, Langnäse, & Grund, 2001) provided parent education and training to promote healthy eating, physical activity, and/or decrease sedentary behaviors at home. Bright Start and PT, which focused on minority populations (Native Americans and Latinos, respectively), reported significant decreases in BMI, with Bright Start also finding reduced intake of sugar-sweetened beverages. KOPS found increases in fruit and vegetable consumption, frequency of daily low-fat food intake, daily physical activity, and decreased TV watching. Bright Start and KOPS supplemented these interventions with concurrent school-based interventions (described in School Environment subsection). These distinct parent-based education and training interventions were effective across multiple measures of obesity-related behaviors in children.

The Childhood Weight Control and Prevention Program (Epstein et al., 2001) implemented a parent education and weight-control program to promote healthy eating for families with at least one obese parent and a nonobese child. They found significant increases in fruit and vegetable intake among parents and children, in addition to a significant decrease in high-fat/sugar consumption. This parent-based education and behavioral intervention had positive effects on healthy eating for parents and children.

Preschool/School Environment

Twelve studies focused on preschool/school policy, education, and environment. These studies assessed how interventions could change sedentary behavior, physical activity, eating behavior, and obesity rates.

The Brocodile the Crocodile Health Promotion Program (Dennison, Russo, Burdick, & Jenkins, 2004) and an intervention by Robinson (1999) used curriculum-based educational
programs to reduce sedentary behavior. Brocodile the Crocodile decreased the intervention group’s TV viewing compared with the control group. Robinson’s intervention, which incorporated electronic TV managers to aid in self-monitoring, decreased BMI, triceps skinfold thickness, waist circumference, and waist-to-hip ratio, while also decreasing TV viewing and number of TV meals relative to the control group. Thus, both curricula demonstrated significant effects on multiple sedentary behavior measures.

Mo-suwan and co-authors (1998), Project SPARK (Sallis et al., 1997), and the Health and Nutrition Education program (Manios, Kafatos, & Mamalakis, 1998) used in-school physical activity and fitness programs to promote physical activity. Mo-suwan and co-authors incorporated walks and aerobic dance into the school schedule, which decreased the intervention group’s BMI compared with the control group. Project SPARK, a health-related physical education (PE) and self-management program, increased moderate/vigorous physical activity, and improved cardiopulmonary endurance and abdominal strength among female students in the intervention schools compared to control schools. Likewise, the Health and Nutrition Education program’s health-related PE program significantly improved the intervention group’s physical fitness, health knowledge, and moderate/vigorous physical activity outside of school. These distinct in-school physical activity and fitness interventions positively impacted multiple physical activity indices.

The Christchurch Obesity Prevention Project in Schools (James, Thomas, Cavan, & Kerr, 2004) was the only study targeting healthy eating exclusively. This nutrition-based education program focused on reducing carbonated beverage intake and resulted in decreased consumption in the intervention group, compared with an increase in the control group.

The majority of studies focused on nutrition/healthy eating while also addressing physical activity and/or sedentary behaviors. KOPS (Müller et al., 2001), Fun 5 program (Jersen, Nigg, & Titchenal, 2011), and the Eat Well and Keep Moving program (Gortmaker et al., 1999) implemented nutrition-based education programs with physical activity components. KOPS’s school-based intervention included a nutritional and health program to promote physical activity, reduce sedentary behaviors, and included an optional structured sports program. Fun 5’s after-school nutrition and physical activity program increased fruit and vegetable consumption and physical activity among children identified as “at-risk” (<5 fruit and vegetable servings/day, <300 min of physical activity/week, and BMI >85th percentile). The Eat Well and Keep Moving program used a behavior-focused health curriculum and physical activity program, which decreased total energy from fat/saturated fat, marginally decreased TV viewing, and increased fruit, vegetable, vitamin C, and fiber consumption relative to the control group. These distinct nutrition education and physical activity interventions were significant across multiple different behavior measures.

Bright Start (Story et al., 2012), Romp & Chomp intervention (de Silva-Sanigorski et al., 2010), and Shape Up Somerville (Economos et al., 2007) targeted eating and physical activity through multilevel interventions addressing various aspects of the school environment and/or policy. Bright Start trained teachers to support students to achieve one hour of physical activity daily and to improve eating habits by controlling the quantity and quality of classroom snacks, promoting water

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**FIGURE 1**

Flow Chart of the Qualitative Review Process of Childhood Obesity Environmental Interventions

Identified Intervention Studies

(N = 33)

Rated for Effectiveness

Using Brennan and Co-Authors’ (2011) Rating System

Insufficient Information Studies (n = 2)

Not Effective Studies (n = 5)

Somewhat Effective Studies (n = 8)

Effective Studies

(n = 18)

Identify Common Evidence-Based Strategies*

Family Environment (n = 4)

Preschool Policy and Environment (n = 12)

Community Environment (n = 12)

*Three studies fell into more than one category and were double counted.
## TABLE 1
Qualitative Review of Research Addressing Children’s Physical Activity (PA) and Nutrition Interventions Including Environmental Components by Family, Preschool, and Community Environments

<table>
<thead>
<tr>
<th>Study Name, Location, and Duration</th>
<th>Target Group, N, and Research Design</th>
<th>Intervention Components</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Family environment</strong></td>
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<tr>
<td>Bright Start; South Dakota; 14 weeks for KG and 31 weeks for G1 (Story et al., 2012)*</td>
<td>KG and G1; 454; RCT</td>
<td>Parent education and training to reduce caloric intake, TV watching, and increase PA</td>
<td>The intervention group had a statistically significant net decrease of obesity prevalence by 10% ($p = .033$); decreased intake of sugar-sweetened beverages by an average of -0.28 ($SE = 0.11$, Prob($t) = .024$); and decreased intake of whole and chocolate milk by an average of -0.22 ($SE = 0.07$, Prob($t) = .011$) and -0.17 ($SE = 0.06$, Prob($t) = 0.025$), respectively.</td>
</tr>
<tr>
<td>Pediatric Overweight Prevention Through a Parent Training Program (PT); Los Angeles, California; 17 months (Siussier et al., 2012)</td>
<td>2–4 years; 81; RCT</td>
<td>Parent education and training to promote healthy eating and PA</td>
<td>The intervention group significantly decreased their BMI z-scores by an average of .20 ($SE = 0.08$) compared to the control group, which had an increase in z-scores by an average of .04 ($SE = 0.09$) at one year ($p &lt; .05$).</td>
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<tr>
<td>Kiel Obesity Prevention Study; Germany; 3 years (Müller et al., 2001)*</td>
<td>5–7 years; 2,440; intervention matched control</td>
<td>Parent nutrition education and health program</td>
<td>The intervention group had increases in daily FVC by 50%, frequency of daily intake of low-fat food from 20% to 50%, PA from 58% to 65%, nutrition knowledge from 48% to 60%, and a decrease in TV watching from 1.9 to 1.6 hours/day. Twenty-eight percent of the children became members of a sports club (all $p &lt; .05$).</td>
</tr>
<tr>
<td>Childhood Weight Control and Prevention Program; New York; 1 year (Epstein et al., 2001)</td>
<td>7–10 years; 51; randomized trial, no control</td>
<td>Parent education and weight control treatment for families with at least one obese parent and a nonobese child</td>
<td>Parents and children in the intervention group had significant differences in FVC ($F[1, 23] = 6.56, p &lt; .025$; $F[1, 24] = 7.20, p &lt; .025$, respectively) and high-fat/sugar food intake ($F[1, 24] = 18.14, p &lt; .001$). Parents in the intervention group showed significant differences in percentage overweight ($F[1, 24] = 5.64, p &lt; .05$).</td>
</tr>
<tr>
<td><strong>School environment</strong></td>
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<tr>
<td>Broccoli the Crocodile Health Promotion Program; New York; 2 years (Dennisson et al., 2004)</td>
<td>2.6–5.5 years; 163; RCT</td>
<td>Educational program (32 sessions about healthy eating and 7 sessions about reducing TV viewing time)</td>
<td>The intervention group decreased TV viewing by 3.1 hr/week while the control group increased by 1.6 hr/week (95% CI [-8.4, -1.0], $p = .02$). The percentage of children viewing TV 2 hr/day also decreased significantly among the intervention group from 33% to 18% compared with an increase in the control group of 41% up to 47% (95% CI [-42.5, -5.1], $p = .046$).</td>
</tr>
<tr>
<td>NA; San Jose, California; 6 months (Robinson, 1999)</td>
<td>8–10 years; 198; RCT</td>
<td>Educational program with electronic self-monitoring device (18 lessons to reduce TV, videotape, and video game use)</td>
<td>The intervention group had statistically significant decreases in BMI (adjusted difference -0.45 kg/m², 95% CI [-0.73, -0.17], $p = .002$), triceps skinfold thickness (adjusted difference 1.47 mm, 95% CI [-2.41, -0.54], $p = .002$), waist circumference (adjusted difference -2.30 cm, 95% CI [-3.27, -1.33], $p &lt; .001$), and waist-to-hip ratio (adjusted difference -0.02, 95% CI [-0.03, -0.01], $p &lt; .001$). The intervention group also had decreases in reported TV viewing and number of meals eaten in front of the TV.</td>
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<tr>
<td>NA; Thailand; 29.6 weeks (Mo-suwan et al., 1998)</td>
<td>G2; 292; RCT</td>
<td>Aerobic program (15 minute walk before morning class and 20 minute aerobic dance following afternoon nap for 3 days/week)</td>
<td>The intervention group had a greater reduction in prevalence of obesity ($OR = 0.32$, 95% CI [0.18, 0.56]). Girls in the intervention group had a lower likelihood of having increases in BMI ($OR = 0.08$, 95% CI [0.01, 0.76]).</td>
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<tr>
<td>Project SPARK; San Diego, California; 2 years (Sallis et al., 1997)</td>
<td>G4 and G5; 1,538; quasi-experimental</td>
<td>SPARK physical education (3 days/week for 30 minutes per session, included health and skill fitness, aerobics, and sports) and self-management program (taught behavior change skills)</td>
<td>The intervention group’s moderate/vigorous PA increased during physical education class by 18 min ($p &lt; .001$). Significant effects were also found on fitness measures of cardiorespiratory endurance and abdominal strength ($p &lt; .001$) among female students.</td>
</tr>
</tbody>
</table>

*For the original paper, these studies are described in the context of their respective methodologies and findings.*
consumption, and rewarding performance with nonfood items. The study also trained food-service staff to offer healthier foods, smaller portions, and limit second servings to fruits and vegetables. The Romp & Chomp intervention enhanced the capacity of two existing health promotion programs, increased in-school physical activity, implemented healthy food policies, and provided children with water bottles and lunchboxes. The intervention group had significantly lower mean weight, BMI, BMI z-score, intake...
of packaged snacks/fruit juice, and higher servings of vegetables per day compared with the control group. Shape Up Somerville introduced a school wellness policy, modified food served at school, led a walk-to-school campaign, and used in-class/after-school curricula for healthy eating and physical activity, which decreased the intervention group’s BMI z-score significantly compared with the control group. Shape Up Somerville also had a community-environment intervention, which is discussed in the following subsection. These comprehensive interventions, which addressed multiple aspects of the school environment, were significant across multiple obesity-related behavior indices.

Community Environment
Five community environmental interventions were identified. Shape up Somerville’s (Economos et al., 2007) community-based intervention included safe walking routes to school, community physician training, “approved” restaurant promotions, farmers markets, city ordinances on walkability and bikeability, community resource guides, and media campaigns. LA Sprouts (Davis, Ventura, Cook, Gyllenhammer, & Gatto, 2011), The Delicious and Nutritious Garden (Heim, Stang, & Ireland, 2009), and a study by McAleese and Rankin (2007) employed community-based gardening interventions. LA Sprouts included nutrition education and cooking, targeted dietary intake, obesity parameters, and blood pressure measurement in Latino youth. Postintervention there was a significant increase in fiber intake, a significant difference in diastolic blood pressure change between groups, and a decrease in overweight prevalence in the intervention group compared with an increase in the control group. The Delicious and Nutritious Garden Intervention, which included cooking and taste testing, reported a significant increase in the number of fruits and vegetables ever eaten, vegetable preferences, and fruit and vegetable asking behavior at home. McAleese and Rankin’s (2007) garden-based nutrition program also found increased servings of fruits and vegetables, as

\[ \text{TABLE 1 continued} \]

Qualitative Review of Research Addressing Children’s Physical Activity (PA) and Nutrition Interventions Including Environmental Components by Family, Preschool, and Community Environments

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<tr>
<td>Shape Up Somerville; Massachusetts; 3 years (Economos et al., 2007)*</td>
<td>G1 and G3; 1,178; nonrandomized control trial</td>
<td>Safe routes to walk to school, community physician training, “approved” restaurant promotions, farmers markets, city ordinances on walkability and bikeability, community resource guides, and media campaigns</td>
<td>BMI z-scores significantly decreased in the intervention group by -0.1005 (p = .001, 95% CI [-0.1151, -0.0859]).</td>
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<tr>
<td>LA Sprouts; Los Angeles, California; 12 weeks (Davis et al., 2011)</td>
<td>9–11 years; 104; quasi-experimental</td>
<td>A 90-minute, garden-based nutrition and interactive cooking program held once a week at a community garden</td>
<td>The intervention group increased dietary fiber intake by 22% versus a 12% decrease in the control group (p = .04), decreased diastolic blood pressure by 5% versus a 3% decrease in the control group (p = .04), and had a 1% decrease in overweight prevalence compared with a 1% increase in the control group (p = .04).</td>
</tr>
<tr>
<td>Delicious and Nutritious Garden Intervention; Minnesota; 12 weeks (Heim et al., 2009)</td>
<td>G4 and G6; 93; pre-post</td>
<td>Pilot garden-based nutrition education programs with cooking and taste testing</td>
<td>The intervention group had increases in fruit and vegetable exposure (p &lt; .001), vegetable preferences (p &lt; .001), and fruit and vegetable asking behavior at home (p &lt; .002).</td>
</tr>
<tr>
<td>NA; Idaho; 12 weeks (McAleese et al., 2007)</td>
<td>10–13 years; 99; nonequivalent control group</td>
<td>Garden-based nutrition education program</td>
<td>The intervention group significantly increased FVC by 1.13 and 1.44 servings, respectively (p &lt; .001). Significant increases were also found in vitamin A, vitamin C, and fiber intake.</td>
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<tr>
<td>Healthy Foods Hawaii intervention; Hawaii; 9–11 months (Gittelsohn et al., 2010)</td>
<td>8–12 years; 116 parent-child dyads; RCT</td>
<td>Increase store stocking of nutritious foods, point-of-purchase promotions, interactive sessions, local producer/distributor involvement</td>
<td>Caregivers in the intervention group had significant improvement in food-related knowledge (β = .26, SE = 0.06) and borderline improvement in the perception that healthy foods are convenient (β = .22, SE = 0.09). Children in the intervention group had significantly increased total health eating index (HEI) scores (β = 8.53, SE = 3.49), increased HEI grain scores (β = 1.83, SE = 0.76), and total water consumption (β = 2.72, SE = 0.74) compared with control group.</td>
</tr>
</tbody>
</table>

*Studies that fell into more than one environment category.

Note: NA = not available; KG = kindergarten; G1 = grade 1; G2 = grade 2; G3 = grade 3; G4 = grade 4; G5 = grade 5; G6 = grade 6; RCT = randomized control trial; FVC = fruit and vegetable consumption; BMI = body mass index; CI = confidence interval; OR = odds ratio; SE = standard error.
well as vitamin A, C, and fiber intake among participants. These gardening interventions demonstrated positive effects on different healthy eating measures.

The Healthy Foods Hawaii intervention (Gittelsohn et al., 2010) modified food placement in stores and conducted point-of-purchase promotions to address the psychosocial factors and behaviors associated with healthier food choices. Parents in the intervention group had significant improvements in food-related knowledge and borderline improvement in the perception that healthy foods are convenient. Children in the intervention group showed significant increases in total healthy eating index (HEI) scores (a quality of diet measure), HEI grain scores, and water consumption compared with the control group. This store-based intervention demonstrated significant healthy eating effects.

Common Strategies Across Effective Interventions

Common to all four of the home-based interventions was the utilization of specific behavioral messages, goal setting/evaluation, and intervention staff support. Three of these (Epstein et al., 2001; Muller et al., 2001; Sussman et al., 2012) also taught parents behavior modification strategies to use with their children, such as positive reinforcement for targeted behaviors.

All 12 of the school-based interventions used curricula with physical activity and/or health components. Six of these (Economos et al., 2007; Gortmaker et al., 1999; Muller et al., 2001; Robinson, 1999; Sallis et al., 1997; Story et al., 2012) used parent outreach, the degree of which ranged from parent newsletters to concurrent family-based interventions. Three (Manios et al., 1998; Robinson, 1999; Sallis et al., 1997) taught students behavior modification skills, such as self-monitoring and goal setting; and three (de Silva-Sanigorski et al., 2010; Economos et al., 2007; Story et al., 2012) were multilevel interventions, involving changes to school policy. Of the community-based programs, three (Davis et al., 2011; Heim et al., 2009; McAleese & Rankin, 2007) were hands-on gardening interventions.

Discussion

As a review inclusion condition, all 18 studies yielded significant findings in favor of the intervention group. Family-based programs are likely to be effective because children’s eating and physical activity habits begin developing at home as parents set standards and role model behaviors. Such interventions necessarily engage parents in the program and as role models, the effects of which may be sustained and reinforced long term. This parallels a systematic review of interventions for overweight children involving the family in weight-loss activities (McLean, Griffin, Toney, & Hardenman, 2003). The common strategies also suggest the importance of providing parents with specific information and practical tools to allow them to promote healthy behaviors.

The success of school-based programs is likely due to the significant portion of time children spend in school, where most of their daily calories are consumed and physical activity is organized. Preschool in particular is a key learning environment, because food preferences are developed during this age (Birley & McAllaster, 2011). The common strategies of parent outreach and teaching students behavior modification skills suggest that interventions that bridge the gap between in-school and out-of-school behaviors also hold promise.

The community environment focus aligns with other community-based studies across settings to modify environments to effectively promote physical activity (Krieger, Rabkin, Sharify, & Song, 2009). The effectiveness of community gardening interventions might reflect their ability to engage children as active participants in the learning process, which may be important for health attitudes and behaviors. Better access to supermarkets and stores where healthy food was available increased healthy eating behavior (Gittelsohn et al., 2010), aligning with other studies demonstrating that access to supermarkets and stores with healthful foods reduces the risk of obesity (Larson, Story, & Nelson, 2009) and increases healthier food intake (Bodor, Rose, Farley, Swalm, & Scott, 2008). Future research should systematically investigate environmental interventions combining the different family, school, and community environments.

This review is limited by the quality of published articles. Using Brennan and co-authors’ (2011) rating system to identify effective studies could have excluded research that might provide important information, possibly limiting generalizability. A lack of generalizability for developing countries and underserved populations is noted, as most interventions were in the U.S. or other developed countries. Brennan and co-authors’ (2011) rating system addresses intervention duration, but not outcome duration. More research is needed to inform the minimal intervention duration necessary and the optimal duration to maximize the desired effects on childhood obesity.

Comprehensive interventions that target each environmental level (home, school, and community) are likely the most effective in supporting sustained behavior change. Increasing levels of physical activity and healthy eating involve individual change, but evidence shows that change is more successful with supportive environments. For example, if schools create easy access to safe drinking water and water bottles, children might drink more water. If communities build bike paths, more students can ride their bikes to school. Physical activity and healthy eating are conducive to environmental and policy interventions based on the premise that an individual’s health status is inextricably connected to their physical and social environments (Sallis et al., 1997). Successful environmental strategies for promoting physical activity and healthy eating involve regulatory interventions, physical facilities development, and policies in large settings like schools (Booth, Owen, Bauman, Clavisi, & Leslie, 2000).

Conclusion

Interventions to reduce or prevent obesity should be designed with components at each level of the environment (home, school, and community) to comprehensively modify children’s surroundings. The specific recommended strategies for developing interventions from this review are to teach parents how to create a home environment that promotes healthy behaviors, as well as healthy behavior changes. Educate and train children on physical activity and healthy eating through behavior change intervention within early school settings. Train teachers, after-school staff, and parents to monitor and encourage physical activity and healthy eating, especially replacing sugar-sweetened beverages with water. Educate and train teachers as trainers on physical activity and healthy eating behavior of children. Introduce, enhance, and support policy to pro-
mote physical activity and healthy eating in young children. Increase accessibility of envi-
ronments for safe play and physical activity. Engage young children in growing and eating
locally produced healthy foods. Most impor-
tantly, the combined involvement of children, parents, teachers, and community members
in intervention activities will produce more effective outcomes.

Acknowledgements: This paper was prepared by the Children's Healthy Living (CHL) Pro-
gram's intervention team. Financial support for the CHL Program is provided by the Agri-
culture and Food Research Initiative Grant No. 2011-68001-30335 from the U.S. Depart-
ment of Agriculture National Institute of Food and Agriculture, a Coordinated Agricul-
tural Project.

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