

# Nutrition: Gardening Interventions to Increase Fruit and Vegetable Consumption Among Children

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## Community Preventive Services Task Force Finding and Rationale Statement Ratified December 2017

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## CPSTF Finding and Rationale Statement

### Context

The [Dietary Guidelines for Americans 2015-2020](https://health.gov/dietaryguidelines/2015/guidelines/) [https://health.gov/dietaryguidelines/2015/guidelines/] recommends a healthy eating pattern that includes a variety of fruits and vegetables. Studies show, however, that most people in the United States, including children and adolescents, do not eat enough fruits and vegetables (CDC, 2017; CDC, 2014). Children who regularly eat vegetables are more likely to develop healthy eating habits as adults (Maynard et al., 2006). Studies have shown that regular exposure to fruits and vegetables increases consumption among children (Patrick et al., 2005; Koch et al., 2006), and gardening interventions have been found to increase children's preferences for, and willingness to try, new fruits and vegetables (Robinson-O'Brien et al., 2009).

CDC recommends gardening as a strategy to increase fruit and vegetable intake among children (CDC, 2011). Gardening interventions also are included within the Healthy Eating Learning Opportunities component of CDC's [Comprehensive Framework for Addressing the School Nutrition Environment and Services](https://www.cdc.gov/healthyschools/nutrition/pdf/school_nutrition_framework_508tagged.pdf) [https://www.cdc.gov/healthyschools/nutrition/pdf/school\_nutrition\_framework\_508tagged.pdf].

### Intervention Definition

Gardening interventions provide children with hands-on experience planting, growing, and harvesting fruits and vegetables, which may increase children's willingness to consume fruits and vegetables. Interventions must include outside gardens, microfarms, container gardens, or other alternative gardening methods. They may also include nutrition education or a parental component. Interventions may be implemented in early care and education settings, schools, afterschool programs, or communities.

### CPSTF Finding (December 2017)

The Community Preventive Services Task Force recommends school-based gardening interventions in combination with nutrition education. This finding is based on sufficient evidence of effectiveness showing school-based interventions increase children's vegetable consumption.

### Rationale

#### Basis of Finding

The Community Preventive Services Task Force (CPSTF) conducts accelerated assessments of recently published systematic reviews to provide program planners and decision-makers with additional, effective intervention options. The following published review was selected and evaluated by a team of specialists in systematic review methods, and in research, practice, and policy related to obesity, nutrition, and school health:

Savoie-Roskos MR, Wengreen H, Durward C. Increasing Fruit and Vegetable Intake among Children and Youth through Gardening-Based Interventions: A Systematic Review. *Journal of the Academy of Nutrition and Dietetics* 2017;11(2):240-50.

In addition to the evidence summarized in the published review, the team examined the included intervention studies and collected additional data on study, intervention, and population characteristics. The final CPSTF assessment considered the findings of the published review, additional information from the included studies, and expert input from team members and the CPSTF.

The CPSTF recommendation is based on evidence from 14 studies that examined gardening interventions conducted with children ages 2 to 18 years (search period January 2005 – October 2015). The finding of sufficient evidence was based on the magnitude of effect estimates, number of studies, and consistency of effects shown in Table 1 below. The Community Guide review team reported summary effect estimates as medians and interquartile intervals (IQI), when possible. Studies that could not be included in the summary estimate are reported individually.

**Table 1: Fruit and Vegetable Intake Outcomes for Gardening Interventions**

Outcome	Summary of Results
Combined Fruit and Vegetable Intake (13 studies)	<p>Median increase of 0.55 servings/day (IQI: -0.04 to 1.63 servings/day) 9 studies</p> <p>Increase of 0.31 cup equivalents 1 study</p> <p>Increase of 1 gram (arm 1) and 41 grams (arm 2) 1 study</p> <p>Increase of 0.3 times/day among younger children and no change among older children 1 study</p> <p>No statistically significant change in home intake 1 study</p>
Fruit Intake Alone (10 studies)	<p>Median increase of 0.05 servings/day (IQI: -0.28 to 1.00 servings/day) 7 studies</p> <p>Increase of 0.1 cup equivalents 1 study</p> <p>Decrease of 8 grams (arm 1) and decrease of 20 grams (arm 2) 1 study</p> <p>Increase of 0.1 times/day among younger children and no change among older children 1 study</p>

Outcome	Summary of Results
Vegetable Intake Alone (12 studies)	<p>Median increase of 0.60 servings/day (IQI: 0.20 to 0.67 servings/day) 8 studies</p> <p>Increase of 0.21 cup equivalents 1 study</p> <p>Increase of 16 grams (arm 1) and increase of 29 grams (arm 2) 1 study</p> <p>Increase of 0.2 times/day among younger children and no change among older children 1 study</p> <p>Increase of 1.2 in number of different vegetable varieties consumed 1 study</p>

IQI: Interquartile interval

Seven studies reported on interventions that included nutrition education in addition to gardening activities. Interventions that included nutrition education produced greater increases in fruit and vegetable consumption (median increase of 0.82 servings/day, IQI: 0.29 to 2.94; 6 studies) when compared to gardening interventions alone (median increase of 0.21 servings/day, IQI: -0.62 to 1.20; 3 studies). One additional study that included nutrition education in addition to gardening activities could not be plotted and reported a greater increase in fruit and vegetable consumption among children in the intervention group when compared to children in the control group.

Eight studies reported on interventions that were implemented in schools. Gardening interventions implemented in schools had a median increase in fruit and vegetable consumption of 0.55 servings/day (IQI: -0.18 to 1.63; 5 studies). The remaining three studies could not be plotted: one study reported an increase in vegetable consumption among children in the intervention group; one study reported an increase in fruit and vegetable consumption; and another study reported a significant increase in fruit and vegetable consumption at home.

Almost all the improvements seen were driven by increases in vegetable consumption (median increase of 0.6 servings/day, IQI: 0.20 to 0.67; 8 studies). There is not enough evidence to determine whether gardening interventions increase fruit consumption among children (median increase of 0.05 servings/day, IQI: -0.28 to 1.00; 7 studies). The available evidence was limited for interventions implemented in afterschool, community, or early care and education settings.

## Applicability and Generalizability Issues

### *Intervention settings*

Included studies were conducted in the United States (10 studies), Australia (1 study), Canada (1 study), and the United Kingdom (2 studies). Studies were conducted in schools (8 studies), afterschool settings (2 studies), communities (2 studies), early care and education settings (1 study), or multiple settings (1 study). Among studies that reported urbanicity, six were from urban settings, one was from a rural setting, and one was conducted in mixed settings. Intervention effectiveness did not vary by country or setting.

### *Demographic characteristics*

Study participants had a mean age of 9.0 years (7 studies) and were 51.5% female (10 studies). Six interventions were implemented in low-income communities. Eleven studies that reported racial and ethnic distributions had populations composed of students in the following groups: white (median 29.6%; 6 studies), black (median 18.0%; 4 studies), Hispanic (median 44.5%; 6 studies), Asian (median 8.0%; 5 studies), and First Nations (100.0%; 1 study). Interventions were effective across sociodemographic groups, including low-income and predominantly racial or ethnic minority populations.

### *Intervention characteristics*

Seven studies examined interventions that included nutrition education in addition to gardening activities. They reported greater increases in fruit and vegetable consumption than gardening interventions alone (7 studies).

The median intervention duration was four months (14 studies); nine studies were less than six months long. Intervention effectiveness did not vary by intervention duration.

## Data Quality Issues

Study designs included randomized control trials (2 studies), pre-post with a comparison group (7 studies), cohort (1 study), and pre-post without a comparison group (4 studies).

Dietary outcomes were based primarily on self-reported or parent-reported data. Common limitations of self-reported dietary data include participants forgetting about consumption of specific foods, inaccurately estimating portion sizes, or accidentally or purposefully failing to report specific items (Grandjean, 2012). There is also the potential for over reporting fruit or vegetable consumption due to social desirability bias. Most studies attempted to address these limitations by using age-appropriate, validated instruments.

## Other Benefits and Harms

No additional benefits or harms were identified in the included studies. Research indicates that gardening interventions may improve academic outcomes when gardening activities are integrated into existing curriculums (Williams et al., 2013). Garden-based learning can incorporate all subjects but is especially well-suited for math and science lessons. The CPSTF identified several potential benefits of gardening interventions, including the potential for an improved home dietary environment through parental involvement. There is also the potential for increased physical activity through active gardening activities. No potential harms were identified.

## Considerations for Implementation

The review by Savoie-Roskos et al. noted that incorporating a parental component could increase intervention effectiveness by encouraging changes in the home environment and providing support and resources to families, such as cooking and nutrition workshops. While the evidence shows gardening interventions are effective for a variety of age

groups, the authors emphasized the importance of considering children's ages when developing and implementing gardening interventions to ensure age appropriateness.

The CPSTF identified several other important areas for consideration, including the potential impact climate and resources may have on intervention success. Programs in milder climates can run longer given the longer growing season. Programs in more severe climates may be able to lengthen their programs using other methods, however, such as green houses and hydroponics.

Schools or communities with greater resources, including financial resources and physical space for gardening, are better able to implement gardening interventions than those with fewer resources. Garden upkeep and maintenance, especially during summer months and school holidays, may be a particular challenge for some programs. Hiring a dedicated garden coordinator or providing stipends to teachers implementing gardening programs can help, though dedicated staff are not a requirement for program success.

Another important consideration is the level of previous exposure to gardening. One study had low retention among students with a prior history of gardening at home, indicating these interventions may be ineffective among certain populations.

### Evidence Gaps

Additional research and evaluation are needed to answer the following questions and fill existing gaps in the evidence base.

- Are gardening-based interventions effective in early care and education, afterschool, and community settings?
- Are gardening-based interventions effective when implemented without nutrition education?
- Does intervention effectiveness vary by age or school level?
- Do children participating in gardening programs act as agents of change by engaging parents in discussions about food and nutrition? Do parents incorporate healthier dietary habits or purchasing practices at home?

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*The data presented here are preliminary and are subject to change as the systematic review goes through the scientific peer review process.*

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## Disclaimer

The findings and conclusions on this page are those of the Community Preventive Services Task Force and do not necessarily represent those of CDC. CPSTF evidence-based recommendations are not mandates for compliance or spending. Instead, they provide information and options for decision makers and stakeholders to consider when determining which programs, services, and other interventions best meet the needs, preferences, available resources, and constraints of their constituents.

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