



OVERVIEW

Community gardens and local food procurement policies and programs are gaining in popularity as health promotion strategies. The term *community* in community gardening signifies the convergence of multiple individuals, joining together in diverse settings, such as schools, hospitals, and nursing homes, to grow fruits, vegetables, and other plant varieties [1]. *Local food procurement* generally refers to strategies to increase the amount and availability of food locally sourced from within a community. Despite growing interest in the use of community garden and local food procurement initiatives to promote health, little is known regarding their role in promoting healthy eating and physical activity for obesity prevention [2, 3]. To inform policy action in this area, the aim of this evidence synthesis was to explore the literature on community gardens and local food procurement in relation to nutrition, physical activity (PA), and body weight.

METHODS

Review of Evidence

This synthesis involved the collection of review articles from five databases (Medline, CINAHL, ERIC, PsycINFO, and Academic Search Complete) and three grey literature sources (Community-Wealth, Food Secure Canada, and National Gardening Association). Additional reviews were provided by the research team, as well as identified through a search of Google Scholar, PubMed related references, and a review of references from key articles. To be included in this synthesis, reviews had to meet the following criteria: (1) English and French language reviews, including comprehensive, systematic, narrative, scoping, or state-of-the evidence reviews, as well as summary papers; (2) published after 2000; (3) focused on research in developed countries; and (3) examined research, strategies, and/or interventions relevant to PA, nutrition, and/or body weight, in the context of community gardens and local food procurement.

The first round of the screening process involved reviewing titles and abstracts to remove irrelevant

articles. The second-level screening consisted of a full-review of remaining articles to ascertain relevance in relation to the inclusion criteria. Given the aim of this synthesis is to inform policy, findings with implications for policy were emphasized during the extraction process.

SYNTHESIS OF EVIDENCE

Thirty-one reviews and papers met the criteria to be included in this synthesis report. Eighteen reviews focused on the school setting, three focused on indigenous settings, and twelve focused on other community settings, such as correctional facilities, hospitals and healthcare facilities, and nursing or long-term care homes. A number of reviews and papers overlapped, falling within more than one setting. While an aim of this synthesis was to explore the impact of community gardens and local food procurement strategies on body weight, only one review specifically discussed the impact of a program on this outcome of interest.

Gardens and Local Food Procurement in the School Setting

Eighteen reviews discussed findings and/or implications relevant to gardens and local food procurement in the school setting. Thirteen reviews and articles focused solely on the school setting, five of which looked specifically at school garden programs or interventions, and four of which focused on farm-to-school (FTS) programs, policies, and/or interventions. Four of these reviews were situated in the school setting, but had broader aims than gardens and/or local food procurement alone (i.e. assessing school-based teaching interventions to improve eating habits) [4]. Further, one review in this category discussed the effects of interventions delivered in the home, in addition to the school and other nutritional environments [5]. Lastly, five reviews did not focus on the school setting specifically, but explored a broad range of factors relevant to community gardens and local food procurement generally, which included discussion of school based programs, policies, and interventions. For findings and characteristics of reviews, see Table 1.

Impact on Nutrition and Physical Activity

Reviews Specific to Gardening in Schools

Five reviews looked specifically at school garden programs [6-10]. Of these reviews, all five reported on nutrition-related outcomes. In a review by Berezowitz et al. [6], school garden programs were found to improve fruit and vegetable (FV) intake in 71% of studies measuring that outcome. Other reviews reported promising [9], or moderate [10] impacts of programs, policies, and interventions on outcomes related to FV consumption. A review by Davis et al. [7] reported mixed evidence for the effectiveness of school garden-based programs on dietary intake, with 6/11 programs reporting increases in vegetable

consumption, and 4 showing no effect. Authors concluded that despite the substantial uptake of school gardens, the evidence underpinning their effects to promote health are limited [7]. Over and above fruit and vegetable consumption, the majority of reviews reported that school gardens created significant improvements in predictors and determinants of FV consumption, such as increased willingness to taste FV [7, 10], improved youth attitudes and preferences for FV [7, 8], and improved identification, knowledge, self-efficacy and variety of FV consumed [7]. However, one of these reviews noted that more research is needed to better understand why children choose the foods they do, and how this may impact lifetime food choices [8].

One study in the review by Ozer [9] reported on the impact of school gardens on PA, stating that following a pre/post evaluation of 338 youth from school garden programs, increases PA and FV consumption were noted [11]. No other reviews looking specifically at school gardens reported on outcomes related to PA.

Reviews Specific to Farm to School

Another four reviews explored farm-to-school (FTS) programs, which involve local food procurement in schools [12-15]. Of these reviews, all reported that programs resulted in at least modest improvements in nutrition-related outcomes, yet most noted difficulties in drawing conclusions due to the limited amount of literature available. In a review by Berlin et al. [12], increased consumption of FV was reported in 3/4 FTS intervention studies. Further, Taylor and Johnson [14] found that students selected 25–82% more servings of FV after the implementation of a FTS program than prior. However, this review also noted that roughly 13% of all school meals are wasted, and about 30-50% of all FV selected in schools are not consumed [14]. That said, this review also reported on a FTS evaluation where less food was found to be wasted by children selecting foods from the salad bar (26% wasted) in comparison to children selecting foods from the hot lunch line (51% wasted) [14]. An additional two reviews noted increases in predictors of FV consumption following implementation of FTS programmes [12, 15]. Thompson et al. [15] reported increased student knowledge about agriculture, nutrition, and health, as well as decreased fear of tasting new foods. In addition, Berlin et al. [12] reported increased willingness to taste FV in 3/6 studies, and increased preference for FV in 2/6 studies. Further, in comparing the impacts of classroom-based nutrition education and hands-on gardening activities, Joshi et al. [13] noted a significant and lasting increase in knowledge and preference for vegetables among students who participated in nutrition education combined with gardening, as compared to a control group. However, similar improvements were noted among students who received nutrition education alone [13].

Joshi et al. [13] additionally reported positive improvements in PA levels as a consequence of FTS and garden programs, which was measured through youth self-reporting and teacher recall [13]. One study in this review also evaluated BMI as an indicator for FTS success in impacting children's health. Overall,

this study did not report significant decreases in BMI for students in experimental schools after one year [13].

Reviews in the School Setting with a Broader Focus

Four reviews were situated in the school setting, but had a broader focus than school gardens and local food procurement [4, 5, 16, 17]. Three of these reviews included studies that reported on nutrition-related outcomes relevant to school garden and/or local food procurement. Of the four reviews, all reported positive impacts related to FV consumption [4, 16, 17]. In a systematic review of school garden programs in the US, Australia, and UK, Frerichs et al. [17] found significant improvements in 6/11 studies that reported on dietary behavior outcomes generally and 9/10 studies that reported on dietary-related psychosocial outcomes (e.g., willingness to try, preferences for vegetables). In a systematic review by Dudley et al. [4], studies with experiential learning strategies, such as garden-enhanced learning, were associated with the largest effects in reduction of food consumption or energy intake, increased FV consumption or preference, and increased nutritional knowledge outcomes. Further, a third systematic review conducted by Ganann et al. [5] included one study with relevance to school gardens. This study, conducted in a YMCA summer camp, combined experiential based gardening and nutrition education, and reported increases in FV consumption, preferences, and asking behaviors [18].

None of the reviews included in this section looked at the effectiveness of programs or interventions on PA-related outcomes.

Reviews in General Settings, Relevant to Schools

Five more reviews were focused on general settings, including schools [1, 2, 19-21]. Of these reviews, only one reported on nutrition and PA-related outcomes. In a review by Draper et al. [1], youth gardening programs were found to increase participants' access to healthy foods, FV consumption, preference, asking behaviors at home, nutrition knowledge, physical activity, and gardening self-efficacy.

Policy and Implementation Considerations

As a policy strategy, school gardens and local food procurement initiatives, such as FTS programs, were described as feasible additions to school environments and curricula. However, significant barriers were noted in relation to program maintenance requirements, such as intensive time [8, 9, 17], human [8, 9, 15] and financial [8, 9, 13, 15])resources, and space (especially for urban-based schools) [8]. Thompson et al. [15], for example, noted that many FTS programs in the USA are “merely token gestures that receive minimal or no funding and resources with no chance of scalability or sustainability” (p.399). As a consequence, a number of reviews noted the need for legislation, which can offer monetary incentives and support for such initiatives [15, 19].

Limitations

A number of reviews related to the school setting reported small and convenience samples within included studies [6, 9, 12], oftentimes with no controls [10, 12, 13]. High levels of heterogeneity among intervention types were also common, making it difficult to draw firm conclusions [4-6]. Whilst some studies reported FV consumption and preferences independently of each other, this tended to be the exception rather than the rule [4]. Definitions of FV also varied between studies. For example, one review examining FTS programs in the USA included a study where fruit juice and french fries were defined and included as FV by researchers [8]. Further, due to resource constraints, many of the studies assessed short-term and medium-term outcomes instead of long-term health indicators [7, 12, 13]. The lengths of studies also varied substantially in some cases, for example from 10 weeks in one study to two school years in another [5, 7]. Two reviews noted the irregularity of outcomes measured, with almost every study using a different measure to evaluate dietary intake and determinants of dietary behaviour [5, 7]. Further, the overwhelming majority of studies did not measure changes before and after the actual establishment of the garden [1]. Lastly, while weighed plate waste is recognized as a 'gold standard' for measuring food consumption (where the exact weights of all foods served are measured before and after a meal), Taylor et al. [14] noted this method was rarely adopted in school-based research because it is labour and time intensive.

Gardens and Local Food Procurement in Indigenous Communities

Three reviews discussed findings and/or implications relevant to community gardens and local food procurement in indigenous settings [22-24]. One reviewed food security issues as they pertain to indigenous communities, particularly in northern Manitoba, and described community and government approaches to tackling food insecurity [22]. Another reviewed the literature on the effectiveness of Traditional Hawaiian Diets (THD) (which include community gardening and local food procurement strategies) to help reduce obesity and improve health among Native Hawaiians [23]. The last review explored the role that home and community gardening initiatives can play in the reduction of diabetes for indigenous populations of the Navajo region (a region including over 250,000 federally recognized tribe members in Arizona, New Mexico, and Utah, USA) [24]. For findings and characteristics of reviews, see Table 2.

Impact on Nutrition and Physical Activity

One of these reviews measured the impact of interventions on nutrition and PA related outcomes. Findings from this review by Fujita et al. [23] indicated that community garden programs most often supported short-term weight loss among Native Hawaiian participants, but that few sustained significant long-term weight loss. Interestingly, however, all reviews reported the potential for community gardens and local food procurement strategies to enhance access to affordable, nutritious food in rural and

remote communities, thereby improving food security, healthy living, and contributing to the prevention of obesity and chronic disease [22-24]. Lombard et al. [24] suggested that because the Navajos have a tradition of farming, expanding Navajo diabetes interventions to include the promotion of community gardens could offer a number of positive benefits, including increased PA and increased access to local foods [24]. This review further reported that gardening ranked highest in exercise preference among diabetic adults and individuals [24].

Policy and Implementation Considerations

Despite the promise of community gardens in rural, remote and indigenous settings, many continuing challenges to implementation were reported, including poor soil conditions, short growing seasons, storing and maintaining equipment, and a need for more community-based skill development for all aspects of food production and preservation [22]. Two reviews noted engagement of youth as an important factor to program success, as their food habits and preferences may be more heavily influenced by mainstream commercial food culture [22, 23].

Overall, all three reviews concluded that community-based action and advocacy, combined with environmental changes and a supportive policy environment, are promising strategies to address the challenges of access to healthy foods in rural and remote communities [22-24]. Necessary components of this strategy include an increase in access to land for community gardening, supporting local farmers, and improving school lunch programmes [23]. Further, as Fujita et al. [23] argued, there is a need for policy changes within health organizations and the broader environment in support of long-term initiatives, which are more likely to reflect overall program success.

Limitations

A number of key limitations were noted within the three reviews, including the use of multi-component interventions with numerous elements additionally focused on weight loss, making causal inferences challenging [23]. In addition, some studies compared participants of differing weights (both overweight and healthy weight), or had a small number of participants overall [23]. Lastly, few long-term studies were included, questioning the rigour of evaluation methods applied [23].

Gardens and Local Food Procurement in Other Community Settings, including Correctional Facilities, Hospitals and Healthcare Facilities, Nursing and Care Homes

Twelve reviews discussed findings and/or implications relevant to gardens and local food procurement in correctional facilities, hospitals and healthcare facilities, nursing and care homes, and other community or miscellaneous settings [1-3, 19, 20, 25-31]. Reviews focused on diverse objectives, including the practical health benefits of farming in the city [25], opportunities for food transformations posed by climate change [20], urban cultivation systems throughout the world [26], and implications of

farmers markets and community gardens on nutrition-related outcomes in American adults [3]. For findings and characteristics of reviews, see Table 3.

Impact on Nutrition and Physical Activity

Of twelve reviews, eight explored findings and/or implications relevant to nutrition. Of these reviews, all presented evidence for community gardening and local food procurement programs and policies to increase consumption of FV [1-3, 25-28, 30]. In a review seeking to identify current trends, efforts, and gaps in research on urban agriculture in the USA, Sheila Golden found that people who participated or had family members that participated in community gardens were 3.5 times more likely to consume FV at least 5 times per day than controls [27]. This review also found that youth involved in community garden programs discussed eating more FV and less junk food as a result of participation, and that neighborhoods with farmers markets had higher FV consumption rates among people of color [27]. In a review by McCormack et al. [3], 6/16 studies reported that participation in a farmers' market program or a community garden was associated with greater intake of FV. An additional three studies found an association with increased intake of vegetables, but not fruit. Further, Draper et al. [1] found that community gardens enhance positive dietary habits, such as increased FV consumption and preference among participants, regardless of setting or population. In particular, one study included in this review found that increases in FV consumption were true even for members of the family who did not garden, suggesting a potential spill-over into the home environment [32]. Lastly, in a review seeking to identify models and best practices for community garden projects in US metropolitan communities, Smith et al. [30] highlighted gardens in school or community settings as promising interventions to promote positive nutritional knowledge, attitudes, and behaviors [30].

In addition to discussing nutrition-related impacts, seven reviews highlighted the potential of community gardens to impact PA, discussing increases in PA-related outcomes as a consequence of gardening activities [1, 25, 27, 28, 30, 31]. For example, in a review by Bellows et al. [25], gardening activities were connected to reduced risks of obesity (children and adults), coronary heart disease (for women and for men, notably menopausal women and elderly males), glycemic control and diabetes (adults, elderly men, Mexicans and Mexican-Americans), and occupational injuries (railway workers). This was the case when gardening activities were both self-defined as exercise by participants or isolated by researchers [25]. This review also found gardening to be a preferred form of exercise across age, gender, and ethnicity, with older persons gardening more than younger ones [25]. Of note, Hutchinson et al. [28] found that purchasing food products directly from producers was associated with greater daily PA in one small US study measuring that outcome [33]. Lastly, in a review seeking to demonstrate links between metro nature and human health, Wolf & Robbins [31] found an association between parks and open spaces (including community gardens) and an increased propensity to engage

in PA.

Policy and Implementation Considerations

While results were promising, numerous reviews noted barriers to implementation. Land access, tenure, and rising property values (specifically in urban areas) were presented as key barriers to program success in a number of settings [2, 27]. The review by Golden [27] noted that in the US specifically, many of the most successful community garden ventures were operated under their city's parks and recreation department, or partnered with other public agencies for land access. Seasonal accessibility and low yield were also presented as challenges in urban agriculture, suggesting that community gardens alone may be inadequate to change the food environment in some settings [30]. Of note, urban agriculture projects that were initiated and driven by the community were found to be most successful because of their local knowledge and understanding of residents' needs and assets [27]. Lastly, in a review by Mok et al. [29], rooftop food production projects, both commercial scale and community-focused, while still a novel concept, were presented as a promising strategy for local food procurement in the North American context.

Limitations

Among the twelve reviews included in this section, a number of potential limitations were discussed. Firstly, reviews noted that a number of studies used different methods to assess FV intake, reducing the comparability of results across studies [3]. In addition, few studies used well-established measures of dietary assessment [3], an overwhelming majority did not measure changes before and after the actual establishment of the garden [1], and few determined knowledge, attitudes, and eating habits of participants prior to initiating the research [30]. In addition, cross-sectional study designs were often employed, not allowing for causal inference. For example, it may be possible that individuals who prefer to eat FV are more likely to seek out community gardens or farmers' markets as an alternative source of produce for their regular diet, rather than these programs having a positive influence on availability and FV consumption preference [3].

In regards to PA, Bellows et al. [25] suggested that research may not sufficiently capture gardening as exercise, because some gardeners perceive it as part of a day's leisure or labor activities and not a separate activity in the category of "exercise." In one study included in their review, men identified gardening as "exercise" more often than women, though women and men reported similar amounts of time gardening [34]. Bellows et al. [25] further suggested that women may be inclined to associate gardening with gendered household food-related chores, rather than exercise. It should also be noted that although gardens were presented as a promising strategy to increase PA related outcomes, it is unclear how many reviews overall sought to measure this as a main outcome, and how systematically it

was done. In most cases, reviews discussed improvements in PA-related measures as secondary to nutrition-related outcomes.

Additional Reviews of Relevance

In addition to the reviews outlined above, two were not situated in any setting, but were deemed relevant as they focused on nutrition and PA-related impacts of gardening, specifically for older adults. In a review by Wang & MacMillan [35], gardening was recommended as an enjoyable moderate-to-rigorous form of exercise and a highly recommended form of PA for older adults, benefiting overall quality of life, physical ability, and activeness. Further, in a review by Wright and Wadsworth [36], one study reported numerous benefits of gardening for older adults, including food security and nutritional health, positive effects on physical health (defined as exercise), and overall community improvement [37].

Synthesis Limitations and Future Research

In drawing conclusions from this evidence synthesis, it is important to consider potential limitations of the analysis. For example, a quality control measure was not employed, so lower quality findings may be equally represented with more rigorous ones from systematic reviews. In addition, while the search strategy was rather comprehensive in nature, it may have failed to represent all potential settings equally.

Reviews in this synthesis highlighted the potential of community gardens and local food procurement to have positive impacts on the outcomes of interest. Nevertheless, they also highlighted a number of areas in need of further research. Firstly, reviews highlighted the limited amount of literature available on community gardens and local food procurement overall [3, 7]. Further, Guitart et al. [2] noted that current research is disproportionately focused on gardens in low-income areas, upon gardeners with diverse cultural backgrounds, in industrial cities in the USA, and done predominantly by scholars in the social sciences, potentially biasing our understanding of the characteristics of the gardens, as well as their motivations, benefits, and limitations [2]. Within included reviews, a large proportion focused on the school setting. No reviews sought to explore the impact of programs, policies, or interventions in settings such as hospitals, correctional facilities, or nursing homes explicitly, but spoke of these in broader terms as potential settings for environmental interventions. In addition, few reviews explored PA as a main outcome of community gardens or local food procurement strategies. As discussed, when PA-related measures were presented, it was often done vaguely as a secondary outcome. Apart from one study reported in the FTS review by Joshi et al. [13], no reviews reported studies focused on body weight outcomes, which may prove a useful measure of program effectiveness. To make up for shortcomings discussed across reviews, future research should additionally seek to measure the longer-term impacts of community gardens and local food procurement strategies in specific settings and

contexts, employing rigorous study designs, which include before and after measurements, comparable intervention designs and outcome measurements, and unbiased samples and controls.

CONCLUSIONS

This evidence synthesis found that gardens and local food procurement programs, policies, and initiatives have the potential to result in positive impacts related to nutrition, such as improved attitudes and eating behaviours, and increased fruit and vegetable consumption. Findings also indicated the potential of such strategies to positively impact on PA-related outcomes, but more research in this area is needed. Despite the potential of such initiatives, reviews highlighted a number of implementation considerations, including financial and human resources, time, and policy support for the success and sustainability of programs. Further, reviews highlighted a paucity of literature across settings, and specifically in relation to PA-related outcomes. While research remains sparse, available evidence is supportive of program development and policy action in this area.

Table 1. Gardens and Local Food Procurement in the School Setting

Author	Title	Journal	Year	Type	Objectives	Relevant Findings
<i>Reviews Specific to Gardening in Schools</i>						
Berezowitz et al.	School Gardens Enhance Academic Performance and Dietary Outcomes in Children	Journal of School Health	2015	Review	To collate findings with respect to school garden interventions that included measures of academic performance and/or FV consumption	<ul style="list-style-type: none"> - This review identified 12 garden studies with dietary measures, all of which showed increases/improvements in predictors of FV consumption. - Results from this review indicated that school-based garden interventions improved or maintained both FV consumption and mediators thereof. Specifically, garden programs improved FV intake in 71% studies measuring that outcome.
Davis et al.	Sustenance and sustainability: maximizing the impact of school gardens on health outcomes	Public Health Nutrition	2015	Review	To (a) review published garden-based programs conducted in schools targeting dietary intake and/or determinants of dietary behavior in children; and (b) to identify similar strategies and components employed by these garden-based programs	<ul style="list-style-type: none"> - This review found mixed evidence for the effectiveness of garden-based programs on dietary intake, with 6/11 programs reporting increases in vegetable consumption, and 4 showing no effect. - The majority of studies in this review showed significant improvements in determinants of dietary behaviors, such as preference, attitudes towards, willingness to taste, identification, knowledge, self-efficacy and variety of consumed FV. - This review concludes that despite the substantial uptake of school gardens, the evidence underpinning their effects to promote health are limited.
Oxenham & King	School Gardens as a Strategy for Increasing Fruit and Vegetable Consumption	Journal of Child Nutrition & Management	2010	Narrative Review	To review the impact of nutrition education interventions on children's food choices, specifically that of school-based gardens	<ul style="list-style-type: none"> - This review suggests school garden and farm-based programs have the potential to promote health and well-being in children, and may ultimately influence food choices through adolescence and adulthood. - This review reported that many educators are including gardening and farm-based nutrition education as teaching tools and that many schools throughout the US are using gardening as part of local wellness policies. - This review presented a number of challenges to implementation of school-based garden learning programs, which included: funding, staffing (teachers are often responsible for maintaining gardens in addition to their other duties, as well as on school vacations), time, and space (especially for urban schools).
Robinson-O'Brien et al.	Impact of Garden-Based Youth Nutrition Intervention Programs: A Review	American Dietetic Association	2009	Review	To examine the scientific literature on garden-based youth nutrition intervention programs and the impact on nutrition-related outcomes	<ul style="list-style-type: none"> - This review presents evidence indicating that school-based nutrition education programs may produce moderate increases in FV consumption among youth, but may be more effective in increasing fruit rather than vegetable intake. - Other outcomes associated with exposure to garden-based nutrition education included increased intake of vitamin A, vitamin C, and fiber; increased likelihood to cook; and increased appreciation for other individuals and cultures. - This review concluded that based on the relevant but relatively limited literature, evidence for the effectiveness of garden-based nutrition education is promising.

Ozer, E.	The Effects of School Gardens on Students and Schools: Conceptualization and Considerations for Maximizing Healthy Development	Health Education & Behavior	2007	Review	To (a) summarize the small literature regarding the impact of school garden curricula on student or school functioning, (b) provide a conceptual framework to guide future inquiry, (c) discuss implications of this conceptualization for practice, and (d) suggest further research needed to better inform practice	<ul style="list-style-type: none"> - This review found limited literature on school gardens, suggesting that available evidence is promising, but inconclusive thus far. Although there is little research on the impact of school garden programs, there are numerous observations and testimonials that these programs make a difference for students and schools. - This review suggests that edible gardens provide students with the opportunity to become familiar with and eat produce that they have grown themselves, an experience that anecdotally increases the appeal of eating vegetables. - Overall, this review found school gardens to be a promising approach in promoting the physical, psychosocial, and intellectual development of school-aged children. - This review presented a number of challenges to implementation and success of school garden learning programs, which included: having only one “champion” or leader, and limited resources of funding, personnel, and time.
Reviews Specific to Farm-to-School (FTS) Programs						
Thompson et al.	Farm-to-school programs in the USA: An examination of state-level enacted, pending and vetoed or dead bills	Health Education Journal	2014	Article - review of state-level legislation	To determine the prevalence and distribution of state-level legislation regulating FTS programs throughout the United States of America (USA)	<ul style="list-style-type: none"> - FTS evaluation data from this review were generally positive, showing that program participation is associated with increased student knowledge about agriculture, nutrition, and health; decreased food-related neophobia; and increased consumption of healthful foods such as FV. - This review identified a total of 43 bills (33 enacted, 2 pending, and 8 vetoed or dead) within the US that aimed to facilitate FTS programs. - This review suggests there is a lack of state-level legislation in place to provide monetary incentives for FTS programs in general and, importantly, there is a lack of state-level commitment to appropriate FTS funds. - This review suggests that, to date, many FTS supports are merely token gestures that receive minimal or no funding and resources with no chance of scalability or sustainability.
Taylor & Johnson	Farm to School as a strategy to increase children’s fruit and vegetable consumption in the United States: Research and recommendations	British Nutrition Foundation National Bulletin	2013	Review	To review the literature assessing the impact of FTS programs on FV consumption among children in the US and make recommendations for future research to improve knowledge of the efficacy of such approaches	<ul style="list-style-type: none"> - 33.1% of public and 25.4% of private schools included in this review reported involvement in FTS and/or garden education activities in a survey conducted in the 2009–2010 school year. - Studies in this review reported increased participation and uptake of school lunches after the introduction of a salad bar. - This review found that students selected 25–82% more servings of FV after the implementation of a FTS program than were selected prior to implementation. - Overall, this review notes it is difficult to draw conclusions about the true impact of FTS programs on FV in children, given the available literature.
Berlin et al.	The Role of Social Cognitive Theory in Farm-to-School-Related Activities: Implications for Child Nutrition	Journal of School Health	2012	Review	To explore research on the dietary health impacts and implications of three key FTS related activities, and explore the component activities of FTS in terms of their potential to address the key constructs of social cognitive theory	<ul style="list-style-type: none"> - This review showed that garden-based nutrition interventions have varying impacts on youth’s produce consumption. Increased consumption of FV was reported in 3/4 studies, willingness to taste FV in 3/6, and preferences for FV in 2/6 studies. - This review identified opportunities for inclusion of school gardens in school curriculums, reporting increases in consumption of FV (from 0.20-0.99 servings) for students in gardening and classroom-based nutrition education programs

Joshi et al.	Do Farm-to-School Programs Make a Difference? Findings and Future Research Needs	Journal of Hunger & Environmental Nutrition	2008	Review	To consolidate and evaluate emerging evaluation research, discuss the strengths and weaknesses of evaluation findings, and suggest a future research agenda to better understand the impacts of FTS programs	<ul style="list-style-type: none"> - This review suggests that school gardens are a viable strategy for improving nutrition and educational outcomes in school settings, but that scant research has been conducted to evaluate outcomes associated with gardening programs. - Only one study in this review evaluated BMI as an indicator for FTS success in impacting children's health. No significant decreases in BMI were found for students in the experimental schools after one year. - In comparing the impacts of classroom-based nutrition education and hands-on gardening activities, research documented a significant and lasting increase in knowledge and preference for vegetables among students who received nutrition education and those who participated in nutrition education combined with gardening, as compared to a control group. - A key barrier to implementation of FTS programs was cost. Increases in school meal participation are important, as revenues support school food service programs.
Reviews in the School Setting with a Broader Focus						
Dudley et al.	Teaching approaches and strategies that promote healthy eating in primary school children: a systematic review and meta-analysis	International Journal of Behavioral Nutrition and Physical Activity	2015	Systematic Review	To: a) perform a systematic review of RCT, quasi-experimental, and cluster controlled trials examining school-based teaching interventions that improve the eating habits of primary school children; and b) perform a meta-analysis to determine the effect of those interventions	<ul style="list-style-type: none"> - This review indicates that studies with experiential learning strategies, such as garden-enhanced learning strategies, were associated with the largest effects in reduction of food consumption or energy intake; increased FV consumption or preference; and increased nutritional knowledge outcomes.
Frerichs et al.	Influence of School Architecture and Design on Healthy Eating: A Review of the Evidence	American Journal of Public Health	2015	Systematic Review	To synthesize literature regarding architecture in school settings through a systems lens to frame research findings in a school's socioenvironmental context	<ul style="list-style-type: none"> - 6/11 studies included in this review which reported on dietary behavior outcomes, and 9/10 studies which reported dietary-related psychosocial outcomes (e.g., willingness to try or preferences for vegetables) found significant improvements. - This review found that school staff and youth believed that the benefits of garden programs extended beyond healthy eating outcomes (e.g., improving social skills; n=4) and that integration with other academic subjects was feasible (n = 4). - This review discussed significant barriers to school gardening programs, in relation to intensive time and resource requirements for ongoing maintenance.
Ganann et al.	Enhancing nutritional environments through access to fruit and vegetables in schools and homes among children and youth: a systematic review	BMC Research Notes	2014	Systematic Review	To examine the effects of interventions delivered in the home, school and other nutritional environments designed to increase FV availability for five to 18-year olds	<ul style="list-style-type: none"> - This review suggests that implementation of school-based policies were effective in impacting food service production and offerings. - This review reports on findings from one study relevant to school gardens, which combined experiential based gardening and nutrition education. The program led to increases in FV consumption, preferences, and asking behaviors.

French et al.	School-based research and initiatives: fruit and vegetable environment, policy, and pricing workshop	Preventive Medicine	2004	Review	To examine school-based interventions that use environmental, policy, or pricing strategies to promote fruit and vegetable intake among youth	<ul style="list-style-type: none"> - This review indicated positive results for school-based interventions overall. - This review reports that although few evaluation data are available, anecdotal reports suggest that school based programs including school gardens, salad bars, free fruit distribution programs, and school policy and environmental change efforts have been well received among students. - A number of implementation recommendations to promote increased FV intake among students in school settings were provided in this review, including: <ul style="list-style-type: none"> o Identifying champions, or energetic individuals who would mobilize people and resources in local school or district settings. o Integrating efforts with school health councils, identifying model programs, and disseminating them through trainings, training of trainers, and training demonstrations centers o Developing and making available simple fact sheets about programmes
Reviews in General Settings, including Schools						
Guitart et al.	Past results and future directions in urban community gardens research	Urban Forestry & Urban Greening	2012	Systematic Review	To review the extent of English academic literature on community gardens, including: who has undertaken the research, where it has been published, the geographical location of the gardens studied, and the various methods used to undertake the research	<ul style="list-style-type: none"> - This review found schools to be the second most common group to run garden projects, following non-profit organizations. - This review indicated a major reason for the employment of school gardens is that they offer science, nutrition, and environmental education benefits.
Hood et al.	Promoting Healthy Food Consumption: A Review of State-Level Policies to Improve Access to Fruits and Vegetables	Wisconsin Medical Society	2012	Review	To present a review of selected state-level policy options recently proposed or implemented in states across the United States, and provides an evidence-based lens through which food access policy can be shaped in the Midwest	<ul style="list-style-type: none"> - This review reveals that while the establishment of state-level food policy councils is relatively new and evidence of effectiveness is still forthcoming, existing US state-level food councils have initiated food policy changes in many areas, including purchasing of local FV for school lunches, promotion of sustainable agriculture, increased ease of access to food assistance programs and healthy foods for low-income individuals and seniors, increased opportunities for locally produced farm products, creation of community and school gardens and farm-to-school program education, creation of new forms of insurance for small producers, and implementation of farm-to-cafeteria and farm-to-school programs.
Draper & Freedman	Review and Analysis of the Benefits, Purposes, and Motivations Associated with Community Gardening in the United States	Journal of Community Practice	2010	Review	To examine the current scholarly, peer-reviewed literature available on community gardening in the United States	<ul style="list-style-type: none"> - Findings from this review indicated that youth gardening programs and projects produce positive dietary, academic, and developmental results. - This review found youth gardening programs to increase participants' nutrition knowledge; FV consumption, preference, and asking behaviors at home; physical activity; and gardening self-efficacy. - Youth gardening programs, not designated as a nutrition intervention, were also found to promote youth development (e.g., social relationships, respect for other individuals and cultures), improve access and consumption of healthy foods, and increase science achievement and environmental attitudes.

DeMattia & Denney	Childhood Obesity Prevention: Successful Community-Based Efforts	The Annals of the American Academy of Political and Social Science	2008	Narrative Review	To focus on community characteristics that interact with children's weight status, through a review of community-based programs including recipe preparation, community gardens, and school-based curricula	- This review proposes for increasing national investment in research dollars, policy change, program funding, and health care benefits aimed at the prevention and early intervention of childhood obesity.
Dixon et al.	Functional foods and urban agriculture: two responses to climate change-related food insecurity	New South Wales Public Health Bulletin	2009	Narrative Review	To focus on the opportunities for food system transformations posed by climate change	- This review reports that gardening programs for children are emerging in schools with the aim of teaching children about the origins of what they eat, the ecological processes of food production and the importance of the table as a social space.

Table 2. Gardens and Local Food Procurement in Indigenous Communities

Author	Title	Journal	Year	Type	Objectives	Relevant Findings
Fieldhouse & Thompson	Tackling food security issues in indigenous communities in Canada: The Manitoba experience	Nutrition & Dietetics	2012	Narrative Review	To review food security issues as they pertain to indigenous communities, particularly in northern Manitoba, and describe community and government approaches to tackling food insecurity	<ul style="list-style-type: none"> - This review reported the potential for gardening programs in Northern Manitoba to enhance access to affordable, nutritious food in northern communities, thereby improving food security, healthy living and preventing chronic disease. - This review concludes that community based action combined with structural changes and a supportive policy environment hold out the prospect of changing the conditions of food access that underlie the ultimate success of healthy living and chronic disease prevention efforts.
Lombard et al.	Diabetes on the Navajo nation: what role can gardening and agriculture extension play to reduce it?	The International Journal of Rural and Remote Health Research, Education, Practice, and Policy	2006	Personal view/review of literature	To review the development of diabetes on the Navajo nation through historical and contemporary literature, to provide insight into the role of diet and exercise in the progression of the disease, and the offer cases and suggestions in the role that home and community gardening can play in diabetes reduction	<ul style="list-style-type: none"> - This review suggests that because the Navajos have a tradition of farming, expanding Navajo diabetes interventions to include the promotion of community gardens offers a number of positive benefits which include: increased PA, and increased access to local foods. - This review reported that gardening ranked highest in exercise preference among diabetic adults and individuals.
Fujita et al.	The traditional Hawaiian diet: a review of the literature	Pacific Health Dialogue	2004	Pacific Health Dialogue	To present a review of the literature and data relevant to the health impacts of Traditional Hawaiian Diet (THD) programs	<ul style="list-style-type: none"> - This review concluded that Traditional Hawaiian Diet (THD) programs (including local food procurement strategies like community gardens) are an encouraging strategy to promote healthy eating and weight loss. - Review findings indicated that programs most often supported short term weight loss, but few sustained significant long-term weight loss. - This review concluded that public health professionals and Native Hawaiians should advocate for environmental changes that will support the availability and affordability of healthy lifestyles, including an increase in access to land for community gardening; supporting local farmers; and improving school lunches.

Table 3. Gardens and Local Food Procurement in Other Community Settings, including Correctional Facilities, Hospitals and Healthcare Facilities, Nursing and Care Homes

Author	Title	Journal	Year	Type	Objectives	Relevant Findings
Eigenbrod et al.	Urban vegetable for food security in cities. A review	Agronomy for Sustainable Development	2015	Review	To review different urban cultivation systems throughout the world	<ul style="list-style-type: none"> - This review presented the availability of fresh, healthy, and cheap food as a major reason to engage in urban horticulture, and argued that locally produced food is usually fresher and more nutritious than imported food and therefore has the potential to increase the overall food intake and improve nutrition. - This review suggests that the integration of urban agriculture into urban planning processes is the key to sustainable implementation.
Hutchinson et al.	A Scoping Review of Observational Studies Examining Relationships between Environmental Behaviors and Health Behaviors	International Journal of Environmental Research and Public Health	2015	Scoping Review	To examine associations between environmental and health behaviours of individuals in high-income countries	<ul style="list-style-type: none"> - This review found that the use of locally sourced food, either by participation in community gardening or via a community supported agriculture scheme, was associated with increased FV intake in two small studies in the USA. - Additionally, purchasing food products directly from producers was associated with greater daily PA in another small study in the USA.
Wolf & Robbins	Metro Nature, Environmental Health, and Economic Value	Environmental Health Perspectives	2015	Review	To demonstrate the numerous opportunities for future research efforts that link metro nature, human health well-being outcomes, and economic values	<ul style="list-style-type: none"> - Although studies are not consistent, research from this review demonstrated an association between parks and open spaces (including community gardens) and obesity reduction, lower blood pressure, the propensity to engage in PA, and extended life spans.
Golden, S.	Urban Agriculture Impacts: Social, Health, and Economic: A Literature Review	Policy Document - UC Sustainable Agriculture Research and Education Program	2013	Literature Review	To identify current trends, efforts, and gaps in researching urban agriculture impacts in the United States	<ul style="list-style-type: none"> - This review showed that people who participate or have family members that participate in community gardens were 3.5 times more likely to consume FV at least 5 times per day than controls. Youth involved in community garden programs discussed eating more FV and less junk food as a result of their participation. - This review suggested that neighborhoods with farmers markets had higher FV consumption rates among people of color. - This review presents community gardens as places for residents to engage in PA. They create opportunities for individuals to be active for sustained amounts of time, which has been found to prevent disease and other ailments. - A main barrier to implementation reported in the review was access to land and tenure. Many of the most successful community garden ventures were operated under the city's parks and recreation departments or partnered with other public agencies for land access. - Urban agriculture projects that were initiated and driven by the community were noted to be more successful because of their local knowledge and understanding of resident's needs and assets.
Mok et al.	Strawberry fields	Agronomy for	2013	Review	To review the growth of	<ul style="list-style-type: none"> - This review presents support for rooftop food production in North America. While still very

	forever? Urban agriculture in developed countries: a review	Sustainable Development			urban agriculture throughout the developed world in order to clarify the different benefits, risks, and hindrances associated with the practice	<p>much a novelty, there are both commercial scale and community-focused projects in existence, as well as household-scale rooftop gardens.</p> <ul style="list-style-type: none"> - This review argues that overemphasizing the benefits of urban agriculture without regard to its downsides (ex. human exposure to agrochemicals) is dangerous and risks marginalizing this movement back to its perceived “hippie roots,” particularly in developed countries.
Smith et al.	Interventions to improve access to fresh food in vulnerable communities: a review of the literature	International Journal on Disability and Human Development	2013	Literature Review	To identify models and best practices of community garden projects in US metropolitan cities	<ul style="list-style-type: none"> - This review suggested that community gardens, as well as other methods, are being utilized as a strategy to provide access to healthy food in food desert communities. - This review discussed gardens in school or community settings to be the most successful interventions to address nutritional knowledge, attitudes, and behaviors. - One included study reported an increase in PA as a consequence of community gardens - This review found that community gardens had only minimal impact on food access issues in urban communities due to seasonal accessibility and low yield, suggesting that community gardens alone cannot change the food environment.
Guitart et al.	Past results and future directions in urban community gardens research	Urban Forestry & Urban Greening	2012	Systematic quantitative literature review	To review the extent of English academic literature on community gardens, including: who has undertaken the research, where it has been published, the geographical location of the gardens studied, and the various methods used to undertake the research	<ul style="list-style-type: none"> - This review indicated that current academic literature on community gardens is dominated by studies in the USA, studies investigating gardens in low-income areas with diverse cultural backgrounds, and by scholars in the social sciences. - This review proposes that community gardens are growing in popularity, involving a wide range of groups such as schools, prisons, youth, elderly, hospitals, and local residents of neighbourhoods. - The most commonly reported motivations for participating in gardening programs reported in this review were: to consume fresh foods, social development or cohesion such as community building and culture exchange, to improve health among members and to make or save money by eating from the garden or selling the produce. - Increasing FV intake was a benefit that was often mentioned in the literature but in some instances could not be demonstrated because of the complexity of evidence required in this field of study. - The main challenge to implementation addressed in this review (focused primarily on the US), was land tenure, and rising property values.
Draper & Freedman	Review and Analysis of the Benefits, Purposes, and Motivations Associated with Community Gardening in the United States	Journal of Community Practice	2010	Review	To examine the current scholarly, peer-reviewed literature available on community gardening in the United States	<ul style="list-style-type: none"> - This review found that community gardens enhance positive dietary habits, such as increased FV consumption and preference among participants, regardless of setting or population. - One study included in this review found that increases in FV consumption was true even for members of the family who did not garden. - This review concluded that community gardens led to a greater amount of PA among both youth and adults in the studies included in this review.
McCormack et al.	Review of the Nutritional Implications of Farmers’ Markets and Community Gardens: A Call	American Dietetic Association	2010	Review	To examine the current scientific literature on the implications of farmers’ market programs and community gardens on nutrition-related	<ul style="list-style-type: none"> - 4 studies included in this review studied the nutritional impact of community gardens: 3/4 reported increases in consumption of FV, and 1/4 reported an increase in the variety of FV consumed, as well as self-reported increases towards a “more balanced diet”. - None of the identified studies in this review examined weight-related outcomes, such as overweight/obesity. - This review concluded that although some evidence exists for the positive effects of farmers’

	for Evaluation and Research Efforts				outcomes in adults	markets and community gardens on community-building and other social outcomes, at this time there is limited research assessing their specific health benefits.
Dixon et al.	Functional foods and urban agriculture: two responses to climate change-related food insecurity	New South Wales Public Health Bulletin	2009	Narrative Review	To focus on the opportunities for food system transformations posed by climate change	<ul style="list-style-type: none"> - The literature from this review about urban agriculture and community gardening points to numerous potential social, ecological and health benefits. - This review recognizes the therapeutic value of community gardening as a physical activity is recognized for creating opportunities for ecological engagement and ‘emotional, physical and spiritual renewal’ and for contributing to the health and wellbeing of the elderly.
DeMattia & Denney	Childhood Obesity Prevention: Successful Community-Based Efforts	The Annals of the American Academy of Political and Social Science	2008	Narrative Review	To focus on community characteristics that interact with children's weight status, through a review of community-based programs including recipe preparation, community gardens, and school-based curricula	<ul style="list-style-type: none"> - This review proposes for increasing national investment in research dollars, policy change, program funding, and health care benefits aimed at the prevention and early intervention of childhood obesity.
Bellows et al.	Health benefits of urban agriculture	Community Food	2003	Narrative Review	To present research on the practical health benefits of farming in the city	<ul style="list-style-type: none"> - This review presents evidence suggesting that community gardens increase both consumption of FV, and physical activity. - Findings from this review indicated that when self-defined as exercise by research subjects or isolated by researchers, gardening was connected to reducing risks of obesity (children and adults), coronary heart disease (for women and for men, notably menopausal women and elderly males), glycemic control and diabetes (adults, elderly men, Mexicans and Mexican-Americans), and occupational injuries (railway workers). - This review indicates that gardening is a preferred form of exercise across age, gender, and ethnicity. Overall, older persons are found to garden more than younger ones.

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