

# Health Benefits and Potential Risks of Urban Agriculture

A Focused Practice Question

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## *Key Messages*

The health benefits associated with urban agriculture include:

1. increased access to healthy food;
2. increased vegetable and fruit consumption;
3. increased physical activity;
4. improved mental health and mental illness; and
5. improved quality of life and general well-being.

Urban agriculture may have negative health implications if vegetables are grown in soil with high lead concentrations.

## 1 Issue & Context

In Peel, unhealthy foods are highly accessible and available. According to the 2013 Diabetes Atlas, less healthy food retail outlets (i.e. fast-food restaurants and convenience stores) outnumber healthy food outlets (i.e. grocery stores) by a factor of at least five to one (1). Approximately eight community gardens are currently operating in Peel (2). The Region of Peel's (RoP) Built Environment Team is exploring policies to improve healthy food access and availability through municipal and regional planning policy levers.

This focused practice question (FPQ) paper builds upon previous food environment work completed by RoP – Public Health, including:

- *Community design elements of the built environment and their influence on eating behaviours: A focused practice question (2015) (3);*
- *The development of a food environment-built environment strategic framework for Peel Public Health (2017) (4); and*
- *Urban agriculture and related outcomes: A background reading (2018) (5).*

In 2018, Public Health and Public Works staff expressed interest in exploring policies that encourage urban agriculture, as part of the Peel 2041 Regional Official Plan Review. Public Health committed to conducting an evidence review on urban agriculture to inform policies within the Regional Official Plan.

In 2018, the Built Environment Team completed a background reading on urban agriculture to determine relevant health outcomes. The outcomes of interest identified in the background reading formed the foundation for this FPQ. This paper describes findings from the FPQ, along with recommendations for practice.

## 2 Literature Review Question

What are the health benefits, risks and unintended consequences of urban agriculture among the general population?

The research question in PECO format is:

<b>Population (P)</b>	General population
<b>Exposure (E)</b>	Urban agriculture <sup>1</sup>
<b>Comparison (C)</b>	None
<b>Outcomes (O)</b>	<ul style="list-style-type: none"><li>• Healthy food access</li><li>• Food security</li><li>• Fruit and vegetable consumption</li><li>• Mental health</li><li>• Physical activity</li><li>• Quality of life and general well-being</li><li>• Health risks</li></ul>

## 3 Literature Search

On September 12, 2018, a published literature search was conducted reviewing databases including Ovid (i.e. Cochrane, Global Health, Ovid Healthstar, Ovid MEDLINE and PsycINFO) and EBSCO. On September 21 and September 26, 2018, grey literature searches were conducted, reviewing search engines and websites such as New York Academy of Medicine (NYAM), Grey Literature Report, Open Grey, Duck Duck Go, Turning Research into Practice (TRIP), Public Health

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<sup>1</sup> Urban agriculture is the practice of food cultivation in metropolitan areas. Practices can involve growing vegetables, herbs, fruits and grains, in addition to raising animals, bees and aquaculture (6). This review only focuses on outcomes relevant to growing vegetables, herbs, fruits and grains.

Ontario (PHO), the National Institute for Health and Care Excellence (NICE) and National Collaborating Centre for Environmental Health (NCCEH). See the literature search flowchart (Appendix B) for more detail.

## 4 *Relevance Assessment*

Two reviewers assessed search results based on relevance criteria.

The inclusion criteria were:

- articles published between January 1, 2007 and September 12, 2018;
- English language publications;
- summaries (e.g. guidelines), syntheses (e.g. meta analyses or systematic reviews), single studies and grey literature;
- articles with outcomes relevant to the health benefits<sup>2</sup>, risks<sup>3</sup> and unintended consequences of urban agriculture;
- general populations in developed countries; and
- exposures and interventions related to urban agriculture.

The exclusion criteria were:

- study settings different from the RoP's local municipalities;
- articles that focus on frameworks or models of urban agriculture;
- indoor private garden settings;
- knowledge, attitudes and skills toward healthy eating; and
- outcomes associated with raising animals, bees and aquaculture.

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<sup>2</sup> *Health benefits* include healthy food access, fruit and vegetable consumption, physical activity, mental health, quality of life and general well-being.

<sup>3</sup> *Health risks* include negative health implications.

Two reviewers conducted a preliminary relevance assessment of search results by screening titles and abstracts. In a second relevance assessment, the reviewers read full-text articles to eliminate irrelevant sources. The reviewers resolved differences in opinion through discussion or by consulting a third reviewer.

## 5 *Results of the Search*

The literature search yielded a total of 800 results. The reviewers removed 305 duplicate articles. Four-hundred and eighty-seven sources did not meet relevance criteria based on the preliminary and secondary relevance screening. Eight articles met the relevancy criteria and were critically appraised. See Appendix B for details on the results selection process.

## 6 *Critical Appraisal*

Two independent reviewers used the Health Evidence Quality Assessment Tool – Review Articles to assess the quality of the eight relevant articles. All eight articles were systematic reviews. The articles received the following quality ratings:

<b>Strong</b>	Garcia et al. (2017)
<b>Moderate</b>	Horst et al. (2017); Russo et al. (2016); McCormack et al. (2010); Al-Delaimy and Webb (2017)
<b>Weak</b>	Golden (2013); Brown (2015); Santo et al. (2016)

The four articles included in this paper were Garcia et al. (2017), Horst et al. (2017), Russo et al. (2016), and McCormack et al. (2010). Articles that received a quality rating lower than a score of six (i.e. articles with 'weak' or lower 'moderate' quality ratings) were excluded from this paper.

## **7 Description of Included Papers**

This section describes characteristics of the articles included in this paper, outlining the study objectives, review methods, number and type of included studies, study populations, and settings. See the data extraction table (Appendix C) for further detail.

### **Garcia et al. (2017): The impact of urban gardens on adequate and healthy food: a systematic review (5)**

Garcia et al. (2017) examined food and nutrition related outcomes associated with urban agriculture (e.g. healthy food practices, healthy food access, and healthy food beliefs, knowledge and attitudes). The authors used qualitative and quantitative review methods. This systematic review drew evidence from 12 articles of the following study types: one cohort study, eight cross-sectional studies and three post-intervention case studies. The article presented a narrative summary of included studies, describing study differences and commonalities. The review reported statistically significant and non-significant results. The study population was adults living in urban areas. Intervention countries were: United States of America (USA), Canada, Australia, New Zealand, South Africa and Colombia.



## Horst et al. (2017): The intersection of planning, urban agriculture and food justice (6)

Horst et al. (2017) drew from a multidisciplinary body of literature to suggest ways urban planners may use urban agriculture to support food justice<sup>4</sup>. The authors selected and synthesized individual case studies to conduct a systematic review. Horst et al. did not report the number of articles included in their review. The review summarized the social benefits and limitations of urban agriculture. The authors focused on a general population. Intervention settings included a variety of cities in the USA, in addition to some Canadian cities and regions.

## Russo et al. (2017) Edible green infrastructure: An approach and review of provisioning ecosystem services and disservices in urban environments (7)

The Russo et al. (2017) review aimed to:

- Raise awareness of *urban provisioning ecosystem service*<sup>5</sup>;
- Identify types of urban agriculture or 'edible green infrastructure';
- Synthesize findings on ecosystem service and disservice (i.e. benefits and risks) of urban agriculture; and
- Provide recommendations/guidelines for the design, planning and management of sustainable urban agriculture.

The review drew from 80 peer-reviewed qualitative and quantitative studies, analyzing information on agriculture in urban settings. The authors identified existing terminology related to urban agriculture, then updated and synthesized relevant terms to improve the framework.

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<sup>4</sup> Food justice definition: the right of communities everywhere to produce, process, distribute, access and eat good food regardless of race, class, gender, ethnicity, citizenship, ability, religion, or community" (6).

<sup>5</sup> *Urban provisioning ecosystem service* definition: a network of edible plants within urban ecosystems primarily designed to provide food (7).

The review also identified indicators and metrics associated with growing edible products in urban lands that are safe for consumption. The review's study population was city dwellers. Studies were set in the following countries: USA, United Kingdom, Italy, Spain, Denmark, Canada, Switzerland, Sweden, South Africa, Singapore, Portugal, Poland, Hungary, Germany, China, Burundi and Australia.

## McCormack et al. (2010): Review of the nutritional implications of farmers' markets and community gardens: a call for evaluation and research efforts (8)

The McCormack et al. (2010) review aimed to:

- Evaluate the scientific literature on farmers' markets and community garden programs, and their nutrition-related implications;
- Advocate for the potential of farmers' markets and community gardens to improve fruit and vegetable consumption; and
- Highlight implications for future research.

The review drew from 16 articles that quantitatively or qualitatively examined nutrition related outcomes, in addition to three program evaluation reports. The study population was adults.

Included studies were set in the USA.

## *8 Synthesis of Findings*

This paper does not quantify associations of urban agriculture and health outcomes, since the included reviews do not describe the magnitude of associations.

### **Health Benefits**

**Urban agriculture is associated with increased access to healthy food.**

Participation in urban agriculture is associated with increased access to healthy foods (i.e. vegetables and fruit) (5, 6, 7, 8). Urban agriculture can also reduce food costs among households (5, 6, 8). One study finds that families who participate in community gardening typically offset 30 to 40 per cent of their fresh produce needs (6). Many urban gardeners also grow beyond their own consumption needs, sharing or donating excess fruit and vegetables (5, 6).

**Urban agriculture is associated with increased vegetable and fruit consumption.**

Participation in urban agriculture is associated with increased vegetable and fruit consumption among participants, and members of their households (5, 6, 7, 8). Urban agriculture also increases the variety of fruit and vegetables consumed (5). One study finds that adults with a household member participating in a community garden are 3.5 times more likely to consume fruit and vegetables at least 5 times daily (8). Another review finds that youth participating in urban agriculture programs are more likely to try vegetables they grew themselves (6). The same review finds that youth gardeners from higher income households are more likely to eat healthy foods. There is no measurable increase in healthy food intake among youth gardeners from lower income households (6).

**Urban agriculture is associated with increased physical activity.**

Cultivating food offers a form of light physical activity that is accessible across the lifespan. Cultivation practices that may involve physical activity include weeding, tilling and using hand tools (6).

**Urban agriculture is associated with improved mental health and mental illness.**

Urban agriculture is associated with reduced stress. Urban agriculture is also associated with improved mental health and benefits individuals experiencing mental illness (6, 7).

**Urban agriculture is associated with an improved quality of life and general well-being.**

Urban agriculture is associated with an improved quality of life (6, 7). One review links community gardening to lower obesity rates. The review does not offer detail on the association between gardening and obesity (6).

## Health Risks

**Urban agriculture may have negative health implications if vegetables are grown in soil with high lead concentrations.**

There have been negative health implications associated with vegetables grown in soil with high lead concentrations. Communities with low socio-economic status are at greater risk for soil, water and air pollution (6).

## *9 Implications for Practice*

In February 2019, the review authors that prepared this paper met with Public Health leadership and Regional Planning and Growth Management staff to discuss research findings and recommendations. Below is a summary of the facilitated discussion.

## Findings of the review

A meeting attendee cautioned that some findings from the included articles may not be applicable to the local context if a study's 'general population' differs from Peel's population.

## Applying Findings to Practice

Meeting attendees advised review authors to consider these factors when applying research findings to practice:

1. The local climate limits the length of Peel's outdoor growing season.
2. Edible forests may alter existing ecosystems. Attendees do not recommend creating policies to encourage edible forests in Peel.
3. Potential partners may assist in promoting urban agriculture. Potential partners may include:

- RoP departments, divisions and teams including but not limited to:
  - Human Services (e.g. Housing Services)
  - Health Services (e.g. Chronic Disease and Injury Prevention, Family Health, Long-Term Care)
  - Public Works (e.g. Development Services, Waste Management)
  - Office of Climate Change
- Peel Agricultural Advisory Working Group
- Peel Food Council
- Community groups (e.g. Ecosource)
- Peel schools and school boards
- City of Mississauga, City of Brampton, Town of Caledon (e.g. Parks and Recreation divisions)
- Toronto and Region Conservation Authority, Credit Valley Conservation Authority
- Religious organizations/groups

## Implementing the recommendations

Meeting attendees agreed that the Agriculture Regional Official Plan Amendment Discussion Paper is a key opportunity to apply findings from this FPQ paper. They also agreed that RoP should create land use planning policies to support urban agriculture. When implementing the recommendations, meeting attendees highlighted the importance of clearly defining the RoP's role in urban agriculture, and considering how RoP can support municipalities, without being overly regulatory.

## Next Steps

Meeting attendees recommended these next steps for RoP – Public Health:

- Apply findings from the FPQ to inform the Regional Official Plan as part of the Peel 2041 update.
- Contribute to appropriate discussion papers and policies.
- Conduct an environmental scan on the current state of urban agriculture programming in Peel.
- Host a brainstorming session to map out programming opportunities for urban agriculture.
- Review evaluation reports from other jurisdictions that implemented successful urban agriculture programs.
- Continue monitoring emerging research on urban agriculture.
- Determine RoP's role in urban agriculture.
- Share findings from this evidence review with municipal partners, the Regional Planning Technical Advisory Committee, Peel Agricultural Advisory Work Group and Peel Food Council.

## *10 Recommendations*

1. Contribute to land use planning policies that support urban agriculture in the Regional Official Plan as part of the Peel 2041 update.
2. Explore opportunities to work with local relevant stakeholders to advance urban agriculture policy in each municipality.
3. Increase awareness among Region of Peel staff, municipal planners and relevant community groups on the health benefits associated with urban agriculture (i.e. increased healthy food access, fruit and vegetable consumption, physical activity, mental health, quality of life, and general well-being).
4. Increase gardeners' awareness of the potential risk of soil pollution; and direct them to Toronto Public Health's Guide for Soil Testing in Urban Gardens (Appendix D) to help gardeners determine if soil conditions are appropriate for agriculture.
5. Determine programming opportunities among groups that may be interested in implementing urban agriculture programs (e.g. internal grant programs such as the Healthy Living Supports Program, faith groups and community groups such as Ecosource).

## References

1. Region of Peel – Public Health. Diabetes Atlas for the Region of Peel. 2013. [cited 2019 January 4]. Available from:  
<http://www.peelregion.ca/health/resources/diabetes-atlas/full-report.pdf>
2. Region of Peel – Peel Data Centre. Peel Food Programs. 2017. [cited 2019 February 25, 2019]. Available from:  
<https://www.peelregion.ca/planning-maps/foodprograms/foodprograms.html>
3. Community design elements of the built environment and their influence on eating behaviours: A focused practice question (2015)
4. The development of a food environment-built environment strategic framework for Peel Public Health (2017)
5. Urban agriculture and related outcomes: A background reading (2018)
6. Garcia et al. (2017): The impact of urban gardens on adequate and healthy food: a systematic review
7. Horst et al. (2017): The intersection of planning, urban agriculture and food justice
8. Russo et al. (2017) Edible green infrastructure: An approach and review of provisioning ecosystem services and disservices in urban environments
9. McCormack et al. (2010): Review of the nutritional implications of farmers' markets and community gardens: a call for evaluation and research efforts
10. Toronto Public Health. Guide for Soil Testing in Urban Gardens. 2013. [cited 2019 May 28].



## *Appendices*

**Appendix A: Search Strategy**

**Appendix B: Literature Search Flowchart**

**Appendix C: Data Extraction Tables**

**Appendix D: Soil Assessment Guide for Community Gardens**

## Appendix A: Search Strategy

### Academic databases searches

Database: EBM Reviews - Cochrane Database of Systematic Reviews <2005 to September 12, 2018>, Global Health <1973 to 2018 Week 35>, Ovid Healthstar <1966 to July 2018>, Ovid MEDLINE(R) <1946 to September Week 1 2018>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <September 12, 2018>, PsycINFO <2002 to September Week 2 2018>

#### Search Strategy:

- 
- 1 urban agric\*.ti,ab. (799)
  - 2 urban garden\*.ti,ab. (255)
  - 3 residential garden\*.ti,ab. (56)
  - 4 community garden\*.ti,ab. (503)
  - 5 (institutional adj4 garden\*).ti,ab. (9)
  - 6 (school adj4 garden\*).ti,ab. (419)
  - 7 (hospital adj4 garden\*).ti,ab. (136)
  - 8 (workplace adj4 garden\*).ti,ab. (6)
  - 9 (church adj4 garden\*).ti,ab. (9)
  - 10 community orchard\*.ti,ab. (0)
  - 11 food forest\*.ti,ab. (7)
  - 12 edible landscap\*.ti,ab. (1)
  - 13 street\* garden\*.ti,ab. (5)
  - 14 (building adj3 agric\*).ti,ab. (126)
  - 15 i-RTG.ti,ab. (2)
  - 16 zero acre\*.ti,ab. (1)
  - 17 zfarm\*.ti,ab. (1)
  - 18 z farm\*.ti,ab. (1)
  - 19 green roof\*.ti,ab. (330)
  - 20 rooftop garden\*.ti,ab. (12)
  - 21 vertical garden\*.ti,ab. (15)
  - 22 vertical farm\*.ti,ab. (12)
  - 23 greenhouse\*.ti,ab. (27494)
  - 24 hydroponic\*.ti,ab. (4706)
  - 25 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 (2553)
  - 26 urban.ti,ab. (326763)
  - 27 23 or 24 (31892)
  - 28 26 and 27 (994)
  - 29 25 or 28 (3503)
  - 30 exp agriculture/ (118414)
  - 31 exp cities/ (220468)
  - 32 exp urban population/ (107587)
  - 33 31 or 32 (317931)
  - 34 30 and 33 (1855)

35 29 or 34 (5151)  
36 exp food/ (1821532)  
37 exp forestry/ (7058)  
38 36 and 37 (287)  
39 exp urban areas/ (41744)  
40 exp orchards/ (401)  
41 exp gardens/ (1058)  
42 exp greenhouses/ (528)  
43 40 or 41 or 42 (1969)  
44 39 and 43 (168)  
45 exp urban agriculture/ (455)  
46 35 or 38 or 44 or 45 (5649)  
47 health.ti,ab. (3639554)  
48 well being.ti,ab. (176394)  
49 (quality adj1 life).ti,ab. (14485)  
50 social connect\*.ti,ab. (4721)  
51 mental\*.ti,ab. (775857)  
52 exp mental health/ (124647)  
53 harm\*.ti,ab. (307515)  
54 risk\*.ti,ab. (3964576)  
55 physical activ\*.ti,ab. (221565)  
56 food\*.ti,ab. (932500)  
57 fruit\*.ti,ab. (200438)  
58 vegetable\*.ti,ab. (125696)  
59 56 or 57 or 58 (1109829)  
60 access\*.ti,ab. (828572)  
61 availab\*.ti,ab. (2003352)  
62 intake\*.ti,ab. (535634)  
63 consump\*.ti,ab. (544239)  
64 60 or 61 or 62 or 63 (3599090)  
65 59 and 64 (399890)  
66 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 65 (7691487)  
67 46 and 66 (2378)  
68 review\*.ti,pt. (4793729)  
69 meta analys\*.ti,pt. (234667)  
70 synthes\*.ti,pt. (365082)  
71 guideline\*.ti,pt. (153422)  
72 overview\*.ti,pt. (70049)  
73 68 or 69 or 70 or 71 or 72 (5405860)  
74 67 and 73 (160)  
75 limit 74 to english language [Limit not valid in CDSR; records were retained] (154)  
76 limit 75 to yr="2007 -Current" (119)  
77 remove duplicates from 76 (75)

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Database: EBSCO

Search Strategy:

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S1 AB "urban agric" OR AB "urban garden" OR AB "residential garden" OR AB "Community garden"  
S2 AB institutional N4 garden\* OR AB school N4 garden\* OR AB hospital N4 garden\* OR AB workplace N4 garden\*  
S3 AB church N4 garden\* OR AB "Community orchard" OR AB "Food forest" OR AB "edible landscape"  
S4 AB street\* N3 garden\* OR AB building N3 agric\* OR AB "l rtg" OR AB "zero acre"  
S5 AB zfarm\* OR AB "z farm\*" OR AB "green roof\*" OR AB "rooftop garden\*"  
S6 AB "vertical farm\*" OR AB "vertical garden\*"  
S7 AB greenhouse\* OR AB hydroponic\* AND AB urban  
S8 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7  
S9 AB health OR AB "well being" OR AB "quality N1 life OR AB "social connect\*" OR AB mental\* OR AB harm\* OR AB rsk\* OR AB "physical active\*"  
S10 AB food\* OR AB fruit\* OR AB vegetable\*  
S11 AB access\* OR AB availab\* OR AB intake\* OR AB consump\*  
S12 S10 AND S11  
S13 S9 OR S12  
S14 S8 AND S13  
S15 Tlreview\* OR TI "meta analys\*" OR TI synthes\* OR TI guideline\* OR TI overview\*  
S16 S15 AND S14

\*\*\*\*\*

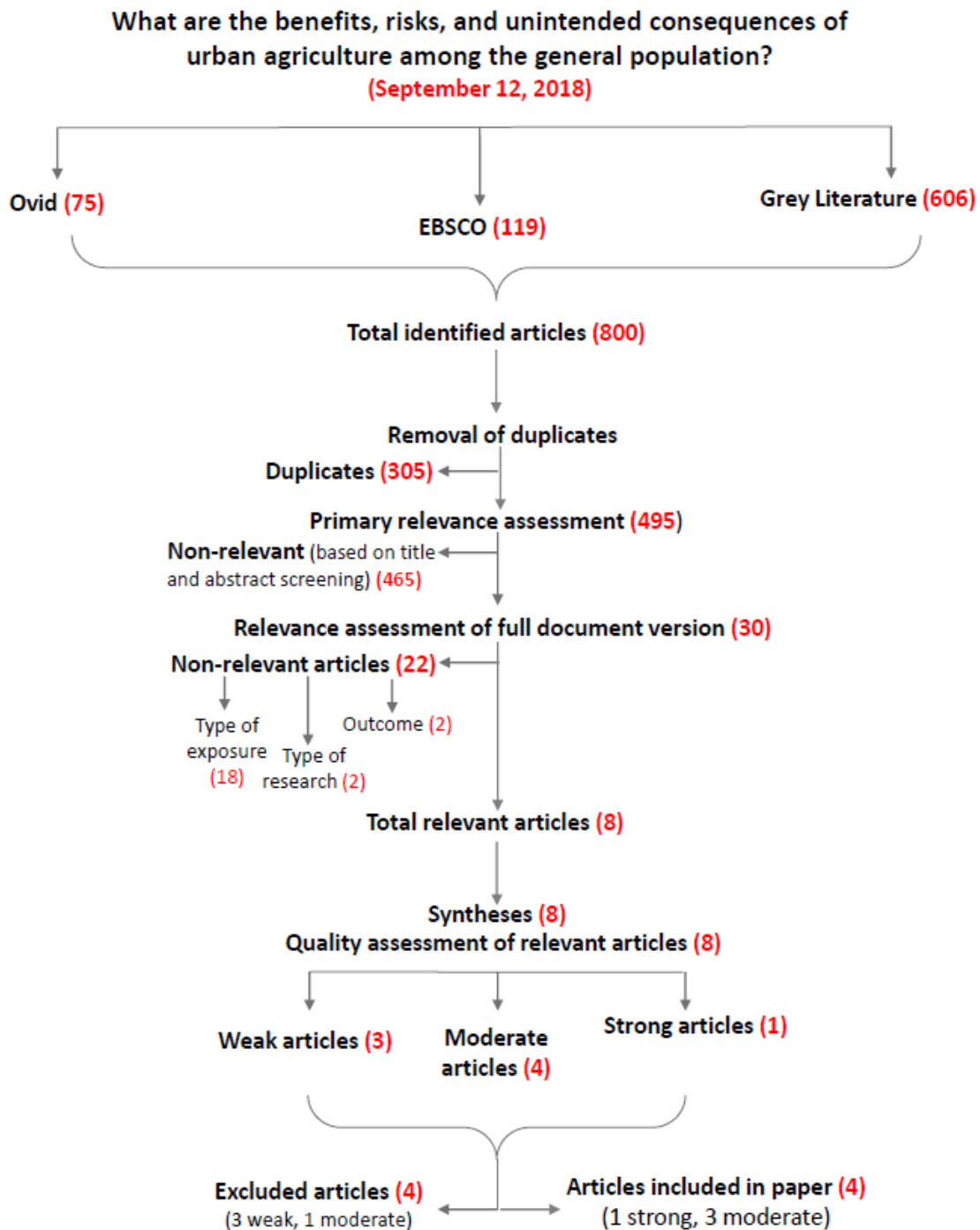
## Grey literature searches

Search Strategy: urban agricultur\*, urban agricultur\*health, urban agricultur\*benefit, urban agricultur\*risk

Process: for websites where searches returned more than two pages of results, the reviewer only searched the first two pages.

<b>Website</b>	<b>Results Screened</b>	<b>Relevant Sources</b>
New York Academy of Medicine (NYAM) Grey Literature Report	39	0
Open Grey	36	0
Duck Duck Go	72	10
Turning Research into Practice (TRIP)	112	6
Public Health Ontario	111	0
National Institute for Health and Care Excellence (NICE)	8	0
National Collaborating Centre for Environmental Health (NCEEH)	89	5

## Appendix B: Literature Search Flowchart



*Adapted from:* Health Evidence (2009, November 25). *Keeping Track of Search Results: A Flowchart*. [Retrieved January 2, 2019], <https://www.healthevidence.org/practice-tools.aspx#PT4>

## Appendix C: Data Extraction Tables

<b>Article 1: The impact of urban gardens on adequate and healthy food: a systematic review</b>	
<b>General Information and Quality Rating</b>	
<b>Author(s) and Date</b>	Garcia, MT., Ribeiro, SM., Germani, ACCG., Bogus, CM. (2017)
<b>Country</b>	Brazil
<b>Type of Article</b>	Systematic Review
<b>Quality Assessment</b>	Strong (HE)
<b>Objectives</b>	To examine food and nutrition related outcomes associated with participation in urban gardens with a focus on healthy food practices, healthy food access and healthy food beliefs, knowledge and attitudes.
<b>Details of the Review</b>	
<b>Number of Articles Included</b>	12
<b>Types of Articles Included</b>	1 cohort, 3 pre-post interventions without control group, 8 cross-sectional
<b>Databases Searched</b>	PubMed, LILACS, ERIC, Embase, Web of Science/ Key Informants/ Reference lists
<b>Search Period</b>	2005-2015
<b>Inclusion/Exclusion Criteria</b>	<p>Inclusion:</p> <ul style="list-style-type: none"> <li>• Study published as original article in peer-reviewed scientific journal</li> <li>• English, Spanish or Portuguese</li> <li>• Adults living in urban areas</li> <li>• Studies with objective relevant to participation in urban gardens</li> <li>• Assessing or reporting food-related outcomes in contexts of health promotion and food security</li> </ul> <p>Exclusion: No exclusion criteria described.</p>
<b>Review Methods</b>	<ul style="list-style-type: none"> <li>• Review followed the PRISMA writing guidelines.</li> <li>• Qualitative and quantitative studies were included.</li> </ul>

	<ul style="list-style-type: none"> <li>• A narrative summary of included studies was prepared since the included studies were heterogeneous.</li> <li>• The review identified and described differences and commonalities between studies.</li> <li>• The review identified food and nutrition related outcomes.</li> <li>• The review reported statistically significant and non-significant results.</li> </ul>
<b>Quality Appraisal Process</b>	<p>Qualitative Tool: Consolidated Criteria for Reporting Qualitative Research</p> <p>Quantitative Tool: National Institutes of Health</p> <p>Inconsistencies in ratings were discussed until consensus was reached.</p>
<b>Quality of Included Articles</b>	<p>‘Strong’ quality rating: 5 of the 12 included studies</p> <p>‘Moderate’ quality rating: 5 of the 12 included studies</p> <p>‘Weak’ quality rating: 2 of the 12 included studies.</p>
<b>Characteristics of the Articles in Review</b>	
<b>Population</b>	Adults living in urban areas
<b>Exposure/Intervention</b>	<p>Exposure: Urban Gardens (8 studies)</p> <p>Intervention: Participation in urban gardens (4 studies)</p>
<b>Study Settings</b>	<ul style="list-style-type: none"> <li>• USA: Dubuque, IA (1 study), Birmingham, AL (1 study), Denver, CO (2 studies), Central Ohio (1 study), 1-Flint, MI (1 study), Iowa State (1 study) [7 USA studies in total]</li> <li>• Canada: Toronto, ON (1 study)</li> <li>• Australia: St Lucia, QLD (1 study)</li> <li>• New Zealand: Dunedin (1 study)</li> <li>• South Africa: Johannesburg (1 study)</li> <li>• Columbia: Tunja (1 study)</li> </ul>
<b>Outcomes of Interest</b>	<ol style="list-style-type: none"> <li>1. Fruit and vegetable consumption</li> <li>2. Healthy food access</li> </ol>
<b>Results of the Review</b>	
<b>Main Results<sup>6</sup></b>	<p>Benefits</p> <ol style="list-style-type: none"> <li>1. Fruit and vegetable consumption: <ul style="list-style-type: none"> <li>• Increased fruit and vegetable intake (6 studies: 3 moderate, 3 strong)</li> <li>• Increased variety of fruit and vegetable consumed (1 strong study)</li> <li>• Improved nutrition of the family (1 moderate study)</li> </ul> </li> </ol>

<sup>6</sup> The main results section only describes study results that are relevant to this Focus Practice Question’s outcomes of interest.



	<p>2. Healthy food access:</p> <ul style="list-style-type: none"> <li>• Increased access to healthy foods (4 studies: 1 strong, 2 moderate, 1 weak)</li> <li>• Shared or thinks produce should be shared (5 studies: 2 strong, 3 moderate)</li> <li>• Reduced food cost (3 studies: 1 strong, 2 moderate)</li> </ul>
<b>Comments and Limitations</b>	<p>Limitations</p> <p>The study population of adults encompass a wide range of ages. The meaning and importance of gardening may differ between ages. This may overgeneralize the interpretation of findings.</p> <ul style="list-style-type: none"> <li>• Both domestic and community gardens are included in this review. Each type of garden has distinct characteristics.</li> <li>• The authors defined their own cut-off points to attribute the following quality ratings to the included studies: <i>strong</i>, <i>moderate</i> and <i>weak</i>.</li> </ul>

<b>Article 2: The intersection of planning, urban agriculture, and food justice: a review of the literature</b>	
<b>General Information and Quality Rating</b>	
<b>Author(s) and Date</b>	Horst, M., McClintock, N., Hoey L. (2017)
<b>Country</b>	USA
<b>Type of Article</b>	Systematic Review
<b>Quality Assessment</b>	Moderate (HE)
<b>Objectives</b>	The review draws from a multidisciplinary body of literature to suggest ways for urban planners to structure urban agriculture in support of food justice <sup>7</sup> .
<b>Details of the Review</b>	
<b>Number of Articles Included</b>	Not defined by authors
<b>Types of Articles Included</b>	Individual case studies
<b>Databases Searched</b>	<p>No databases were searched. Authors searched the following journals, books and grey literature sources:</p> <ul style="list-style-type: none"> <li>• Public health journals including, but not limited to Annual Review of Public Health.</li> <li>• Food studies and food systems journals, including but not limited to Journal of Agriculture, Food Systems and Community Development.</li> <li>• Sociology and geography journals including but not limited to Antipode, Progress in Human Geography.</li> <li>• Planning journals including but not limited to Journal of the American Planning Association, International Planning Studies, Journal of planning Education and Research, Journal of Planning Literature.</li> <li>• Books including Cultivating Food Justice: Race, Class, and Sustainability, Food Justice, Beyond the Kale: Urban Agriculture and Social Justice Activism in New York City.</li> <li>• Grey literature reports from relevant national organizations including but not limited to American Planning Association, PolicyLink, Johns Hopkins Centre for a Livable Future.</li> </ul>
<b>Search Period</b>	2000-2016
<b>Inclusion/Exclusion Criteria</b>	<p>Inclusion:</p> <ul style="list-style-type: none"> <li>• Urban agriculture in US and Canada</li> <li>• Food justice literature</li> <li>• Urban agriculture literature</li> </ul>

<sup>7</sup> Food justice definition: food justice is the right of communities everywhere to produce, process, distribute, access and eat good food regardless of race, class, gender, ethnicity, citizenship, ability, religion, or community”.

	<p>Exclusion:</p> <ul style="list-style-type: none"> <li>Literature from places outside of US/Canada given the unique social, political, economic and land use contexts.</li> </ul>
<b>Review Methods</b>	<ul style="list-style-type: none"> <li>The review synthesizes the main social benefits and limitations of urban agriculture found in the included case studies.</li> </ul>
<b>Quality Appraisal Process</b>	There was no quality appraisal process.
<b>Quality of Included Articles</b>	Quality was not appraised.
<b>Characteristics of the Articles in Review</b>	
<b>Population</b>	General Population
<b>Exposure</b>	Urban agriculture
<b>Study Settings</b>	<ul style="list-style-type: none"> <li>USA including but not limited to: Seattle, WA (2 studies), Baltimore, MD (2 studies), Detroit, MI (6 studies), Buffalo, NY(1 study), Milwaukee, WI (1 study), Chicago, IL (1 study), Los Angeles, CA (2 studies), St Louis, MO (1 study), New York, NY (10 studies), Portland, OR (3 studies), New Orleans, LA (1 study), Central Puget Sound Region (2 studies), San Jose, CA (2 studies), Boston, MA (1 study), California (3 studies), Oakland, CA (4 studies), San Francisco, CA (1 study), Denver, CO (1 study), Philadelphia, PA (1 study), Brooklyn, NY (1 study)</li> <li>Canada including but not limited to: Vancouver, BC (3 studies), Eastern Ontario (1 study), Gabriola Island, BC (1 study), Kingston, ON (1 study), Toronto (1 study)</li> </ul>
<b>Outcomes of Interest</b>	<p>Benefits:</p> <ol style="list-style-type: none"> <li>Healthy food access</li> <li>Increased fruit and vegetable consumption</li> <li>Physical activity</li> <li>Mental health</li> <li>Quality of life and general well-being</li> <li>Generating income</li> <li>Building skills</li> <li>Community development</li> <li>Connections to broader social change efforts</li> </ol> <p>Risks:</p> <ol style="list-style-type: none"> <li>Health risks</li> </ol>
<b>Results of the Review</b>	

<p><b>Main Results<sup>8</sup></b></p>	<p><b>Benefits</b></p> <p>1. Healthy Food Access</p> <ul style="list-style-type: none"> <li>• Urban agriculture cultivation can increase food access and food security for those involved and sometimes for recipients of donated food (2 studies).</li> <li>• Many urban agriculture participants grow beyond their own consumption needs and share excess with other community members and local food banks (2 studies).</li> <li>• In one study, half of the gardeners donated their produce, earning the garden a reputation among food-insecure neighbours as a place to get free food (1 study).</li> <li>• Urban agriculture’s ability to contribute to food security for any individual, household, or city ranges widely depending on factors such as climate; the amount and type of land available; and the time, availability and skills of practitioners (1 study).</li> <li>• Urban agriculture practitioners save household money by supplementing some of their produce expenditures (3 studies).</li> <li>• In one study, families who participate in community gardening typically offset 30-40% of their fresh produce needs (1 study).</li> </ul> <p>2. Fruit and Vegetable Consumption</p> <ul style="list-style-type: none"> <li>• Adults in households where someone participates in community gardening eat fruit and vegetables more frequently than adults in nonparticipating households (1 study).</li> <li>• In one study, youth gardeners from wealthier households were more likely to engage in healthy eating with no measurable increase in healthy eating by youth gardeners from poorer households (1 study).</li> <li>• In one study, youth participants in urban agriculture programing were more likely to taste vegetables they grew themselves (1 study).</li> </ul> <p>3. Physical Activity</p> <ul style="list-style-type: none"> <li>• The physical practice of cultivating food, including weeding, tilling and using hand tools, offers a form of exercise that is preferred across different populations by age, gender, race and ethnicity (2 studies)</li> </ul> <p>4. Mental Health and Wellness</p> <ul style="list-style-type: none"> <li>• Urban agriculture is associated with reduced stress and improved mental well-being (2 studies).</li> <li>• Urban agriculture may be especially beneficial for people experiencing mental illness and for people who have</li> </ul>
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<sup>8</sup> The main results section only describes study results that are relevant to this Focus Practice Question’s outcomes of interest.

	<p>been incarcerated (1 study).</p> <p>6. Quality of Life and General Well-Being</p> <ul style="list-style-type: none"> <li>• Community gardens provide places for nearby residents to recreate, relax and contribute to beautification, environmental sustainability, quality of life and community pride (2 studies)</li> <li>• Two studies link community gardening to lower obesity rates (2 studies).</li> </ul> <p><b>Risks</b></p> <p>1. Health risks</p> <ul style="list-style-type: none"> <li>• Urban agriculture poses health risks in poor communities where there is soil, water and air pollution (4 studies).</li> <li>• One study shows high uptake of lead in vegetables grown in soils with high lead concentrations, with associated negative health implications (1 study).</li> </ul>
<p><b>Comments and Limitations</b></p>	<p>Limitations:</p> <ul style="list-style-type: none"> <li>• Urban agriculture literature is emerging</li> <li>• There's a limited amount of food justice literature</li> <li>• The included evidence is based on individual cases studies</li> <li>• Studies did not assess/evaluate impacts or outcomes</li> </ul> <p>Comment:</p> <ul style="list-style-type: none"> <li>• Focusing on urban agriculture as a solution to food injustice obscures the systematic conditions that produce food insecurity (including poverty, low wages and income disparity). Urban agriculture is one potential intervention among an array of strategies, including antipoverty measures, needed to enhance food justice.</li> </ul>

<b>Article 3: Edible green infrastructure: an approach and review of provisioning ecosystem services and disservices in urban environments</b>	
<b>General Information and Quality Rating</b>	
<b>Author(s) and Date</b>	Russo, A., Escobedo, F.J., Cirella GT., Zerbe, S. (2017)
<b>Country</b>	Russia, Colombia, Italy
<b>Type of Article</b>	Systematic Review
<b>Quality Assessment</b>	Moderate (HE)
<b>Objectives</b>	The review's aim is to: 1. Raise awareness of urban <i>provisioning</i> (i.e. providing food) ecosystem service, identifying types of urban agriculture 2. Synthesize findings on ecosystem service and disservice of urban agriculture 3. Provide recommendations/guidelines for the design, planning and management of sustainable urban agriculture
<b>Details of the Review</b>	
<b>Number of Articles Included</b>	80
<b>Types of Articles Included</b>	Qualitative and quantitative studies
<b>Databases Searched</b>	Science Direct, Web of Knowledge, Scopus, ProQuest, Sage, Directory of Open Access Journals, Google Scholar, Google
<b>Search Period</b>	1989 to present
<b>Inclusion/Exclusion Criteria</b>	<p>Inclusion:</p> <ul style="list-style-type: none"> <li>• Peer-reviewed quantitative and qualitative studies</li> <li>• Studies that presented specific findings on urban ecosystem services, nature-based solutions and ecosystem disservices related to urban agriculture or 'edible green infrastructure'.</li> </ul> <p>Exclusion:</p> <ul style="list-style-type: none"> <li>• Papers on cultural ecosystem services</li> <li>• Papers that did not focus on ecosystem services and food production in urban and peri-urban areas</li> <li>• Intensive urban-agriculture practices such as commercial farming, biomass feedstock, aquaculture and livestock in urban areas</li> <li>• Papers that did not consider articles published before 1989.</li> </ul>
<b>Review Methods</b>	<ul style="list-style-type: none"> <li>• The review analyzed the included literature and relevant information regarding different components of urban agriculture</li> <li>• The review summarized results of the included studies</li> <li>• The authors identified existing terminology related to <i>green infrastructure</i> and <i>urban and peri-urban agriculture and forestry</i>, then updated and synthesized the terms to improve urban agriculture's framework.</li> </ul>

	<ul style="list-style-type: none"> <li>The authors identified related indicators and metrics associated with urban agriculture</li> </ul>
<b>Quality Appraisal Process</b>	There was no quality appraisal process.
<b>Quality of Included Articles</b>	Quality was not appraised.
<b>Characteristics of the Articles in Review</b>	
<b>Population</b>	City Dwellers
<b>Exposure</b>	Urban agriculture, or 'Edible Green Infrastructure'
<b>Study Settings</b>	<p>Study settings include, but are not limited to:</p> <ul style="list-style-type: none"> <li>USA (12 studies)</li> <li>United Kingdom (7 studies)</li> <li>Italy (5 studies)</li> <li>Spain (3 studies)</li> <li>Denmark (3 studies)</li> <li>Canada (1 study)</li> <li>Switzerland (1 study)</li> <li>Sweden (1 study)</li> <li>South Africa (1 study)</li> <li>Singapore (1 study)</li> <li>Portugal (1 study)</li> <li>Poland (1 study)</li> <li>Hungary (1 study)</li> <li>Germany (1 study)</li> <li>China (1 study)</li> <li>Burundi (1 study)</li> <li>Australia (1 study)</li> </ul>
<b>Outcome Variables of Interest</b>	<p>Benefits:</p> <ol style="list-style-type: none"> <li>Fruit and vegetable consumption</li> <li>Healthy food access</li> <li>General health and well-being</li> <li>Quality of life</li> <li>Mental health</li> <li>Habitat or supporting services – biodiversity, soil formation</li> </ol> <p>Risks:</p> <ol style="list-style-type: none"> <li>Vegetables and soil contamination</li> <li>Water pollution</li> <li>Fruit fall problems</li> <li>Water consumption</li> <li>Volatile organic compounds</li> <li>Invasive species</li> <li>Over application of chemicals</li> <li>Installation costs</li> </ol>
<b>Results of the Review</b>	

<p><b>Main Results<sup>9</sup></b></p>	<p><b>Benefits:</b></p> <ol style="list-style-type: none"> <li>1. Fruit and vegetable consumption Community gardens can also have the potential for nutrition intervention approaches for increased fruit and vegetable intake (1 study).</li> <li>2. Healthy food access: <ul style="list-style-type: none"> <li>• Edible urban forests<sup>10</sup> and edible urban greening produces a variety of food and medicine (8 studies).</li> <li>• Community gardens produce a variety of food and medicine (10 studies).</li> </ul> </li> <li>3. Quality of life <ul style="list-style-type: none"> <li>• Edible urban forests and urban greening improve human well-being, aesthetics, and reduces stress (3 studies).</li> <li>• Community gardens improve human well-being, aesthetics and reduces stress (15 studies).</li> </ul> </li> <li>4. Mental health and well-being <ul style="list-style-type: none"> <li>• Community gardening can play a key role in promoting mental wellbeing and usefulness as a preventive health measure (1 study).</li> </ul> </li> </ol>
<p><b>Comments and Limitations</b></p>	<p>Limitations:</p> <ul style="list-style-type: none"> <li>• The review only examined English language literature. This may have limited the number of relevant results as a search completed in Spanish returned 64 publications that the authors state would have fit their criteria.</li> </ul> <p>Recommendations for the design, planning and management of urban agriculture that is safe for consumption (i.e. indicators and metrics for growing edible products on urban lands):</p> <ul style="list-style-type: none"> <li>• Grow crops at least ten meters away from busy roads (1 study).</li> <li>• When plants are grown 10 meters from roads (compared to 60 meters), the risk of heavy metal contamination increases approximately 1.5-fold (1 study).</li> <li>• Use buildings and large masses of woody vegetation as barriers between crops and roads (1 study).</li> <li>• Be aware of past site history, existing soil properties and distance from possible nearby sources of pollutions (e.g. roads, factories) (1 study).</li> </ul>

<sup>9</sup> The main results section only describes study results that are relevant to this Focus Practice Question’s outcomes of interest.

<sup>10</sup> Edible forests defined: includes plants and trees found in forests for fruit, nut and medicine production.



The following ecological risks are identified:

1. Edible urban forests and edible urban greening may be at risk for soil contamination by heavy metals and pollutants (1 study).
2. Community gardens may be at risk for soil contamination by heavy metals and pollutants (15 studies).
3. Edible urban forests and urban greening may increase risks for water pollution from fertilizers and chemical inputs (1 study).

<b>Article 4: Review of the nutritional implications of farmers' markets and community gardens: a call for evaluation and research efforts</b>	
<b>General Information and Quality Rating</b>	
<b>Author(s) and Date</b>	McCormack, Laska, Larson and Story (2010)
<b>Country</b>	United States
<b>Type of Article</b>	Systematic Review
<b>Quality Assessment</b>	Moderate (HE)
<b>Objectives</b>	The review aims to: <ol style="list-style-type: none"> <li>1. Evaluate the scientific literature on farmers' market and community garden programs and their nutrition-related implications.</li> <li>2. Advocate for the potential for farmers' markets and community gardens to improve fruit and vegetable consumption</li> <li>3. Highlight implications for future research.</li> </ol>
<b>Details of the Review</b>	
<b>Number of Articles Included</b>	16
<b>Types of Articles Included</b>	Scientific peer-reviewed articles that used cross sectional survey designs and three program evaluation reports (pre and post assessment questionnaires)
<b>Databases Searched</b>	PubMed and Agricola
<b>Search Period</b>	January 1980 to January 2009
<b>Inclusion/Exclusion Criteria</b>	<p>Inclusion:</p> <ul style="list-style-type: none"> <li>• Studies conducted in the US</li> <li>• Studies that quantitatively or qualitatively examine nutrition related outcomes</li> </ul> <p>Exclusion:</p> <ul style="list-style-type: none"> <li>• Studies that focused on youth-based programs</li> </ul>
<b>Review Methods</b>	<ul style="list-style-type: none"> <li>• A snowball strategy was used to retrieve additional articles and reports relevant to the outcomes of interest.</li> <li>• 16 peer-reviewed articles were included, in addition to three program evaluation reports.</li> </ul>
<b>Quality Appraisal Process</b>	There was no quality appraisal process.
<b>Quality of Included Articles</b>	The quality of included articles was not appraised.
<b>Characteristics of the Articles in Review</b>	
<b>Population</b>	Adults
<b>Intervention/Exposure</b>	Farmers' market programs and community gardens

<b>Study Settings</b>	Unites States including: Ohio (2 studies), Iowa (1 study), Massachusetts (3 studies), Pennsylvania (2 studies), Texas (1 study), Vermont (1 study), Washington (4 studies), Michigan (2 studies), Connecticut (1 study), California (1 study), South Carolina (1 study), Wisconsin (1 study)
<b>Outcomes of Interest</b>	<ol style="list-style-type: none"> <li>1. Fruit and vegetable consumption</li> <li>2. Healthy food access</li> <li>3. Attitudes and beliefs related to buying, preparing, or eating fruits and vegetable</li> <li>4. Behaviours and perceptions on obtaining produce from farmers' markets or community gardens</li> </ol>
<b>Results of the Review</b>	
<b>Main Results<sup>11</sup></b>	<p>Benefits:</p> <ol style="list-style-type: none"> <li>1. Fruit and vegetable consumption <ul style="list-style-type: none"> <li>• Adults with household member who participated in a community garden consumed fruit and vegetable 1.4 more times per day than non-participating households (1 study).</li> <li>• Adults with household members who participated in a community garden were 3.5 times more likely to consume fruit and vegetables at least 5 times daily (1 study).</li> <li>• Gardeners consumed significantly more of six vegetable categories than nongardeners (1 study).</li> <li>• Gardeners reported consuming 11.1 (or ½ cup) each of vegetable servings (1 study).</li> <li>• More than half of gardeners reported eating more fruits and vegetables (1 study).</li> </ul> </li> <li>3. Healthy food access <ul style="list-style-type: none"> <li>• 81% of respondents reported using their community garden to stretch food dollars (1 study).</li> </ul> </li> </ol>
<b>Comments and Limitations</b>	<p>Limitations:</p> <ul style="list-style-type: none"> <li>• Many of the included studies assess dietary intake with tools possessing a variety of limitations (e.g. non-validated surveys).</li> <li>• Studies used different methods to assess fruit and vegetable consumption, limiting the comparability of results across studies.</li> </ul> <p>Comment:</p> <ul style="list-style-type: none"> <li>• Accurate dietary assessment continues to be an ongoing challenge for researchers.</li> </ul>

<sup>11</sup> The main results section only describes study results that are relevant to this Focus Practice Question's outcomes of interest.

## Appendix D- Guide for Soil Testing in Urban Gardens

Toronto Public Health developed a practical guide for people interested in starting an urban garden and wanting to learn about soil safety. The guide outlines a three-step process to assess and mitigate soil contamination concerns. The three steps are briefly described below. The complete guide can be accessed online at: <http://hcgnc.ca/wp-content/uploads/2015/04/Guide-for-Soil-Testing-in-Urban-Gardens.pdf>.

### Step 1: Establish a level of concern

There are low, medium, and high concern sites. See Table 1 for examples of sites and how their history of use determines the level of concern.

### Step 2: Assess the soil

In some cases, the guide recommends that gardeners test their soil. Soil testing is recommended for large gardens<sup>12</sup> located on medium or high concern sites.

### Step 3: Take actions to reduce risks

The guide recommends specific actions gardeners may take to mitigate the potential health risks associated with soil contaminants. See Table 1 for recommended actions based on a site's level of concern.

Table 1 – Recommended actions for gardeners, based on level of concern

Level of concern	Site examples	Recommended actions
Low	Site was previously residential, parkland, farmland or a school.	Wash hands after gardening and always before eating, wash produce with soap and water.
Medium	Site was previously an orchard, hydro corridor, or is located 30m from a rail line or arterial road.	<ul style="list-style-type: none"><li>-Lower concentration of contaminants by adding clean soil and organic matter to existing soil.</li><li>-Reduce dust by covering bare soil with ground cover/mulch.</li><li>-Peel root vegetables before you eat or cook them.</li><li>-Avoid growing the types of produce that accumulate soil contaminants (see list in the complete guide).</li></ul>
High	Site was once a gas station, dry cleaner, autobody shop, print shop or industrial land.	<ul style="list-style-type: none"><li>-Build raised bed gardens (add a minimum of 40cm of clean soil on top of garden fabric) or grow food in containers.</li><li>-Reduce dust by covering soil with ground cover or mulch.</li><li>-Add clean soil and organic matter annually (compost and manure) to the raised bed or containers; or grow only nut and fruit trees (not any other types of produce).</li></ul>

Sites and recommended actions listed in Table 1 are not exhaustive. See the complete guide for more information.

<sup>12</sup> Toronto Public Health defines a *large* garden as a garden measuring more than 16 m<sup>2</sup> (170 ft<sup>2</sup>) or 4 X 4 m (13X13 ft).