

BMJ Open

Community gardening, community farming and other local community-based gardening interventions to prevent overweight and obesity in high- and middle-income countries: protocol for a systematic review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-016237
Article Type:	Protocol
Date Submitted by the Author:	02-Feb-2017
Complete List of Authors:	Heise, Thomas; University of Bremen, Institute for Public Health and Nursing Research, Health Sciences; Leibniz Institute for Prevention Research and Epidemiology - BIPS, ebph - Research Group for Evidence-Based Public Health Romppel, Matthias; University of Bremen, Institute for Public Health and Nursing Research, Health Sciences Molnar, Sandra; Institute for Quality and Efficiency in Health Care - IQWiG, Department of Non-Drug Interventions Buchberger, Barbara; University of Duisburg-Essen, Institute for Health Care Management and Research van den Berg, Agnes; University of Groningen, Faculty of Spatial Sciences Gartlehner, Gerald; Danube University Krems, Department for Evidence-based Medicine and Clinical Epidemiology; RTI-International Lhachimi, Stefan; University of Bremen, Institute for Public Health and Nursing Research, Health Sciences; Leibniz Institute for Prevention Research and Epidemiology - BIPS, ebph - Research Group for Evidence-Based Public Health
Primary Subject Heading:	Nutrition and metabolism
Secondary Subject Heading:	Public health, Diabetes and endocrinology
Keywords:	Community gardening, Gardening, Overweight, Obesity, Physical activity

SCHOLARONE™
Manuscripts

Community gardening, community farming and other local community-based gardening interventions to prevent overweight and obesity in high- and middle-income countries: protocol for a systematic review

Thomas L Heise^{1,2*}, Matthias Romppel¹, Sandra Molnar³, Barbara Buchberger⁴, Agnes van den Berg⁵, Gerald Gartlehner^{6,7}, Stefan K Lhachimi^{1,2}

¹Institute for Public Health and Nursing Research, Health Sciences Bremen, University of Bremen, Bremen, Germany

²Research Group for Evidence-Based Public Health, Leibniz Institute for Prevention Research and Epidemiology, Bremen, Germany

³Department of Non-Drug Interventions, Institute for Quality and Efficiency in Health Care - IQWiG, Cologne, Germany

⁴Institute for Health Care Management and Research, University of Duisburg-Essen, Essen, Germany

⁵Faculty of Spatial Sciences, Department of Cultural Geography, University of Groningen, Groningen, the Netherlands

⁶Department for Evidence-based Medicine and Clinical Epidemiology, Danube University Krems, Krems, Austria

⁷RTI-International, Research Triangle Park, North Carolina, USA

*Corresponding author

Thomas L Heise

Institute for Public Health and Nursing Research

University of Bremen

Grazer Straße 2

28359 Bremen

Email: heise@leibniz-bips.de

Phone: +49-421-218-56920

(Physical addresses and email-addresses of co-authors can be obtained via the corresponding author)

Word count abstract: 299

Word count main manuscript: 3430

Abstract

Introduction

The worldwide prevalence of overweight/obesity has continued to rise over the last decades. To reverse this trend, public health authorities are exploring cost-effective interventions, especially in high- and middle-income countries (HMICs). Community gardening offers a unique opportunity for individuals to enhance physical activity levels and improve their diet. However, synthesised evidence on the short/long-term effectiveness, and on the costs of community gardening interventions to prevent overweight/obesity, remains limited. Therefore, this review will investigate: i) the effectiveness of voluntary participation in community gardening compared with no or control treatment to prevent overweight/obesity, or to improve related outcomes, ii) effects on different sub-groups of populations and settings, and iii) the costs of community gardening interventions.

Methods and analysis

We will conduct a systematic review, limited to evaluations of community gardening interventions with controlled quantitative and interrupted time series designs. To identify relevant articles, we will systematically search 12 academic and five grey literature databases, as well as two trial registers and six websites. Articles will then be assessed for eligibility based on a pre-defined set of criteria. At least two independent reviewers will assess each article for relevance, before evaluating the methodological quality and potential bias of the studies. Data relevant to the objectives of this review will be extracted and cross-validated. Any disagreements will be mediated by a third reviewer. If feasible, meta-analyses of primary outcomes (overweight/obesity, physical activity, nutritional intake, energy intake) will be conducted. We will use the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) method to assess the overall quality of evidence.

Ethics and dissemination

For this review, no ethical approval is required as we will only extract and analyse secondary data. We aim to submit the final review manuscript to an Open Access journal for publication and disseminate results via conferences and social media.

Systematic review registration

PROSPERO CRD42017043696

Keywords

Community gardening, Gardening, Nutrition, Overweight, Obesity, Costs

Strengths and limitations of this study

- The proposed systematic review will report the effects of voluntary participation in community gardening interventions in various settings on overweight, obesity and associated health-related outcomes in the general population of HMICs
- Methods include a working definition of non-therapeutic community gardening, rigorous inclusion criteria for the study designs, and a comprehensive search strategy
- The design process and selection of the main objectives is guided by a logic/causal pathway model
- The limited availability of high-quality studies, as well as variations in intervention duration and components, may be a challenge for conducting robust meta-analyses and drawing definitive conclusions

Introduction

Rationale

According to the World Health Organization, 39% of the global adult population is classified as overweight, with only small differences by gender (40% for women vs. 38% for men). Global obesity prevalence differs more in terms of gender with 15% for women vs. 11% for men. Overweight and obesity are one of the leading global health risk factors for mortality and account for 4.8% of deaths worldwide, especially in high-income countries (8.4%).¹ Overweight and obesity also cause a considerable socio-economic burden on a global scale. In 2010, high levels of body mass index (BMI) as a risk factor were estimated to cause 93.6 million disability-adjusted life years (DALYs) worldwide.² This corresponds to an increase of 44.7% in DALYs attributable to this specific risk factor between 1990 and 2010.^{2,3} Overweight and obesity are also strongly related to a wide range of negative health outcomes (e.g. diabetes mellitus type 2, hypertension etc.).⁴ Besides surgical and drug-based treatments, which are often associated with adverse effects, prevention measures, such as community-based initiatives to promote physical activity embedded in natural and built environments, have gained considerable attention.⁵ From a public health perspective, interventions to prevent and control overweight and obesity in the general population should: i) reflect the complexity of this health condition, ii) simultaneously aim at various health-related behaviours, and iii) be of low risk and cost-effective, with the aim to have sustainable positive effects on health on the long term. Community gardening may represent a potentially powerful and sustainable intervention that combines physical activity, improved food supply and education, to support culturally-tailored healthy living in the local context.⁶ For the proposed review, we define community gardening as: voluntary non-professional cultivation of plants and supportive gardening activities with active physical participation by community members, either collectively on a single piece of land, or on individual (non-domestic) plots of land, with regular community meetings or other social activities, including educational and training activities.^{7,8}

Gardening initiatives with active participation of community members are widespread at schools, nursing homes and other community facilities (e.g. over 500 exist in Germany).⁹ Community gardens are integrated on the local level, in different settings, and are usually cultivated and operated by individuals or non-profit organisations (e.g. community networks, NGOs, or schools).^{6,7} Although these initiatives are not necessarily driven by a health-promotion perspective, there is evidence that community gardening may reduce overweight/obesity and diseases related to these conditions, by stimulating physical exercise and improving healthy food supply and nutritional

1
2
3 intake (e.g. vegetables, fruits).¹⁰ Additional evidence from studies using more rigorous controlled designs has
4 recently become available.^{11,12} Moreover, there is an acknowledged need to summarise and synthesise this
5 rapidly expanding body of evidence.^{7,8,11} Meanwhile, less is known about the cost-effectiveness of this approach.
6
7 Therefore, synthesised evidence is essential to improve the knowledge base for policymaking and planning
8
9 decisions regarding the physical/social infrastructure required for optimal use of community gardens for disease
10 prevention and health promotion.^{13,14}
11
12

13 14 15 **How this intervention might work**

16
17 *Figure 1 Logic/causal pathway model of community gardening interventions to prevent overweight and obesity.*

18
19
20 To visualise important interactions as causal pathways between the core elements to be examined in this review,
21 we developed a preliminary logic model (Figure 1). The basic concept of this model is introduced: for this we
22 focus on the hypothetical effects on 'overweight/obesity' and on other (intermediate) outcomes.¹⁵⁻¹⁷ Following our
23 working definition, 'community gardening', as introduced and maintained by different community groups,
24 institutions, organisations or governments, is characterised by two main activities: 'education/training' and 'active
25 gardening'.^{7,8} 'Education/training' using single or multiple channels (e.g. community meetings, classes) aims to
26 improve the participants' food-related or gardening-related 'knowledge' (e.g. gardening techniques, food
27 preparation). If these interventional components are effective in stimulating a positive behavioural change, this
28 may support participants to actively work in a gardening environment and critically examine, both consciously and
29 unconsciously, their own 'food supply' and 'intake of nutrients' towards a healthier life-style.¹¹ First, 'active
30 gardening', such as weekly gardening sessions, may lead to low-to-moderate levels of 'physical activity'
31 associated with enhanced 'energy expenditure'. Moreover, this may have a positive impact on other health
32 outcomes such as 'quality of life' (e.g. stress relief).¹⁸ Second, 'community gardening' may also serve to alter the
33 'food supply' (e.g. vegetables, fruits) leading to a change in nutritional intake (e.g. increased intake of dietary
34 fibres and essential vitamins; decreased consumption of macronutrients such as sugar and fat).^{11,19} Besides the
35 other outcomes, 'food supply' is particularly relevant in case of socio-economic inequality, as individuals with a
36 lower socioeconomic status (SES) spend relatively more of their 'financial resources' on food compared with
37 those with a higher SES. Third, participants working in cooperative activities may also benefit from aspects of
38 social cohesion (i.e. social capital, social inclusion) that may prevent them from social exclusion and increase
39 their 'quality of life'; this may especially apply to the elderly.²⁰ The primary outcomes of this review, i.e.
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 'overweight and obesity', are mainly caused by an imbalance between 'energy expenditure' and 'energy intake'.
4
5 Therefore, if the intervention is effective in improving participants' 'energy expenditure', represented in this review
6
7 by the proxy outcome 'physical activity', or in lowering their 'energy intake' (with no simultaneous negative
8
9 changes), then 'community gardening' activities may prevent 'overweight and obesity' (e.g. by lowering an
10
11 individual's BMI). The logic model visualises feedback loops of health conditions such as 'diabetes type 2',
12
13 'cardiovascular disease', and 'quality of life' that are closely related to 'overweight/obesity'. To provide a balanced
14
15 picture of interventional effects, we will also investigate unique health risks of 'community gardening' (e.g. injuries,
16
17 soil contamination). In addition to the elements along the pathway of 'community gardening', the 'contextual and
18
19 individual' factors may also help to elucidate the direction and strength of the effects on the selected outcomes.
20

21 22 **Objectives**

- 23
24 i) To examine the effectiveness of participation in community-based gardening compared to no or control
25
26 treatment to prevent overweight and obesity, and/or to improve health-related outcomes (i.e. physical activity and
27
28 nutritional intake) in the general population and in populations at risk for overweight and obesity in HMICs;
29
30
31 ii) to examine the effects of community gardening interventions in different sub-groups of populations and settings
32
33 (e.g. schools, neighbourhoods, community facilities) as well as based on the components of the intervention;
34
35
36 iii) to assess the costs of community gardening interventions aimed at preventing overweight and obesity.
37

38 **Methods**

39 40 **Reporting standards and registration**

41
42 This protocol follows the reporting standards as defined in the 'Preferred Reporting Items for Systematic Review
43
44 and Meta-Analysis Protocols (PRISMA-P) 2015 statement'.²¹ The protocol is registered in the 'International
45
46 Prospective Register of Systematic Reviews' (PROSPERO): CRD42017043696.
47

48
49 For the proposed review, authors will comply with the PRISMA checklist published as 'Preferred Reporting Items
50
51 for Systematic Reviews and Meta-Analyses: The PRISMA Statement'.²²
52

53 54 **Eligibility criteria**

55 56 57 58 **Population**

1
2
3 Inclusion criteria are:

- 4 • members of the general population of any age or ethnicity in HMICs, including persons at high risk for
- 5 overweight or obesity (e.g. low SES, living in deprived geographical areas).
- 6
- 7
- 8
- 9

10 Exclusion criteria are:

- 11 • persons with active drug treatment, surgical interventions, or disease-specific psychological treatment.
- 12
- 13
- 14
- 15

16 **Experimental intervention**

17 Inclusion criteria for studies with community-based gardening as interventions, defined as:

18 interventions with voluntary non-professional cultivation of plants and supportive gardening activities with active
19 physical participation by community members, either collectively on a single piece of land or on individual (non-
20 domestic) plots of land, with regular community meetings or other social activities, including educational and
21 training activities.^{7,8}
22
23
24
25
26
27

28 Inclusion criteria for environments and settings are:

- 29 • community gardens;
- 30
- 31 • gardens at community care facilities;
- 32
- 33 • school gardens;
- 34
- 35 • community farms with mandatory physical participation; and
- 36
- 37 • other public environments with community gardens accessible for community members.
- 38
- 39
- 40
- 41
- 42
- 43
- 44

45 Exclusion criteria for environments and settings are:

- 46 • professional farming;
- 47
- 48 • subsistence agriculture;
- 49
- 50 • domestic gardening; and
- 51
- 52 • disease-specific therapeutic gardening in a closed environment.
- 53
- 54
- 55
- 56
- 57
- 58

59 **Control intervention**

1
2
3 Inclusion criteria for the studies are:

4
5 Any control intervention or passive control group, including:

- 6
7
8
 - 9 • health education interventions other than community gardening (e.g. cooking classes, nutritional
10 information);
 - 11 • sports-based interventions;
 - 12 • other nutritional interventions aimed to support healthy eating patterns (e.g. coupons for farmers'
13 markets, etc.); and
 - 14 • no intervention or waiting list.

15
16
17
18
19
20
21

22 Outcomes

23 Inclusion criteria for the studies are:

- 24
25
 - 26 • reporting of at least one primary outcome.

27
28
29

30 Primary outcomes are:

- 31
32
 - 33 • overweight and obesity (e.g. incidence or prevalence; body mass indices, i.e. BMI, waist-to-hip ratio);
 - 34 • physical activity (e.g. data based on self-reports, activity diaries, accelerometers, etc.);
 - 35 • nutritional intake (e.g. food groups, ingredients); and
 - 36 • energy intake (e.g. total energy intake).

37
38
39
40

41 Secondary outcomes are:

- 42
43
 - 44 • adverse health outcomes or outcomes with a direct link to overweight/obesity or physical activity (e.g.
45 health-related quality of life, cardiovascular disease, type 2 diabetes, mortality, fracture);
 - 46 • costs;
 - 47 • total expenditure of participants on food;
 - 48 • knowledge on food and gardening techniques; and
 - 49 • indices on social cohesion.

50
51
52
53
54
55
56

57 Study design

58 Inclusion criteria for a study to be included in the main analysis are:

- randomised controlled trials (RCT);
- cluster randomised controlled trials (cRCT);
- non-randomised controlled trials (nRCT);
- controlled before-after (CBA) studies; and
- interrupted time series (ITS) studies

that comply with the criteria of the 'Cochrane Effective Practice and Organisation of Care' (EPOC) group. In accordance with the EPOC criteria, we will include studies with a design that adheres to an appropriate controlled design (e.g. EPOC recommends more than one intervention or control site), or ITS studies with a clearly defined point in time for the intervention's implementation as well as at least three data points before/after the intervention for the included outcomes.²³

Information sources

To identify potentially relevant references of studies, we will consider academic and grey literature databases, as well as (clinical) trial registers and handsearching. The selection of relevant repositories was mainly based on potential coverage of the proposed review's 'patient/population, intervention, control, outcomes' (PICO) format.²⁴

We will include and search the following 12 bibliographic databases to identify relevant studies:

- Agricultural Online Access (AGRICOLA) (1970 to present);
- Agricultural Science and Technology Information (AGRIS) (1974 to present);
- Applied Social Sciences Index and Abstracts (ASSIA) (1987 to present);
- Cochrane Central Register of Controlled Trials (CENTRAL) (1948 to present);
- Cumulative Index to Nursing and Allied Health Literature (CINAHL) (1937 to present);
- Current Contents Medicine Database of German and German-Language Journals (CC MED) (2000 to present);
- Education Resources Information Center (ERIC) (1966 to present);
- Excerpta Medica database (EMBASE) (1947 to present);
- Food Science and Technology Abstracts (FSTA) (1969 to present);

- Medical Literature Analysis and Retrieval System Online (MEDLINE) (1946 to present);
- PsycINFO (1887 to present); and
- Web of Science Core Collection (1900 to present).

In addition, we will perform searches in five electronic grey literature databases:

- Directory of Open Access Repositories (OpenDOAR) [first 50 hits];
- Google Scholar [first 50 hits];
- ProQuest Dissertations & Theses Database (PQDT);
- Social Science Research Network (SSRN); and
- System for Information on Grey Literature in Europe (OpenGrey) [first 50 hits].

We will search the following meta-trial registers to retrieve records of ongoing or unpublished trials:

- Trials Register of Promoting Health Interventions (TRoPHI); and
- WHO International Clinical Trials Registry Platform (ICTRP).

We will search the following websites using keywords:

- American Community Gardening Association;
- Benefits Hub;
- Centre for Agricultural Bioscience International;
- Food Security and Nutrition Network;
- Stiftungsgemeinschaft anstiftung & ertomis; and
- Therapeutic Landscapes Network.

Search strategy

We have developed a highly sensitive search strategy for MEDLINE, incorporating a combination of medical subject headings (MeSH) and text words for the intervention, outcomes, and population of interest. Because commonly used study design filters missed several potentially relevant references, we will use a list of text words for the search strategy to take into account the study designs. The search strategy has been piloted and will be modified according to the requirements of the other bibliographic databases (Table 1).

Table 1 Search strategy for MEDLINE

Search strategy for MEDLINE (via OVID SP)	
1.	exp gardening/
2.	((garden or gardens or gardening or allotment? or horticulture or agriculture or botanical or cultivating or cultivation or plant or plants or planting or greening or harvest or harvests or harvesting) adj5 (community or communities or intercultural or guerrilla or civic or neighbour?hood or residential? or solidarity or co?operative or communal or collective or shared or voluntary or volunteer or volunteers or volunteering or school or educational or education or recreational or recreation or retirement or nursing or kindergarten or pop?up or urban or rural or local)).tw.
3.	health.tw.
4.	obes*.tw.
5.	overweight.tw.
6.	(body weight or body mass).tw.
7.	("body mass index" or bmi).tw.
8.	(physical adj (activity or activities)).tw.
9.	training.tw.
10.	fitness.tw.
11.	endurance.tw.
12.	exercise.tw.
13.	mortality.tw.
14.	quality of life.tw.
15.	(qol or hrqol or hql).tw.
16.	(psychological adj (stress or pain or relief)).tw.
17.	resilience.tw.
18.	well?being.tw.
19.	mental.tw.
20.	(knowledge or attitude).tw.
21.	(calories or caloric or consumption).tw.
22.	(diet or diets).tw.
23.	social cohesion.tw.
24.	(expenditures or spending).tw.
25.	costs.tw.
26.	economic.tw.
27.	effectiveness.tw.
28.	or/3-27
29.	intervention?.tw.
30.	(experiment? or experimental).tw.
31.	trial?.tw.
32.	(study or studies).tw.
33.	(evaluation? or evaluating).tw.
34.	(comparison? or comparing).tw.
35.	group?.tw.
36.	or/29-35
37.	1 and 28 and 36
38.	2 and 28 and 36
39.	or/37-38
40.	(animals not (humans and animals)).sh.
41.	39 not 40

We will limit search results to articles published in the last 25 years (1992-2017) to avoid possible negative impact on the generalisability of our results caused, notably, by substantial shifts in risk patterns and/or general lifestyle changes over time (e.g. sedentary behaviour/physical activity, energy intake, etc.).²⁵ No additional search filters

1
2
3 will be used. We will include references or full-texts in the English or German language. Documents in languages
4 that cannot be translated by the authors of the review team (via internet-based translators, or by colleagues) will
5 be excluded. We will select keywords derived from our PICO and MEDLINE search strategy to identify potentially
6 relevant articles on websites, as well as in databases lacking the option to use search operators/syntax. This
7 includes, in particular, keywords for the intervention (i.e. "community gardening", "community farming",
8 "horticulture", and "school gardens"). Also considered will be keywords for the main outcomes of interest (i.e.
9 "overweight", "obesity", and their corresponding indices such as "BMI").
10
11
12
13
14
15
16

17 **Data management**

18
19 Search results will be saved as an EndNote database to backup all reference files, and to remove duplicate
20 references. We will then upload the references to a screening software (e.g. Covidence: a cloud-based system to
21 support the review process).²⁶ We will pilot the title and abstract screening against eligibility criteria. Files of the
22 included studies, the data extraction forms and reference lists will be available to all authors through internet-
23 based exchange options (e.g. Covidence, internet file hosting, or email).
24
25
26
27
28
29

30 **Study selection**

31
32 Study selection will be performed in two rounds based on the inclusion/exclusion criteria derived from our PICO
33 question and on the designs of the included study. First, we will perform the title and abstract screening based on
34 a de-duplicated EndNote database of all the references retrieved from the search. Second, the full-texts derived
35 from the references identified in the first step will be screened. All steps will be independently performed by at
36 least two authors; a third author will solve potential conflicts. The inclusion/exclusion of all studies will be
37 presented in a PRISMA flowchart clearly showing the screening and selection process.²²
38
39
40
41
42
43
44

45 **Data collection process and extraction**

46
47 Data extraction of retrieved references will be performed by more than one author to avoid transcription errors.
48 Any disagreements will be resolved by discussion with a third author. Adapted data extraction and assessment
49 templates will be piloted and then used to extract relevant data from the included studies. All data will be
50 transferred to our review software by one author and double-checked by a second author.^{24, 27, 28}
51
52
53
54
55
56
57
58
59
60

Outcomes and data items

We selected patient-relevant outcomes based on the recommendations of the 'Cochrane Metabolic and Endocrine Disorders Group' for a review that focuses on diseases such as overweight/obesity; these include, in particular: mortality, morbidity (i.e. overweight/obesity), health-related quality of life, and adverse events.²⁹ We will also assess economic outcomes relevant to individuals (e.g. participant's total expenditure on food) and to society (implementation costs). Other health-related outcomes (e.g. physical activity) will provide additional information for end-users, as they are closely linked to our main outcomes of interest, i.e. overweight/obesity. We will extract relevant data time points of reported outcomes in order to summarise the effects on outcomes across studies for specific time intervals. Also, potential implications of surrogate outcomes (i.e. BMI) and the impact of length of follow-up, will be addressed throughout this review.

Risk of bias

At least two authors will independently perform a risk of bias (RoB) assessment for the included studies. A third author will resolve conflicts and ensure consensus in case of any disagreement. Results of the RoB assessment will be provided in RoB tables and discussed throughout the review.²⁴ The domain-based Cochrane's RoB tool and EPOC guidelines will be used to assess potential bias for studies relevant for the main results.^{30,31}

Data synthesis

Considering our outcome selection, we will extract data for both dichotomous and continuous outcome variables. Preferably, we will extract, report and synthesise risk ratios (RRs) for evaluation of the treatment effect. However, if RRs cannot be obtained or calculated, we will report or calculate odds ratios (ORs) or risk differences (RDs). Continuous data will be harmonised and expressed as standardised mean differences (SMDs). If appropriate, we will convert shorter ordinal data into dichotomous data (RRs, ORs, or RDs). Similarly, we will consider to convert longer ordinal data into continuous data (SMDs).^{24,28} For outcomes reported in two or more studies and considered sufficiently homogenous, we will conduct a meta-analysis of the corresponding studies or relevant study arms. Meta-analyses will be performed using the Mantel-Haenszel (dichotomous data) and inverse variance method (continuous data). Based on the results of the pre-screening of potentially relevant studies, we expect variation across studies due to both contextual heterogeneity and differences related to the context of implementation. To address this issue, we will apply the random effects method. Quantitative measures of heterogeneity will be reported (e.g. I^2 , Chi^2) together with synthesised data on treatment effects, presented as

1
2
3 forest plots. The most reported outcome measure (e.g. BMI) across the included studies of one outcome
4 (overweight and obesity) will guide the selection process for data suitable to be reported and synthesised.
5
6 Generally, we will favour the longest follow-up data if multiple follow-up data are available at the individual study
7
8 level. To determine the role of heterogeneity on treatment effects, and to assess the robustness of the results, we
9
10 will perform subgroup and sensitivity analyses. If feasible, we will consider subgroup analyses for at least income
11
12 groups, gender/sex, educational level and age groups, as well as for characteristics of the implementation of the
13
14 community gardening intervention (e.g. co-interventions). Similarly, if sufficient data are available we will perform
15
16 sensitivity analyses with respect to quality of studies, source of funding, publication status, intervention duration,
17
18 and length of follow-up.²⁴ Study results with insufficient homogeneity will be narratively synthesised. In addition to
19
20 reporting findings as text and tables, we may consider graphical visualisation (e.g. harvest plots or effect direction
21
22 plots) to synthesise and present data.^{32,33}

23 24 25 26 **Meta-bias(es)**

27
28 To study the impact of potential reporting bias, we will calculate and discuss funnel plots of the primary outcomes,
29
30 if sufficient data are available (> 10 studies).²⁴

31 32 33 **Confidence in cumulative evidence**

34
35 We will present GRADE tables for primary outcomes to demonstrate the degree of confidence end-users can
36
37 place on the quality of evidence and strength of the recommendations. GRADE ratings are based on study
38
39 design, including potential upgrades/downgrades (e.g. according to effect size, publication bias, and
40
41 inconsistency).^{34,35}

42 43 **Conclusion**

44
45 Research on the effects of voluntary community gardening on overweight, obesity and related outcomes is rapidly
46
47 expanding (e.g. RCTs), especially for populations with low SES and at high risk for overweight and obesity. The
48
49 proposed review will focus on quantitative studies and differs from previous systematic reviews on gardening
50
51 interventions in terms of: i) inclusion of economic outcomes, such as costs of the intervention, ii) a focus on non-
52
53 therapeutic, community-based gardening initiatives to ensure homogeneity and external validity in terms of
54
55 interventions (e.g. voluntary participation), populations (e.g. general public, non-patient samples), and level of
56
57 outcome variables (e.g. similar baseline risk levels for overweight/obesity), iii) study selection for the main results
58
59
60

1
2
3 based on rigorous standards/criteria, and iv) provision of GRADE tables to inform end-users about the quality of
4 evidence and strength of the recommendations emerging from the review.^{7,10,36,37} The potential effectiveness of
5 community gardening as a public health intervention to prevent overweight/obesity and to close equity gaps is of
6 particular interest for public health authorities, local governments/municipalities, and urban/regional planners, all
7 of whom play an important role in funding and decisions regarding land use (e.g. zoning). Moreover, the review
8 will address educational stakeholders, who are essential for passing on knowledge for future implementations of
9 community gardening.⁸

17 Footnotes

20 Contributors

21 TLH and SKL initiated this review project. TLH was responsible for the first protocol draft, including the study
22 question, study selection criteria, search strategy, synthesis of data, and risk of bias assessment. He is the
23 guarantor of this review. All authors (TLH, MR, SM, BB, AB, GG, and SKL) read, revised and approved the final
24 manuscript before submission.

31 Funding

32 This research project received no special funding or specific grant from any funding agency in the public, for-
33 profit, or non-profit sectors.

37 Competing interests

38 TLH was co-initiator of a community gardening project (CampusGarten) in 2013 funded by the Students Union of
39 the University of Cologne, Cologne, Germany.

44 Authors' information

45 TLH is a research associate with the Research Group for Evidence-based Public Health, BIPS & University
46 Bremen, Bremen, Germany. MR is a senior lecturer in the Institute for Public Health and Nursing Research,
47 University Bremen, Bremen, Germany. SM is a scientific staff member at the Department of Non-Drug
48 Interventions, Institute for Quality and Efficiency in Health Care, Cologne, Germany. BB is head of a research unit
49 at the Institute for Health Care Management and Research, University of Duisburg-Essen, Essen, Germany. AB
50 is a professor at the Faculty of Spatial Sciences, Department of Cultural Geography, University of Groningen,
51 Groningen, the Netherlands. GG is head of the department for Evidence-based Medicine and Clinical
52
53
54
55
56
57
58
59
60

1
2
3 Epidemiology, Danube University Krems, Austria. SKL is the group head of the Research Group for Evidence-
4 based Public Health, BIPS & University Bremen, Bremen, Germany.
5
6

7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

References

1. WHO. Global health risks. Geneva: World Health Organization 2009.
2. Lim SS, Vos T, Flaxman AD, *et al.* A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012;380(9859):2224-60. doi: 10.1016/S0140-6736(12)61766-8
3. WHO. Global status report on noncommunicable diseases 2014. Geneva: World Health Organization 2014.
4. Ng M, Fleming T, Robinson M, *et al.* Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2014;384(9945) doi: 10.1016/s0140-6736(14)60460-8
5. Baker PRA, Francis DP, Soares J, *et al.* Community wide interventions for increasing physical activity. *Cochrane Database Syst Rev* 2011(4) doi: 10.1002/14651858.CD008366.pub2
6. Armstrong D. A survey of community gardens in upstate New York: implications for health promotion and community development. *Health Place* 2000;6(4):319-27. doi: 10.1016/S1353-8292(00)00013-7
7. McCormack LA, Laska MN, Larson NI, *et al.* Review of the nutritional implications of farmers' markets and community gardens: a call for evaluation and research efforts. *J Am Diet Assoc* 2010;110(3):399-408. doi: 10.1016/j.jada.2009.11.023
8. Burges Watson DL, Moore HJ. Community gardening and obesity. *Perspect in Public Health* 2011;131(4):163-4. doi: 10.1177/1757913911412475
9. Stiftungsgemeinschaft anstiftung & ertomis. Die urbanen Gemeinschaftsgärten im Überblick [Internet]. 2016 [cited Mar 24 2016]. Available from: <http://anstiftung.de/urbane-gaerten/gaerten-im-ueberblick>.
10. Ohly H, Gentry S, Wigglesworth R, *et al.* A systematic review of the health and well-being impacts of school gardening: synthesis of quantitative and qualitative evidence. *BMC Public Health* 2016;16:286. doi: 10.1186/s12889-016-2941-0
11. Castro DC, Samuels M, Harman AE. Growing healthy kids: a community garden-based obesity prevention program. *Am J Prev Med* 2013;44(3 Suppl 3):193-9. doi: 10.1016/j.amepre.2012.11.024

- 1
2
3 12. Gatto NM, Martinez LC, Spruijt-Metz D, *et al.* LA sprouts randomized controlled nutrition and gardening
4 program reduces obesity and metabolic risk in Latino youth. *Obesity (Silver Spring)* 2015;23(6):1244-51.
5 doi: 10.1002/oby.21077
6
7
8
9 13. Zick CD, Smith KR, Kowaleski-Jones L, *et al.* Harvesting more than vegetables: the potential weight control
10 benefits of community gardening. *Am J Public Health* 2013;103(6):1110-5. doi:
11 10.2105/ajph.2012.301009
12
13
14 14. Davis JN, Ventura EE, Cook LT, *et al.* LA Sprouts: a gardening, nutrition, and cooking intervention for Latino
15 youth improves diet and reduces obesity. *J Am Diet Assoc* 2011;111(8):1224-30. doi:
16 10.1016/j.jada.2011.05.009
17
18
19 15. Anderson LM, Petticrew M, Rehfuss E, *et al.* Using logic models to capture complexity in systematic reviews.
20 *Res Synth Methods* 2011;2(1):33-42. doi: 10.1002/jrsm.32
21
22
23 16. Wakefield S, Yeudall F, Taron C, *et al.* Growing urban health: community gardening in South-East Toronto.
24 *Health Promot Int* 2007;22(2):92-101. doi: 10.1093/heapro/dam001
25
26
27 17. Heise TL, Katikireddi SV, Pega F, *et al.* Taxation of sugar-sweetened beverages for reducing their
28 consumption and preventing obesity or other adverse health outcomes. *Cochrane Database Syst Rev*
29 2016(8) doi: 10.1002/14651858.CD012319
30
31
32 18. van den Berg AE, Custers MH. Gardening promotes neuroendocrine and affective restoration from stress. *J*
33 *Health Psychol* 2011;16(1):3-11. doi: 10.1177/1359105310365577
34
35
36 19. Carney PA, Hamada JL, Rdesinski R, *et al.* Impact of a community gardening project on vegetable intake,
37 food security and family relationships: a community-based participatory research study. *J Community*
38 *Health* 2012;37(4):874-81. doi: 10.1007/s10900-011-9522-z
39
40
41 20. OECD. Perspectives on Global Development 2012: OECD Publishing 2011.
42
43
44 21. Shamseer L, Moher D, Clarke M, *et al.* Preferred reporting items for systematic review and meta-analysis
45 protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ* 2015;350:g7647. doi: 10.1136/bmj.g7647
46
47
48 22. Moher D, Liberati A, Tetzlaff J, *et al.* Preferred reporting items for systematic reviews and meta-analyses: the
49 PRISMA statement. *PLoS Med* 2009;6(7):e1000097. doi: 10.1371/journal.pmed.1000097
50
51
52 23. EPOC. What study designs should be included in an EPOC review? [Internet]. 2013 [cited 2016 Aug 11].
53 Available from:
54
55
56
57
58
59
60

- http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/05%20What%20study%20designs%20should%20be%20included%20in%20an%20EPOC%20review%202013%2008%2012_2.pdf.
24. Higgins JPT, Green S. Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [Internet]. 2011 [cited 2016 Mar 16]. Available from: <http://www.cochrane-handbook.org>.
25. Swinburn BA, Sacks G, Hall KD, *et al*. The global obesity pandemic: shaped by global drivers and local environments. *Lancet* 2011;378(9793):804-14. doi: 10.1016/S0140-6736(11)60813-1
26. Covidence. Covidence Software [Internet]. 2016 [cited Nov 19 2016]. Available from: <http://www.covidence.org>.
27. Anderson LM, Petticrew M, Rehfuss E, *et al*. Equity Checklist for Systematic Review Authors [Internet]. 2015 [cited 2016 Dec 16]. Available from: <http://equity.cochrane.org/sites/equity.cochrane.org/files/uploads/equitychecklist2011.pdf>.
28. CPH. Guide for developing a Cochrane protocol [Internet]. 2011 [cited 2016 Dec 16]. Available from: http://ph.cochrane.org/sites/ph.cochrane.org/files/uploads/Guide%20for%20PH%20protocol_Nov%202011_final%20for%20website.pdf.
29. CMED. Title Registration Form [Internet]. 2015 [cited 2016 Dec 16]. Available from: http://endoc.cochrane.org/sites/endoc.cochrane.org/files/public/uploads/title%20registration%20INT%20reviews%202015_06.doc.
30. Higgins JPT, Altman DG, Gøtzsche PC, *et al*. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *BMJ* 2011;343:d5928.
31. EPOC. Suggested risk of bias criteria for EPOC reviews [Internet]. 2009 [cited 2016 Dec 16]. Available from: <http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/Suggested%20risk%20of%20bias%20criteria%20for%20EPOC%20reviews.pdf>.
32. Thomson HJ, Thomas S. The effect direction plot: visual display of non-standardised effects across multiple outcome domains. *Res Synth Methods* 2013;4(1):95-101.
33. Ogilvie D, Fayer D, Petticrew M, *et al*. The harvest plot: A method for synthesising evidence about the differential effects of interventions. *BMC Med Res Methodol* 2008;8(1):8-8. doi: 10.1186/1471-2288-8-8
34. GRADEpro [program]. Hamilton: McMaster University, 2014.

- 1
2
3 35. The Grade Working Group. Handbook for grading the quality of evidence and the strength of
4 recommendations using the GRADE approach [Internet]. 2013 [cited 2016 Nov 10]. Available from:
5 <http://www.guidelinedevelopment.org/handbook/>.
6
7
8
9 36. Wang D, MacMillan T. The Benefits of Gardening for Older Adults: A Systematic Review of the Literature. *Act*
10 *Adapt Aging* 2013;37(2):153-81. doi: 10.1080/01924788.2013.784942
11
12
13 37. Robinson-O'Brien R, Story M, Heim S. Impact of garden-based youth nutrition intervention programs: a
14 review. *J Am Diet Assoc* 2009;109(2):273-80. doi: 10.1016/j.jada.2008.10.051
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

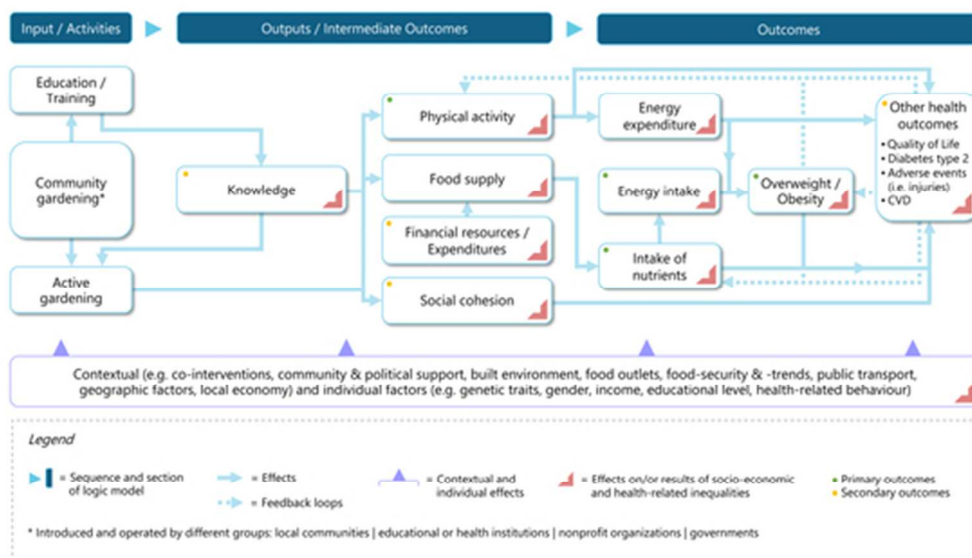


Figure 1 Logic/causal pathway model of community gardening interventions to prevent overweight and obesity

46x27mm (300 x 300 DPI)

Review only

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist:
recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	PAGE NUMBER AND AUTHOR'S RESPONSE (TLH)
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	not applicable
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	2; 6 [CRD42017043696]
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	15
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	not applicable
Support:			
Sources	5a	Indicate sources of financial or other support for the review	15 [no financial or other support]
Sponsor	5b	Provide name for the review funder and/or sponsor	not applicable
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	not applicable
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	4-6
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	6
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	6-12
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	9-12

Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	11 [see: Table 1 Search strategy for MEDLINE]
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	12
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	12-14
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	12
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	13
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	8; 13
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	13
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	13-14
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I ² , Kendall's τ)	13-14
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	14
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	14
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	14
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	14

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ*. 2015 Jan 2;349(jan02 1):g7647.

BMJ Open

Community gardening, community farming and other local community-based gardening interventions to prevent overweight and obesity in high- and middle-income countries: protocol for a systematic review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-016237.R1
Article Type:	Protocol
Date Submitted by the Author:	30-Mar-2017
Complete List of Authors:	Heise, Thomas; University of Bremen, Institute for Public Health and Nursing Research, Health Sciences; Leibniz Institute for Prevention Research and Epidemiology - BIPS, ebph - Research Group for Evidence-Based Public Health Romppel, Matthias; University of Bremen, Institute for Public Health and Nursing Research, Health Sciences Molnar, Sandra; Institute for Quality and Efficiency in Health Care - IQWiG, Department of Non-Drug Interventions Buchberger, Barbara; University of Duisburg-Essen, Institute for Health Care Management and Research van den Berg, Agnes; University of Groningen, Faculty of Spatial Sciences Gartlehner, Gerald; Danube University Krems, Department for Evidence-based Medicine and Clinical Epidemiology; RTI-International Lhachimi, Stefan; University of Bremen, Institute for Public Health and Nursing Research, Health Sciences; Leibniz Institute for Prevention Research and Epidemiology - BIPS, ebph - Research Group for Evidence-Based Public Health
Primary Subject Heading:	Nutrition and metabolism
Secondary Subject Heading:	Public health, Diabetes and endocrinology
Keywords:	Community gardening, Gardening, Overweight, Obesity, Physical activity

SCHOLARONE™
Manuscripts

Community gardening, community farming and other local community-based gardening interventions to prevent overweight and obesity in high- and middle-income countries: protocol for a systematic review

Thomas L Heise^{1,2*}, Matthias Romppel¹, Sandra Molnar³, Barbara Buchberger⁴, Agnes van den Berg⁵, Gerald Gartlehner^{6,7}, Stefan K Lhachimi^{1,2}

¹Institute for Public Health and Nursing Research, Health Sciences Bremen, University of Bremen, Bremen, Germany

²Research Group for Evidence-Based Public Health, Leibniz Institute for Prevention Research and Epidemiology, Bremen, Germany

³Department of Non-Drug Interventions, Institute for Quality and Efficiency in Health Care - IQWiG, Cologne, Germany

⁴Institute for Health Care Management and Research, University of Duisburg-Essen, Essen, Germany

⁵Faculty of Spatial Sciences, Department of Cultural Geography, University of Groningen, Groningen, the Netherlands

⁶Department for Evidence-based Medicine and Clinical Epidemiology, Danube University Krems, Krems, Austria

⁷RTI-International, Research Triangle Park, North Carolina, USA

*Corresponding author

Thomas L Heise

Institute for Public Health and Nursing Research

University of Bremen

Grazer Straße 2

28359 Bremen

Email: heise@leibniz-bips.de

Phone: +49-421-218-56920

(Physical addresses and email-addresses of co-authors can be obtained via the corresponding author)

Word count abstract: 300

Word count main manuscript: 3965

Abstract

Introduction

The worldwide prevalence of overweight/obesity has continued to rise over the last decades. To reverse this trend, public health authorities are exploring cost-effective interventions, especially in high- and middle-income countries (HMICs). Community gardening offers a unique opportunity for individuals to enhance physical activity levels and improve their diet. However, synthesised evidence on the short or long-term effectiveness, and on the costs of community gardening interventions to prevent overweight/obesity, remains limited. Therefore, this review will investigate: i) the effectiveness of voluntary participation in community gardening compared with no or control treatment to prevent overweight/obesity, or to improve associated health outcomes, ii) effects on different sub-groups of populations, and iii) the costs of community gardening interventions.

Methods and analysis

We will conduct a systematic review, limited to evaluations of community gardening interventions with controlled quantitative and interrupted time series designs. To identify relevant articles, we will systematically search 12 academic and five grey literature databases, as well as two trial registers and six websites. Articles will then be assessed for eligibility based on a pre-defined set of criteria. At least two independent reviewers will assess each article for relevance, before evaluating the methodological quality and potential bias of the studies. Data relevant to the objectives of this review will be extracted and cross-validated. Any disagreements will be mediated by a third reviewer. If feasible, meta-analyses of primary outcomes (overweight/obesity, physical activity, food intake, energy intake) will be conducted. We will use the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) method to assess the overall quality of evidence.

Ethics and dissemination

For this review, no ethical approval is required as we will only extract and analyse secondary data. We aim to submit the final review manuscript to an Open Access journal for publication and disseminate results via conferences and social media.

Systematic review registration

PROSPERO CRD42017043696

Keywords

Community gardening, Gardening, Nutrition, Overweight, Obesity, Costs

Strengths and limitations of this study

- The proposed systematic review will report the effects of voluntary participation in community gardening interventions in various settings on overweight, obesity and associated health-related outcomes in the general population of HMICs
- Methods include a working definition of non-therapeutic community gardening, rigorous inclusion criteria for the study designs, and a comprehensive search strategy
- The design process and selection of the main objectives is guided by a logic/causal pathway model
- The limited availability of high-quality studies, as well as variations in intervention duration and components, may be a challenge for conducting robust meta-analyses and drawing definitive conclusions

Introduction

Rationale

According to the World Health Organization, 39% of the global adult population is classified as overweight, with only small differences by gender (40% for women vs. 38% for men). Global obesity prevalence differs more in terms of gender with 15% for women vs. 11% for men. Overweight and obesity are one of the leading global health risk factors for mortality and account for 4.8% of deaths worldwide, especially in high-income countries (8.4%).¹ Overweight and obesity also cause a considerable socio-economic burden on a global scale. In 2010, high levels of body mass index (BMI) as a risk factor were estimated to cause 93.6 million disability-adjusted life years (DALYs) worldwide.² This corresponds to an increase of 44.7% in DALYs attributable to this specific risk factor between 1990 and 2010.^{2,3} Overweight and obesity are also strongly related to a wide range of negative health outcomes (e.g. diabetes mellitus type 2, hypertension etc.).⁴ Costly surgical and drug-based treatments in HMCs, which are often associated with adverse effects, can be considered as last options in treating severe obesity. Therefore, prevention measures with lower risks intervening on weight development early in the life course, such as community-based initiatives to promote physical activity embedded in natural and built environments, have gained considerable attention.^{5,6} From a public health perspective, interventions to prevent and control overweight and obesity in the general population should: i) reflect the complexity of this health condition including an individual's life course perspective, ii) simultaneously aim at various health-related behaviours, and iii) be of low risk and cost-effective, with the aim to have sustainable positive effects on health on the long term. Community gardening may represent a potentially powerful and sustainable intervention that combines physical activity, improved food supply and education, to support culturally-tailored healthy living in the local context.⁷ This type of intervention is particularly attractive, as it is applicable to the needs of community members at almost any stage of life. Further, it is a form of active recreation that can easily be accessed and is able to influence multiple "systems levers" (food-related factors and the physical activity environment).^{6,8} For the proposed review, we define community gardening as: voluntary non-professional cultivation of plants and supportive gardening activities with active physical participation by community members, either collectively on a single piece of land, or on individual (non-domestic) plots of land, with regular community meetings or other social activities, including educational and training activities.^{9,10}

1
2
3 Gardening initiatives with active participation of community members are widespread at schools, nursing homes
4 and other community facilities (e.g. over 500 exist in Germany).¹¹ Community gardens are integrated on the local
5 level, in different settings, and are usually cultivated and operated by individuals or non-profit organisations (e.g.
6 community networks, NGOs, or schools).^{7,9} Although these initiatives are not necessarily driven by a health-
7 promotion perspective, there is evidence that community gardening may reduce overweight/obesity and diseases
8 related to these conditions, by stimulating physical exercise and improving healthy food supply and food intake
9 (e.g. vegetables, fruits).^{12,13} Additional evidence from studies using more rigorous controlled designs has recently
10 become available.^{14,15} Moreover, there is an acknowledged need to summarise and synthesise this rapidly
11 expanding body of evidence.^{9,10,14} Meanwhile, less is known about the cost-effectiveness of this approach.
12 Therefore, synthesised evidence is essential to improve the knowledge base for policymaking and planning
13 decisions regarding the physical/social infrastructure required for optimal use of community gardens for disease
14 prevention and health promotion.^{16,17}

27 28 **How this intervention might work**

29
30 *Figure 1 Logic/causal pathway model of community gardening interventions to prevent overweight and obesity.*

31
32 To visualise important interactions as causal pathways between the core elements to be examined in this review,
33 we developed a preliminary logic model (Figure 1). The basic concept of this model is introduced: for this we
34 focus on the hypothetical effects on 'overweight/obesity' and on other (intermediate) outcomes.¹⁸⁻²¹ Following our
35 working definition, 'community gardening', as introduced and maintained by different community groups,
36 institutions, organisations or governments, is characterised by two main activities: 'education/training' and 'active
37 gardening'.^{9,10} 'Education/training' using single or multiple channels (e.g. community meetings, classes) aims to
38 improve the participants' food-related or gardening-related 'knowledge' (e.g. gardening techniques, food
39 preparation). If these interventional components are effective in stimulating a positive behavioural change, this
40 may support participants to actively work in a gardening environment and critically examine, both consciously and
41 unconsciously, their own 'food supply' and 'intake of nutrients' towards a healthier life-style.¹⁴ First, 'active
42 gardening', such as weekly gardening sessions, may lead to low-to-moderate levels of 'physical activity'
43 associated with enhanced 'energy expenditure'. Moreover, this may have a positive impact on other health
44 outcomes such as 'quality of life' (e.g. stress relief).²² Second, 'community gardening' may also serve to alter the
45 'food supply' (e.g. vegetables, fruits) leading to a change in nutritional intake (e.g. increased intake of dietary
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 fibres and essential vitamins; decreased consumption of macronutrients such as sugar and fat).^{13, 14, 23} Besides
4 the other outcomes, 'food supply' is particularly relevant in case of socio-economic inequality, as individuals with
5 a lower socioeconomic status (SES) spend relatively more of their 'financial resources' on food compared with
6 those with a higher SES. Considering that, individuals with lower SES could benefit from their own harvest of
7 unprocessed foods (e.g. rich in fibres and vitamins) in the context of community gardening interventions, thus,
8 this could lead to improved diets and counteract the negative effects of SES disparities on health.²¹ Third,
9 participants working in cooperative activities may also benefit from aspects of social cohesion (i.e. social capital,
10 social inclusion) that may prevent them from social exclusion and increase their 'quality of life'; this may
11 especially apply to the elderly.²⁴ The primary outcomes of this review, i.e. 'overweight and obesity', are mainly
12 caused by an imbalance between 'energy expenditure' and 'energy intake'. Despite the complexity of 'overweight
13 and obesity', the equation of energy balance is simplified to illustrate the potential impact of quantifiable primary
14 outcomes included in this review.⁶ If the intervention is effective in improving participants' 'energy expenditure',
15 represented in this review by the proxy outcome 'physical activity', or in lowering their 'energy intake' (with no
16 simultaneous negative changes), then 'community gardening' activities may prevent 'overweight and obesity' (e.g.
17 by lowering an individual's BMI). The logic model visualises feedback loops of health conditions such as 'diabetes
18 type 2', 'cardiovascular disease', and 'quality of life' that are closely related to 'overweight/obesity'. To provide a
19 balanced picture of interventional effects, we will also investigate unique health risks of 'community gardening'
20 (e.g. injuries, soil contamination). In addition to the elements along the pathway of 'community gardening', the
21 'contextual and individual' factors may also help to elucidate the direction and strength of the effects on the
22 selected outcomes and changes of the complex equation of energy balance in particular.⁶

Objectives

- 23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46 i) To examine the effectiveness of participation in community-based gardening compared to no or control
47 treatment to prevent overweight and obesity, and associated health outcomes (i.e. physical activity and food
48 intake) in the general population in HMICs;
49
50
51
52
53 ii) to examine the effects of community gardening interventions in different sub-groups of populations and settings
54 (e.g. schools, neighbourhoods, community facilities);
55
56
57
58 iii) to assess the costs of community gardening interventions aimed at preventing overweight and obesity.
59
60

Methods

Reporting standards and registration

This protocol follows the reporting standards as defined in the 'Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement', the upcoming review will comply with the PRISMA checklist published as 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement'.^{25, 26} The protocol is registered in the 'International Prospective Register of Systematic Reviews' (PROSPERO): CRD42017043696.

Eligibility criteria

Population

Inclusion criteria are:

- members of the general population in HMICs, including persons at high risk for overweight or obesity (e.g. low SES, living in deprived geographical areas).

Exclusion criteria are:

- persons with active drug treatment, surgical interventions, or disease-specific psychological treatment.

Experimental intervention

Inclusion criteria for studies with community-based gardening as interventions, defined as:

interventions with voluntary non-professional cultivation of plants and supportive gardening activities with active physical participation by community members, either collectively on a single piece of land or on individual (non-domestic) plots of land, with regular community meetings or other social activities, including educational and training activities.^{9,10}

To be included the interventions have to be in one of the following environments or settings:

- community gardens;
- gardens at community care facilities;
- school gardens;

- community farms and community supported agriculture with mandatory physical participation; or
- other public environments with community gardens accessible for community members.

Exclusion criteria for environments or settings are:

- professional farming;
- subsistence agriculture;
- domestic gardening; or
- disease-specific therapeutic gardening in a closed environment.

Control intervention

Inclusion criteria for the studies are:

Any of the listed control intervention or a passive control group, including:

- health education interventions other than community gardening (e.g. cooking classes, nutritional information);
- sports-based interventions; or
- other nutritional interventions aimed to support healthy eating patterns (e.g. coupons for farmers' markets, etc.).

We will favour the inclusion of active control interventions to serve as approximation of the counterfactual condition for the intervention group (community gardening) to estimate relative effects. However, if data of no active control interventions are being reported we will also consider the inclusion of passive control interventions (no intervention or waiting list) to estimate absolute-effect estimates and will carefully discuss major limitations of this approach throughout the review.²⁷

Outcomes

Inclusion criteria for the studies are:

- reporting of at least one primary outcome.

1
2
3 Primary outcomes are:

- 4 • overweight and obesity (e.g. incidence or prevalence; body mass indices, i.e. BMI, waist-to-hip ratio);
- 5 • physical activity (e.g. activity diaries, accelerometers, etc.);
- 6 • food intake (e.g. food groups, nutrients, ingredients); and
- 7 • energy intake (e.g. total energy intake).

8
9
10
11
12
13
14 Secondary outcomes are:

- 15 • disease outcomes with a direct link to overweight/obesity or physical activity (e.g. health-related quality
- 16 of life, cardiovascular disease, type 2 diabetes);
- 17 • adverse events (e.g. mortality, fracture);
- 18 • costs;
- 19 • total expenditure of participants on food;
- 20 • knowledge on food and gardening techniques; and
- 21 • indices on social cohesion.

22
23
24
25
26
27
28
29
30
31
32 Both primary and secondary outcomes can be self-reported or measured by physicians or other professionals.

33 34 35 **Study design**

36
37 Inclusion criteria for a study to be included in the main analysis are:

- 38 • randomised controlled trials (RCT);
- 39 • cluster randomised controlled trials (cRCT);
- 40 • non-randomised controlled trials (nRCT);
- 41 • controlled before-after (CBA) studies; or
- 42 • interrupted time series (ITS) studies

43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
that comply with the criteria of the 'Cochrane Effective Practice and Organisation of Care' (EPOC) group. In accordance with the EPOC criteria, we will include studies with a design that adheres to an appropriate controlled design. EPOC recommends more than one intervention or control site for RCT, cRCT, nRCT, and CBA designs.

1
2
3 For CBA designs it also defines use of contemporaneous data collection methods and identical methods of
4 measurement as inclusion criteria. Studies with ITS design require a clearly defined point in time for the
5 intervention's implementation as well as at least three data points before/after the intervention for the included
6 outcomes.²⁸
7
8
9

10 11 **Information sources**

12 To identify potentially relevant references of studies, we will consider academic and grey literature (e.g. including
13 conference proceedings, reports, PhD thesis) databases, as well as (clinical) trial registers and handsearching.
14 This broad search approach that covers various sources beyond academic literature databases aims to minimise
15 negatives impacts of potential publication bias.²⁹ The selection of relevant repositories was mainly based on
16 potential coverage of the proposed review's 'patient/population, intervention, control, outcomes' (PICO) format.²⁹
17
18
19
20
21
22
23

24 We will include and search the following 12 bibliographic databases to identify relevant studies:

- 25 • Agricultural Online Access (AGRICOLA) (1970 to present);
- 26 • Agricultural Science and Technology Information (AGRIS) (1974 to present);
- 27 • Applied Social Sciences Index and Abstracts (ASSIA) (1987 to present);
- 28 • Cochrane Central Register of Controlled Trials (CENTRAL) (1948 to present);
- 29 • Cumulative Index to Nursing and Allied Health Literature (CINAHL) (1937 to present);
- 30 • Current Contents Medicine Database of German and German-Language Journals (CC MED) (2000 to
31 present);
- 32 • Education Resources Information Center (ERIC) (1966 to present);
- 33 • Excerpta Medica database (EMBASE) (1947 to present);
- 34 • Food Science and Technology Abstracts (FSTA) (1969 to present);
- 35 • Medical Literature Analysis and Retrieval System Online (MEDLINE) (1946 to present);
- 36 • PsycINFO (1887 to present); and
- 37 • Web of Science Core Collection (1900 to present).

38 In addition, we will perform searches in five electronic grey literature databases:

- 39 • Directory of Open Access Repositories (OpenDOAR) [first 50 hits];

- Google Scholar [first 50 hits];
- ProQuest Dissertations & Theses Database (PQDT);
- Social Science Research Network (SSRN); and
- System for Information on Grey Literature in Europe (OpenGrey) [first 50 hits].

We will search the following meta-trial registers to retrieve records of ongoing or unpublished trials:

- Trials Register of Promoting Health Interventions (TRoPHI); and
- WHO International Clinical Trials Registry Platform (ICTRP).

We will search the following websites using keywords:

- American Community Gardening Association;
- Benefits Hub;
- Centre for Agricultural Bioscience International;
- Food Security and Nutrition Network;
- Stiftungsgemeinschaft anstiftung & ertomis; and
- Therapeutic Landscapes Network.

Search strategy

We have developed a highly sensitive search strategy for MEDLINE, incorporating a combination of medical subject headings (MeSH) and text words for the intervention, outcomes, and population of interest. Because commonly used study design filters missed several potentially relevant references, we will use a list of text words for the search strategy to take into account the study designs. The search strategy has been piloted by the author team and will be modified according to the requirements of the other bibliographic databases (Table 1).

Table 1 Search strategy for MEDLINE

Search strategy for MEDLINE (via OVID SP)
1. exp gardening/
2. ((garden or gardens or gardening or allotment? or horticulture or agriculture or botanical or cultivating or cultivation or plant or plants or planting or greening or harvest or harvests or harvesting) adj5 (community or communities or intercultural or guerrilla or civic or neighbour?hood or residential? or solidarity or co?operative or communal or collective or shared or voluntary or volunteer or volunteers or volunteering or school or educational or education or recreational or recreation or retirement or nursing or kindergarten or pop?up or urban or rural or local)).tw.
3. health.tw.
4. obes*.tw.
5. overweight.tw.
6. (body weight or body mass).tw.
7. ("body mass index" or bmi).tw.
8. (physical adj (activity or activities)).tw.
9. training.tw.
10. fitness.tw.
11. endurance.tw.
12. exercise.tw.
13. mortality.tw.
14. quality of life.tw.
15. (qol or hrqol or hql).tw.
16. (psychological adj (stress or pain or relief)).tw.
17. resilience.tw.
18. well?being.tw.
19. mental.tw.
20. (knowledge or attitude).tw.
21. (calories or caloric or consumption).tw.
22. (diet or diets).tw.
23. social cohesion.tw.
24. (expenditures or spending).tw.
25. costs.tw.
26. economic.tw.
27. effectiveness.tw.
28. or/3-27
29. intervention?.tw.
30. (experiment? or experimental).tw.
31. trial?.tw.
32. (study or studies).tw.
33. (evaluation? or evaluating).tw.
34. (comparison? or comparing).tw.
35. group?.tw.
36. or/29-35
37. 1 and 28 and 36
38. 2 and 28 and 36
39. or/37-38
40. (animals not (humans and animals)).sh.
41. 39 not 40

We will limit search results to articles published in the last 25 years (1992-2017) to avoid possible negative impact on the generalisability of our results caused, notably, by substantial shifts in risk patterns and/or general lifestyle changes over time (e.g. sedentary behaviour/physical activity, energy intake, etc.).³⁰ Our decision not to limit this

1
2
3 time frame even further was based on the fact that advanced research designs such as cRCTs were already
4 introduced to evaluate lifestyle interventions in the early 1990s and could be used to evaluate the effects of
5 community gardening interventions of this time.^{31,32} We will apply a search filter to exclude animal studies if a
6 database or provider offers this feature. No additional search filters will be used. We will include references or full-
7 texts in the English or German language. If documents in other languages cannot be translated by the authors of
8 the review team (via internet-based translators, or by colleagues) they will be excluded. We will select keywords
9 derived from our PICO and MEDLINE search strategy to identify potentially relevant articles on websites, as well
10 as in databases lacking the option to use search operators/syntax. This includes, in particular, keywords for the
11 intervention (i.e. "community gardening", "community farming", "horticulture", and "school gardens"). Also
12 considered will be keywords for the main outcomes of interest (i.e. "overweight", "obesity", and their
13 corresponding indices such as "BMI").

24 25 26 Data extraction and analysis

27 Data management

28
29 Search results will be saved as an EndNote database to backup all reference files, and to remove duplicate
30 references. We will then upload the references to a screening software (e.g. Covidence: a cloud-based system to
31 support the review process).³³ We will pilot the title and abstract screening against eligibility criteria. Files of the
32 included studies, the data extraction forms and reference lists will be available to all authors through internet-
33 based exchange options (e.g. Covidence, internet file hosting, or email).

34 35 36 37 38 39 40 Study selection

41
42 Study selection will be performed in two rounds based on the inclusion/exclusion criteria derived from our PICO
43 question and on the designs of the included study. First, we will perform the title and abstract screening based on
44 a de-duplicated EndNote database of all the references retrieved from the search. Second, the full-texts derived
45 from the references identified in the first step will be screened. All steps will be independently performed by at
46 least two authors; a third author will solve potential conflicts. The inclusion/exclusion of all studies will be
47 presented in a PRISMA flowchart clearly showing the screening and selection process.²⁶

Data collection process and extraction

Data extraction of retrieved references will be performed by two authors to avoid transcription errors. Any disagreements will be resolved by discussion with a third author. Adapted data extraction and assessment templates will be piloted and then used to extract relevant data from the included studies. All data will be transferred to our review software by one author and double-checked by a second author.^{29,34,35}

Outcomes and data items

We selected patient-relevant outcomes based on the recommendations of the 'Cochrane Metabolic and Endocrine Disorders Group' for a review that focuses on diseases such as overweight/obesity; these include, in particular: mortality, morbidity (i.e. overweight/obesity), health-related quality of life, and adverse events.³⁶ We will also assess economic outcomes relevant to individuals (e.g. participant's total expenditure on food) and to society (implementation costs). Other health-related outcomes (e.g. physical activity) will provide additional information for end-users, as they are closely linked to our main outcomes of interest, i.e. overweight/obesity. We will extract relevant data time points of reported outcomes in order to summarise the effects on outcomes across studies for specific time intervals. Also, potential implications of surrogate outcomes (i.e. BMI) and the impact of length of follow-up, will be addressed throughout this review.

Risk of bias

At least two authors will independently perform a risk of bias (RoB) assessment for the included studies. A third author will resolve conflicts and ensure consensus in case of any disagreement. Results of the RoB assessment will be provided in RoB tables and discussed throughout the review.²⁹ The domain-based Cochrane's RoB tool including the adaptation to EPOC specific designs will be used to assess potential bias for studies relevant for the main results.^{37,38}

Data synthesis

Considering our outcome selection, we will extract data for both dichotomous and continuous outcome variables. Preferably, we will extract, report and synthesise risk ratios (RRs) for evaluation of the treatment effect. However, if RRs cannot be obtained or calculated, we will report or calculate odds ratios (ORs) or risk differences (RDs). Continuous data will be harmonised and expressed as standardised mean differences (SMDs). If appropriate, we will convert shorter ordinal data into dichotomous data (RRs, ORs, or RDs). Similarly, we will consider to convert

1
2
3 longer ordinal data into continuous data (SMDs).^{29,35} For outcomes reported in two or more studies and
4 considered sufficiently homogenous, we will conduct a meta-analysis of the corresponding studies or relevant
5 study arms. Meta-analyses will be performed using the Mantel-Haenszel (dichotomous data) and inverse
6 variance method (continuous data). Based on the results of the pre-screening of potentially relevant studies, we
7 expect variation across studies due to both contextual heterogeneity and differences related to the context of
8 implementation. To address this issue, we will apply the random effects method. Quantitative measures of
9 heterogeneity will be reported (e.g. I^2 , Chi^2) together with synthesised data on treatment effects, presented as
10 forest plots. The most frequently reported outcome measure (e.g. BMI) across the included studies of one
11 outcome (overweight and obesity) will guide the selection process for data suitable to be reported and
12 synthesised. We consider this approach superior in terms of information value compared to pooling
13 heterogeneous outcomes across health domains that substantially differ in scope and intended use.³⁹ Generally,
14 we will favour the longest follow-up data if multiple follow-up data are available at the individual study level. To
15 determine the role of heterogeneity on treatment effects, and to assess the robustness of the results, we will
16 perform subgroup and sensitivity analyses. If feasible, we will consider subgroup analyses of primary outcomes
17 for at least income groups, gender/sex, educational level and age groups, as well as for characteristics of the
18 implementation of the community gardening intervention (e.g. co-interventions).²¹ Similarly, if sufficient data are
19 available we will perform sensitivity analyses with respect to quality of studies, source of funding, publication
20 status, intervention duration, and length of follow-up.²⁹ Study results with insufficient homogeneity will be
21 narratively synthesised. In addition to reporting findings as text and tables, we may consider graphical
22 visualisation (e.g. harvest plots or effect direction plots) to synthesise and present data.^{40,41}

23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 **Meta-bias(es)**

45
46 To study the impact of potential reporting bias, we will calculate and discuss funnel plots of the primary outcomes,
47 if sufficient data are available (> 10 studies).²⁹

48 49 50 51 **Confidence in cumulative evidence**

52 We will present GRADE tables for primary outcomes to demonstrate the degree of confidence end-users can
53 place on the quality of evidence and strength of the recommendations including outcome specific information.
54 GRADE ratings are based on study design, including potential upgrades/downgrades (e.g. according to effect
55 size, publication bias, and inconsistency). Ratings applied to a body of evidence can be 'high', 'moderate', 'low',
56
57
58
59
60

1
2
3 or 'very low'. RCTs begin the assessment process with a 'high' evidence rating, whereas observational studies
4 begin with a 'low' evidence rating. Final ratings for included point estimates will be based on the results of the
5 design-specific upgrade/downgrade process. At least two authors will be involved in this assessment. Any
6 disagreements will be resolved by discussion with a third author.^{42,43}
7
8
9

10 11 Conclusion

12
13
14 Research on the effects of voluntary community gardening on overweight, obesity and related outcomes is rapidly
15 expanding (e.g. RCTs), especially for populations with low SES and at high risk for overweight and obesity. The
16 proposed review will focus on quantitative studies and differs from previous systematic reviews on gardening
17 interventions that were retrieved from the PROSPERO database and MEDLINE by the authors in terms of: i)
18 inclusion of economic outcomes, such as costs of the intervention, ii) a focus on non-therapeutic, community-
19 based gardening initiatives to ensure homogeneity and external validity in terms of interventions (e.g. voluntary
20 participation), populations (e.g. general public, non-patient samples), and level of outcome variables (e.g. similar
21 baseline risk levels for overweight/obesity), iii) study selection for the main results based on rigorous
22 standards/criteria, and iv) provision of GRADE tables to inform end-users about the quality of evidence and
23 strength of the recommendations emerging from the review v) a discussion focusing on advances in research
24 designs of community gardening interventions over time.^{9,12,39,44-46} The limited availability of i) high-quality
25 studies, expected variations in ii) intervention duration, and iii) components, as well as iv) outcome measures may
26 be a challenge for conducting robust meta-analyses and drawing definitive conclusions. The potential
27 effectiveness of community gardening as a public health intervention to prevent overweight/obesity and to close
28 equity gaps is of particular interest for public health authorities, local governments/municipalities, and
29 urban/regional planners, all of whom play an important role in funding and decisions regarding land use (e.g.
30 zoning). Moreover, the review will address educational stakeholders, who are essential for passing on knowledge
31 for future implementations of community gardening.¹⁰
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50

51 Footnotes

52 53 54 Contributors

55
56 TLH and SKL initiated this review project. TLH was responsible for the first protocol draft, including the study
57 question, study selection criteria, search strategy, synthesis of data, and risk of bias assessment. He is the
58
59
60

1
2
3 guarantor of this review. All authors (TLH, MR, SM, BB, AB, GG, and SKL) read, revised and approved the final
4 manuscript before submission.
5
6

7 8 **Data sharing statement**

9
10 The review process will be documented and access to the documents (e.g. reference files, extracted data) will be
11 provided upon request.
12

13 14 **Funding**

15 This research project received no special funding or specific grant from any funding agency in the public, for-
16 profit, or non-profit sectors.
17
18

19 20 **Competing interests**

21 TLH was co-initiator of a community gardening project (CampusGarten) in 2013 funded by the Students Union of
22 the University of Cologne, Cologne, Germany.
23
24

25 26 **Authors' information**

27 TLH is a research associate with the Research Group for Evidence-based Public Health, BIPS & University
28 Bremen, Bremen, Germany. MR is a senior lecturer in the Institute for Public Health and Nursing Research,
29 University Bremen, Bremen, Germany. SM is a scientific staff member at the Department of Non-Drug
30 Interventions, Institute for Quality and Efficiency in Health Care, Cologne, Germany. BB is head of a research unit
31 at the Institute for Health Care Management and Research, University of Duisburg-Essen, Essen, Germany. AB
32 is a professor at the Faculty of Spatial Sciences, Department of Cultural Geography, University of Groningen,
33 Groningen, the Netherlands. GG is head of the department for Evidence-based Medicine and Clinical
34 Epidemiology, Danube University Krems, Austria. SKL is the group head of the Research Group for Evidence-
35 based Public Health, BIPS & University Bremen, Bremen, Germany.
36
37
38
39
40
41
42
43
44
45
46
47

48 49 **References**

- 50 1. WHO. Global health risks. Geneva: World Health Organization 2009.
- 51 2. Lim SS, Vos T, Flaxman AD, *et al*. A comparative risk assessment of burden of disease and injury attributable
52 to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global
53 Burden of Disease Study 2010. *Lancet* 2012;380(9859):2224-60. doi: 10.1016/S0140-6736(12)61766-8
- 54 3. WHO. Global status report on noncommunicable diseases 2014. Geneva: World Health Organization 2014.
- 55 4. Ng M, Fleming T, Robinson M, *et al*. Global, regional, and national prevalence of overweight and obesity in
56 children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study
57 2013. *Lancet* 2014;384(9945) doi: 10.1016/s0140-6736(14)60460-8
- 58 5. Baker PRA, Francis DP, Soares J, *et al*. Community wide interventions for increasing physical activity.
59 *Cochrane Database Syst Rev* 2011(4) doi: 10.1002/14651858.CD008366.pub2
60

6. Butland B, Jebb S, Kopelman P, *et al*. Tackling obesities: future choices - project report (2nd edition) [Internet]. 2007 [cited 2017 Mar 22]. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/287937/07-1184x-tackling-obesities-future-choices-report.pdf.
7. Armstrong D. A survey of community gardens in upstate New York: implications for health promotion and community development. *Health Place* 2000;6(4):319-27. doi: 10.1016/S1353-8292(00)00013-7
8. Fox KR, Hillsdon M. Physical activity and obesity. *Obes Rev* 2007;8(s1):115-21. doi: 10.1111/j.1467-789X.2007.00329.x
9. McCormack LA, Laska MN, Larson NI, *et al*. Review of the nutritional implications of farmers' markets and community gardens: a call for evaluation and research efforts. *J Am Diet Assoc* 2010;110(3):399-408. doi: 10.1016/j.jada.2009.11.023
10. Burges Watson DL, Moore HJ. Community gardening and obesity. *Perspect in Public Health* 2011;131(4):163-4. doi: 10.1177/1757913911412475
11. Stiftungsgemeinschaft anstiftung & ertomis. Die urbanen Gemeinschaftsgärten im Überblick [Internet]. 2016 [cited Mar 24 2016]. Available from: <http://anstiftung.de/urbane-gaerten/gaerten-im-ueberblick>.
12. Ohly H, Gentry S, Wigglesworth R, *et al*. A systematic review of the health and well-being impacts of school gardening: synthesis of quantitative and qualitative evidence. *BMC Public Health* 2016;16:286. doi: 10.1186/s12889-016-2941-0
13. Savoie-Roskos MR, Wengreen H, Durward C. Increasing Fruit and Vegetable Intake among Children and Youth through Gardening-Based Interventions: A Systematic Review. *J Acad Nutr Diet* 2017;117(2):240-50. doi: 10.1016/j.jand.2016.10.014 [published Online First: 2016/12/15]
14. Castro DC, Samuels M, Harman AE. Growing healthy kids: a community garden-based obesity prevention program. *Am J Prev Med* 2013;44(3 Suppl 3):193-9. doi: 10.1016/j.amepre.2012.11.024
15. Gatto NM, Martinez LC, Spruijt-Metz D, *et al*. LA sprouts randomized controlled nutrition and gardening program reduces obesity and metabolic risk in Latino youth. *Obesity (Silver Spring)* 2015;23(6):1244-51. doi: 10.1002/oby.21077
16. Zick CD, Smith KR, Kowaleski-Jones L, *et al*. Harvesting more than vegetables: the potential weight control benefits of community gardening. *Am J Public Health* 2013;103(6):1110-5. doi: 10.2105/ajph.2012.301009
17. Davis JN, Ventura EE, Cook LT, *et al*. LA Sprouts: a gardening, nutrition, and cooking intervention for Latino youth improves diet and reduces obesity. *J Am Diet Assoc* 2011;111(8):1224-30. doi: 10.1016/j.jada.2011.05.009
18. Anderson LM, Petticrew M, Rehfues E, *et al*. Using logic models to capture complexity in systematic reviews. *Res Synth Methods* 2011;2(1):33-42. doi: 10.1002/jrsm.32
19. Wakefield S, Yeudall F, Taron C, *et al*. Growing urban health: community gardening in South-East Toronto. *Health Promot Int* 2007;22(2):92-101. doi: 10.1093/heapro/dam001
20. Heise TL, Katikireddi SV, Pega F, *et al*. Taxation of sugar-sweetened beverages for reducing their consumption and preventing obesity or other adverse health outcomes. *Cochrane Database Syst Rev* 2016(8) doi: 10.1002/14651858.CD012319
21. Welch V, Petticrew M, Tugwell P, *et al*. PRISMA-Equity 2012 Extension: Reporting Guidelines for Systematic Reviews with a Focus on Health Equity. *PLoS Med* 2012;9(10):e1001333. doi: 10.1371/journal.pmed.1001333
22. van den Berg AE, Custers MH. Gardening promotes neuroendocrine and affective restoration from stress. *J Health Psychol* 2011;16(1):3-11. doi: 10.1177/1359105310365577
23. Carney PA, Hamada JL, Rdesinski R, *et al*. Impact of a community gardening project on vegetable intake, food security and family relationships: a community-based participatory research study. *J Community Health* 2012;37(4):874-81. doi: 10.1007/s10900-011-9522-z
24. OECD. Perspectives on Global Development 2012: OECD Publishing 2011.
25. Shamseer L, Moher D, Clarke M, *et al*. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ* 2015;350:g7647. doi: 10.1136/bmj.g7647
26. Moher D, Liberati A, Tetzlaff J, *et al*. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med* 2009;6(7):e1000097. doi: 10.1371/journal.pmed.1000097
27. Karlsson P, Bergmark A. Compared with what? An analysis of control-group types in Cochrane and Campbell reviews of psychosocial treatment efficacy with substance use disorders. *Addiction* 2015;110(3):420-8. doi: 10.1111/add.12799

- 1
2
3 28. EPOC. What study designs should be included in an EPOC review? [Internet]. 2013 [cited 2016 Aug 11].
4 Available from:
5 [http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/05%20What%20study%20designs%20sh](http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/05%20What%20study%20designs%20should%20be%20included%20in%20an%20EPOC%20review%202013%2008%2012_2.pdf)
6 [ould%20be%20included%20in%20an%20EPOC%20review%202013%2008%2012_2.pdf](http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/05%20What%20study%20designs%20should%20be%20included%20in%20an%20EPOC%20review%202013%2008%2012_2.pdf).
7
8 29. Higgins JPT, Green S. Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [Internet].
9 2011 [cited 2016 Mar 19]. Available from: <http://www.cochrane-handbook.org>.
10
11 30. Swinburn BA, Sacks G, Hall KD, *et al*. The global obesity pandemic: shaped by global drivers and local
12 environments. *Lancet* 2011;378(9793):804-14. doi: 10.1016/S0140-6736(11)60813-1
13
14 31. Bland JM. Cluster randomised trials in the medical literature: two bibliometric surveys. *BMC Med Res*
15 *Methodol* 2004;4:21-21. doi: 10.1186/1471-2288-4-21
16
17 32. Nutbeam D, Macaskill P, Smith C, *et al*. Evaluation of two school smoking education programmes under
18 normal classroom conditions. *BMJ* 1993;306(6870):102-7. [published Online First: 1993/01/09]
19
20 33. Covidence. Covidence Software [Internet]. 2016 [cited Nov 19 2016]. Available from:
21 <http://www.covidence.org>.
22
23 34. Anderson LM, Petticrew M, Rehfuess E, *et al*. Equity Checklist for Systematic Review Authors [Internet]. 2015
24 [cited 2016 Dec 16]. Available from:
25 <http://equity.cochrane.org/sites/equity.cochrane.org/files/uploads/equitychecklist2011.pdf>.
26
27 35. CPH. Guide for developing a Cochrane protocol [Internet]. 2011 [cited 2016 Dec 16]. Available from:
28 [http://ph.cochrane.org/sites/ph.cochrane.org/files/uploads/Guide%20for%20PH%20protocol_Nov%2020](http://ph.cochrane.org/sites/ph.cochrane.org/files/uploads/Guide%20for%20PH%20protocol_Nov%202011_final%20for%20website.pdf)
29 [11_final%20for%20website.pdf](http://ph.cochrane.org/sites/ph.cochrane.org/files/uploads/Guide%20for%20PH%20protocol_Nov%202011_final%20for%20website.pdf).
30
31 36. CMED. Title Registration Form [Internet]. 2015 [cited 2016 Dec 16]. Available from:
32 [http://endoc.cochrane.org/sites/endoc.cochrane.org/files/public/uploads/title%20registration%20INT%20](http://endoc.cochrane.org/sites/endoc.cochrane.org/files/public/uploads/title%20registration%20INT%20reviews%202015_06.doc)
33 [reviews%202015_06.doc](http://endoc.cochrane.org/sites/endoc.cochrane.org/files/public/uploads/title%20registration%20INT%20reviews%202015_06.doc).
34
35 37. Higgins JPT, Altman DG, Gøtzsche PC, *et al*. The Cochrane Collaboration's tool for assessing risk of bias in
36 randomised trials. *BMJ* 2011;343:d5928.
37
38 38. EPOC. Suggested risk of bias criteria for EPOC reviews [Internet]. 2009 [cited 2016 Dec 16]. Available from:
39 [http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/Suggested%20risk%20of%20bias%20crit](http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/Suggested%20risk%20of%20bias%20criteria%20for%20EPOC%20reviews.pdf)
40 [eria%20for%20EPOC%20reviews.pdf](http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/Suggested%20risk%20of%20bias%20criteria%20for%20EPOC%20reviews.pdf).
41
42 39. Soga M, Gaston KJ, Yamaura Y. Gardening is beneficial for health: A meta-analysis. *Prev Med Rep*
43 2017;5:92-9. doi: 10.1016/j.pmedr.2016.11.007
44
45 40. Thomson HJ, Thomas S. The effect direction plot: visual display of non-standardised effects across multiple
46 outcome domains. *Res Synth Methods* 2013;4(1):95-101.
47
48 41. Ogilvie D, Fayer D, Petticrew M, *et al*. The harvest plot: A method for synthesising evidence about the
49 differential effects of interventions. *BMC Med Res Methodol* 2008;8(1):8-8. doi: 10.1186/1471-2288-8-8
50
51 42. GRADEpro [program]. Hamilton: McMaster University, 2014.
52
53 43. The Grade Working Group. Handbook for grading the quality of evidence and the strength of
54 recommendations using the GRADE approach [Internet]. 2013 [cited 2016 Nov 10]. Available from:
55 <http://www.guidelinedevelopment.org/handbook/>.
56
57 44. Wang D, MacMillan T. The Benefits of Gardening for Older Adults: A Systematic Review of the Literature. *Act*
58 *Adapt Aging* 2013;37(2):153-81. doi: 10.1080/01924788.2013.784942
59
60 45. Robinson-O'Brien R, Story M, Heim S. Impact of garden-based youth nutrition intervention programs: a
review. *J Am Diet Assoc* 2009;109(2):273-80. doi: 10.1016/j.jada.2008.10.051
46. Whear R, Coon JT, Bethel A, *et al*. What Is the Impact of Using Outdoor Spaces Such as Gardens on the
Physical and Mental Well-Being of Those With Dementia? A Systematic Review of Quantitative and
Qualitative Evidence. *J Am Med Dir Assoc*;15(10):697-705. doi: 10.1016/j.jamda.2014.05.013

Figure legends

Figure 1 Logic/causal pathway model of community gardening interventions to prevent overweight and obesity.

Definitions and descriptions of the model are included as a dashed box in Figure 1.

List of tables

Table 1 Search strategy for MEDLINE

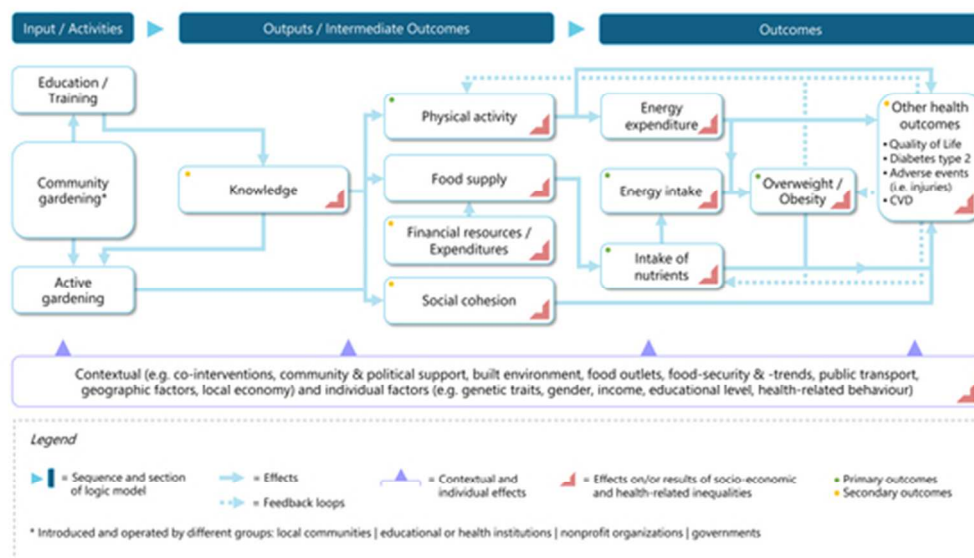


Figure 1 Logic/causal pathway model of community gardening interventions to prevent overweight and obesity

46x27mm (300 x 300 DPI)

Review only

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist:
recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	PAGE NUMBER (SUBMITTED MANUSCRIPT) AND AUTHOR'S RESPONSE (TLH)
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	not applicable
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	2; 7 [CRD42017043696]
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	16-17
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	not applicable
Support:			
Sources	5a	Indicate sources of financial or other support for the review	17 [no financial or other support]
Sponsor	5b	Provide name for the review funder and/or sponsor	not applicable
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	not applicable
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	4-6
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	6
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	6-13
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	10-13

Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	12 [see: Table 1 Search strategy for MEDLINE]
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	13
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	13-15
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	13
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	14
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	8-9; 14
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	14
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	14-15
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I ² , Kendall's τ)	14-15
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	15
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	15
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	15
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	15-16

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ*. 2015 Jan 2;349(jan02 1):g7647.

BMJ Open

Community gardening, community farming and other local community-based gardening interventions to prevent overweight and obesity in high- and middle-income countries: protocol for a systematic review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-016237.R2
Article Type:	Protocol
Date Submitted by the Author:	01-May-2017
Complete List of Authors:	Heise, Thomas; University of Bremen, Institute for Public Health and Nursing Research, Health Sciences; Leibniz Institute for Prevention Research and Epidemiology - BIPS, ebph - Research Group for Evidence-Based Public Health Romppel, Matthias; University of Bremen, Institute for Public Health and Nursing Research, Health Sciences Molnar, Sandra; Institute for Quality and Efficiency in Health Care - IQWiG, Department of Non-Drug Interventions Buchberger, Barbara; University of Duisburg-Essen, Institute for Health Care Management and Research van den Berg, Agnes; University of Groningen, Faculty of Spatial Sciences Gartlehner, Gerald; Danube University Krems, Department for Evidence-based Medicine and Clinical Epidemiology; RTI-International Lhachimi, Stefan; University of Bremen, Institute for Public Health and Nursing Research, Health Sciences; Leibniz Institute for Prevention Research and Epidemiology - BIPS, ebph - Research Group for Evidence-Based Public Health
Primary Subject Heading:	Nutrition and metabolism
Secondary Subject Heading:	Public health, Diabetes and endocrinology
Keywords:	Community gardening, Gardening, Overweight, Obesity, Physical activity

SCHOLARONE™
Manuscripts

Community gardening, community farming and other local community-based gardening interventions to prevent overweight and obesity in high- and middle-income countries: protocol for a systematic review

Thomas L Heise^{1,2*}, Matthias Romppel¹, Sandra Molnar³, Barbara Buchberger⁴, Agnes van den Berg⁵, Gerald Gartlehner^{6,7}, Stefan K Lhachimi^{1,2}

¹Institute for Public Health and Nursing Research, Health Sciences Bremen, University of Bremen, Bremen, Germany

²Research Group for Evidence-Based Public Health, Leibniz Institute for Prevention Research and Epidemiology, Bremen, Germany

³Department of Non-Drug Interventions, Institute for Quality and Efficiency in Health Care - IQWiG, Cologne, Germany

⁴Institute for Health Care Management and Research, University of Duisburg-Essen, Essen, Germany

⁵Faculty of Spatial Sciences, Department of Cultural Geography, University of Groningen, Groningen, the Netherlands

⁶Department for Evidence-based Medicine and Clinical Epidemiology, Danube University Krems, Krems, Austria

⁷RTI-International, Research Triangle Park, North Carolina, USA

*Corresponding author

Thomas L Heise

Institute for Public Health and Nursing Research

University of Bremen

Grazer Straße 2

28359 Bremen

Email: heise@leibniz-bips.de

Phone: +49-421-218-56920

(Physical addresses and email-addresses of co-authors can be obtained via the corresponding author)

Word count abstract: 298

Word count main manuscript: 4081

Abstract

Introduction

The worldwide prevalence of overweight/obesity has continued to rise over the last decades. To reverse this trend, public health authorities are exploring cost-effective interventions, especially in high- and middle-income countries (HMICs). Community gardening offers a unique opportunity for individuals to enhance physical activity levels and improve their diet. However, synthesised evidence on the short or long-term effectiveness, and on the costs of community gardening interventions to prevent overweight/obesity, remains limited. Therefore, this review will investigate: i) the effectiveness of voluntary participation in community gardening compared to no or a control intervention on overweight/obesity, and associated health outcomes, ii) effects on different sub-groups of populations, and iii) the costs of community gardening interventions.

Methods and analysis

We will conduct a systematic review, limited to evaluations of community gardening interventions with controlled quantitative and interrupted time series designs. To identify relevant articles, we will systematically search 12 academic and five grey literature databases, as well as two trial registers and six websites. Articles will then be assessed for eligibility based on a pre-defined set of criteria. At least two independent reviewers will assess each article for relevance, before evaluating the methodological quality and potential bias of the studies. Data relevant to the objectives of this review will be extracted and cross-validated. Any disagreements will be mediated by a third reviewer. If feasible, meta-analyses of primary outcomes (overweight/obesity, physical activity, food intake, energy intake) will be conducted. We will use the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) method to assess the overall quality of evidence.

Ethics and dissemination

For this review, no ethical approval is required as we will only extract and analyse secondary data. We aim to submit the final review manuscript to an Open Access journal for publication and disseminate results via conferences and social media.

Systematic review registration

PROSPERO CRD42017043696

Keywords

Community gardening, Gardening, Nutrition, Overweight, Obesity, Costs

Strengths and limitations of this study

- The proposed systematic review will report the effects of voluntary participation in community gardening interventions in various settings on overweight, obesity and associated health-related outcomes in the general population of HMICs
- Methods include a working definition of non-therapeutic community gardening, rigorous inclusion criteria for the study designs, and a comprehensive search strategy
- The design process and selection of the main objectives is guided by a logic/causal pathway model
- The limited availability of high-quality studies, as well as variations in intervention duration and components, may be a challenge for conducting robust meta-analyses and drawing definitive conclusions

Introduction

Rationale

According to the World Health Organization, 39% of the global adult population is classified as overweight, with only small differences by gender (40% for women vs. 38% for men). Global obesity prevalence differs more in terms of gender with 15% for women vs. 11% for men. Overweight and obesity are one of the leading global health risk factors for mortality and account for 4.8% of deaths worldwide, especially in high-income countries (8.4%).¹ Overweight and obesity also cause a considerable socio-economic burden on a global scale. In 2010, high levels of body mass index (BMI) as a risk factor were estimated to cause 93.6 million disability-adjusted life years (DALYs) worldwide.² This corresponds to an increase of 44.7% in DALYs attributable to this specific risk factor between 1990 and 2010.^{2,3} Overweight and obesity are also strongly related to a wide range of negative health outcomes (e.g. diabetes mellitus type 2, hypertension etc.).⁴ Costly surgical and drug-based treatments in HMCs, which are often associated with adverse effects, can be considered as last options in treating severe obesity. Therefore, prevention measures with lower risks intervening on weight development early in the life course, such as community-based initiatives to promote physical activity embedded in natural and built environments, have gained considerable attention.^{5,6} From a public health perspective, interventions to prevent and control overweight and obesity in the general population should: i) reflect the complexity of this health condition including an individual's life course perspective, ii) simultaneously aim at various health-related behaviours, and iii) be of low risk and cost-effective, with the aim to have sustainable positive effects on health on the long term. Community gardening may represent a potentially powerful and sustainable intervention that combines physical activity, improved food supply and education, to support culturally-tailored healthy living in the local context.⁷ This type of intervention is particularly attractive, as it is applicable to the needs of community members and may constantly influence environmental and societal factors including spill over effects on behaviour that cause or modify the risk of weight gain at almost any stage of life and, thus, prevent or delay the onset of chronic diseases by reducing the accumulated risk throughout the life course.⁸ Further, it is a form of active recreation that can easily be accessed and is able to influence multiple "systems levers" (food-related factors and the physical activity environment).^{6,9} For the proposed review, we define community gardening as: voluntary non-professional cultivation of plants and supportive gardening activities with active physical participation by community members, either collectively on a single piece of land, or on individual (non-domestic)

1
2
3 plots of land, with regular community meetings or other social activities, including educational and training
4
5 activities.^{10,11}
6

7 Gardening initiatives with active participation of community members are widespread at schools, nursing homes
8 and other community facilities (e.g. over 500 exist in Germany).¹² Community gardens are integrated on the local
9 level, in different settings, and are usually cultivated and operated by individuals or non-profit organisations (e.g.
10 community networks, NGOs, or schools).^{7,10} Although these initiatives are not necessarily driven by a health-
11 promotion perspective, there is evidence that community gardening may reduce overweight/obesity and diseases
12 related to these conditions, by stimulating physical exercise and improving healthy food supply and food intake
13 (e.g. vegetables, fruits).^{13,14} Additional evidence from studies using more rigorous controlled designs has recently
14 become available.^{15,16} Moreover, there is an acknowledged need to summarise and synthesise this rapidly
15 expanding body of evidence.^{10,11,15} Meanwhile, less is known about the cost-effectiveness of this approach.
16
17 Therefore, synthesised evidence is essential to improve the knowledge base for policymaking and planning
18 decisions regarding the physical/social infrastructure required for optimal use of community gardens for disease
19 prevention and health promotion.^{17,18}
20
21
22
23
24
25
26
27
28
29
30
31

32 **How this intervention might work**

33
34
35 *Figure 1 Logic/causal pathway model of community gardening interventions to prevent overweight and obesity.*

36
37 To visualise important interactions as causal pathways between the core elements to be examined in this review,
38 we developed a preliminary logic model (Figure 1). The basic concept of this model is introduced: for this we
39 focus on the hypothetical effects on 'overweight/obesity' and on other (intermediate) outcomes.¹⁹⁻²² Following our
40 working definition, 'community gardening', as introduced and maintained by different community groups,
41 institutions, organisations or governments, is characterised by two main activities: 'education/training' and 'active
42 gardening'.^{10,11} 'Education/training' using single or multiple channels (e.g. community meetings, classes) aims to
43 improve the participants' food-related or gardening-related 'knowledge' (e.g. gardening techniques, food
44 preparation). If these interventional components are effective in stimulating a positive behavioural change, this
45 may support participants to actively work in a gardening environment and critically examine, both consciously and
46 unconsciously, their own 'food supply' and 'intake of nutrients' towards a healthier life-style.¹⁵ First, 'active
47 gardening', such as weekly gardening sessions, may lead to low-to-moderate levels of 'physical activity'
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 associated with enhanced 'energy expenditure'. Moreover, this may have a positive impact on other health
4
5 outcomes such as 'quality of life' (e.g. stress relief).²³ Second, 'community gardening' may also serve to alter the
6
7 'food supply' (e.g. vegetables, fruits) leading to a change in nutritional intake (e.g. increased intake of dietary
8
9 fibres and essential vitamins; decreased consumption of macronutrients such as sugar and fat).^{14, 15, 24} Besides
10
11 the other outcomes, 'food supply' is particularly relevant in case of socio-economic inequality, as individuals with
12
13 a lower socioeconomic status (SES) spend relatively more of their 'financial resources' on food compared with
14
15 those with a higher SES. Considering that, individuals with lower SES could benefit from their own harvest of
16
17 unprocessed foods (e.g. rich in fibres and vitamins) in the context of community gardening interventions, thus,
18
19 this could lead to improved diets and counteract the negative effects of SES disparities on health.²² Third,
20
21 participants working in cooperative activities may also benefit from aspects of social cohesion (i.e. social capital,
22
23 social inclusion) that may prevent them from social exclusion and increase their 'quality of life'; this may
24
25 especially apply to the elderly.²⁵ The primary outcomes of this review, i.e. 'overweight and obesity', are mainly
26
27 caused by an imbalance between 'energy expenditure' and 'energy intake'. Despite the complexity of 'overweight
28
29 and obesity', the equation of energy balance is simplified to illustrate the potential impact of quantifiable primary
30
31 outcomes included in this review.⁶ If the intervention is effective in improving participants' 'energy expenditure',
32
33 represented in this review by the proxy outcome 'physical activity', or in lowering their 'energy intake' (with no
34
35 simultaneous negative changes), then 'community gardening' activities may prevent 'overweight and obesity' (e.g.
36
37 by lowering an individual's BMI). The logic model visualises feedback loops of health conditions such as 'diabetes
38
39 type 2', 'cardiovascular disease', and 'quality of life' that are closely related to 'overweight/obesity'. To provide a
40
41 balanced picture of interventional effects, we will also investigate unique health risks of 'community gardening'
42
43 (e.g. injuries, soil contamination). In addition to the elements along the pathway of 'community gardening', the
44
45 'contextual and individual' factors may also help to elucidate the direction and strength of the effects on the
46
47 selected outcomes and changes of the complex equation of energy balance in particular.⁶

50 Objectives

51
52 i) To examine the effectiveness of participation in community-based gardening compared to no or control
53
54 interventions on overweight, obesity, and associated health outcomes (i.e. physical activity and food intake) in the
55
56 general population of HMICs;
57
58
59
60

1
2
3 ii) to examine the effects of community gardening interventions in different sub-groups of populations and settings
4 (e.g. schools, neighbourhoods, community facilities);

5
6
7 iii) to assess the costs of community gardening interventions aimed at preventing overweight and obesity.
8
9

10 Methods

11 Reporting standards and registration

12 This protocol follows the reporting standards as defined in the 'Preferred Reporting Items for Systematic Review
13 and Meta-Analysis Protocols (PRISMA-P) 2015 statement', the upcoming review will comply with the PRISMA
14 checklist published as 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA
15 Statement'.^{26,27} The protocol is registered in the 'International Prospective Register of Systematic Reviews'
16 (PROSPERO): CRD42017043696.
17
18
19
20
21
22
23
24

25 Eligibility criteria

26 Population

27 Our upcoming review will include studies with populations that can be considered as members of the general
28 population in HMICs, including persons at high risk for overweight or obesity (e.g. low SES, living in deprived
29 geographical areas). We will exclude persons with active drug treatment, surgical interventions, or disease-
30 specific psychological treatment.
31
32
33
34
35
36
37
38
39

40 Experimental intervention

41 Inclusion criteria for studies with community-based gardening as interventions, defined as:

42 interventions with voluntary non-professional cultivation of plants and supportive gardening activities with active
43 physical participation by community members, either collectively on a single piece of land or on individual (non-
44 domestic) plots of land, with regular community meetings or other social activities, including educational and
45 training activities.^{10,11}
46
47
48
49
50
51

52 To be included the interventions have to be in one of the following environments or settings:

- 53 • community gardens;
- 54 • gardens at community care facilities;
- 55
- 56
- 57
- 58
- 59
- 60

- school gardens;
- community farms and community supported agriculture with mandatory physical participation; or
- other public environments with community gardens accessible for community members.

Exclusion criteria for environments or settings are:

- professional farming;
- subsistence agriculture;
- domestic gardening; or
- disease-specific therapeutic gardening in a closed environment.

Control intervention

Inclusion criteria for the studies are:

Any of the listed active control interventions, including:

- health education interventions other than community gardening (e.g. cooking classes, nutritional information);
- sports-based interventions; or
- other nutritional interventions aimed to support healthy eating patterns (e.g. coupons for farmers' markets, etc.),

or a passive control group.

Our primary analyses will focus on active control interventions to serve as approximation of the counterfactual condition for the intervention group (community gardening) to estimate relative effects. Subsequently, if data of no active control interventions are being reported we will also consider the inclusion of passive control groups (no intervention or waiting list) as being part of a secondary analyses to estimate absolute-effect estimates and will carefully discuss major limitations of this approach throughout the review (i.e. missing placebo intervention).²⁸

Both types of comparisons will be separately analysed.

Outcomes

We will include studies reporting at least one of the following primary outcomes.

Primary outcomes are:

- overweight and obesity (e.g. incidence or prevalence; body mass indices, i.e. BMI, waist-to-hip ratio);
- physical activity (e.g. activity diaries, accelerometers, etc.);
- food intake (e.g. food groups, nutrients, ingredients); and
- energy intake (e.g. total energy intake).

Secondary outcomes are:

- disease outcomes with a direct link to overweight/obesity or physical activity (e.g. health-related quality of life, cardiovascular disease, type 2 diabetes);
- adverse events (e.g. mortality, fracture);
- costs;
- total expenditure of participants on food;
- knowledge on food and gardening techniques; and
- indices on social cohesion.

Both primary and secondary outcomes can be self-reported or measured by physicians or other professionals.

Study design

Inclusion criteria for a study to be included in the main analysis are:

- randomised controlled trials (RCT);
- cluster randomised controlled trials (cRCT);
- non-randomised controlled trials (nRCT);
- controlled before-after (CBA) studies; or
- interrupted time series (ITS) studies

1
2
3 that comply with the criteria of the 'Cochrane Effective Practice and Organisation of Care' (EPOC) group. In
4 accordance with the EPOC criteria, we will include studies with a design that adheres to an appropriate controlled
5 design. EPOC recommends at least two or more intervention or control sites for RCT, cRCT, nRCT, and CBA
6 designs. For CBA designs it also defines use of contemporaneous data collection methods and identical methods
7 of measurement as inclusion criteria. Studies with ITS design require a clearly defined point in time for the
8 intervention's implementation as well as at least three data points before/after the intervention for the included
9 outcomes.²⁹ This review will summarise evidence of quantitative studies only. Hence, we will exclude qualitative
10 studies during the selection process.

11 12 13 14 15 16 17 18 19 20 **Information sources**

21 To identify potentially relevant references of studies, we will consider academic and grey literature (e.g. including
22 conference proceedings, reports, PhD thesis) databases, as well as (clinical) trial registers and handsearching.
23 This broad search approach that covers various sources beyond academic literature databases aims to minimise
24 negatives impacts of potential publication bias.³⁰ The selection of relevant repositories was mainly based on
25 potential coverage of the proposed review's 'patient/population, intervention, control, outcomes' (PICO) format.³⁰

26 We will include and search the following 12 bibliographic databases to identify relevant studies:

- 27 • Agricultural Online Access (AGRICOLA) (1970 to present);
- 28 • Agricultural Science and Technology Information (AGRIS) (1974 to present);
- 29 • Applied Social Sciences Index and Abstracts (ASSIA) (1987 to present);
- 30 • Cochrane Central Register of Controlled Trials (CENTRAL) (1948 to present);
- 31 • Cumulative Index to Nursing and Allied Health Literature (CINAHL) (1937 to present);
- 32 • Current Contents Medicine Database of German and German-Language Journals (CC MED) (2000 to
33 present);
- 34 • Education Resources Information Center (ERIC) (1966 to present);
- 35 • Excerpta Medica database (EMBASE) (1947 to present);
- 36 • Food Science and Technology Abstracts (FSTA) (1969 to present);
- 37 • Medical Literature Analysis and Retrieval System Online (MEDLINE) (1946 to present);
- 38 • PsycINFO (1887 to present); and

- Web of Science Core Collection (1900 to present).

In addition, we will perform searches in five electronic grey literature databases:

- Directory of Open Access Repositories (OpenDOAR) [first 50 hits];
- Google Scholar [first 50 hits];
- ProQuest Dissertations & Theses Database (PQDT);
- Social Science Research Network (SSRN); and
- System for Information on Grey Literature in Europe (OpenGrey) [first 50 hits].

We will search the following meta-trial registers to retrieve records of ongoing or unpublished trials:

- Trials Register of Promoting Health Interventions (TRoPHI); and
- WHO International Clinical Trials Registry Platform (ICTRP).

We will search the following websites using keywords:

- American Community Gardening Association;
- Benefits Hub;
- Centre for Agricultural Bioscience International;
- Food Security and Nutrition Network;
- Stiftungsgemeinschaft anstiftung & ertomis; and
- Therapeutic Landscapes Network.

Search strategy

We have developed a highly sensitive search strategy for MEDLINE, incorporating a combination of medical subject headings (MeSH) and text words for the intervention, outcomes, and population of interest. Because commonly used study design filters missed several potentially relevant references, we will use a list of text words for the search strategy to take into account the study designs. The search strategy has been piloted by the author team and will be modified according to the requirements of the other bibliographic databases (Table 1).

Table 1 Search strategy for MEDLINE

Search strategy for MEDLINE (via OVID SP)
1. exp gardening/
2. ((garden or gardens or gardening or allotment? or horticulture or agriculture or botanical or cultivating or cultivation or plant or plants or planting or greening or harvest or harvests or harvesting) adj5 (community or communities or intercultural or guerrilla or civic or neighbour?hood or residential? or solidarity or co?operative or communal or collective or shared or voluntary or volunteer or volunteers or volunteering or school or educational or education or recreational or recreation or retirement or nursing or kindergarten or pop?up or urban or rural or local)).tw.
3. health.tw.
4. obes*.tw.
5. overweight.tw.
6. (body weight or body mass).tw.
7. ("body mass index" or bmi).tw.
8. (physical adj (activity or activities)).tw.
9. training.tw.
10. fitness.tw.
11. endurance.tw.
12. exercise.tw.
13. mortality.tw.
14. quality of life.tw.
15. (qol or hrqol or hql).tw.
16. (psychological adj (stress or pain or relief)).tw.
17. resilience.tw.
18. well?being.tw.
19. mental.tw.
20. (knowledge or attitude).tw.
21. (calories or caloric or consumption).tw.
22. (diet or diets).tw.
23. social cohesion.tw.
24. (expenditures or spending).tw.
25. costs.tw.
26. economic.tw.
27. effectiveness.tw.
28. or/3-27
29. intervention?.tw.
30. (experiment? or experimental).tw.
31. trial?.tw.
32. (study or studies).tw.
33. (evaluation? or evaluating).tw.
34. (comparison? or comparing).tw.
35. group?.tw.
36. or/29-35
37. 1 and 28 and 36
38. 2 and 28 and 36
39. or/37-38
40. (animals not (humans and animals)).sh.
41. 39 not 40

We will limit search results to articles published in the last 25 years (1992-2017) to avoid possible negative impact on the generalisability of our results caused, notably, by substantial shifts in risk patterns and/or general lifestyle changes over time (e.g. sedentary behaviour/physical activity, energy intake, etc.).³¹ Our decision not to limit this

1
2
3 time frame even further was based on the fact that advanced research designs such as cRCTs were already
4 introduced to evaluate lifestyle interventions in the early 1990s and could be used to evaluate the effects of
5 community gardening interventions of this time.^{32,33} We will apply a search filter to exclude animal studies if a
6 database or provider offers this feature. No additional search filters will be used. We will include references or full-
7 texts in the English or German language. If documents in other languages cannot be translated by the authors of
8 the review team (via internet-based translators, or by colleagues) they will be excluded. We will select keywords
9 derived from our PICO and MEDLINE search strategy to identify potentially relevant articles on websites, as well
10 as in databases lacking the option to use search operators/syntax. This includes, in particular, keywords for the
11 intervention (i.e. "community gardening", "community farming", "horticulture", and "school gardens"). Also
12 considered will be keywords for the main outcomes of interest (i.e. "overweight", "obesity", and their
13 corresponding indices such as "BMI").

24 25 26 Data extraction and analysis

27 Data management

28
29 Search results will be saved as an EndNote database to backup all reference files, and to remove duplicate
30 references. We will then upload the references to a screening software (e.g. Covidence: a cloud-based system to
31 support the review process).³⁴ We will pilot the title and abstract screening against eligibility criteria. Files of the
32 included studies, the data extraction forms and reference lists will be available to all authors through internet-
33 based exchange options (e.g. Covidence, internet file hosting, or email).

34 35 36 37 38 39 40 Study selection

41
42 Study selection will be performed in two rounds based on the inclusion/exclusion criteria derived from our PICO
43 question and on the designs of the included study. First, we will perform the title and abstract screening based on
44 a de-duplicated EndNote database of all the references retrieved from the search. Second, the full-texts derived
45 from the references identified in the first step will be screened. All steps will be independently performed by at
46 least two authors; a third author will solve potential conflicts. The inclusion/exclusion of all studies will be
47 presented in a PRISMA flowchart clearly showing the screening and selection process.²⁷
48
49
50
51
52
53
54
55
56
57
58
59
60

Data collection process and extraction

Data extraction of retrieved references will be performed by two authors to avoid transcription errors. Any disagreements will be resolved by discussion with a third author. Adapted data extraction and assessment templates will be piloted and then used to extract relevant data from the included studies. All data will be transferred to our review software by one author and double-checked by a second author.^{30,35,36}

Outcomes and data items

We selected patient-relevant outcomes based on the recommendations of the 'Cochrane Metabolic and Endocrine Disorders Group' for a review that focuses on diseases such as overweight/obesity; these include, in particular: mortality, morbidity (i.e. overweight/obesity), health-related quality of life, and adverse events.³⁷ We will also assess economic outcomes relevant to individuals (e.g. participant's total expenditure on food) and to society (implementation costs). Other health-related outcomes (e.g. physical activity) will provide additional information for end-users, as they are closely linked to our main outcomes of interest, i.e. overweight/obesity. We will extract relevant data time points of reported outcomes in order to summarise the effects on outcomes across studies for specific time intervals. Also, potential implications of surrogate outcomes (i.e. BMI) and the impact of length of follow-up, will be addressed throughout this review.

Risk of bias

At least two authors will independently perform a risk of bias (RoB) assessment for the included studies. A third author will resolve conflicts and ensure consensus in case of any disagreement. Results of the RoB assessment will be provided in RoB tables and discussed throughout the review.³⁰ The domain-based Cochrane's RoB tool including the adaptation to EPOC specific designs will be used to assess potential bias for studies relevant for the main results.^{38,39}

Data synthesis

Considering our outcome selection, we will extract data for both dichotomous and continuous outcome variables. Preferably, we will extract, report and synthesise risk ratios (RRs) for evaluation of the treatment effect. However, if RRs cannot be obtained or calculated, we will report or calculate odds ratios (ORs) or risk differences (RDs). Continuous data will be harmonised and expressed as standardised mean differences (SMDs). If appropriate, we will convert shorter ordinal data into dichotomous data (RRs, ORs, or RDs). Similarly, we will consider to convert

1
2
3 longer ordinal data into continuous data (SMDs).^{30,36} For outcomes reported in two or more studies and
4 considered sufficiently homogenous, we will conduct a meta-analysis of the corresponding studies or relevant
5 study arms. Meta-analyses will be performed using the Mantel-Haenszel (dichotomous data) and inverse
6 variance method (continuous data). Based on the results of the pre-screening of potentially relevant studies, we
7 expect variation across studies due to both contextual heterogeneity and differences related to the context of
8 implementation. To address this issue, we will apply the random effects method. Quantitative measures of
9 heterogeneity will be reported (e.g. I^2 , Chi^2) together with synthesised data on treatment effects, presented as
10 forest plots. The most frequently reported outcome measure (e.g. BMI) across the included studies of one
11 outcome (overweight and obesity) will guide the selection process for data suitable to be reported and
12 synthesised. We consider this approach superior in terms of information value compared to pooling
13 heterogeneous outcomes across health domains that substantially differ in scope and intended use.⁴⁰ Generally,
14 we will favour the longest follow-up data if multiple follow-up data are available at the individual study level. To
15 determine the role of heterogeneity on treatment effects, and to assess the robustness of the results, we will
16 perform subgroup and sensitivity analyses. If feasible, we will consider subgroup analyses of primary outcomes
17 for at least income groups, gender/sex, educational level and age groups, as well as for characteristics of the
18 implementation of the community gardening intervention (e.g. co-interventions).²² Similarly, if sufficient data are
19 available we will perform sensitivity analyses with respect to quality of studies, source of funding, publication
20 status, intervention duration, and length of follow-up.³⁰ Study results with insufficient homogeneity will be
21 narratively synthesised. In addition to reporting findings as text and tables, we may consider graphical
22 visualisation (e.g. harvest plots or effect direction plots) to synthesise and present data.^{41,42}

23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 **Meta-bias(es)**

45
46 To study the impact of potential reporting bias, we will calculate and discuss funnel plots of the primary outcomes,
47 if sufficient data are available (> 10 studies).³⁰

48 49 50 51 **Confidence in cumulative evidence**

52 We will present GRADE tables for primary outcomes to demonstrate the degree of confidence end-users can
53 place on the quality of evidence and strength of the recommendations including outcome specific information.
54 GRADE ratings are based on study design, including potential upgrades/downgrades (e.g. according to effect
55 size, publication bias, and inconsistency). Ratings applied to a body of evidence can be 'high', 'moderate', 'low',
56
57
58
59
60

1
2
3 or 'very low'. RCTs begin the assessment process with a 'high' evidence rating, whereas observational studies
4 begin with a 'low' evidence rating. Final ratings for included point estimates will be based on the results of the
5 design-specific upgrade/downgrade process. At least two authors will be involved in this assessment. Any
6 disagreements will be resolved by discussion with a third author.^{43,44}
7
8
9

10 Conclusion

11
12 Research on the effects of voluntary community gardening on overweight, obesity and related outcomes is rapidly
13 expanding (e.g. RCTs), especially for populations with low SES and at high risk for overweight and obesity. The
14 proposed review will focus on quantitative studies and differs from previous systematic reviews on gardening
15 interventions that were retrieved from the PROSPERO database and MEDLINE by the authors in terms of: i)
16 inclusion of economic outcomes, such as costs of the intervention, ii) a focus on non-therapeutic, community-
17 based gardening initiatives to ensure homogeneity and external validity in terms of interventions (e.g. voluntary
18 participation), populations (e.g. general public, non-patient samples), and level of outcome variables (e.g. similar
19 baseline risk levels for overweight/obesity), iii) study selection for the main results based on rigorous
20 standards/criteria, and iv) provision of GRADE tables to inform end-users about the quality of evidence and
21 strength of the recommendations emerging from the review v) a discussion focusing on advances in research
22 designs of community gardening interventions over time.^{10,13,40,45-47} The limited availability of i) high-quality
23 studies, expected variations in ii) intervention duration, and iii) components, as well as iv) outcome measures may
24 be a challenge for conducting robust meta-analyses and drawing definitive conclusions. The potential
25 effectiveness of community gardening as a public health intervention to prevent overweight/obesity and to close
26 equity gaps is of particular interest for public health authorities, local governments/municipalities, and
27 urban/regional planners, all of whom play an important role in funding and decisions regarding land use (e.g.
28 zoning). Moreover, the review will address educational stakeholders, who are essential for passing on knowledge
29 for future implementations of community gardening.¹¹
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50

51 Footnotes

52 Contributors

53
54
55
56 TLH and SKL initiated this review project. TLH was responsible for the first protocol draft, including the study
57 question, study selection criteria, search strategy, synthesis of data, and risk of bias assessment. He is the
58
59
60

1
2
3 guarantor of this review. All authors (TLH, MR, SM, BB, AB, GG, and SKL) read, revised and approved the final
4 manuscript before submission.
5
6

7 8 **Data sharing statement**

9
10 The review process will be documented and access to the documents (e.g. reference files, extracted data) will be
11 provided upon request.
12

13 14 **Funding**

15 This research project received no special funding or specific grant from any funding agency in the public, for-
16 profit, or non-profit sectors.
17
18

19 20 **Competing interests**

21 TLH was co-initiator of a community gardening project (CampusGarten) in 2013 funded by the Students Union of
22 the University of Cologne, Cologne, Germany.
23
24

25 26 **Authors' information**

27 TLH is a research associate with the Research Group for Evidence-based Public Health, BIPS & University
28 Bremen, Bremen, Germany. MR is a senior lecturer in the Institute for Public Health and Nursing Research,
29 University Bremen, Bremen, Germany. SM is a scientific staff member at the Department of Non-Drug
30 Interventions, Institute for Quality and Efficiency in Health Care, Cologne, Germany. BB is head of a research unit
31 at the Institute for Health Care Management and Research, University of Duisburg-Essen, Essen, Germany. AB
32 is a professor at the Faculty of Spatial Sciences, Department of Cultural Geography, University of Groningen,
33 Groningen, the Netherlands. GG is head of the department for Evidence-based Medicine and Clinical
34 Epidemiology, Danube University Krems, Austria. SKL is the group head of the Research Group for Evidence-
35 based Public Health, BIPS & University Bremen, Bremen, Germany.
36
37
38
39
40
41
42
43
44
45
46
47

48 49 **References**

- 50 1. WHO. Global health risks. Geneva: World Health Organization 2009.
- 51 2. Lim SS, Vos T, Flaxman AD, *et al*. A comparative risk assessment of burden of disease and injury attributable
52 to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global
53 Burden of Disease Study 2010. *Lancet* 2012;380(9859):2224-60. doi: 10.1016/S0140-6736(12)61766-8
- 54 3. WHO. Global status report on noncommunicable diseases 2014. Geneva: World Health Organization 2014.
- 55 4. Ng M, Fleming T, Robinson M, *et al*. Global, regional, and national prevalence of overweight and obesity in
56 children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study
57 2013. *Lancet* 2014;384(9945) doi: 10.1016/s0140-6736(14)60460-8
- 58 5. Baker PRA, Francis DP, Soares J, *et al*. Community wide interventions for increasing physical activity.
59 *Cochrane Database Syst Rev* 2011(4) doi: 10.1002/14651858.CD008366.pub2
60

6. Butland B, Jebb S, Kopelman P, *et al*. Tackling obesities: future choices - project report (2nd edition) [Internet]. 2007 [cited 2017 Mar 22]. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/287937/07-1184x-tackling-obesities-future-choices-report.pdf.
7. Armstrong D. A survey of community gardens in upstate New York: implications for health promotion and community development. *Health Place* 2000;6(4):319-27. doi: 10.1016/S1353-8292(00)00013-7
8. Darnton-Hill I, Nishida C, James WP. A life course approach to diet, nutrition and the prevention of chronic diseases. *Public Health Nutr* 2004;7(1a):101-21. doi: 10.1079/PHN2003584
9. Fox KR, Hillsdon M. Physical activity and obesity. *Obes Rev* 2007;8(s1):115-21. doi: 10.1111/j.1467-789X.2007.00329.x
10. McCormack LA, Laska MN, Larson NI, *et al*. Review of the nutritional implications of farmers' markets and community gardens: a call for evaluation and research efforts. *J Am Diet Assoc* 2010;110(3):399-408. doi: 10.1016/j.jada.2009.11.023
11. Burges Watson DL, Moore HJ. Community gardening and obesity. *Perspect in Public Health* 2011;131(4):163-4. doi: 10.1177/1757913911412475
12. Stiftungsgemeinschaft anstiftung & ertomis. Die urbanen Gemeinschaftsgärten im Überblick [Internet]. 2016 [cited Mar 24 2016]. Available from: <http://anstiftung.de/urbane-gaerten/gaerten-im-ueberblick>.
13. Ohly H, Gentry S, Wigglesworth R, *et al*. A systematic review of the health and well-being impacts of school gardening: synthesis of quantitative and qualitative evidence. *BMC Public Health* 2016;16:286. doi: 10.1186/s12889-016-2941-0
14. Savoie-Roskos MR, Wengreen H, Durward C. Increasing Fruit and Vegetable Intake among Children and Youth through Gardening-Based Interventions: A Systematic Review. *J Acad Nutr Diet* 2017;117(2):240-50. doi: 10.1016/j.jand.2016.10.014 [published Online First: 2016/12/15]
15. Castro DC, Samuels M, Harman AE. Growing healthy kids: a community garden-based obesity prevention program. *Am J Prev Med* 2013;44(3 Suppl 3):193-9. doi: 10.1016/j.amepre.2012.11.024
16. Gatto NM, Martinez LC, Spruijt-Metz D, *et al*. LA sprouts randomized controlled nutrition and gardening program reduces obesity and metabolic risk in Latino youth. *Obesity (Silver Spring)* 2015;23(6):1244-51. doi: 10.1002/oby.21077
17. Zick CD, Smith KR, Kowaleski-Jones L, *et al*. Harvesting more than vegetables: the potential weight control benefits of community gardening. *Am J Public Health* 2013;103(6):1110-5. doi: 10.2105/ajph.2012.301009
18. Davis JN, Ventura EE, Cook LT, *et al*. LA Sprouts: a gardening, nutrition, and cooking intervention for Latino youth improves diet and reduces obesity. *J Am Diet Assoc* 2011;111(8):1224-30. doi: 10.1016/j.jada.2011.05.009
19. Anderson LM, Petticrew M, Rehfues E, *et al*. Using logic models to capture complexity in systematic reviews. *Res Synth Methods* 2011;2(1):33-42. doi: 10.1002/jrsm.32
20. Wakefield S, Yeudall F, Taron C, *et al*. Growing urban health: community gardening in South-East Toronto. *Health Promot Int* 2007;22(2):92-101. doi: 10.1093/heapro/dam001
21. Heise TL, Katikireddi SV, Pega F, *et al*. Taxation of sugar-sweetened beverages for reducing their consumption and preventing obesity or other adverse health outcomes. *Cochrane Database Syst Rev* 2016(8) doi: 10.1002/14651858.CD012319
22. Welch V, Petticrew M, Tugwell P, *et al*. PRISMA-Equity 2012 Extension: Reporting Guidelines for Systematic Reviews with a Focus on Health Equity. *PLoS Med* 2012;9(10):e1001333. doi: 10.1371/journal.pmed.1001333
23. van den Berg AE, Custers MH. Gardening promotes neuroendocrine and affective restoration from stress. *J Health Psychol* 2011;16(1):3-11. doi: 10.1177/1359105310365577
24. Carney PA, Hamada JL, Rdesinski R, *et al*. Impact of a community gardening project on vegetable intake, food security and family relationships: a community-based participatory research study. *J Community Health* 2012;37(4):874-81. doi: 10.1007/s10900-011-9522-z
25. OECD. Perspectives on Global Development 2012: OECD Publishing 2011.
26. Shamseer L, Moher D, Clarke M, *et al*. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ* 2015;350:g7647. doi: 10.1136/bmj.g7647
27. Moher D, Liberati A, Tetzlaff J, *et al*. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med* 2009;6(7):e1000097. doi: 10.1371/journal.pmed.1000097

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
28. Karlsson P, Bergmark A. Compared with what? An analysis of control-group types in Cochrane and Campbell reviews of psychosocial treatment efficacy with substance use disorders. *Addiction* 2015;110(3):420-8. doi: 10.1111/add.12799
 29. EPOC. What study designs should be included in an EPOC review? [Internet]. 2013 [cited 2016 Aug 11]. Available from: http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/05%20What%20study%20designs%20should%20be%20included%20in%20an%20EPOC%20review%202013%2008%2012_2.pdf.
 30. Higgins JPT, Green S. Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [Internet]. 2011 [cited 2016 Mar 16]. Available from: <http://www.cochrane-handbook.org>.
 31. Swinburn BA, Sacks G, Hall KD, *et al*. The global obesity pandemic: shaped by global drivers and local environments. *Lancet* 2011;378(9793):804-14. doi: 10.1016/S0140-6736(11)60813-1
 32. Bland JM. Cluster randomised trials in the medical literature: two bibliometric surveys. *BMC Med Res Methodol* 2004;4:21-21. doi: 10.1186/1471-2288-4-21
 33. Nutbeam D, Macaskill P, Smith C, *et al*. Evaluation of two school smoking education programmes under normal classroom conditions. *BMJ* 1993;306(6870):102-7. [published Online First: 1993/01/09]
 34. Covidence. Covidence Software [Internet]. 2016 [cited Nov 19 2016]. Available from: <http://www.covidence.org>.
 35. Anderson LM, Petticrew M, Rehfuess E, *et al*. Equity Checklist for Systematic Review Authors [Internet]. 2015 [cited 2016 Dec 16]. Available from: <http://equity.cochrane.org/sites/equity.cochrane.org/files/uploads/equitychecklist2011.pdf>.
 36. CPH. Guide for developing a Cochrane protocol [Internet]. 2011 [cited 2016 Dec 16]. Available from: http://ph.cochrane.org/sites/ph.cochrane.org/files/uploads/Guide%20for%20PH%20protocol_Nov%202011_final%20for%20website.pdf.
 37. CMED. Title Registration Form [Internet]. 2015 [cited 2016 Dec 16]. Available from: http://endoc.cochrane.org/sites/endoc.cochrane.org/files/public/uploads/title%20registration%20INT%20reviews%202015_06.doc.
 38. Higgins JPT, Altman DG, Gøtzsche PC, *et al*. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *BMJ* 2011;343:d5928.
 39. EPOC. Suggested risk of bias criteria for EPOC reviews [Internet]. 2009 [cited 2016 Dec 16]. Available from: <http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/Suggested%20risk%20of%20bias%20criteria%20for%20EPOC%20reviews.pdf>.
 40. Soga M, Gaston KJ, Yamaura Y. Gardening is beneficial for health: A meta-analysis. *Prev Med Rep* 2017;5:92-9. doi: 10.1016/j.pmedr.2016.11.007
 41. Thomson HJ, Thomas S. The effect direction plot: visual display of non-standardised effects across multiple outcome domains. *Res Synth Methods* 2013;4(1):95-101.
 42. Ogilvie D, Fayer D, Petticrew M, *et al*. The harvest plot: A method for synthesising evidence about the differential effects of interventions. *BMC Med Res Methodol* 2008;8(1):8-8. doi: 10.1186/1471-2288-8-8
 43. GRADEpro [program]. Hamilton: McMaster University, 2014.
 44. The Grade Working Group. Handbook for grading the quality of evidence and the strength of recommendations using the GRADE approach [Internet]. 2013 [cited 2016 Nov 10]. Available from: <http://www.guidelinedevelopment.org/handbook/>.
 45. Wang D, MacMillan T. The Benefits of Gardening for Older Adults: A Systematic Review of the Literature. *Act Adapt Aging* 2013;37(2):153-81. doi: 10.1080/01924788.2013.784942
 46. Robinson-O'Brien R, Story M, Heim S. Impact of garden-based youth nutrition intervention programs: a review. *J Am Diet Assoc* 2009;109(2):273-80. doi: 10.1016/j.jada.2008.10.051
 47. Whear R, Coon JT, Bethel A, *et al*. What Is the Impact of Using Outdoor Spaces Such as Gardens on the Physical and Mental Well-Being of Those With Dementia? A Systematic Review of Quantitative and Qualitative Evidence. *J Am Med Dir Assoc*;15(10):697-705. doi: 10.1016/j.jamda.2014.05.013

52 Figure legends

53
54 Figure 1 Logic/causal pathway model of community gardening interventions to prevent overweight and obesity.

55
56 Definitions and descriptions of the model are included as a dashed box in Figure 1.

List of tables

Table 1 Search strategy for MEDLINE

For peer review only

BMJ Open: first published as 10.1136/bmjopen-2017-016237 on 15 June 2017. Downloaded from <http://bmjopen.bmj.com/> on April 19, 2024 by guest. Protected by copyright.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

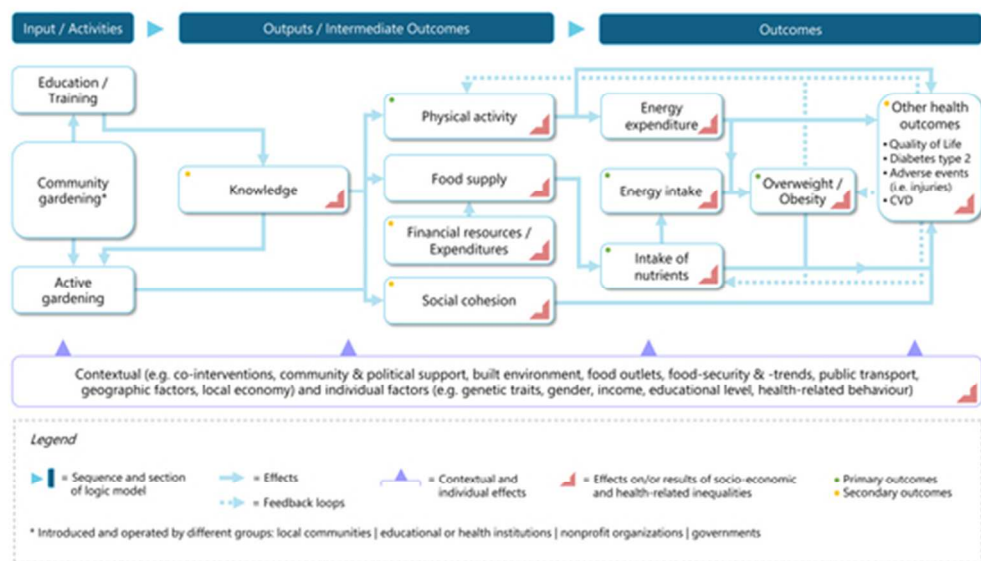


Figure 1 Logic/causal pathway model of community gardening interventions to prevent overweight and obesity

46x27mm (300 x 300 DPI)

Review only

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist:
recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	PAGE NUMBER (SUBMITTED MANUSCRIPT) AND AUTHOR'S RESPONSE (TLH)
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	not applicable
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	2; 7 [CRD42017043696]
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	16-17
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	not applicable
Support:			
Sources	5a	Indicate sources of financial or other support for the review	17 [no financial or other support]
Sponsor	5b	Provide name for the review funder and/or sponsor	not applicable
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	not applicable
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	4-6
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	6-7
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	7-13
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	10-13

Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	12 [see: Table 1 Search strategy for MEDLINE]
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	13
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	13-16
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	14
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	14
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	9; 14
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	14
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	14-15
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I ² , Kendall's τ)	14-15
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	15
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	15
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	15
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	15-16

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.