

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

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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-income and middle-income countries. Community gardening offers a unique opportunity for individuals to enhance physical activity levels and improve their diet. However, synthesised evidence on the short-term or long-term effectiveness and on the costs of community gardening interventions to prevent overweight/obesity remains limited. Therefore, this review will investigate: (1) the effectiveness of voluntary participation in community gardening compared with no or a control intervention on overweight/obesity and associated health outcomes, (2) effects on different subgroups of populations and (3) 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 5 grey literature databases, as well as 2 trial registers and 6 websites. Articles will then be assessed for eligibility based on a predefined 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 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.

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 high-income and middle-income countries.
- 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.

Trial registration number International Prospective Register of Systematic Reviews (PROSPERO) (CRD42017043696).

INTRODUCTION

Rationale

According to the WHO, 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 socioeconomic 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 (eg, diabetes mellitus type 2, hypertension and so on).⁴ Costly surgical and drug-based treatments in high-income and middle-income countries (HMICs), 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: (1) reflect the complexity of this health condition including an individual's life course perspective, (2) simultaneously aim at various health-related behaviours and (3) be of low risk and cost-effective, with the aim to have sustainable positive effects on health in 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 spillover 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) plots of land, with regular community meetings or other social activities, including educational and training activities.^{10,11}

Gardening initiatives with active participation of community members are widespread at schools, nursing homes and other community facilities (eg, over 500 exist in Germany).¹² Community gardens are integrated on the local level, in different settings and are usually cultivated and operated by individuals or non-profit organisations (eg, community networks, non-governmental organisations or schools).^{7,10} 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 food intake (eg, vegetables, fruits).^{13,14} Additional evidence from studies using more rigorous controlled designs has recently become available.^{15,16} Moreover, there is an acknowledged need to summarise and synthesise this rapidly expanding body of evidence.^{10,11,15} Meanwhile, less is known about the cost-effectiveness of this approach. Therefore, synthesised evidence is essential to improve the knowledge base for policy-making and planning decisions regarding the physical/social infrastructure required for optimal use of community gardens for disease prevention and health promotion.^{17,18}

How this intervention might work?

To visualise important interactions as causal pathways between the core elements to be examined in this review, we developed a preliminary logic model (figure 1). The basic concept of this model is introduced: for this, we focus on the hypothetical effects on 'overweight/obesity' and on other (intermediate) outcomes.^{19–22} Following our working definition, 'community gardening', as introduced and maintained by different community groups, institutions, organisations or governments, is characterised by two main activities: 'education/training' and 'active gardening'.^{10,11} 'Education/training' using single or multiple channels (eg, community meetings, classes) aims to improve the participants' food-related or gardening-related 'knowledge' (eg, gardening techniques, food preparation). If these interventional components are effective in stimulating a positive behavioural change, this may support participants to actively work in a gardening environment and critically examine, both consciously and unconsciously, their own 'food supply' and 'intake of nutrients' towards a healthier lifestyle.¹⁵ First, 'active gardening', such as weekly gardening sessions, may lead to low-to-moderate levels of 'physical activity' associated with enhanced 'energy expenditure'. Moreover, this may have a positive impact on other health outcomes such as 'quality of life' (eg, stress relief).²³ Second, 'community gardening' may also serve to alter the 'food supply' (eg, vegetables, fruits) leading to a change in nutritional intake (eg, increased intake of dietary fibres and essential vitamins; decreased consumption of macronutrients such as sugar and fat).^{14,15,24} Besides the other outcomes, 'food supply' is particularly relevant in case of socioeconomic inequality, as individuals with a lower socioeconomic status (SES) spend relatively more of their 'financial resources' on food compared with those with a higher SES. Considering that, individuals with lower SES could benefit from their own harvest of unprocessed foods (eg, rich in fibres and vitamins) in the context of community gardening interventions; thus, this could lead to improved diets and counteract the negative effects of SES disparities on health.²² Third, participants working in cooperative activities may also benefit from aspects of social cohesion (i.e., social capital, social inclusion) that may prevent them from social exclusion and increase their 'quality of life'; this may especially apply to the elderly.²⁵ The primary outcomes of this review, that is, 'overweight and obesity', are mainly

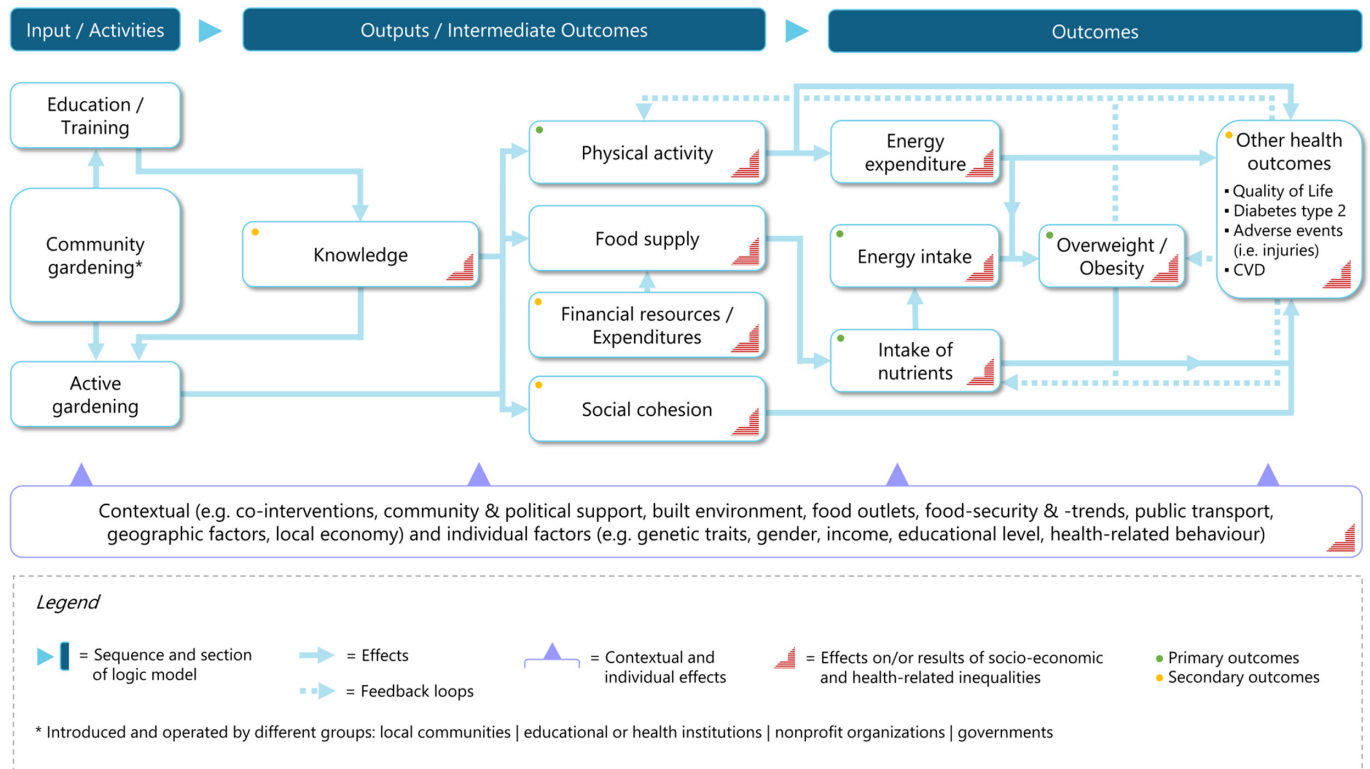


Figure 1 Logic/causal pathway model of community gardening interventions to prevent overweight and obesity.

caused by an imbalance between ‘energy expenditure’ and ‘energy intake’. Despite the complexity of ‘overweight and obesity’, the equation of energy balance is simplified to illustrate the potential impact of quantifiable primary outcomes included in this review.⁶ If the intervention is effective in improving participants’ ‘energy expenditure’, represented in this review by the proxy outcome ‘physical activity’, or in lowering their ‘energy intake’ (with no simultaneous negative changes), then ‘community gardening’ activities may prevent ‘overweight and obesity’ (eg, by lowering an individual’s BMI). The logic model visualises feedback loops of health conditions such as ‘diabetes type 2’, ‘cardiovascular disease’ and ‘quality of life’ that are closely related to ‘overweight/obesity’. To provide a balanced picture of interventional effects, we will also investigate unique health risks of ‘community gardening’ (eg, injuries, soil contamination). In addition to the elements along the pathway of ‘community gardening’, the ‘contextual and individual’ factors may also help to elucidate the direction and strength of the effects on the selected outcomes and changes in the complex equation of energy balance in particular.⁶

Objectives

(1) To examine the effectiveness of participation in community-based gardening compared with no or control interventions on overweight, obesity and associated health outcomes (ie, physical activity and food intake) in the general population of HMICs; (2) to examine the effects of community gardening interventions in different subgroups of populations and settings (eg, schools, neighbourhoods, community facilities) and (3) to assess

the costs of community gardening interventions aimed at preventing overweight and obesity.

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’, and the upcoming review will comply with the PRISMA checklist published as ‘Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement’.^{26 27} The protocol is registered in the ‘International Prospective Register of Systematic Reviews’ (PROSPERO): CRD42017043696.

Eligibility criteria

Population

Our upcoming review will include studies with populations that can be considered as members of the general population in HMICs, including persons at high risk for overweight or obesity (eg, low SES, living in deprived geographical areas). We will exclude 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.^{10 11}

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, and
- ▶ other public environments with community gardens accessible for community members.

Exclusion criteria for environments or settings are the following:

- ▶ professional farming,
- ▶ subsistence agriculture,
- ▶ domestic gardening, and
- ▶ 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 (eg, cooking classes, nutritional information),
 - ▶ sports-based interventions, and
 - ▶ other nutritional interventions aimed to support healthy eating patterns (eg, coupons for farmers' markets and so on) 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 the following:

- ▶ overweight and obesity (eg, incidence or prevalence; body mass indices, that is, BMI, waist to hip ratio),
- ▶ physical activity (eg, activity diaries, accelerometers and so on),
- ▶ food intake (eg, food groups, nutrients, ingredients), and
- ▶ energy intake (eg, total energy intake).

Secondary outcomes are the following:

- ▶ disease outcomes with a direct link to overweight/obesity or physical activity (eg, health-related quality of life, cardiovascular disease, type 2 diabetes),
- ▶ adverse events (eg, 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, 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. EPOC recommends at least two or more intervention or control sites for RCT, cRCT, nRCT and CBA designs. For CBA designs, it also defines use of contemporaneous data collection methods and identical methods of measurement as inclusion criteria. Studies with ITS design require 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.²⁹ This review will summarise evidence of quantitative studies only. Hence, we will exclude qualitative studies during the selection process.

Information sources

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

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 Centre (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 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 the study designs into account. The search strategy has been piloted by the author team and will be modified according to the requirements of the other bibliographic databases (box 1).

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 (eg, sedentary behaviour/physical activity, energy intake and so on).³¹ Our decision not to limit this time frame even further was based on the

Box 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 neighbo?rhood 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

fact that advanced research designs such as cRCTs were already introduced to evaluate lifestyle interventions in the early 1990s and could be used to evaluate the effects of community gardening interventions of this time.^{32 33} We will apply a search filter to exclude animal studies if a database or provider offers this feature. No additional search filters will be used. We will include references or full-texts in the English or German language. If documents

in other languages cannot be translated by the authors of the review team (via internet-based translators or by colleagues), they will be excluded. We will select keywords derived from our PICO and MEDLINE search strategy to identify potentially relevant articles on websites as well as in databases lacking the option to use search operators/syntax. This includes, in particular, keywords for the intervention (i.e., 'community gardening', 'community farming', 'horticulture' and 'school gardens'). Also considered will be keywords for the main outcomes of interest (i.e., 'overweight', 'obesity' and their corresponding indices such as 'BMI').

Data extraction and analysis

Data management

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

Study selection

Study selection will be performed in two rounds based on the inclusion/exclusion criteria derived from our PICO question and on the included/excluded study designs. First, we will perform the title and abstract screening based on a de-duplicated EndNote database of all the references retrieved from the search. Second, the full-texts derived from the references identified in the first step will be screened. All steps will be independently performed by at least two authors; a third author will solve potential conflicts. The inclusion/exclusion of all studies will be presented in a PRISMA flowchart clearly showing the screening and selection process.²⁷

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 (eg, participant's total expenditure on food) and to society

(implementation costs). Other health-related outcomes (eg, physical activity) will provide additional information for end-users, as they are closely linked to our main outcomes of interest, that is, 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 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).^{30 36} For outcomes reported in two or more studies and considered sufficiently homogeneous, 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 prescreening 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 (eg, I^2 , χ^2) together with synthesised data on treatment effects, presented as forest plots. The most frequently reported outcome measure (eg, BMI) across the included studies of one outcome (overweight and obesity) will guide the selection process for data suitable to be reported and synthesised. We consider this approach superior in terms of information value compared with pooling heterogeneous outcomes across health domains that substantially differ in scope and intended use.⁴⁰ Generally, we will favour the longest follow-up data if multiple follow-up data are available at the individual study level. To determine the role of heterogeneity on treatment effects and to assess the robustness of the results, we will perform subgroup and sensitivity analyses. If feasible, we will

consider subgroup analyses of primary outcomes for at least income groups, gender/sex, educational level and age groups as well as for characteristics of the implementation of the community gardening intervention (eg, cointerventions).²² Similarly, if sufficient data are available, we will perform sensitivity analyses with respect to quality of studies, source of funding, publication status, intervention duration and length of follow-up.³⁰ Study results with insufficient homogeneity will be narratively synthesised. In addition to reporting findings as text and tables, we may consider graphical visualisation (eg, harvest plots or effect direction plots) to synthesise and present data.^{41 42}

Meta-bias(es)

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

Confidence in cumulative evidence

We will present Grading of Recommendations Assessment, Development and Evaluation (GRADE) tables for primary outcomes to demonstrate the degree of confidence end-users can place on the quality of evidence and strength of the recommendations including outcome specific information. GRADE ratings are based on study design, including potential upgrades/downgrades (eg, according to effect size, publication bias and inconsistency). Ratings applied to a body of evidence can be 'high', 'moderate', 'low' or 'very low'. RCTs begin the assessment process with a 'high' evidence rating, whereas observational studies begin with a 'low' evidence rating. Final ratings for included point estimates will be based on the results of the design-specific upgrade/downgrade process. At least two authors will be involved in this assessment. Any disagreements will be resolved by discussion with a third author.^{43 44}

CONCLUSION

Research on the effects of voluntary community gardening on overweight, obesity and related outcomes is rapidly expanding (eg, RCTs), especially for populations with low SES and at high risk for overweight and obesity. The proposed review will focus on quantitative studies and differs from previous systematic reviews on gardening interventions that were retrieved from the PROSPERO database and MEDLINE by the authors in terms of: (1) inclusion of economic outcomes, such as costs of the intervention, (2) a focus on non-therapeutic, community-based gardening initiatives to ensure homogeneity and external validity in terms of interventions (eg, voluntary participation), populations (eg, general public, non-patient samples) and level of outcome variables (eg, similar baseline risk levels for overweight/obesity), (3) study selection for the main results based on rigorous standards/criteria, (4) provision of GRADE tables to inform end-users about the quality of evidence and strength of the recommendations emerging from

the review and (5) a discussion focusing on advances in research designs of community gardening interventions over time.^{10 13 40 45-47} The limited availability of (1) high-quality studies, expected variations in (2) intervention duration and (3) components as well as (4) outcome measures may be a challenge for conducting robust meta-analyses and drawing definitive conclusions. The potential effectiveness of community gardening as a public health intervention to prevent overweight/obesity and to close equity gaps is of particular interest for public health authorities, local governments/municipalities and urban/regional planners, all of whom play an important role in funding and decisions regarding land use (eg, zoning). Moreover, the review will address educational stakeholders, who are essential for passing on knowledge for future implementations of community gardening.¹¹

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Contributors TLH and SKL initiated this review project. TLH was responsible for the first protocol draft, including the study question, study selection criteria, search strategy, synthesis of data and risk of bias assessment. He is the guarantor of this review. All authors read, revised and approved the final manuscript before submission.

Competing interests TLH was the coinventor of a community gardening project (CampusGarten) in 2013 funded by the Students Union of the University of Cologne, Cologne, Germany.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement The review process will be documented and access to the documents (eg, reference files, extracted data) will be provided on request.

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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;380:2224-60.
3. WHO. *Global status report on noncommunicable diseases*. 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;384:766-81.

5. Baker PRA, Francis DP, Soares J, *et al.* Community wide interventions for increasing physical activity. *Cochrane Database Syst Rev* 2011;4.
6. Butland B, Jebb S, Kopelman P, *et al.* Tackling obesity: future choices - project report. 2nd edition, 2007. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/287937/07-1184x-tackling-obesity-future-choices-report.pdf. (cited 2017 Mar 22).
7. Armstrong D. A survey of community gardens in Upstate New York: implications for health promotion and community development. *Health Place* 2000;6:319–27.
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;7:101.
9. Fox KR, Hillsdon M. Physical activity and obesity. *Obes Rev* 2007;8(s1):115–21.
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;110:399–408.
11. Burges DL, Moore HJ. Community gardening and obesity. *Perspect Public Health* 2011;131:163–4.
12. Stiftungsgemeinschaft anstiftung & ertomis. Die urbanen Gemeinschaftsgärten im Überblick [Internet], 2016. <http://anstiftung.de/urbane-gaerten/gaerten-im-ueberblick>. (cited Mar 24 2016).
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.
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;117:240–50.
15. Castro DC, Samuels M, Harman AE. Growing healthy kids: a community garden-based obesity prevention program. *Am J Prev Med* 2013;44(Suppl 3):193–9.
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* 2015;23:1244–51.
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;103:1110–5.
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;111:1224–30.
19. Anderson LM, Petticrew M, Rehfuss E, *et al.* Using logic models to capture complexity in systematic reviews. *Res Synth Methods* 2011;2:33–42.
20. Wakefield S, Yeudall F, Taron C, *et al.* Growing urban health: community gardening in South-East Toronto. *Health Promot Int* 2007;22:92–101.
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.
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:e1001333.
23. Van Den Berg AE, Custers MH. Gardening promotes neuroendocrine and affective restoration from stress. *J Health Psychol* 2011;16:3–11.
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;37:874–81.
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;349: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:e1000097.
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;110:420–8.
29. EPOC. What study designs should be included in an EPOC review? [Internet], 2013. 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. (cited 2016 Aug 11).
30. Higgins JPT, Green S. *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0* [Internet], 2011. <http://www.cochrane-handbook.org>. (cited 2016 Mar 16).
31. Swinburn BA, Sacks G, Hall KD, *et al.* The global obesity pandemic: shaped by global drivers and local environments. *Lancet* 2011;378:804–14.
32. Bland JM. Cluster randomised trials in the medical literature: two bibliometric surveys. *BMC Med Res Methodol* 2004;4:21.
33. Nutbeam D, Macaskill P, Smith C, *et al.* Evaluation of two school smoking education programmes under normal classroom conditions. *BMJ* 1993;306:102–7.
34. Covidence. Covidence Software [Internet], 2016. <http://www.covidence.org>. (cited Nov 19 2016).
35. Anderson LM, Petticrew M, Rehfuss E, *et al.* Equity Checklist for Systematic Review Authors [Internet], 2015. <http://equity.cochrane.org/sites/equity.cochrane.org/files/uploads/equitychecklist2011.pdf>. (cited 2016 Dec 16).
36. CPH. Guide for developing a cochrane protocol [Internet], 2011. http://ph.cochrane.org/sites/ph.cochrane.org/files/uploads/Guide%20for%20PH%20protocol_Nov%202011_final%20for%20website.pdf. (cited 2016 Dec 16).
37. CMED. Title Registration form [Internet], 2015. http://endoc.cochrane.org/sites/endoc.cochrane.org/files/public/uploads/title%20registration%20INT%20reviews%202015_06.doc. (cited 2016 Dec 16).
38. Higgins JP, Altman DG, Gotzsche 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. <http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/Suggested%20risk%20of%20bias%20criteria%20for%20EPOC%20reviews.pdf>. (cited 2016 Dec 16).
40. Soga M, Gaston KJ, Yamaura Y. Gardening is beneficial for health: a meta-analysis. *Prev Med Rep* 2017;5:92–9.
41. Thomson HJ, Thomas S. The effect direction plot: visual display of non-standardised effects across multiple outcome domains. *Res Synth Methods* 2013;4:95–101.
42. Ogilvie D, Fayter D, Petticrew M, *et al.* The harvest plot: a method for synthesising evidence about the differential effects of interventions. *BMC Med Res Methodol* 2008;8:8.
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. <http://www.guidelinedevelopment.org/handbook/>. (cited 2016 Nov 10).
45. Wang D, MacMillan T. The benefits of gardening for older adults: a systematic review of the literature. *Act Adapt Aging* 2013;37:153–81.
46. Robinson-O'Brien R, Story M, Heim S. Impact of garden-based youth nutrition intervention programs: a review. *J Am Diet Assoc* 2009;109:273–80.
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* 2014;15:697–705.