

Review Article

Identifying Key Benefits and Characteristics of Community Gardening for Vulnerable Populations: A Systematic Review

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Vulnerable communities (including people from refugee, Indigenous, culturally and linguistically diverse, and low socioeconomic backgrounds) represent the most at-risk populations facing inequities and negative health, economic, and social outcomes. The recent COVID-19 pandemic both highlighted and fuelled these disparities. Community gardening has emerged as a community-based solution to address these inequities, yet the research literature has largely considered outcomes for the general population rather than those with the most need. This paper represents the first systematic review to summarise the evidence on the broad impact of community gardening on outcomes for vulnerable populations. A systematic search of 13 databases (PubMed, Medline, Scopus, ScienceDirect, Cumulative Index to Nursing and Allied Health Literature, PsycINFO, Web of Science, Academic Search Complete, Education Source, Education Resources Information Center, Psychology and Behavioral Science Collection, SocINDEX, and Allied Health and Complementary Medicine Database) for English language articles from 1985 to 2022 was conducted. There were 33 studies identified where females were substantially overrepresented in the studies compared to males, and the main criteria for vulnerability included low socioeconomic-status and culturally diverse populations. Findings revealed that community gardening provides a wide range of benefits for vulnerable populations, with social connection, health, education, and nutrition being the more commonly cited. A relative emphasis on benefits of social connections, education, and nutrition is apparent for vulnerable populations in comparison to reviews considering the general population. The quality of studies was evaluated as moderate with little information provided about program characteristics. These shortcomings reduce the understanding of what characteristics are most likely to result in improvements and limit the capacity of practitioners to translate research into policy and practice for vulnerable communities.

1. Introduction

The present study seeks to identify the benefits of community gardening for vulnerable populations reported in the literature and determine if there are specific program characteristics associated with such benefits. Community gardening is operationalised as a form of gardening that “requires individuals to converge to share space, resources,

food, and knowledge in a collective and cooperative way” [1]: p. 3).

Evidence highlights a growing interest in the exploration of health, social, and economic inequalities globally and within countries themselves [2]. Ostensibly, this is due to initiatives such as the World Health Organization’s 2005 *Commission on Social Determinants of Health* and *Fair Society, Healthy Lives* [3], which are predominantly focused

on high-income countries. No matter the location, Wilkinson and Pickett's [4] extensive global research shows that the more extreme these economic inequalities are within countries themselves, the poorer overall the health and social outcomes will be within society. The recent COVID-19 pandemic highlighted and fuelled these disparities with examples including virus-related infections and mortality and reduced access to healthcare services such as mental health support [5, 6].

The intersection between these inequalities and vulnerable communities is apparent with the most at-risk populations facing the brunt of negative health, economic, and social outcomes. The research team defines vulnerable peoples and populations by applying World Health Organization classifications and is inclusive of terms such as disadvantaged and marginalised groups [7]. We recognise that certain segments of the population are more affected by health inequalities including groups such as those who are homeless [8, 9], youth refugees [10], social housing residents [11, 12], and Indigenous populations [13]. In the Australian context (where the authors of this paper are located), there are a range of varying determinants of health, which are unique to the geographical location including rural and remote communities [14] and population groups, for example, Aboriginal and Torres Strait Islander peoples [15].

The United Nations has created frameworks to operationalise concepts and objectives to reduce health, social, and economic inequalities. The Millennium Development Goals (MDGs) established in 2000 drove genuine progress across a range of economic and social development indicators and have been succeeded by the Sustainable Development Goals (SDGs). For the first time, these provide specific targets and indicators across the 17 aspirational areas of sustainable development. Health inequalities, sustainability, and equity have been emphasised by leaders as former United Nations Secretary General Ban Ki-Moon, for example, highlighted that the SDGs seek to "leave no one behind" [16]: 54). Nonetheless, there still remains a major gap to address with vulnerable communities still facing major inequalities. This paper seeks to systematically explore the evidence available around community gardens as an initiative to improve health outcomes for the most vulnerable in our society.

Evidence-based research highlights the importance of green spaces on people's health outcomes [17]. During the COVID-19 pandemic, research highlighted a negative correlation between green neighbourhoods and higher COVID-19 rates [18] with subsequent calls to enhance access to green spaces as a solution to reduce health inequalities exacerbated by COVID-19 [19]. Engaging in green spaces is shown to be a protective measure against poor cardiovascular health, diabetes, obesity, and hypertension which are causally linked as risk factors for COVID-19 [20]. In addition, with exposure to green spaces boosting physical and mental health, closure of these spaces during COVID-19 impacted vulnerable populations more than others [20].

The impact on health, however, transcends mortality rates with green space and the destruction of nature impacting people's mental, social, and emotional wellbeing [21–23]. Gardening is one of the most popular leisure time activities to connect with these green spaces [24] and has experienced a burgeoning interest during COVID-19 [25–27]. Evidence around gardening shows the clear health, wellbeing, and social benefits of this activity [28–31].

Recent academic evidence highlights the public health, social capital/cohesion, and economic benefits of community gardening [32–37]. Some specific community garden benefits include increasing social capital [1], mental wellbeing, and life satisfaction [38]. A recent scoping review by Howarth et al. [28] identified the positive impact on health and wellbeing as a result of participation in gardening. Although beneficial to direct healthcare strategies, the span of the scoping review means that further comprehensive review of the literature to inform policy and practice would be valuable.

First, there is a need to focus specifically on vulnerable populations as they are in most dire need of evidence-based and effective healthcare strategies. Second, with burgeoning resources being invested into community gardening for vulnerable populations (e.g., Botanic Gardens around the world seek a new social role), Brooklyn's Botanic Gardens in the USA since 1993 and the Royal Botanic Gardens in Sydney since 2000 have developed outreach programs that support vulnerable communities to community garden [39, 40] and studies demonstrating benefits for vulnerable populations such as refugees' communities (e.g., [41, 42]), and it is paramount to understand and capitalise on this literature as it pertains specifically to community gardening for the benefit of communities. Finally, an open-ended review where the types of outcomes are not limited within the inclusion and exclusion criteria will produce a comprehensive understanding of documented outcomes more so than achieved in current reviews such as by Howarth et al. [28], where only limited outcomes have been considered.

Recent systematic literature reviews published in the English language indicate the benefits of gardening and community gardening to health, wellbeing, and social outcomes [28, 29, 43–45]. However, except for one review [46], there is a lack of information on how these benefits translate for marginalised and vulnerable communities. The present study will address this gap by systematically identifying the benefits of community gardening for vulnerable populations. The secondary aim of this study is to examine if there are specific program characteristics associated with such a change and "thereby provide a solid basis for policymakers and practitioners to work more effectively to address health and social inequities" [7]: p. 2).

2. Materials and Methods

A systematic review was the method chosen for this study because, to date, no such review of peer-reviewed academic literature published in the English language has been undertaken to explore this topic. The protocol for the systematic review is available in a study by Tracey et al. [7].

2.1. Search and Selection Criteria. The Population, Intervention/Exposure, Comparator, Outcome, and Study design (P(I/E)COS) criteria [47] were used to describe the eligibility criterion for this review (see Table 1). In addition, the inclusion and exclusion criteria are described in detail below.

2.1.1. Inclusion Criteria. This systematic review included peer-reviewed articles, published in the English language, which explored either impact or outcomes of community garden participation between 1985 and 2022. The authorship team classified this activity as either needing to be undertaken in a community setting or population focused or having a social aspect to it. Both qualitative and quantitative study designs have been included in this review. Specified medical subject headings (MeSH) terms and keywords were prepared by the investigators to ensure comprehensiveness. The search terms were pretested in the CINAHL database and adapted to all other databases (see Supplementary Appendix 1). Furthermore, only papers that had an emphasis on vulnerable populations were included (keywords such as marginalised and disadvantaged were included in search terms). These populations include, for example, refugees, social housing residents, people of low socioeconomic status (SES), Indigenous peoples, people who are homeless, those unemployed, and people with disabilities.

2.1.2. Exclusion Criteria. Studies that focused on a population with a specific health condition (for example, lung or skin cancer) were excluded from the systematic literature review because this study is focused on vulnerable populations and not those with specific medical conditions. Only peer-reviewed quantitative and qualitative research studies published in the English language were included. Thus, case reports, case series, letter to editors, and systematic and literature reviews were excluded.

2.2. Data Extraction and Analysis. The search results were screened initially (both titles and abstracts) by one author (N.M). After this, three authors (D.T; A.B; T.G) independently reviewed potentially relevant abstracts and titles to include and exclude articles. Following the initial screening process, all articles were assessed by two authors independently to deem if they were appropriate to include in the systematic review analysis. When there was a disagreement between these authors, we had a group discussion to resolve this issue, and if it was unable to be resolved, a third author reviewed papers in question.

Thirteen academic search engines were utilised, and articles were put onto EndNote to document the systematic review process (Figure 1: Prisma). The following databases were used to collect this information: (1) PubMed, (2) Medline, (3) Scopus, (4) ScienceDirect, (5) Cumulative Index to Nursing and Allied Health Literature (CINAHL), (6) PsycINFO, (7) Web of Science, (8) Academic Search Complete, (9) Education Source, (10) Education Resources Information Center (ERIC), (11) Psychology and Behavioral

Science Collection, (12) SocINDEX, and (13) Allied Health and Complementary Medicine Database (AMED). The keywords of the search examined outcomes related to community gardening (including allotment gardening). Search strings also included words related to vulnerability (for further information, please see the previously published study by [7]).

The initial screening process removed all duplicates, articles not in English, and other studies identified as clearly unsuitable for inclusion, for example, due to a lack of focus on community gardening. The extracted data included authors, setting/country, year of publication, sample, study type, intervention characteristics, and outcomes measured. Figure 1 presents the PRISMA flow diagram.

This study involved a narrative synthesis of the literature. The narrative synthesis assessed the outcomes measured and the key findings across each outcome. These findings were evaluated against study type and intervention characteristics. Table 2 presents the results of the present review.

2.2.1. Critical Appraisal Tool. The Critical Appraisal Skills Program (CASP) checklist [78] was used to assess the methodological quality of both qualitative and quantitative studies. The CASP checklist was selected as it has different checklists (examining the study validity, risk of bias in recruitment, exposure, outcome, confounding factors, reporting of results, and acceptability of findings) to assess the quality of different research designs. Hence, this tool ensured that all studies included in this review were assessed for their design and to highlight any biases. For every study, each criterion within the CASP checklist was given a score of 1 for being “met” and 0 for being either “unmet” or “can’t tell.” These individual scores were summed to give an overall score for the respective study (see Supplementary Appendices 2 and 3). Three authors (N.M, J.K, and A.B) independently applied the appropriate checklist to the included studies, and disagreements (if any) were resolved by a third author (D.T).

3. Results

3.1. Study Selection. Initially, a total of 13,959 studies were identified following the outlined search strategy from all selected electronic databases and manual search. Duplicates were removed, and a total of 11,200 titles and abstracts were identified for further reading. Of these, 307 studies were selected for full-text reading, and finally, 29 studies were included in this review (see Figure 1). An updated literature search was conducted in late 2022, and four more studies that matched the inclusion criteria were subsequently included in the narrative review (see Figure 1).

3.2. Study and Participant Characteristics. Table 2 provides a detailed overview of the main characteristics of the 33 studies included in this review. In brief, the most common country where studies were conducted was in the US ($n = 17$, 52%). The remainder of the studies were conducted in South Africa ($n = 5$, 15%), Australia ($n = 4$, 12%), Canada ($n = 2$,

TABLE 1: Eligibility criteria according to the Population, Intervention/Exposure, Comparator, Outcome, and Study design (P(I/E)COS) criteria.

	Inclusion criteria	Exclusion criteria
Population	<ul style="list-style-type: none"> (i) Any age (ii) Any gender (iii) Any ethnicity, culture, or race (iv) Vulnerable/marginalised/disadvantaged based on their socioeconomic status, income, employment, ethnicity, refugee status (v) Both developed and developing countries 	<ul style="list-style-type: none"> (i) Individuals with psychological conditions (e.g., Alzheimer's and dementia) (ii) Individuals not considered to be vulnerable or marginalised such as high socioeconomic status, high income, or employed (iii) Studies which did not specify the participants
Intervention/ exposure	<ul style="list-style-type: none"> (i) Any kind of community gardening program implemented at schools, hospitals, worship places, and social housing (ii) Any kind of gardening activities (1) Maintenance (2) Planting (3) Harvesting 	<ul style="list-style-type: none"> (i) Any nongardening program (ii) Any gardening program implemented in nonsocial settings
Comparator	(i) Nongardeners	—
Outcomes	<ul style="list-style-type: none"> (i) Studies evaluating the impact of community gardening programs (ii) Studies in which the gardening project involves a social aspect, for example, undertaken in community settings 	<ul style="list-style-type: none"> (i) Studies which did not specify the settings of community gardening programs (ii) Studies which did not report the gardening program
Study design	<ul style="list-style-type: none"> (i) Human observational studies: longitudinal/cohort design (prospective and retrospective), cross-sectional studies nested within a cohort study, and case-control designs (ii) Qualitative study design (iii) Cross-sectional studies, case report, case series (iv) Birth cohort studies with follow-up of minimum 1 year (v) Studies published in peer-reviewed journals (vi) Studies published between 1985 and 8 September 2022 	<ul style="list-style-type: none"> (i) Letter to the editor (ii) Quasi-experiments or randomised control trials (RCTs) (iii) Systematic reviews, literature reviews, minireviews (iv) Studies published in grey literature (v) Studied identified by field experts (vi) Studies published in a non-English language

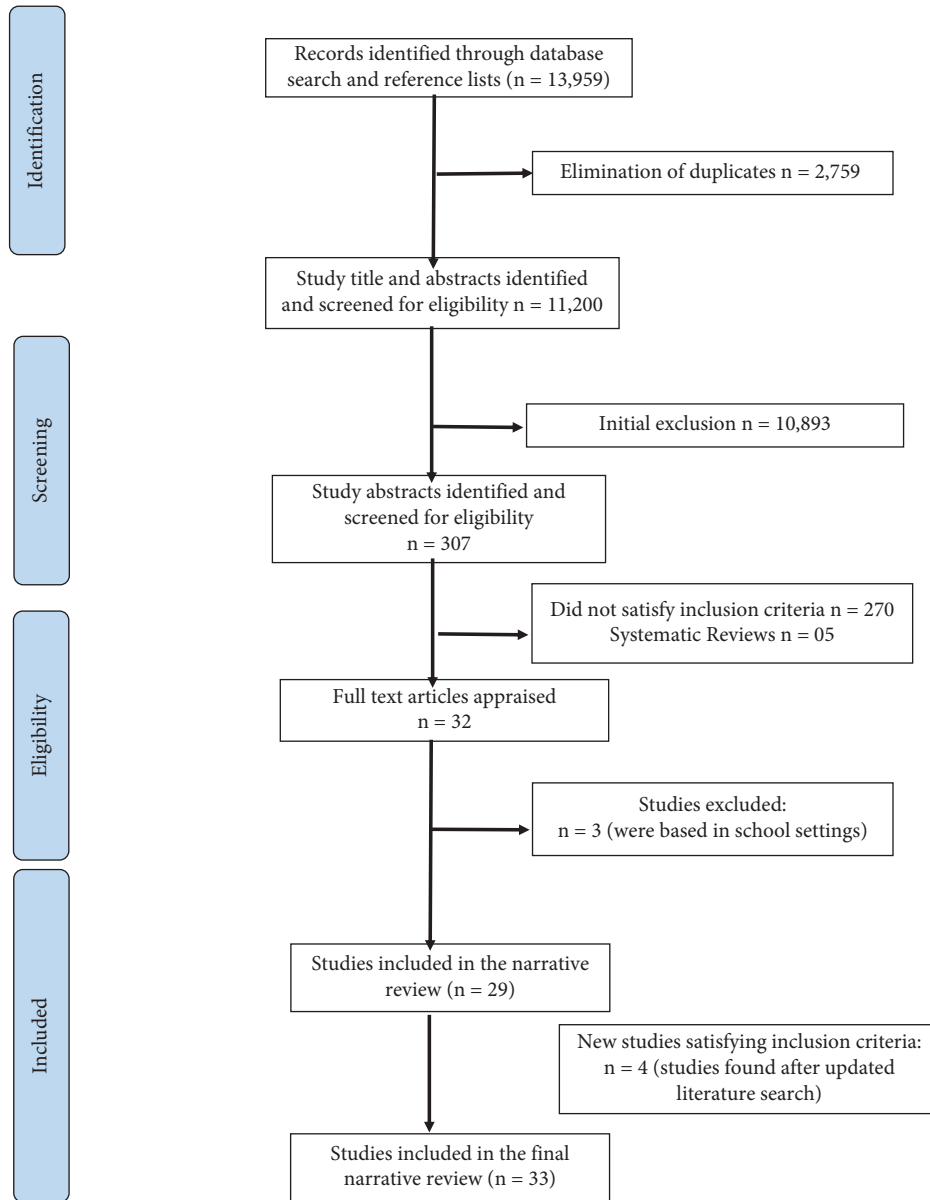


FIGURE 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram of the literature search and study selection process.

6%), the UK ($n = 3$, 9%), France ($n = 1$, 3%), and Lebanon ($n = 1$, 3%). Approximately, one half of the studies were published since 2015 ($n = 19$, 58%), with the remainder published between 2010 and 2014 ($n = 10$, 30%) and relatively few prior to 2010 ($n = 4$, 12%). Variability was witnessed in the research design, with just under half of the studies citing a mixed-method approach ($n = 12$, 36%), followed by qualitative ($n = 9$, 27%), case study ($n = 5$, 15%), survey ($n = 3$, 9%), participatory research ($n = 4$, 12%), quasi-experimental exploration ($n = 1$, 3%), and ethnographic research ($n = 2$, 6%). However, some of the studies had an overlap in terms of their specified research design.

Of the total 33 studies, only two studies used a comparator design, that is, gardeners vs. nongardeners [56, 64]. One study included only program coordinators as

participants [49], while two studies included both gardeners and garden managers/organisers [52, 75]. Only one study had a preintervention and postintervention without a control group and had a mixed-method study design [58].

The total number of participants (including males and females) were 1,674, ranging from five to 520 participants. Of these, 1,556 were gardeners, 25 were program coordinators or garden managers, and 93 were nongardeners. In terms of age, participants ranged from five to 89.5 years of age. In terms of gender, based on the studies which had clearly specified the gender of the participants, 504 were women and 153 were men out of the total participants. As for the nature of vulnerability, most studies had participants with overlapping vulnerabilities. Twenty studies included participants categorised to be of low socioeconomic status

TABLE 2: Study characteristics, intervention specifications, and findings.

Author and year	Settings	Description of the sample	Comparators	Intervention [†]	Study methods	Findings*
Algert et al. [48] (2016)	Four CG run by San Jose Parks, Recreation, and Neighbourhood Services Department in San Jose, California, USA	Gardeners: N = 85 Age: mean 58 years \pm 12 (range: 46–70 years) Gender: 42 females (50%) Low-income households and ethnically diverse	None	Not specified	Mixed-method research Study collected information on demographics, nutrition, gardening, and benefits (including perceived health) Quantitative: survey Qualitative: Open-ended interviews	Nutrition Cost benefits Social connections Health benefits: mental health Education: gardening skills
Armstrong [49] (2000)	Sixty-three gardens spread over 20 CG programs in upstate New York. 5 programs in rural and 15 in urban and suburban areas, USA	Program coordinators: N = 20 N = 35–350 (90% programs had <200 gardeners) Age: 1–21 years Gender: not stated 46% gardens located in low-income urban areas African Americans/Hispanic/other racial minority groups: 30% Biracial groups: 35% Caucasians: 35%	None	(i) Intensity length: 1 week (ii) Number of session participants: <35–350 across different gardens (iii) Personnel involved: program coordinators, gardeners. One half of the programs reported having 10 or more regular volunteers	Descriptive survey Study collected information on demographics, neighbourhood dynamics where gardens are located, nutrition, and benefits (including perceived health) Quantitative: survey Qualitative: telephonic standardised interviews	Education: life skills Health benefits: physical and mental health Social awareness Social connections Safety Area development
Agustina and Bellin [41] (2011)	Five gardens run by cultivating community managed by Department of Human Services in culturally diverse areas in Melbourne, Australia	Gardeners: N = 11 Age: 35–70 years Gender: 2 males and 9 females Multicultural immigrants	None	(i) Length: 3 months–8 years (ii) Personnel involved: 2 garden support workers	Qualitative case study Study collected information on demographics, relationship between gardening practices and cultures, and social benefits Qualitative: one-to-one interviews using open-ended questions	Education: life skills Social connections
Booth et al. [50] (2018)	Four CGs under the United States Department of Agriculture, and located close to low-income residential facility for older adults and disabled individuals, USA	Gardeners: N = 115 Age: mean 42.1 years Gender: 52.2% males Older adults and disabled individuals from multicultural backgrounds living in disadvantaged and low-income neighbourhoods	3 groups based on frequency of gardening: nongardeners, occasional, and regular	(i) Curriculum: every second and fourth Saturday of the month included walk, lunch, and entertainment. Every Tuesday and Thursday of the month included taking produce to the farmers' market. Core activities included landscaping, but focus was on gardening (ii) Number of sessions: once a week	Cross-sectional survey Quantitative: survey	Nutrition Health: benefits mental health Social connections Education: life skills
Bussell et al. [51] (2017)	Eight CGs across San Diego County, USA	Gardeners: N = 120 Age: 76.6% were 30–79 years old Gender: not stated Low-income neighbourhoods and ethnically diverse (40% Caucasian, 23.3% Hispanic or Latino, 6.7% African American, 7.5% Asian, 6.7% African, 5% Middle Eastern, and 5% other ethnicities)	None	Not specified	Mixed-method research Study collected information on demographics, what motivates gardening, nutrition, and benefits (including perceived economic, social, and health benefits) Quantitative: survey Qualitative: not specified	Social connections Health benefits: physical and mental health Nutrition Cost benefits

TABLE 2: Continued.

Author and year	Settings	Description of the sample	Comparators	Intervention [†]	Study methods	Findings [*]
Corkery [52] (2004)	Three CGs in Waterloo public housing estate in Sydney, Australia	Gardeners: N = 5 focus groups (actual sample not specified) Age: not stated Gender: not stated Organisers and managers of gardens: N = 5 Tenants of public housing estate, some have diverse language backgrounds, e.g., Russian-speaking and Vietnamese-speaking	None	(i) Personnel involved: 5 organisers and/or managers	Qualitative Action research approach Study collected information on demographics, connections, and benefits Qualitative: one-to-one and focus group interviews	Social connections Health benefits: physical and mental health Cost benefits Connection to nature
Coughlan and Hermes [53] (2016)	Gardens in Juba Valley in Somalia, Kenyan refugee camps, and CGs in municipal housing authority in New York, USA	Gardeners: N = 22 Age: > 21 years Gender: females (n = 22) Somali Bantu women refugees	None	(i) Personnel involved: service-learning students from local college along with a senior author/researcher	Qualitative study Study collected information on demographics, nutrition, gardening experiences in different countries/environments, and benefits Qualitative: Semistructured interviews using photo elicitation Relational participatory action research (PAR)	Health benefits: physical and mental health Social connections Connection to nature
Datta [54] (2019)	One CG managed by small farming cooperative in Canada	Gardeners: N = 520 Age: not stated (a mix of elders, adults, and children) Gender: not stated First Nations, visible minorities, and nonvisible minorities	None	(i) Curriculum: four activities: blanket exercise, art-based activities, individual and collective story-sharing, and a commonplace book	Study collected information on demographics, experiences, learning, sense of belonging and connection with elders, and benefits (including perceived health) Qualitative: participants' responses recorded in form of phrases and keywords used during activities	Education: life skills Health benefits: mental health Social connections Cultural awareness and/or connection
Furness and Gallaher [55] (2018)	A range of community-based gardens: individual plots, communal space run/managed by a neighbourhood network in partnership with the City of Rockford Human Services Department, Illinois, USA	Gardeners: N = 17 Age: > 45 years Gender: females White, low SES, and mostly retired	None	(i) Length: May 2014–Feb 2015	Mixed-method ethnographic design Study collected information on demographics, motivation in gardening, food security, and social benefits Qualitative: semistructured interviews	Nutrition Social connections

TABLE 2: Continued.

Author and year	Settings	Description of the sample	Comparators	Intervention [†]	Study methods	Findings*
Gerber et al. [56] (2017)	Four CGs managed by a refugee resettlement agency in the USA	Gardeners: $N = 22$ Age: mean 46 years ± 14.32 Gender: females ($n = 15$) and males ($n = 7$) Nongardeners: $N = 28$ Age: mean 43.32 years ± 15.69 Gender: females ($n = 16$) and males ($n = 12$) Nepalese and Bhutanese refugees in the USA	Nongardeners	Not specified	Mixed-method research Researcher used refugee health screener-15, patient health questionnaire-15, and adapted client assessment tool. The researcher also created questions for demographics, local acculturation, social support, and gardening Quantitative: survey Qualitative: semistructured interviews	Social connections Cultural awareness and/or connection Education: life skills Health benefits: physical and mental health Nutrition
Grabbe et al. [57] (2013)	One shelter-based garden run by two nurses associated with a local university and shelter-based clinic in a large southeastern city in the USA	Gardeners: $N = 8$ Age: mean 50 years (range 20–59 years) Gender: females ($n = 8$) Women living in shelters or on the street (homeless)	None	(i) Curriculum: outdoor physical activity, horticulture and nutrition education, stress reduction, and healthy food preparation (ii) Length: 4 weeks (iii) Number of sessions: 8 sessions over a 4-week period (twice a week) (iv) Duration of sessions: 2 hours (v) Number of session participants: over 110 women attended some twice-weekly sessions, but only 8 women attended on average every session (vi) Personnel involved: study/project staff members such as nurses and student volunteers) and shelter staff just for encouragement	Qualitative descriptive design Study collected information on demographics, perceptions towards gardening, and benefits of being involved in gardening Qualitative: semistructured interviews	Health benefits: physical and mental health Social connections Education: life skills

TABLE 2: Continued.

Author and year	Settings	Description of the sample	Comparators	Intervention [†]	Study methods	Findings [*]
Grier et al. [58] (2015)	Two CGs located in public housing sites in the Dan River region of south central Virginia, USA	<p>Gardeners:</p> <p>Preintervention: N = 43 Age: mean age 8.7 years (range 5–17 years)</p> <p>Gender: males (n = 20) and females (n = 23)</p> <p>Postintervention: N = 25 Preassessment and postassessment completion: N = 32</p> <p>Predominantly (98%) black youth residing with a single female parent with low-income living in public housing authority</p>	None	<p>(i) Curriculum: CG educational material was adapted from the junior master gardener curriculum. Incorporate nutrition-focused lessons into it to align more closely with social cognitive theory and to address cultural relevance for the targeted youth</p> <p>(ii) Length: 10 weeks</p> <p>(iii) Number of sessions: once a week</p> <p>(iv) Duration of sessions: 1-hour interactive gardening and/or nutrition education and 30 mins hands on gardening (weeks 1–4 focused on gardening education and weeks 5–9 focused on nutrition education)</p> <p>(v) Personnel involved: researchers and site leaders</p>	<p>Mixed-method participatory research approach</p> <p>Quantitative: preintervention and postintervention survey</p> <p>Qualitative: interviews (not specified in detail)</p>	<p>Education: life skills and gardening knowledge</p> <p>Nutrition</p> <p>Food safety</p>
Guerlain and Campbell [59]	Three CGs located at a local museum, city farm, and housing estate on two boroughs of east London, UK	<p>Gardeners: N = 28 (for semistructured interviews) N = 12 (for photovoice)</p> <p>Age: not stated</p> <p>Gender: not stated</p> <p>Socioeconomically deprived, culturally diverse individuals and refugees</p> <p>1st CG: women from India, Pakistan, Bangladesh, and East Africa who migrated in the last 10 years</p> <p>2nd CG: asylum seekers and refugees from Zimbabwe</p> <p>3rd CG: large housing estate residents</p>	None	Not specified	<p>Qualitative study</p> <p>Study collected information on demographics, social impact of gardening, and perceived benefits (including health)</p> <p>Qualitative: interviews, group discussions, and photovoice</p>	<p>Health benefits: physical and mental health</p> <p>Education: life skills</p> <p>Connection to nature</p> <p>Social connections</p>
Harris et al. [42] (2014)	Logan campus-based community food garden with forty-five individual plots located in Logan City in Queensland, Australia	<p>Gardeners: N = 12</p> <p>Age: not stated</p> <p>Gender: not specified, but mostly female</p> <p>African (Congo, Burundi, Somalia, and Sudan) refugees/migrants of low SES with mostly unemployed</p>	Not stated	<p>(i) Number of sessions: 4–5 times a week</p>	<p>Cross-sectional or critical case study</p> <p>Study collected information on demographics and importance of gardens and gardening</p> <p>Qualitative: semistructured interviews</p>	<p>Safety connection to nature</p> <p>Cultural awareness and/or connection</p> <p>Social connections</p>

TABLE 2: Continued.

Author and year	Settings	Description of the sample	Comparators	Intervention [†]	Study methods	Findings [*]
Hartwig and Mason [60] (2016)	Eight church lawns converted to gardening sites in Minnesota, USA	Gardeners: Survey: $N = 97$ Age: mean 39 years (range: 16–80 years) Gender: 65% females Focus groups interviews: $N = 48$ Age: not specified Gender: not specified Immigrants and refugees: South and Southeast Asia and sub-Saharan	None	(i) Number of sessions: 3 days a week (ii) Number of session participants: 8 churches supported between 6 and 100 individual or family plots	Mixed-method research Study collected information on demographics, food behaviours, hunger, depression (using PHQ-15 questionnaire), gardening experience, nutrition, and benefits (including perceived health) Food behaviour checklist and photos for fruit and vegetable intake, variety, frequency, and portion sizes Hunger assessed by a validated food security questionnaire developed by United Nations Depression: patient health questionnaire-2 (PH-2) screening questions and open-ended questions in interviews Quantitative: pre-season and post-season survey Qualitative: focus group interviews	Nutrition Health benefits: physical and mental health Cost benefits Social connections
Jackson and Ronzi [61] (2021)	Grange Park Estate in North West England	Gardeners: $N = 6$ Age: mean 51 years (range: 26–75) Gender: females ($n = 4$) and males ($n = 2$) Socioeconomically deprived individuals	None	Not specified	Community-based participatory research (CBPR) approach Study collected information on demographics, perceptions, experiences of CG, and CGs' impact on health, wellbeing, and community inclusion Qualitative: photovoice methodology with a CBPR approach and semistructured interviews	Health benefits: physical and mental health Social connections
Lucke et al. [62] (2019)	One CG developed by a local NGO located in a Masakhane township in Western Cape, South Africa	Gardeners: $N = 18$ Age: 21–57 years Gender: females ($n = 17$) and male ($n = 1$) Primarily black, low income, low food security community	None	(i) Number of sessions: 1–4 days a week (ii) Duration of sessions: 20–120 mins per visit	Qualitative study Study collected information on demographics, motivation to join garden, effects of garden, harvest output, shopping habits, and benefits (including perceived health) Qualitative: photovoice and individual interviews	Nutrition Cost benefits Social connections Health benefits: mental health Education: life skills and gardening knowledge Connection to nature

TABLE 2: Continued.

Author and year	Settings	Description of the sample	Comparators	Intervention [†]	Study methods	Findings*
Mangadu et al. [63] (2017)	Three CGs in El Paso, Texas, and Las Cruces and Anthony, New Mexico, USA (1) Neighbourhood community garden only and (2) neighbourhood community garden including a juvenile probation	Gardeners: N = 35 Age: not specified Gender: not specified A minority community group located at US-Mexico border characterized by cultural, geographical, and socioeconomic barriers	None	Not specified	Mixed-method research Study collected information on demographics, nutrition, physical activity, and psychosocial wellbeing Food security coalition's (2006) community gardener/farm-to-school survey used to assess outcomes on nutrition and physical activity Quantitative: survey Qualitative: focus group interviews	Nutrition Education: life skills and gardening knowledge Social connections
Martin et al. [64] (2017)	Give CG plots close to social housing in Marseille, France	Gardeners: N = 21 Age: mean 52 years ±11.5 Gender: females (n = 21) Nongardeners: N = 65 Age: mean 48 years Gender: females (n = 65) Socioeconomically disadvantaged and multicultural groups	Nongardeners	(i) Curriculum: intervention consisted of a program of nutritional education aimed at improving the nutritional quality of food purchases. The assigned plots were cultivated on the ground, and gardeners shared access to water, tools, and composters. Maintenance of each plot was the responsibility of the gardener granted gardening privileges (ii) Length: 2–5 years (iii) Number of sessions: weekly (most gardeners went to the garden several times a week, and four of the gardeners visited the garden every day) (iv) Personnel involved: social centre or by the heads of the charitable or social organisation	Mixed-method research Study collected information on demographics, food production, nutrition, and benefits (economic, social, and health) Quantitative: survey Qualitative: semistructured interviews	Social connections Education: life skills and gardening knowledge Cultural awareness and/or connection Health benefits: physical and mental health Nutrition Cost benefits

TABLE 2: Continued.

Author and year	Settings	Description of the sample	Comparators	Intervention [†]	Study methods	Findings [*]
McArthur et al. [65] (2010)	After-school youth garden program in Tuskegee University campus based in Macon County, Alabama, USA	Gardeners: N = 20–30 (not specified clearly) Age: 6–13 years Gender: 85% females Low SES, African American children, with a single parent and living in public housing	None	(i) Curriculum: participants carried out activities such as planting, watering, weeding, identifying insects, and harvesting crops. After harvest, the children sold some of their crops at the local Macon County farmers market. However, most of the vegetables were taken home and eaten or shared with family and friends (ii) Length: > 16 weeks (iii) Number of sessions: once a week (iv) Number of session participants: 55 but 20–30 participated regularly (v) Personnel involved: university social work student mentors	Mixed-method research Study collected information on demographics, crop knowledge, gardening practices, harvesting, teamwork, learning, and impact on school grades Quantitative: not specified Qualitative: interviews (not specified in detail)	Education: academic performance
Midding et al. [66] (2011)	Four garden groups based in disadvantaged communities in Manchester: Ardwick, Newton Heath, Moss Side, and Cheetham, UK 1–2: tenants of a sheltered housing scheme for older people, and new and inexperienced 3–4: working in other locations in the city and experienced in gardening	Gardeners: N = not specified Age: old-aged gardeners but exact age not specified Gender: not specified Older people living in disadvantaged communities	None	(i) Curriculum: implemented a CALL-ME (community action in the later life-Manchester engagement) project to examine older peoples' social engagement, challenges faced in neighbourhoods, gardening activities, and benefits (ii) Length: not clear (1. existed for 2 years, 2. existed for 10 months, 3. existed for many years, 4. established March 2009) (iii) Personnel involved: academic researchers from different disciplines working closely with stakeholders	Participatory action research (PAR) approach Qualitative: focus group interviews	Education: life skills and gardening knowledge Health benefits: physical and mental health
Mundel and Chapman [67] (2010)	A farm on the University of British Columbia campus located in Vancouver, which is on the traditional territory of the Musqueam Aboriginal Nation in Canada	Gardeners: N = 10 Age: not specified Gender: not specified Aboriginal people	None	(i) Curriculum: kitchen and gardening sessions were implemented (ii) Number of sessions: weekly kitchen/garden sessions plus large events (iii) Number of session participants: 7–20 (iv) Personnel involved: university students	Case study Qualitative: semistructured interviews, observations and field notes	Education: life skills Social connections Nutrition

TABLE 2: Continued.

Author and year	Settings	Description of the sample	Comparators	Intervention [†]	Study methods	Findings*
Pierce and Seals [68] (2006)	A family shelter community garden under the guidance of the cooperative extension master gardener in South Florida, USA	Gardeners: <i>N</i> = 6 Age: 23–45 years Gender: females (<i>n</i> = 6) Homeless women	None	(i) Length: 12 weeks (ii) Number of sessions: 12 each session (iii) Duration of sessions: 1 hour (iv) Number of session participants: 20–24 participants (1/3rd regularly participated) (v) Personnel involved: master gardeners	Mixed-method research Study collected information on demographics and used a questionnaire adapted from the Compton Community College Department of Psychology gardening study questionnaire to evaluate gardening practices such as mulching, composting, fertilizing, soil testing, irrigation, plant installation, pruning, pest management, citrus care, palm care, and butterfly gardening. The questionnaire also examined personal wellbeing, future employment, housing, abstinence from alcohol and drugs, and personal development Quantitative: survey Qualitative: direct quotes of interview responses	Education: life skills and academic performance Health benefits: mental health Social connections
Rahm [69] (2002)	One garden plot hosting the City Farmers Program in the Midwest, USA	Gardeners: <i>N</i> = 6 Age: mean 12.5 years (range 11–14 years) Gender: not specified African American, lower income neighbourhood	Not stated	(i) Length: 8 weeks (ii) Number of sessions: 3 times a week (<i>n</i> = 24) (iii) Personnel involved: 4 adult team leaders, 2 master gardeners, and program director	Qualitative case study Study collected information on demographics and designed activities related to nurturing, harvesting, marketing, and academic learning through gardening Qualitative: ethnographic methods using video and field notes	Education: life skills and gardening knowledge Social connections
Shisanya and Hendriks [70] (2011)	CGs located in Maphetheni, KwaZulu-Natal, South Africa	Gardeners: <i>N</i> = 53 households Age: not specified Gender: not specified Poor households	None	Not specified	Cross-sectional survey Study collected information on demographics and used a food security questionnaire Quantitative: survey	Food safety

TABLE 2: Continued.

Author and year	Settings	Description of the sample	Comparators	Intervention [†]	Study methods	Findings*
Strout et al. [71] (2017)	CGs located within private, affordable housing development in northeast, USA	Gardeners: <i>N</i> = 10 Age: mean 77 years (range: 67–89.5 years) Gender: females (<i>n</i> = 8) and males (<i>n</i> = 2) Older adults living in low-income neighbourhoods	None	(i) Curriculum: 10 six feet by four feet, waist-height garden beds. Each participant was assigned a garden bed and provided ergonomic gardening tools. Participants planted their first seeds during the third week of May. The gardening expert demonstrated proper gardening techniques (i.e., planting seeds, thinning, harvesting, and watering) and observed the participants performing displayed tasks in their raised beds weekly. Guidance was also provided as needed outside of the regular 1 hr sessions to enable the free participation of study subjects (ii) Length: 17 weeks (iii) Number of sessions: 17 (iv) Duration: 1 hour (v) Number of session participants: on average 8 in every weekly session (vi) Personnel involved: college students; gardening experts from partner university; principal investigator	Mixed-method research Quantitative: Mini-Mental State Examination (MMSE) preintervention and postintervention Mininutritional assessment (MNA) preintervention and postintervention Percentages of positive and negative improvements Qualitative: focus group interviews	Health benefits: physical and mental health Nutrition Social connections
Strunk and Richardson [72] (2019)	Rock Island in northwestern Illinois, USA	Gardeners: <i>N</i> = 48 Age: not specified Gender: not specified East Africa, South Asia, and Southeast Asia refugees	Not stated	Not specified	Ethnographic study Study collected information on demographics, agricultural and cooking practices, understandings of belonging and community, and connections Qualitative: interviews (not specified in detail)	Cultural awareness and/or connection Social connections Education: life skills

TABLE 2: Continued.

Author and year	Settings	Description of the sample	Comparators	Intervention [†]	Study methods	Findings [*]
Talhouk et al. [73] (2021)	Four CG sites in north Lebanon, Lebanon	Gardeners: N=44 Age: not specified Gender: females (n=44) Displaced Syrian women refugees	None	(i) Length: 20 weeks (ii) Number of sessions: 1 per week (iii) Number of session participants: on average 7 at every workshop visit (iv) Personnel involved: research staff	Quasi-experimental exploration study Study collected information on demographics, motivations and benefits of gardening, gardening productivity, and depression scores Quantitative: Beck depression inventory questionnaire Qualitative: group interviews	Health benefits: mental health Food safety Nutrition Education: gardening skills Social connections
Tembo and Louw [74]	Two CGs named Fazek and Scaga (Siyazama community allotment gardening association), located in Cape Town Metropole, South Africa	Gardeners: N=15 Fazek: N=6 Age: not stated Gender: females (n=5) and males (n=1) Scaga: N=9 Age: >60 years Gender: all females (n=9) Urban poor communities	None	(i) Length: 12 weeks (ii) Number of sessions: once a week	Qualitative study Study collected information on demographics, health benefits, nutritional needs, and views on gardens Qualitative: participant observation and semistructured and focus group interviews	Food safety Nutrition Cost benefits Social connections Health benefits: physical health
Tigere and Moyo [75] (2022)	A CG in a local municipality in Limpopo province, South Africa	Gardeners: N=21 Age: mean age 35.7 years (females: mean age 35 years and males: mean age 36.5 years) Gender: females (n=11) and males (n=10) Persons with disabilities (paraplegics and hemiplegics)	None	(i) Personnel involved: 2 management personnel	Qualitative case study design Study collected information on demographics and benefits of gardening for people with disabilities Qualitative: face-to-face interviews	Cost benefits Education: gardening skills Source of employment Social connections Health benefits: mental health Accessibility and participation constraints
Truong and Gray [12] (2022)	CGs in six social housing communities within Greater Sydney, NSW, Australia	Gardeners: N=42 Age: mean 59 years (range: 29–83 years) Gender: females (n=26) and males (n=16) Culturally, linguistically, and socioeconomically diverse communities	None	(i) Length: 7 months (ii) Personnel involved: research staff	Qualitative study Study collected information on demographics, experiences, and impact of CGs, perceived benefits, and suggestions or recommendations Qualitative: semistructured focus group interviews Not specified	Education: gardening and life skills Connection to nature Social connections Social awareness
Vibert [76] (2016)	A Hleketani CG in Limpopo province, South Africa	Gardeners: N=27 Age: >45 years Gender: females (n=27) Low SES/income groups	None	Not specified	Study collected information on demographics, impact on employment and poverty, and health benefits Qualitative: direct quotes reported from interviews	Cost benefits Social connections Health benefits: physical and mental health Education: life skills

TABLE 2: Continued.

Author and year	Settings	Description of the sample	Comparators	Intervention [†]	Study methods	Findings*
Wang and Glicksman [77]	Three low-income housing sites in North and West Philadelphia, USA	Gardeners: N = 20 Age: mean 71.5 years Gender: 70% females and 30% males Older adults living in 3 low-income housing sites and ethnically diverse: African Americans (88.2%), Hispanic (5.8%), and biracial/multiracial (5.8%)	None	(i) Personnel involved: building staff or management of the site	Mixed-method research Study collected information on demographics, reason for gardening, and health benefits Qualitative: semistructured and focus group interviews	Health benefits: physical and mental health Social connections Education: life skills Nutrition Cost benefits

[†]All studies were assessed for curriculum, length of sessions, number of sessions, duration of sessions, number of participants in each session, personnel involved, and intensity of physical activity in sessions. Studies which had information on these measures were reported in the table. * Certain themes were identified in the included studies and have been described narratively in the results section.

(SES) or socioeconomically disadvantaged. Fifteen studies included participants from various ethnically and culturally diverse backgrounds ranging from Africa, Asia, South America, the Middle East, and Russia. One study [67] included only Aboriginal participants in Canada, while one study [54] included a mix of participants from First Nation and minority groups in Canada. One study [75] included persons with physical disabilities. Seven studies included refugees and asylum seekers from culturally diverse backgrounds, while two studies solely included homeless women. Three studies primarily included African American participants with low SES. Lastly, four studies included older participants and/or participants with disability from multicultural and low socioeconomic-status backgrounds.

3.3. Critical Appraisal. The CASP quantitative study appraisal scores varied, though two [50, 64] out of the total five studies scored ten from a possible CASP score of 12. Due to limited quantitative analysis within the studies, most of the studies could not score perfectly (see Supplementary Appendix 2 for CASP appraisal scores). All the studies had a clearly focused question, and the results were considered reliable. Most studies scored poorly on the identification of important confounding factors and precision of results.

The CASP qualitative study appraisal scores also varied, though eleven studies [41, 57, 58, 60, 62, 66, 67, 71] out of a total of twenty-eight studies scored eight or more from a possible CASP score of 10. Only one study took into consideration the influence of the researcher and participant relationship on the study outcomes (see Supplementary Appendix 3 for CASP appraisal scores). All included studies had clear aims and used appropriate methodologies except one study [65] which did not provide any description of the data collection method, sample selection and recruitment, and analytical methods used. Most studies did not adequately report how they addressed ethical issues such as informed consent in recruitment, which also restricted their CASP scores.

Besides undertaking the critical appraisal of the included studies using the CASP tool, the investigators identified an important limitation in fifteen included studies [41, 49, 52–56, 60, 65, 68–70, 72, 74, 76]. These 15 studies did not report on receiving ethical approval to conduct their respective study despite some of these studies involving young children.

3.4. Narrative of Interventions and Study Findings

3.4.1. Identified Benefits of Community Gardening for Vulnerable Populations. Every study, except the one by Shisanya and Hendriks [70], found wide-ranging positive benefits of community gardening among vulnerable target groups, while Shisanya and Hendriks [70] reported improved food safety as the sole benefit of community gardening. The reported results in terms of benefits of community gardening were grouped into the following categories (described in order with most prevalent benefit first): “social connection,” “health,” “education,” “nutrition,”

“cost benefits,” “cultural awareness and/or connection,” “connection to the nature,” “food safety,” and “area development and safety” (see Table 2). Only one study [70] conveyed no beneficial outcome following participation in community gardening. This study established no improvement in food security among low-income households from community gardening. Furthermore, one study [75] reported community gardens serving as a source of employment for some participants but also identified accessibility and participation constraints (due to participants’ physical disabilities) along with undesirable social cohesion with the garden managers.

(1) Studies Reporting Outcomes on Social Connection Benefits. The majority of studies ($n=29$) [12, 41, 42, 48–57, 59–64, 67–69, 71–77] reported a positive influence of community gardening towards developing social connections with families, neighbours, and fellow gardeners. For example, Gerber et al. [56] examined various dimensions of social support based on the “Medical Outcomes Study Social Support Survey” (MOSS SSS) [79]. Compared to non-gardeners, gardeners articulated greater social support (with moderate to large effect size), tangible social support (with a large effect size), emotional/informational social support (with a medium effect size), and positive social interaction (with a large effect size), respectively. Furthermore, Bussell et al. [51] discovered 50% of the participating gardeners recounted better community connection and 61% developed new friendships during the program. Additional outcomes reported across the abovementioned studies were a medium to meet and interact with family and friends, build relationships, experience feelings of community, improved community cohesion, ability to resolve disputes, develop a social support system within community, and an inclusive space for a diverse range of people.

(2) Studies Reporting Outcomes on Health Benefits. Twenty-two studies described outcomes on health benefits of participants engaged in community gardening. The studies reporting on this dimension addressed several outcomes: an improvement in both mental and physical health [49, 51–53, 56, 57, 59–61, 64, 66, 71, 76, 77], only mental health gains [48, 50, 54, 62, 68, 73, 75], and finally physical health improvements [74]. Based on the quantitative research design, the study by Armstrong [49] reported 75% of participants had an enhancement of their mental health and 70% had an improvement in their physical health following their participation in community gardening. Bussell et al. [51] found after participation in gardening, 65% of the gardeners felt mentally relaxed and 58% felt advancement in their overall health. Strout et al. [71] reported participation in gardens led to a 10% positive difference in participants’ distress and cognitive health based on the Mini-Mental State Examination (MMSE) assessment tool [80]. In relation to qualitative studies, all studies displayed varying health benefits from gardening ranging from participants feeling relief, happiness, alleviation of mood, psychological boost, improvement in depression, avenue for exercise, stretching, and physical activity.

(3) *Studies Reporting Outcomes on Educational Benefits.* A total of 22 studies reported a positive impact of community gardening on the education of gardeners [12, 41, 49, 50, 54, 56–59, 62–69, 72, 73, 75–77]. The educational outcomes were categorised into life skills, gardening skills, and academic performance, respectively. Eleven studies [41, 49, 50, 54, 56, 57, 59, 67, 72, 76, 77] reported a positive impact on participants' life skills; six studies [12, 58, 62–64, 66, 69] conveyed a positive impact on both life skills and gardening knowledge; one study showed a positive impact on academic performance [65]; one study [68] recounted a positive impact on both life skills and academic performance; two studies [73, 75] reported a positive impact on participants' gardening knowledge and/or skills.

In terms of benefits in life skills, Armstrong [49] discovered 51% of participants stated gardening improved their attitudes about their neighbourhood and 33% felt that gardening played a role in addressing neighbourhood issues. Booth et al. [50] observed statistically significant differences ($F=3.18$, $p=0.045$) in individual empowerment among three participant groups, regular gardeners, occasional gardeners, and nonparticipants. Other reported life skills acquired through community gardening were gardeners serving as a relational teacher in terms of how an individual should live, share, and care for others [54]. Also, gardeners identified improved communication, empowerment, autonomy, self-efficacy, sensory awareness, mindfulness, and leadership skills [56, 57, 59, 67, 72, 76, 77].

In terms of benefits in gardening knowledge, Grier et al. [58] showed a significant improvement in preinterventional and postinterventional gardening knowledge (effect size = 0.33, $p=0.01$). Other studies reported gaining knowledge and skills of gardening, learning about economic benefits of harvested foods as outputs for income means, and increased knowledge of fruits, vegetables, and traditional foods [62–64, 66, 69]. McArthur et al. [65] explored the impact of gardening projects on academic learning of youth aged 6–13 years during summer 2007, fall 2007, and spring 2008. The study found that gardening activities positively influenced children's academic performance. In comparison to public school system grades, the participating youths' grades increased in science, mathematics, language, and reading. Pierce and Seals [68] uncovered a similar positive impact of gardening on life skills and academic performance.

(4) *Studies Reporting Outcomes on Nutrition-Related Benefits.* Fifteen studies identified nutritional benefits of community gardening ranging from improved access to healthy foods, increase in availability, and/or intake of healthy foods [48, 50, 55, 56, 58, 51, 60, 62–64, 67, 71, 73, 74, 77]. Algert et al. [48] discovered that after harvesting vegetables in their gardens, there was a twofold increase in the vegetable intake of community gardeners (i.e., from 2.0 cups/day to 4.0 cups/day, 2.0 ± 0.8 additional cups/person/day). Booth et al. [50] compared fruit and vegetable intake between three groups: nonparticipants, occasional participants, and regular participants. The study found a higher intake of fruit and vegetables among regular and occasional participants in

comparison to nonparticipants, with statistically significant differences across the three participant groups in vegetable intake ($F=3.30$; $p=0.04$). Hartwig and Mason [60] described an increase between the preseason and postseason surveys for the question “do you eat fruits and vegetables throughout the day.” Initially, 64% respondents stated that they ate fruit and vegetables throughout the day, and this increased to 78% by the end of the season. Bussell et al. [51] conveyed that 90% of participants felt that not only had their household diet improved, but they had also eaten more fresh fruit and vegetables since they started to grow their own produce. Some studies uncovered that many community gardeners reported that their produce was of higher quality, organic, and tasted much better than store-brought produce [48, 60, 77]. Some other nutritional benefits identified were that community gardening enabled gardeners and their households to learn to eat healthy foods, develop food skills, eat new foods, and/or eat more fruit and vegetables, respectively [55, 63, 67, 74]. In contrast, one study [70] found community gardening had no impact on participants' food intake, with 72% of participating households reporting that they still consumed poor-quality food.

(5) *Studies Reporting Outcomes on Cost Benefits.* Nine studies reported financial benefits and/or cost savings because of community gardening [48, 49, 51, 52, 60, 62, 64, 74, 75, 77]. This aspect is important considering its potential significance in low-income communities. In terms of cost savings, participants in different studies disclosed their estimated savings were from as low as \$25 to as high as \$84 in a month or season [48, 51, 60]. Hartwig and Mason [60] interviewed immigrants and refugees from Asia and sub-Saharan Africa based in the USA and reported that 92% of participants stated they spent less money on food and that the majority (61%) shared that they saved around \$25 during the gardening season. A study by Bussell et al. [51] also found significant cost savings from gardening among low-income, ethnically diverse groups based in the USA. For instance, 78% participants reported savings in their grocery bills, ranging from <\$39 to \$60. Some (12.5%) participants, besides self-consuming the produce, sold some of their produce to buyers, hence gaining income from it. Similarly, using produce from gardening as an income supplement was conveyed by 10% of gardeners in a study by Armstrong [49].

(6) *Studies Reporting Outcomes on Cultural Awareness and/or Connection Benefits.* Six studies reported a positive influence of community gardening on raising cultural awareness and/or developing cultural connection among gardeners [42, 52, 54, 56, 64, 72]. For instance, Datta [54] implemented cross-cultural gardening activities for gardeners from First Nations and minority groups from Canada and reported the development of decolonisation and reconciliation skills among participants. The activities allowed participants to directly engage with their First Nation elders and story holders and hear stories of colonisation in their region to get an understanding of it. Furthermore, other studies (e.g., [42, 52, 56]) found gardening provided participants an opportunity to connect with their own cultural

roots and also develop an understanding of other cultures. Participants from Bhutan and Nepal, for example, often discussed memories and exchanged stories from their home counties [56].

(7) *Studies Reporting Outcomes on Connection to Nature Benefits.* Seven studies reported a positive impact of community gardening on establishing a connection with nature [12, 49, 52, 53, 59, 62]. All of these studies highlighted that participating in gardening provides a source of contact and relationship with nature and its beauty. In addition, Armstrong [49] stated that 70% of participants felt that gardening allows them to enjoy open space or nature.

(8) *Studies Reporting Outcomes on Food Safety Benefits.* Three studies explored the impact of community gardening on food safety [12, 70, 74] with two studies [70, 74] based in South Africa explored the impact of community gardening on food safety. Tembo and Louw [74] conveyed one of the major achievements of their community gardening project was that it enabled gardeners to combat hunger by improving access to food for their households. In contrast, Shisanya and Hendriks [70] reported 89% of households participating in community gardening remained anxious about food supplies, were severely food insecure, and consumed inadequate food based on the Household Food Insecurity Access Scale [81]. The study concluded that community gardens were not able to solve the specific issue of food insecurity in low-income households based in the rural area of KwaZulu-Natal, South Africa.

(9) *Studies Reporting Outcomes on Area Development and Safety Benefits.* Only one study explored the impact of community gardening on area development and neighbourhood safety [49]. Participants discovered that community gardens create a sort of neighbourhood watch which helps them look out for each other in the context of a high crime rate area and that a neighbourhood association was also established. Furthermore, following the setup of community gardens, the adjoining area was developed with new sidewalks, tree plantations, landscaping, parks, and playgrounds [49].

(10) *Studies Reporting Outcomes on Enhanced Employment.* Only one study reported the benefit of employment creation through community gardens [75]. All study participants had physical disabilities, but they were employed informally at the garden and received monthly stipend based on the sales of the produce. Such arrangements gave the participants a sense of work responsibility and working according to employment codes.

3.4.2. *Identified Characteristics of Community Gardening as an Intervention for Vulnerable Populations.* Twenty-four studies reported limited or no information in terms of how community gardening was used as an intervention for improving the health and wellbeing of vulnerable population groups. Of the remaining nine studies, two studies [50, 54]

provided limited information on the intervention characteristics, that is, only curriculum related details, while seven studies [57, 58, 64–67, 71] provided descriptive information on various components of the intervention categorised as curriculum, length, the number of sessions, duration of each session, the number of participants in each session, and the personnel involved (see Table 2). In terms of curriculum, of the seven studies, only one [58] used a validated curriculum. Grier et al. [58] adapted the community gardening educational material from the Junior Master Gardener curriculum [82] and incorporated nutrition-focused lessons (taken from the US Department of Agriculture's MyPlate website [83] to align it closely with social cognitive theory [84]). Furthermore, the lessons were modified to create cultural relevance for the participants. The most cited intervention characteristics were that of personnel involved, the number of sessions delivered, and the length of the sessions. The reporting of these details, however, was scant, with only 13 out of 29 (45%), 14 out of 29 (48%), and 12 out of 29 (41%) of studies, respectively, providing such details which would facilitate future intervention replication or critique. In relation to the secondary aim of the present review (that is, to evaluate the association between program characteristics and outcomes of community gardening), considering only seven out of the total 29 included studies reported certain program characteristics. Therefore, there is limited information on how program characteristics can influence a positive change in vulnerable individuals or groups involved in community gardening.

3.4.3. *Association between Program Characteristics and Positive Life Outcomes.* As mentioned previously, only seven studies [57, 58, 64–67, 71] provided detailed information on the respective program characteristics (see Table 2). However, most of the information related to the program characteristics varied between the studies, thus limiting the understanding of which program characteristics might lead to positive life changes among participants involved in community gardening. Nonetheless, it is suggested that length of the community gardening intervention may potentially influence positive outcomes among the study participants. For instance, a study by Martin et al. [64] ran the intervention for a period of two–five years and reported multiple positive outcomes such as improvement in health and wellbeing, educational skills, nutrition, social and cultural connections, and financial costs.

4. Discussion

This systematic review is the first attempt to identify what type of positive changes were experienced by vulnerable participants engaged in community gardening and key program characteristics associated with such a change. Previous reviews published in the English language focused solely on the benefits of community gardening more generally and did not apply to disadvantaged groups specifically. Collectively, the included studies provide important information on the extensive benefits of community gardening

for vulnerable populations. The systematic review, however, identifies limitations in methodological rigor and breadth of intervention description which restricts future replication.

In terms of origin of studies, of the 33 studies, the majority ($n = 27$) were conducted in high-income countries except for five studies [62, 70, 74–76] that were conducted in an upper middle-income country and one study was [73] conducted in a lower middle-income country. This may reflect the limited scope of employing community gardening to alleviate the health and wellbeing of vulnerable populations based in lower middle- and low-income countries across the globe [85]. It may also be the result of the inclusion criteria which specified that studies must be published in the English language. Furthermore, this review highlights significant recent interest in community gardening and its benefits focusing primarily on vulnerable groups since most of the included studies ($n = 29$) have been published within the last decade. Women were substantially overrepresented in studies compared to men, while the main criteria for vulnerability depicted in the studies included low socioeconomic-status and cultural diversity.

The included studies suggested that community gardening provides a multitude of positive benefits for vulnerable and marginalised individuals. In order of most to least frequently cited outcomes, community gardening was shown to improve social connection, health, education, nutrition, cost benefits, cultural awareness and/or connection, connection to nature, food safety, area development and safety, and employment. An enhancement of social connection was the most prevalent finding (29 out of 33 studies), followed by health and education (22 out of 33 studies), and nutrition (15 out of 33 studies).

These findings are consistent with the literature that highlights the positive influence of community gardening on health and wellbeing of the general population [30, 43–45] and social and economic benefits [32–37]. The systematic review extends current knowledge by focusing specifically on vulnerable populations and considering outcomes beyond just health and wellbeing unlike other recent reviews, e.g., [28]. Here, a relative emphasis on benefits to social connections, education, and nutrition is apparent for vulnerable populations in comparison to reviews considering the general population. Given the widening inequity experienced by vulnerable populations [5, 6] comparatively, this new knowledge is timely to influence community policy and practice.

In relation to the association between specific characteristics of community gardening programs and positive life outcomes, this review could not clearly identify any specific program characteristic that would enhance the impact of community gardening on participants' lives. The probable reasons might be heterogeneity in the study settings, population, and assessment methods; similar findings have been reported by previous reviews on this topic [30, 44, 45]. Furthermore, most of the studies did not follow any validated or recognised community gardening curriculum with defined parameters. Hence, it was difficult to compare the program characteristics across the included studies.

The variability in terms of participants, settings, study design, and assessment methods was the likely reason for a high level of heterogeneity among the included studies. Moreover, the quality assessment of most studies was measured to be moderate, which indicates the need for improved methodological rigor in future research. These limitations have also been acknowledged in previous reviews [43–45, 86]. In fact, the current review identified that only two out of the 33 studies employed a comparator and that only one study utilised a pre-postintervention design with no control group. Although the findings of the systematic review are encouraging, the employed methodologies are unable to attribute positive outcomes specifically to participants' engagement in community gardening. Furthermore, with 22 studies reporting limited or no information about the community gardening intervention, policymakers and practitioners have reduced capacity to capitalise on the research to replicate program characteristics that have demonstrated positive outcomes for vulnerable populations.

5. Conclusion

This systematic review represents a landmark study as it is the first to evaluate what outcomes are evidenced for vulnerable populations following their participation in community gardening. The narrative synthesis of the 33 included studies shows that all studies reported positive outcomes of community gardening for participants, with the most frequently cited benefits being in areas of social connection, health, education, and nutrition. Hence, the review findings have the capacity to assist policymakers and practitioners to leverage existing benefits of community gardening to better address health and social inequities for vulnerable populations

While the findings are encouraging, the review aim of identifying program characteristics associated with a positive impact was not achieved. More can be done to inform and guide the implementation of community gardening for the benefit of vulnerable communities. Researchers are urged to strengthen evidence available by employing methodologies that utilise comparator groups or pre-post designs and provide practitioners with comprehensive program descriptions to allow the replication of evaluated programs.

Data Availability

No underlying data were collected or produced in this study.

Additional Points

What Is Known about the Topic? (1) Community gardening results in positive benefits for the general population. (2) There is limited knowledge about the benefits experienced by vulnerable populations. (3) Program developers have scant advice about what program characteristics are crucial to realise the inherent benefits for participants. *What This Paper Adds.* (1) Community gardening benefits vulnerable populations by increasing social connection, education

attainment, and nutritional intake. (2) Studies provide limited information and identification of characteristics of community gardening programs limiting the translation of research to practice. (3) The quality of the methodological designs on this research topic is moderate; thus, there is a pressing need to improve the robustness of design to strengthen the evidence.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Supplementary Materials

S1: EBSCOhost search output. A full list of search terms used to search the electronic databases. S2: CASP assessment for quantitative studies. S3: CASP assessment for qualitative studies. The Critical Appraisal Skills Program (CASP) checklist [78] was used to assess the methodological quality of both qualitative and quantitative studies. (*Supplementary Materials*)

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