

Community gardens and wellbeing amongst vulnerable populations: a thematic review

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Summary

The aim of the thematic review is to document the effects of community gardens on wellbeing amongst vulnerable populations. We searched for articles published between 1980 and 2017 in major databases resulting in the inclusion of 51 articles. Vulnerable populations included, amongst others, ethnic minorities and refugees, socioeconomically disadvantaged neighbourhoods or low-income or food insecure families. Our findings suggest that community garden participation may have a positive impact on physical health, such as reducing body weight and hypertension, and increasing physical activity and food knowledge. However, findings relating to community gardens and their potential to enhance food security were inconsistent. Furthermore we found that community gardens can have a positive influence both at the individual level (i.e. self-esteem, independence, personal control, etc.), particularly for refugees; the relational and social level (i.e. relationships, social connections, community and neighbourhood). Community garden participation have the potential to enhance wellbeing amongst vulnerable populations. However, two articles in our review presented potential food safety concerns related to community gardens, indicating that, particularly in urban settings, attention must be given to minimizing potential food safety concerns, e.g. by using raised garden beds. Based on this review, we recommend that further research and evaluation on non-US-based community gardens is carried out, as community gardens are practiced globally but there is little research to document the effects of community gardens on wellbeing amongst vulnerable populations outside of the USA.

Key words: community gardens, wellbeing, health, vulnerable populations

INTRODUCTION

The connection between nature and wellbeing has been acknowledged for centuries (Kaplan and Kaplan, 1989) and in the 1980s, the WHO Ottawa Charter for Health Promotion recognized the importance of environments supportive of health (WHO, 1986). Community gardens (CGs) and urban agriculture have since spread across the world (<http://www.fao.org/soils-2015/news/news-detail/en/c/329009/>; <http://www.fao.org/urban-agriculture/en/>) with rationales of beautifying urban spaces,

building community and social capital, and promoting food security and health (Egli *et al.*, 2016).

In this review, we employ a broad definition of CGs, as open spaces managed and operated by members of the community in which food or flowers are cultivated (Guitart *et al.*, 2012). CGs are often seen as a positive solution to address social, health and environmental challenges (Hlubik *et al.*, 1994; Furnass, 1996; Kuo *et al.*, 1998; Saldivar-tanaka and Krasny 2004; Shinew *et al.*, 2004; Elings, 2006; Kingsley *et al.*, 2009;

Comstock *et al.*, 2010; Guitart *et al.*, 2012; Colding and Barthel, 2013; Harris *et al.*, 2014; Middle *et al.*, 2014). In this study, we review how existing research identifies a range of health and wellbeing benefits particularly for vulnerable populations (VPs). Wellbeing is a widely used term framed within different fields: from biological-, mental-, social, economic- and environmental wellbeing; to life satisfaction, spiritual or existential wellbeing (Australian Institute of Health and Welfare, 1998). Prilleltensky and Prilleltensky [(Prilleltensky and Prilleltensky, 2006), p. 12] define wellbeing as ‘a positive state of affairs, brought about by the synergistic satisfaction of personal, organizational and collective needs of individuals, organizations and communities alike’. Egli *et al.* (Egli *et al.*, 2016) developed a conceptual model of the benefits of CG participation on wellbeing within nutritional health and social environment/social health. VPs in this review, are defined as groups of people with common characteristics, who are likely to fall or remain below a certain welfare threshold due to factors outside their control [e.g. ethnicity, refugee status, lower socioeconomic status (SES), age and illness], and is linked to health, SES and food security perspectives, which put individuals at higher risk for food-, health- and economic vulnerability (FAO, 2004; https://www.who.int/environmental_health_emergencies/vulnerable_groups/en/).

Aim of the review

The aim was to identify effects of CG participation on health and wellbeing, specifically on VPs, and was conducted as part of a CG research and development project in Denmark. This review provides a solid background for expanding CGs and evidence-based recommendations related to upscaling CGs for VPs in Denmark and internationally. While there is a wealth of research on CGs, no global review of scientific literature related to the impact of CGs on health and wellbeing of VPs has been carried out.

MATERIALS

Scholarly peer-reviewed journal articles published between 1980 and 2017 focusing on the health and wellbeing benefits of CGs amongst VPs were included in this review to identify research past and present on CGs. The majority of articles were published after 2010. The selected 1066 articles were identified in PubMed, CINAHL, EMBASE and PsychInfo using these search term combinations: (‘CGs’ OR ‘urban gardens’ OR ‘gardens’ OR ‘urban agriculture’ OR ‘city farms’) AND (‘well being’ OR ‘quality of life’ OR ‘health’ OR ‘nutrition’ OR ‘food intake’ OR ‘eating habits’ OR ‘food

environment’ OR ‘food diversity’ OR ‘food security’ OR ‘physical activity’ OR ‘exercise’ OR ‘inactivity’ OR ‘lethargy’). Inclusion criteria included studies investigating participants affected by different vulnerability factors. Exclusion criteria included: (i) study type and quality (e.g. dissertations, conference papers, commentaries, review articles, trials, and non-original research, some of which with low-academic quality); (ii) garden type (e.g. residential-, prison-, hospital-, - home- and school gardens, which are closed settings, were excluded) and (iii) target group and theme (studies that did not focus on health, VPs and/or did not have human subjects/participants) (see Figure 1). Each article was included based on a read and re-read process by two members of the research team. After full papers were read, more studies were excluded based on these criteria. Some studies were further excluded due to low-academic quality (lack of methods, findings and/or peer review).

A total of 51 articles were identified and analysed by a read and re-read process where results were recorded and analysed thematically taking point of departure in Egli *et al.* (Egli *et al.*, 2016) and Prilleltensky and Prilleltensky’s (Prilleltensky and Prilleltensky, 2006).

FINDINGS

The majority of studies used quantitative methods ($n=21$), while qualitative and mixed methods were used to a lesser extent. Case study ($n=16$), intervention ($n=13$) and cross-sectional ($n=22$) study designs were identified (see Table 1).

Studies were conducted in North America ($n=41$), Europe ($n=4$), Australia ($n=3$) and Africa ($n=2$). VPs encompassed ethnic minorities (Australian Aboriginals, African Americans, Canadian First Nations, Hispanic or Latinos, Marshallese and Navajo people), refugees (African and Bhutanese and Karen), socioeconomically disadvantaged neighbourhoods, low-income or food insecure families, elderly, people living with disease and cancer survivors.

Effects on wellbeing

The definitions by Prilleltensky and Prilleltensky (Prilleltensky and Prilleltensky, 2006) and Egli *et al.* (Egli *et al.*, 2016) of wellbeing are used to analyse the studies combined with additional themes originating from the review of studies.

Health and nutrition

Physical health. Physical health findings included general health complaints, self-rated health, body weight,

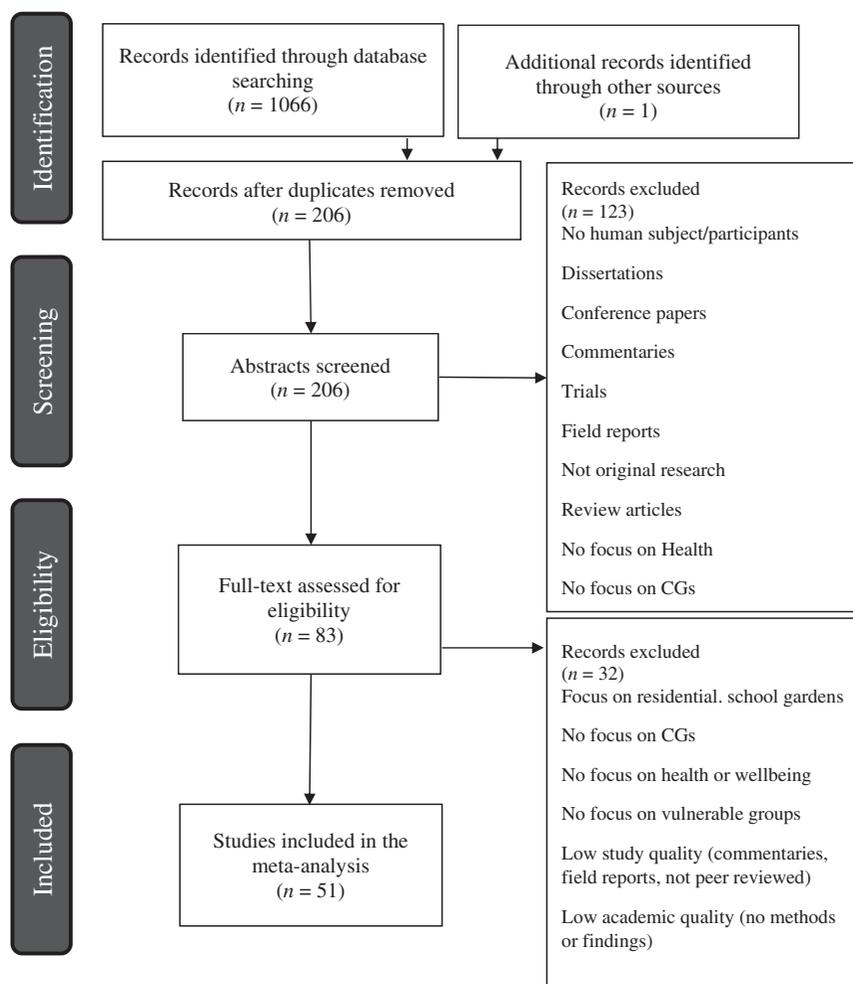


Fig. 1: Flow diagram for the selection process.

blood sugar levels and hypertension. Five articles presented positive findings relating to general health amongst various VPs, including ethnic minorities and low-income or socially disadvantaged areas (Austin *et al.*, 2006; Carney *et al.*, 2012; Roncarolo *et al.*, 2015; Spees *et al.*, 2015; Soga *et al.*, 2017). Contesting these findings, Litt *et al.* (Litt *et al.*, 2015) investigated the relationship between CG participation and self-rated health in a population-based study in Denver, Colorado and found that in both studies, CG participation did not directly predict higher self-rated health, but that the impact occurred indirectly by way of social involvement, aesthetics and collective efficacy. Four studies including ethnic minorities measured prevalence of overweight and obesity, or BMI and CG participation, all of which indicated a decrease in prevalence of overweight and

obesity, or BMI (Castro *et al.*, 2013; Zick *et al.*, 2013; Barnidge *et al.*, 2015; Baker *et al.*, 2016).

Physical activity. Findings related to physical activity included results from studies that measured both physical activity and physical fitness amongst elderly, refugees, ethnic minorities and lower SES individuals (Austin *et al.*, 2006; Wakefield *et al.*, 2007; Kaiser and Baumann, 2010; Gichunge and Kidwaro, 2014; Zanko *et al.*, 2014; Haynes-Maslow *et al.*, 2015; Camps-Calvet *et al.*, 2016; Mangadu *et al.*, 2017). One intervention found that CG participation increased physical fitness amongst elderly, while three studies concluded that amongst refugee and minority populations, CGs were perceived as a good opportunity to engage in physical activity.

Table 1: Synthesis of article review and thematic analysis of wellbeing

Author, year	Population	Setting	Study design	Results (key outcomes)	Theme
Alaimo <i>et al.</i> , 2008	N=766 (adults) African American (61.5%), Caucasian, other. Female (50%)	Flint, MI, USA Urban	Cross-sectional, quantitative, population-based telephone interview, behavioural risk factor surveillance system	↑ fruit and vegetable consumption	D
Armstrong, 2000	N=20 (CG programmes)	Upstate New York, USA	Cross-sectional, quantitative, survey	↑ access to fruits and vegetables	FS
Austin <i>et al.</i> , 2006	N = 6 (older adults) Female (50%)	Upstate New York, USA	Intervention, quantitative, Dartmouth COOP Functional Health Assessment Charts, Geriatric Depression Scale	↑ overall health ↑ physical fitness ↑ social activities	PH, PA, RSC
Baker <i>et al.</i> , 2013	N = 50 (adults) African American (86%) Female (74%)	MI, USA Rural	Cross-sectional, mixed methods, survey, focus groups	↓ money spent on food ↑ fruit and vegetable consumption ↑ dietary diversity ↓ less fast food ↑ awareness of food	FS, D, FK
Baker <i>et al.</i> , 2016	N = 794 (adults) African American Female (65%)	Pemiscot and Dunklin County, USA Rural	Intervention (quasi-experimental cross-sectional), quantitative, Transtheoretical model of self-rated behaviours, behavioural risk factor surveillance system	↓ in prevalence of overweight and obesity ($p<0.01$). ↓ in mean systolic blood pressure ($p=0.09$). However, not associated with level of participation in CGs. ↑ likelihood to eat more fruits and vegetables. ↓ consumption of fast food & processed food. ↓ spending on food. ↑ ability to provide for their families/themselves.	PH, D, FS
Barnidge <i>et al.</i> , 2015	N = 794 (adults) African American Female (65%)	Pemiscot and Dunklin County, USA Rural	Intervention (quasi-experimental cross-sectional), quantitative, survey, Behavioural Risk Factor Surveillance System, Transtheoretical Model	↓ hypertension in intervention county (61.0–45.0%) ($p<0.01$). ↓ prevalence of overweight and obesity in intervention county (69.8–60.9%) ($p<0.01$) ↑ odds of eating five servings of fruit and vegetables daily (3.06)	PH, D
Barnidge <i>et al.</i> , 2013	N = 1141 (adults) African Americans (35%), Female (73%)	MI, USA Rural	Cross-sectional, quantitative, population survey	↑ fruit and vegetable consumption ($p=0.0088$) ↓ money spent on food ↓ fast food consumption	FS, D
Brown-Fraser <i>et al.</i> , 2015	N = 13 (adults) African American (70%)	Baltimore, MD, USA Urban	Intervention, mixed methods	↓ money spent on food ↓ consumption of fast food ↑ fruit and vegetable consumption	FS, D
Camps-Calvet <i>et al.</i> , 2016	N = 27 (gardens)	Barcelona, Spain Urban	Case study, mixed methods, semi-structured interviews, face-to-face interviews	Gardeners perceive CGs to provide a wide range of ecosystem services, including providing a place for exercise and physical recreation.	PA
Carney <i>et al.</i> , 2012	N = 38 (families) Hispanic, Latino	Columbia River Gorge, OR, USA Rural	Intervention, mixed methods, interviews and observations	↑ physical health benefits ↓ frequency of 'sometimes' and 'frequently' worrying in the past month that food would run out	PH, FS, D

(continued)

Table 1: (Continued)

Author, year	Population	Setting	Study design	Results (key outcomes)	Theme
Castro <i>et al.</i> , 2013	N = 60 (families) Female (51%) Latino, low-income	North Carolina, USA	Intervention, quantitative, pre- and post-measures	before money was available to buy more (31.2–3.1%) ↑ vegetable intake of ‘several times a day’ for adults (18.2–84.8%, $p < 0.001$) and children (24.0–64.0%, $p = 0.003$) ↓ BMI amongst overweight or obese children ↑ fruits consumed on a typical weekday increased by 28% ($p < 0.001$) ↑ vegetables consumed on a typical weekday increased by 33% ($p < 0.001$)	PH, D
Comstock <i>et al.</i> , 2010	N = 1154 (adults)	Denver, CO, USA Urban	Cross-sectional, quantitative, survey, observations	↑ neighbourhood attachment	CN
Cyzman <i>et al.</i> , 2009	N = (not reported) Low-income, African American, Latino communities	Greater Grand Rapids, MI, USA Urban	Intervention, mixed methods	↑ access to low-cost and fresh fruits and vegetables	FS
Fish <i>et al.</i> , 2015	N=48 (adults) African American, Latino Female (100%)	Forsyth County, GA, USA Urban	Case study, qualitative, semi-structured interviews	↑ food access	FS
Gerber <i>et al.</i> , 2017	N=50 (adults) Bhutanese and Karen Refugees Female (62%)	USA	Cross-sectional, mixed methods, survey, patient health questionnaire-15, adapted client assessment tool, semi-structured interviews	↑ sense of independence and self-efficacy ↑ social support [$t(48) = 2.47$, $p = 0.017$] with a moderate to large effect size [$d = 0.70$; 95% CI (0.12, 1.27)] ↑ opportunities to develop new relationships ↓ frequency of social interactions	I, RSC
Gichunge and Kidwaro, 2014	N=13 (adults) African Refugees Female (85%)	South East Queensland, Australia	Case study, in-depth interviews	↑ opportunities to engage in physical activity ↑ access to traditional foods ↓ spending money on food ↑ self-worth ↓ stress	PA, FS, I
Grier <i>et al.</i> , 2015	N=43 (children and youth) African American, Public Housing Female (54%)	Dan River Region, VA, USA Urban	Intervention, mixed methods, survey, interviews	↑ fruit and vegetable asking self-efficacy ↑ knowledge of dietary recommendations	FK
Hale <i>et al.</i> , 2011	N = 67 (adults) Hispanic/Latino (12%) African American (8%) Native American (2%) Female (64%)	Denver, CO, USA Urban	Cross-sectional, qualitative, in-depth interviews, focus groups	CGs encouraged healthy lifestyles by physically and socially connecting gardeners through relationships. CGs encouraged and support the expression of values, such as food, trust, accountability and the expression of beauty.	RSC
Harris <i>et al.</i> , 2014	N = 11 (adults) African Refugees	Logan City, Queensland, Australia	Case study, qualitative, semi-structured interviews	CGs provided opportunity to build connections with others.	I, RSC

(continued)

Table 1: (Continued)

Author, year	Population	Setting	Study design	Results (key outcomes)	Theme
		Urban, Suburban		↑ sense of belonging and connectedness.	
Hartwig and Mason, 2016	N=94 (adults) Bhutanese and Karen Refugees Female (65%)	Twin Cities, MN, USA Urban	Intervention, mixed methods, survey, focus groups	↑ number of participants consuming fruits and vegetables throughout the day, every day (64–78%) ↑ number of participants consuming more than one vegetable type per day, every day (59–67%) ↓ spending on food during the intervention (92% of participants) ↓ depression and bring them joy, and ↑ social support.	FS, D, I, RSC
Hatchett et al., 2015	N = 22 (adults) African American (75%) Female (25%)	Chicago, IL, USA Urban	Case study, mixed methods, survey, focus groups, interviews	↑ awareness of the relationship between food and health, and reported becoming more aware of their food choices.	FK
Haynes-Maslow et al., 2015	N = 13 (focus groups) African American	North Carolina, USA Urban/Suburban	Cross-sectional, qualitative, focus groups	CGs were perceived by participants to be a convenient method to get community involved in healthy behaviours, including physical activity and improving mental and physical health. Participants mentioned that CGs were an affordable strategy to obtain a wide variety of fruits and vegetables.	PA, FS
Huisken et al., 2016	N = 16 496 Population-based	Canada	Cross-sectional, quantitative, Canadian community health survey	Odds of food insecurity was not significantly associated with the use of gardens for food. 29% of adults in food-insecure homes reported using a home or community garden for food, compared to 44% of those in food secure homes.	FS
Hume et al., 2013	N=15 (gardens) Australian Aboriginals	Northern Territory, Australia	Cross-sectional, quantitative, survey	↑ diet diversity and quality.	D
Kaiser et al., 2015	N = 67 (adults) Hispanic/Latino (12%) African American (8%) Native American (2%) Female (64%)	Cleveland and Columbus, OH, USA Urban	Cross-sectional, qualitative, focus groups, soil sample collections	Long-term gardening can ↓ soil contaminants and their threat to food quality and human health, and ↑ access to fresh produce in low-income communities.	FSaf
Kaiser and Baumann, 2010	N = 20 (adults) Latino Female (55%)	Wisconsin, USA Rural	Case study, qualitative, focus groups	Findings found a need for resources such as CGs for physical activity.	PA
Kirkpatrick and Tarasuk, 2009	N = 484 (families) Low-income	Toronto, ON, Canada Urban	Cross-sectional, quantitative, survey, household food security survey	Few families who are food insecure utilize CGs. Of the sample populations, 10 families participated in CGs (2.1%), of which nine families were moderately or severely food insecure.	FS

(continued)

Table 1: (Continued)

Author, year	Population	Setting	Study design	Results (key outcomes)	Theme
Litt <i>et al.</i> , 2011	N = 436 (adults) Female (68%)	Denver, CO, USA Urban	Cross-sectional, quantitative, survey	↑ fruit and vegetable consumption amongst CG participants 56% of gardeners consumed F&V at least five times per day, compared with 37% who gardened at home, and 25% of non-gardeners	D
Litt <i>et al.</i> , 2015	N = 469 (households) Female (67%)	Denver, CO, USA Urban	Cross-sectional, quantitative, survey, neighbourhood audit	↑ social involvement, ↑ positive ratings of aesthetics ↑ increased times per day of fruit and vegetable consumption	PH, D, RSC
Lombard <i>et al.</i> , 2014	N = 31 (adults) Navajo, Native American	San Juan County, NM, USA	Case study, qualitative, focus groups	CGs may have a positive influence on diet.	D
Mangadu <i>et al.</i> , 2017	N = 139 (youth, adults) Minorities, USA–Mexican border	El Paso, TX, USA, and Las Cruces, NM, USA	Intervention, mixed methods, focus groups, interviews, surveys	CGs may have immediate positive effects on nutritional and psychosocial outcomes. CGs may increase dietary and nutritional knowledge, increase fruit and vegetable consumption, physical activity and amount of time spent with families.	
PA, D, FK, RSC					
Martin <i>et al.</i> , 2017	N = 223 (adults) Socially disadvantaged Female (75%)	Marseille, France Urban	Cross-sectional, quantitative, survey	CGs could encourage socio-economically disadvantaged women to adopt dietary practices that more closely meet dietary recommendations.	D
Milligan <i>et al.</i> , 2004	N = 19 (elderly) Female (32%)	Northwest England, UK Urban (deprived neighbourhood)	Intervention, mixed methods, focus groups, semi-structured interviews, diaries	Positive effect on wellbeing, relaxation and provides opportunity for social interaction and may relieve stress.	RSC
Milliron <i>et al.</i> , 2017	N = 411 (adults) African American (65%) Out-patients	North Carolina, USA Urban (high-poverty neighbourhoods)	Cross-sectional, survey	CGs may increase feeling of neighbourhood involvement. CGs were used to teach value of fresh produce and importance of vegetables in the diet.	CN
Ober Allen <i>et al.</i> , 2008	N = 26 (adolescents) African American (100%) Disadvantaged Youth	Flint, MI, USA Urban	Case study, qualitative, semi-structured interviews, observations, photos	↑ food and nutrition knowledge ↑ positive contributions to community ↑ relationships with adults and other youth ↑ interpersonal skills ↑ behavioural and cognitive competencies	FK, RSC
Puett <i>et al.</i> , 2014	N = 171 (adults) People living with HIV	Chipinge District, Zimbabwe Rural	Cross-sectional, quantitative, survey	↑ food consumption scores ↑ dietary diversity scores ↑ quality of life	D
Raske, 2010	N = 16 (elderly) Female (63%)	Midwest, IN, USA Rural	Case study, qualitative, interviews	↑ quality of life ↑ relationships with others	
Roncarolo <i>et al.</i> , 2015	N = 824 (adults) Female (32%) Vulnerable Populations	Quebec, Canada Urban	Cross-sectional, quantitative, survey	CGs may improve physical and mental health, and increase household food security	PH

(continued)

Table 1: (Continued)

Author, year	Population	Setting	Study design	Results (key outcomes)	Theme
Soga et al., 2017	N = 332 (adults)	Japan Urban/suburban	Cross-sectional, quantitative, survey	↑ perceived general health ($\beta=1.40$) ↑ social cohesion ($\beta=0.57$) negative effects on subjective health complaints ($\beta=-0.43$) and general mental health ($\beta=-0.91$) Furthermore, gardeners reported significantly better perceived general health and mental health, lower numbers of subjective health complaints and greater social cohesion.	PH, RSC
Spees et al., 2015	N = 28 (adults) Female (89%) Cancer-survivors	Ohio, USA Urban (Central Ohio Complimentary Cancer Survivor Garden)	Case study, mixed methods, focus group, survey	CGs may increase fresh produce intake, mental and physical health, and community support. May have a positive influence on health and wellbeing.	PH, CN
Spliethoff et al., 2016	N = 106 (children, adults)	New York, USA Urban	Case study, quantitative, survey	CGs may expose gardeners to high levels of Pb in New York City.	FSaf
Stroink and Nelson, 2009	N = 20 (youth, adults) Female (70%) First Nations	Northwestern Ontario, ON, Canada	Case study, mixed methods, survey, observations	CGs may increase food knowledge	FK
Teig et al., 2009	N = 67 (adults) Female (64%)	Denver, CO, USA Urban	Cross-sectional, qualitative, interviews, focus groups	CGs may have positive effect on social connections, reciprocity, trust, collective decision making, civic engagement and community building.	RSC, CN
Tsang et al., 2011	N = 35 (adults) Female (89%) Low-income, food insecure	Cobourg, ON, Canada Urban	Case study, qualitative, interviews	CGs may increase access to food	D
Wakefield et al., 2007	N = 55 (adults)	Toronto, ON, Canada Urban	Case study, qualitative, focus groups, interviews, observations	CGs may promote health, increase access to food, improve nutrition, increase PA and improve mental health. CGs may promote social health and community cohesion	D, PA, RSC, CN
Ward Thompson et al., 2016	N = 406 (adults) Female (55%) Low income	Scotland, UK	Cross-sectional, quantitative, survey	Green spaces, including CGs may reduce stress and social isolation.	I
Weltin and Lavin, 2012	N = 17 (adults) Female (47%) Marshallese, diabetic patients	USA Rural	Intervention, mixed methods, field observations	CGs may lower blood sugar levels and improve HgA1c levels through an increase in cardiovascular exercise and access to fresh fruit and vegetables.	PH
Wills et al., 2010	N = 19 (adults) Female (100%) Black South African Women	Johannesburg, South Africa Urban	Case study, qualitative, narrative interviews	↑ nutritional status of household ↑ access to fresh fruits and vegetables	FS, D
Zanko et al., 2014	N = 27 (adults)	Dan River Region, VA, USA	Case study, qualitative, semi-structured interviews, focus groups, demographic survey	CGs may increase knowledge and availability of fresh fruits and vegetables, increase physical activity, and influence eating habits	PA, FS, D, FK

(continued)

Table 1: (Continued)

Author, year	Population	Setting	Study design	Results (key outcomes)	Theme
Zick <i>et al.</i> , 2013	N = 423 (adults) Female (60%)	Salt Lake City, UT, USA	Cross-sectional, quantitative, survey	CGs may lower BMI and reduce odds of obesity and overweight	PH
Zoellner <i>et al.</i> , 2012	N = 154 (youth, parents) Female (50%) African American (47%)	Dan River Region, VI, USA	Intervention, mixed methods, survey, interviews	↑ willingness to taste fruits and vegetables	D

PH, physical health; PA, physical activity; FS, food security; D, diet; FK, food knowledge; FSaf, food safety; I, individual; RSC, relationships and social connections; CN, community and neighbourhood.

Food security. Fifteen articles had findings related to food security, focusing on food access, affordability and availability and included lower SES, or low-income families or communities; minorities (African Americans and Latinos) and refugees. Seven studies investigated the perceived benefits of CG participation, and suggested that CGs may provide greater access to food amongst refugees, Black South African, African American and American Latino women, and low-income individuals (Armstrong, 2000; Wills *et al.*, 2010; Tsang *et al.*, 2011; Zanko *et al.*, 2014; Fish *et al.*, 2015; Hartwig and Mason, 2016). Two studies from Michigan, USA and one from Queensland, Australia; showed a positive relationship between CG participation, and access and availability of fruits and vegetables (FVs) amongst African American and Latino communities, and African refugees, respectively (Cyzman *et al.*, 2009; Barnidge *et al.*, 2013; Gichunge and Kidwaro, 2014). Contrary to these findings, one population-based study in Canada, found that the odds of food insecurity was not significantly associated with the use of gardens for food, and that individuals in food insecure households were less likely to garden for food (Huisken *et al.*, 2016). Five studies indicated that to some degree, individuals who received FVs from a CG, also reported having spent less money on food (Baker *et al.*, 2013; Barnidge *et al.*, 2013; Gichunge and Kidwaro, 2014; Brown-Fraser *et al.*, 2015; Hartwig and Mason, 2016). However, one cross-sectional study in Toronto, Canada, indicated that low-income families often used other strategies to free economic resources and that very few families participated in community food programmes, including CGs, as a means to obtain food (Kirkpatrick and Tarasuk, 2009).

Diet. Findings related to diet varied from the consumption, of FVs, fast food, processed food, and/or sodium. Five studies conclude that, CGs may have a positive

influence on dietary habits (Wakefield *et al.*, 2007; Wills *et al.*, 2010; Lombard *et al.*, 2014; Zanko *et al.*, 2014; Martin *et al.*, 2017). A total of thirteen articles found a positive relationship between CG participation and FV consumption (Alaimo *et al.*, 2008; Litt *et al.*, 2011, 2015; Tsang *et al.*, 2011; Carney *et al.*, 2012; Baker *et al.*, 2013, 2016; Barnidge *et al.*, 2013, 2015; Castro *et al.*, 2013; Brown-Fraser *et al.*, 2015; Hartwig and Mason, 2016; Mangadu *et al.*, 2017). Four studies reported findings related to increased dietary diversity, primarily in terms of FVs (Hume *et al.*, 2013; Puett *et al.*, 2014; Baker *et al.*, 2016; Hartwig and Mason, 2016). Four studies conducted in the US found that CG participation had the potential to reduce fast food, processed food, and salt and/or sodium intake (Baker *et al.*, 2013, 2016; Barnidge *et al.*, 2013; Brown-Fraser *et al.*, 2015).

Food knowledge. Seven studies indicated that CG participation may increase food knowledge, which may have a positive influence on eating habits amongst both disadvantaged or minority, youth and adults, particularly in terms of dietary and nutritional knowledge (Ober Allen *et al.*, 2008; Baker *et al.*, 2013; Zanko *et al.*, 2014; Grier *et al.*, 2015; Mangadu *et al.*, 2017).

Food safety. Two studies investigating soil contamination and heavy metals included human participants (Kaiser *et al.*, 2015; Spliethoff *et al.*, 2016). Both investigated potential food safety concerns in urban areas, suggesting that gardening could expose gardeners to high levels of lead, but that long-term gardening can reduce these threats to food quality and human health (Kaiser *et al.*, 2015; Spliethoff *et al.*, 2016).

Individual, relational and social

Individual. Several studies documented a positive impact on wellbeing at the individual level; improved sense of

ownership, joy, self-worth, relaxation and independence; and reduced stress or depression were identified primarily amongst refugees in both the USA and Australia (Gichunge and Kidwaro, 2014; Harris et al., 2014; Hartwig and Mason, 2016; Ward Thompsen et al., 2016; Gerber et al., 2017).

Relational. On the relational level, wellbeing is understood as the individual being embedded in a network of positive and supportive relationships, and their ability to participate in social, community and political life (Prilleltensky and Prilleltensky, 2006). Thus, we have separated findings into two relationships and social connections; and community and neighbourhood.

Relationships and social connections. Twelve of the articles found that CGs helped to build relationships or increased social connections. Harris et al. (Harris et al., 2014) looked at how refugees in Australia used CGs as a means to connect to their new country, and found that it played a role in facilitating integration into society. Gerber et al. (Gerber et al., 2017) found that gardeners reported greater social support than non-gardeners, providing opportunities to develop new relationships. Hartwig and Mason (Hartwig and Mason, 2016), on the other hand, found that their quantitative results revealed a drop in the frequency of social interactions at the end of the study. Two studies found that CGs had a positive impact on social interaction and social activities amongst elderly people (Milligan et al., 2004; Austin et al., 2006).

Ober Allen et al. (Ober Allen et al., 2008) documented a positive relationship between CG participation and interpersonal skills, informal social control, and cognitive and behavioural competencies amongst disadvantaged youth. Mangadu et al. (Mangadu et al., 2017) conducted a CG intervention that included children and adults at the USA–Mexican border and found that CGs might have immediate positive effects on nutritional and psychosocial outcomes.

Litt et al. (Litt et al., 2015) found that garden participation significantly predicted greater social involvement., while Teig et al. (Teig et al., 2009) found that gardens promote social processes including social connections, reciprocity, mutual trust, collective decision making, civic engagement and community building. Hale et al. (Hale et al., 2011) found that CGs may encourage healthy lifestyles by physically and socially connecting gardeners. Lastly, Soga et al. (Soga et al., 2017) indicated that gardening had a positive effect on social cohesion.

Community and neighbourhood. Supportive of several of findings previously mentioned, Milliron et al. (Milliron et al., 2017) demonstrated that CG participation may enable citizens to be more involved in the neighbourhood. Participants in CGs felt that they were able to make positive contributions to their community, and facilitated community building. Comstock et al. (Comstock et al., 2010) examined the relationship between perceived neighbourhood conditions (i.e. crime, physical incivilities and sense of safety) and social processes, and recreational gardening and neighbourhood attachment and found that CG participation was associated with neighbourhood attachment. Spees et al. (Spees et al., 2015) focused on the benefits of CGs amongst cancer survivors, and found that it provided them a place for community support.

Vulnerable populations

Ethnic minorities

Nearly half of the articles ($n=25$) focused on ethnic minorities, primarily adults, and predominately investigated the relationship between CGs and diet ($n=14$). Many studies document that CG participation may increase FV consumption (Carney et al., 2012; Baker et al., 2013, 2016; Barnidge et al., 2013, 2015; Castro et al., 2013; Brown-Fraser et al., 2015; Mangadu et al., 2017; Alaimo et al., 2008); increase dietary diversity (Baker et al., 2013; Hume et al., 2013) and decrease fast food consumption (Baker et al., 2013; Barnidge et al., 2015; Brown-Fraser et al., 2015). Fewer studies documented findings suggesting that CG participation has the potential to increase food security (Kaiser and Baumann, 2010; Wills et al., 2010; Baker et al., 2013, 2016; Haynes-Maslow et al., 2015) and food knowledge (Stroink and Nelson, 2009; Baker et al., 2013; Hatchett et al., 2015; Mangadu et al., 2017), improve physical health (Barnidge et al., 2015; Baker et al., 2016) and improve relationships and social connections (Hale et al., 2011; Mangadu et al., 2017).

Refugees

Four articles focused on refugees, and suggest that CG participation can increase individual psychosocial outcomes, such as independence (Gerber et al., 2017), self-worth (Gichunge and Kidwaro, 2014), and sense of belonging (Harris et al., 2014), and can enhance relationships and social connections (Harris et al., 2014; Hartwig and Mason, 2016; Gerber et al., 2017). Two of these articles focused on Bhutanese and Karen refugees in the USA (Hartwig and Mason, 2016; Gerber et al., 2017),

and two articles focused on African refugees in Australia (Gichunge and Kidwaro, 2014; Harris *et al.*, 2014).

Socially disadvantaged individuals or households

Fifteen articles focused on low-income, food insecure or socially disadvantaged individuals, or deprived neighbourhoods, and seemed to focus on physical health in general ($n=2$), and diet ($n=5$), food security ($n=4$) and physical activity ($n=2$) more specifically. Most of these studies focused specifically on adults, while others focused on the family or community level. Amongst low-income adults, findings suggest that CG participation may improve physical health and lower BMI (Zick *et al.*, 2013; Roncarolo *et al.*, 2015; Soga *et al.*, 2017). CG participation may also increase FV consumption and improve nutrition amongst these target groups (Wakefield *et al.*, 2007; Litt *et al.*, 2011, 2015; Martin *et al.*, 2017). There were some discrepancies in findings relating to CGs' ability to enhance food security amongst low-income or food insecure households. It seems that CGs have the potential to increase food security, or at least access and availability of fresh FVs. Smaller CG interventions seem to reduce household food expenses, enable families to better provide for their families and increase access to fresh FVs. However, the number of households, population-wide, that actually take advantage of alternative food programmes seemed somewhat low, putting into question whether CGs aiming to increase food security, actually reach those in need.

Elderly

Only three studies focused exclusively on elderly. One study found that a CG intervention improved overall health and physical fitness amongst elderly in New York, USA (Austin *et al.*, 2006). A second study in the USA, and found that elderly reported an increased quality of life and relationships with others (Raske, 2010). Similar findings were found in a study in Northwest England that suggests that CG participation had a positive effect on wellbeing, relaxation and provided the opportunity for social interactions, which in turn, may relieve stress (Milligan *et al.*, 2004).

Individuals living with disease

Two studies focused on individuals living with disease. The first looked at adults living with HIV in rural Zambia, which found that community gardening had increased food consumptions and diversity scores, and may increase quality of life (Puett *et al.*, 2014). The second focused on Marshallese diabetic patients in rural USA (Weltin and Lavin, 2012). The results demonstrated that community gardening may lower blood

sugar levels and improve HgA1c levels through an increase in cardiovascular exercise, and access to fresh FVs.

DISCUSSION

This review provided an overview of the wealth of knowledge available on health and wellbeing related to CG participation amongst VPs. We found a large number of articles, with a wide variety of study designs and methods, resulting in difficulties in comparing results. However, there are some consistent results, especially on the link between CG participation, and the positive effect on relationship building and social connections, particularly where refugee and ethnic minority populations, disadvantaged youth and elderly are included.

While most of the studies were conducted on CGs in the USA, there is evidence that CGs are also a common practice globally, and the wide prevalence of CGs and urban agriculture across Europe has been documented (Keshavarz *et al.*, 2016; van der Jagt *et al.*, 2017). Given that the vast majority of the studies were conducted in the USA, and that CGs are context specific, we suggest that additional studies are carried out in more countries specifically on VPs.

Studies not published in English were excluded, which may explain why more studies and findings outside of North America and Australia were not identified. Key words such as 'Kitchen Gardens' and 'Home Gardens' were not included in the search process due to their lack of community access. However, including these terms might have provided more literature from the global community about their role in providing food security for a large cohort of vulnerable people. Selection bias may have occurred during the read and re-read process, however, the research team strived to reduce this risk by having first two researchers read the same abstracts to agree on the inclusion and exclusion of each abstract. Secondly, in the re-read phase full articles were read by additionally two researchers to further avoid selection bias.

CONCLUSION

The purpose of this review was to capture and document the variety of impacts that CGs can have on health and wellbeing amongst VPs. Within the health and nutritional environment, we identified positive findings relating to physical health, physical activity, diet and food knowledge. Within the social environment, CGs can have a positive influence on the individual level (i.e. self-esteem, independence, personal control, etc.) and on the

relational level (i.e. relationships and social connections, and community and neighbourhood). CGs seem to have the potential to address a number of health concerns and enhance wellbeing. Based on these findings, CGs can be a constructive venue for community-based and targeted health promotion initiatives for a variety of target groups including elderly, people living with disease and ethnic minorities. Gardens should be seen as a serious and effective approach to community health promotion practice and policy. However, to realize the full potential of CGs for VPs, health and social policy needs to provide a supportive environment for gardens and garden-based health promotion. Future research ought to focus on how to create better conditions and successful ways of reaching vulnerable groups, specifically socially disadvantaged groups through gardens. We recommend that future research identifies potential barriers, including not only formal barriers and opportunities but also the real barriers for vulnerable groups to participate, and examine conditions particularly supportive of garden-based health promotion.

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