



Review



Pandemic gardening: A narrative review, vignettes and implications for future research

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ABSTRACT

There is a significant amount of evidence highlighting the health, wellbeing and social benefits of gardening during previous periods of crises. These benefits were also evident during the COVID-19 pandemic. This paper presents a narrative review exploring gardening during the early stages of the COVID-19 pandemic to understand

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the different forms of gardening that took place during this crisis and key elements of this activity. Research about gardening during the pandemic focused on food (in)security and disrupted food systems, the health and wellbeing benefits of gardening, and the social dimensions of gardening. We offer three vignettes of our own research to highlight key insights from local, national and international perspectives of gardening during the pandemic. The paper's conclusion outlines how researchers, policy makers and public health practitioners can harness what has been learned from gardening during the pandemic to ensure these benefits are more widely available and do not exacerbate already entrenched health inequalities in society.

1. Introduction

During economic, environmental, public health, and political crises, gardening becomes an important activity to alleviate the challenges that come with abrupt and disruptive change (Mullins et al., 2021; Cerda et al., 2022; Purwanto et al., 2022). Gardening is a multifaceted activity that can take different forms (e.g., home, community and guerilla) representative of diverse cultural practices and geographical contexts (Alaimo et al., 2016; Kingsley et al., 2021). People turn to gardening for many different reasons (e.g., utilitarian, social, therapeutic) in their response to crisis events (Clarke et al., 2000; Partalidou and Anthopoulos, 2015; Daněk et al., 2022).

Myriad examples draw attention to gardening as both a top-down and grassroots response to the devastations of war or natural disasters and as a defiant expression of hope, empowerment, and resilience in the face of adversity (Lawson, 2005; Birky, 2009; Okvat and Zautra, 2014; Helphand, 2014; Gripper et al., 2022). During the two World Wars and the 1930s Great Depression, governments promoted gardening campaigns as a strategy for self-provision (Bassett, 1981; Gaynor, 2006; Ginn, 2012; Smith, 2013; Herrmann, 2015). Similarly, the demise of the Soviet Union and the difficult socio-economic transformation of the early 1990s mobilized an increase in successful organic practices and urban food growing in Cuba and some Eastern European countries (Altieri et al., 1999; Novo and Murphy, 2000; Caskie, 2000). During the economic recession of the 1970s, the organized resurgence of community gardeners in New York City illustrates the vital role of edible gardens for food provisioning, social capital, and the reclamation of disused urban land in low-income neighborhoods as an act of community empowerment (Lawson, 2005). In 2008, the global financial crisis led to a spike in requests for allotment garden spots, not only for food provisioning, but also for reducing stress and enhancing social relationships and ecological connectedness (Cohen, 2016; Schoen et al., 2021). Gardening is often a symbol for or response to sustainability imperatives in the face of issues such as global urbanization, dwindling food security, and supply chain challenges. Further, research shows that gardening can relieve anxiety, foster physical activity, nurture social interactions, mental wellbeing and inclusive spaces (Odeh et al., 2022; Fjaestad et al., 2023; Litt et al., 2023).

In this paper we aim to explore the multifaceted character of gardening during the COVID-19 pandemic through a synthesis of relevant literature on this topic during this period of time and three vignettes from our own research that help illustrate themes from the literature. We are 26 authors from ten countries (namely, Australia, Canada, Czechia, England, Germany, Japan, Netherlands, Sweden, United States and Wales) each involved in research relevant to what is increasingly described and termed as 'pandemic gardening' (Perks et al., 2022). Our engagement with other literature on pandemic gardening does not propose to be a systematic synthesis of all research on pandemic gardening globally. Rather we present a narrative review on pandemic gardening to provide deeper insight into how COVID-19 affected different experiences and types of gardening in different spatial and socio-economic contexts, predominantly in high-income countries. The narrative review approach is useful for synthesis, interpretation and critique of both grey and academic literature as it brings together diverse knowledges and approaches, and helps to build our understanding of a situation as it is occurring (Sukhera, 2022). Grey literature specifically

refers to evidence that is not published by commercial publishers but can be from academic, government and business sources, for example dissertations, presentations, reports and evaluations (Paez, 2017). Building an understanding on this specific topic is important because, as Cattivelli (2023) highlights, there is a gap in both grey and academic literature around gardening during the pandemic. Narrative reviews have been used to similar effect to highlight the importance of nature exposure for young people (e.g., Norwood et al., 2019). The research team met regularly over the period of December 2021 to March 2023 to explore key elements of gardening identified during the initial stages of COVID-19 in the literature (March 2020 until August 2022). We identified three key themes within the academic and grey literature on pandemic gardening: (1) food (in)security and food system disruptions; (2) health and wellbeing benefits of gardening; and (3) the social dimensions of gardening. We also explored literature highlighting the contexts of gardening that occurred during the pandemic. We have come together to write this narrative review because, although the COVID-19 gardening literature continues to evolve, a comprehensive summary of the topic is timely. At the same time, we acknowledge that the pandemic and its effects are far from over. Recommendations that flow from this paper will assist in informing future research on pandemic gardening and the interplay between urban agroecology and public health, particularly as many nations globally grapple with cost-of-living crises and growing food insecurities.

2. The COVID-19 pandemic

The COVID-19 pandemic that started in March 2020 in some ways resembled earlier health and economic disruptions in that it greatly affected both individual and social spheres on a large scale, changing patterns of social interaction almost overnight. These radical transformations contributed to diminished mental health and wellbeing as communities—and indeed entire nations—went into various stages of lockdown. The 24-hour news cycle coverage of escalating COVID-19 case numbers had the effect of amplifying anxiety and the sense of profound uncertainty (Cullen et al., 2020; Wahaj et al., 2022). These transformations increased social unrest and, in extreme circumstances even entrenched racism at an interpersonal and structural level (Mushangwe et al., 2021). Supply chain disruptions, empty shelves in supermarkets and sudden job losses also sharpened attention on food and economic security in new ways, while rapidly transforming day-to-day practices of food provisioning and consumption.

A defining aspect of pandemic lockdowns was "quarantine", as some describe it, which reflected a marked disruption of the prevailing temporalities by which daily life is structured for many—the rhythms of work and leisure (Irons, 2020). While essential workers continued to work outside the home, mandatory lockdowns and restrictive stay-at-home orders tied significant populations of people to their homes. Digital technologies meant that, for many, work and school invaded domestic life by blurring their conventional boundaries. However, many people reported having more time available to undertake non-work activities, such as cooking (Vittuari et al., 2021; Ronto et al., 2021).

"Quarantine" allowed many to encounter and engage with the rhythms of gardens in ways that were experienced by many as profoundly therapeutic (Donati and Rose, 2020; Marsh et al., 2021). It also

reflected a shift that has been referred to as “leisure-in-public”—that is, engagement in “activities that take place outside of the home in the view of others for eudaimonic (i.e., personal enrichment) and/or hedonic (i.e., pleasure) purposes” (Glover, 2022: 158). Glover (2022) explains that this behavior offered expressions of resilience, hope, and creativity in response to a public health crisis. The public expression of a collective desire to garden was evident across many countries, so much so that media headlines featured stories about seeds and seedlings selling out while many new gardeners turned to the internet for information on how to garden (Timmins, 2020; Lin et al., 2021; McCartney et al., 2022).

The increased engagement in gardening was, however, far from universal. Indeed, some people reported having less time to connect with nature and their gardens depending on their work status (e.g., health care professionals) and domestic commitments (e.g., home schooling) (Kingsley et al., 2022; Astell-Burt and Feng, 2021). Moreover, the impacts of the pandemic on mental and physical health and well-being were not experienced or distributed equitably (Rahimi-Ardabili et al., 2022). Despite the oft-repeated catch phrase that ‘we’re all in this together’, the pandemic highlighted and indeed exacerbated existing and well-documented health and gender inequalities, the inadequacies of many welfare support systems, and the global magnitude of food insecurity (Lal, 2020; Manzo and Minello, 2020; Rose-Redwood et al., 2020; Wolff, 2020; Hansman, 2022). These differences highlight the importance of understanding how inequity and context shaped the experience of gardening during the pandemic. The following sub-headings highlight three key themes that emerged from our review of literature on gardening during the pandemic which focused on food (in)security and systems, health and wellbeing and social dimensions.

2.1. Linking food (in)security and systems to pandemic gardening

The World Health Organization (2022) and the United Nations Sustainable Development Group (2020) report that the COVID-19 pandemic led to an increase in worldwide hunger and concerns about food security on a global scale. Many countries found themselves unprepared for the massive shock to the food supply system brought about by the pandemic (Laborde et al., 2020). For some, this lack of preparedness (e.g. empty supermarket shelves) led to an increased focus on local food supplies and changes in the perceived value of different forms of urban agriculture practiced around the world (Kingsley et al., 2022). With food security under threat, many turned to their gardens or gardening to mitigate the impacts of the crisis and associated inequalities as has been the case in many crises that preceded the pandemic (Pulighe and Lupia, 2020). Lal (2020) discusses the potential importance of local food production networks and home growing for strengthening urban food distribution systems disrupted by the pandemic.

Many urban food growers responded to the pandemic by increasing local production, with a greater focus on food production evident in studies from Canada (Mullins et al., 2021; Music et al., 2022), Sri Lanka (Herath, 2021), and the UK (Mead et al., 2021), as well as improved community food systems resilience (Joshi and Wende, 2022), and diets and eating behaviors (Robinson et al., 2021) more broadly. A multi-country study using data from a wide range of garden settings, including policy makers and practitioners, noted that gardening practices produced a diverse range of responses to the pandemic, including changes in plants grown and how produce was used, both with the goal to improve community food security (Schoen et al., 2021). A pan-European survey reported various effects of the pandemic on households’ food-related attitudes and behavior, including higher importance of food in one’s everyday life, an increase of missed meals, use of food banks and anxiety about obtaining food (Millard et al., 2022). The study also revealed a slight increase of food growing in households, especially in rural areas, whose incomes dropped during the pandemic. Whilst the debate on the potential of edible gardening to meaningfully contribute to local food security continues (Gulyas and

Edmondson, 2021; Du Toit et al., 2022), the ways in which local food production influenced food security in populated areas within the very particular context of the COVID-19 pandemic warrant greater understanding.

2.2. Health and wellbeing

Although food security was a potential driver of pandemic gardening, a burgeoning body of literature suggests that significant benefits to health and wellbeing in the face of social restriction and isolation were another key reason for gardening. Some studies highlight how gardening became more valuable for individuals than in pre-pandemic times because it reduced or moderated mental distress (Basu et al., 2021; Marques et al., 2021; Egerer et al., 2022; Wu et al., 2022). Others note that gardening activities enhanced mental resilience for gardeners (Sia et al., 2022). These findings align with other studies which associate encounters with nature enabled by pandemic gardening as decreasing stress and improving mood and mental health (Corley et al., 2021; Sunga and Advincula, 2021; Theodorou et al., 2021; Samus et al., 2022; Basarir et al. 2022; Wirkkala et al., 2023). Some scholars described how the garden became a refuge for people from the physical and mental challenges of the pandemic (Marsh et al., 2021).

Lehberger et al. (2021) found individuals who owned gardens during the pandemic had improved life satisfaction and self-reported mental wellbeing compared to non-garden owners. However, it must be noted that this comparison of garden versus non-garden ownership benefits could also be based on several other determinants of health and inequalities such as socio-economic status, stress, housing issues, and so forth. Recognizing that not all individuals have access to garden spaces, some authors advocate for an increased provision of garden allotments to address the social, physical, and mental health challenges and inequalities associated with the pandemic and future crises (Niala, 2020).

2.3. Social connections in the garden

Despite physical distancing requirements across many jurisdictions globally, numerous studies report the ways in which gardeners benefited from the social connection enabled by the exchange of skills, seeds and seedlings (Cerdeira et al., 2022; Mullins et al., 2021; Egerer et al., 2022) and conversation over the garden fence (Schoen et al. 2021). Many gardeners preferred or missed the direct interaction with gardening companions and fellow gardeners (Mullins et al., 2021). However, gardeners connected socially with others through more flexible or informal methods of interaction according to their pandemic situation, including online forums (Joshi and Wende, 2022). Some studies report that gardeners began gardening in their front yard as a means of cultivating social connection with neighbors (Donati and Rose, 2020).

These observations align with recent conceptual advances in the literature linking contact with green space (including gardening) with reduced loneliness and despair through multiple and entwined pathways, emphasizing the importance of congruence between personal and place-based characteristics to the potency of gardens as spaces for generating meaningful connections, companionship, and camaraderie (Astell-Burt et al., 2022). However, the evidence remains unclear regarding the extent to which social connectedness is enabled and maintained through crisis gardening, and whether this varies according to cultural differences and lockdown conditions. Complementary findings from studies of contact with nature during COVID-19 provide indirect evidence of the benefits of nature for maintaining social connections (Feng and Astell-Burt, 2022).

3. Different experiences, contexts, and types of pandemic gardening

It is important to note the many forms that gardening takes across diverse spatial contexts, from private properties to public spaces such as

median strips or schools (McClintock, 2014; Milbourne, 2021; Daněk et al., 2022). Edible gardening has been integrated into a range of institutional contexts from schools and prisons to aged care facilities and hospitals, often framed as ‘therapeutic horticulture’ or sensory gardening. The way pandemic gardening is described in the literature reflects this diversity of forms, with scholars utilizing a broad range of terminology to explain this activity, along with new language like “quarantine gardening” (e.g., Anggita et al., 2021; Mejia et al., 2020; Mercado and Mercado, 2021; Niles et al., 2021; Perks et al., 2022; Perera et al., 2022; Simon, 2023). Diverse spatial contexts have directly shaped the practice and experience of pandemic gardening, intensifying this activity in some settings while restricting or shutting them down completely in others.

Much of the academic literature on pandemic gardening focuses on home and community gardening rather than gardening in institutional settings. The setting of home and community gardening—on private land or allotment plots—allowed for fewer structural constraints during the pandemic due to the ability to socially distance in this outdoor activity compared to other institutional settings. Gardening in the home or community gardens appears to have expanded significantly in some countries in Europe during this time as well because of the strong desire of individuals to engage in such activities (Schoen et al., 2021; Turnšek et al., 2022). Allotment, community and home gardeners spent more time in their gardens, increased their share of food production, and reported increased cooperation and exchange with other gardeners (even while following government guidelines) that enhanced social connections, nature connectedness, and local social and environmental activism (Schoen et al., 2021; Egerer et al., 2022). The pandemic left some newly working-from-home urban dwellers with more time to engage in gardening and develop new approaches to sharing information online (Kingsley et al., 2022).

The literature also suggests the pandemic has triggered an interest in urban foraging as a response to food system disruptions and food stress experienced by many communities, including the “intentional cultivation of edible crops in public areas” as a means of expanding foraging opportunities (Clouse, 2022: 286). This self-organizing approach is consistent with pre-pandemic examples of guerilla gardening as a form of do-it-yourself urbanism and ‘green citizenship’ (Lewis, 2012; Hardman and Larkham, 2014). Because the pandemic made visible and therefore sharpened public focus on vulnerabilities within the food system, food insecurity, and socioeconomic inequities, the value of ‘freeness’ (Nyman, 2019) took on a more economic and political meaning. Some studies on pandemic gardening show that many gardeners set up ‘free food’ carts outside their homes or expressed greater awareness of the broader socioeconomic inequities around them (Donati and Rose, 2020; Cortez et al., 2022). This pro-social behavior was not confined to home gardens but rather part of a bigger movement in which community organizations and even businesses mobilized locally to develop innovative exchange responses to acute levels of food insecurity (O’Brien, 2020; Cattivelli, 2022).

While some unstructured approaches to gardening had time and space to flourish during the pandemic, differences in national responses also shaped the extent to which more organized gardening activities were able to continue. In some jurisdictions, community and school gardeners remained locked out of their gardens completely or faced major restrictions that made it hard to undertake common/regular activities in these more public settings (Kingsley et al., 2022). With the closure of restaurants, hotels, cafés and school-canteens, some community gardens growing produce for sale lost important customers (Caputo et al., 2023).

However, the academic literature on the impact of the pandemic on gardening in institutional settings such as schools, prisons, hospitals, and aged care facilities is relatively limited compared to household contexts, which had fewer structural constraints during the early pandemic. Nevertheless, there is some evidence of institutional practitioners attempting to maintain or integrate gardening into these settings

either remotely or at a smaller scale. For example, evidence from Australia and Trinidad and Tobago suggests that some teachers attempted to integrate the gardening curriculum into online teaching, though there is limited evidence that this received widespread institutional support within the broader shift to online education (Mollineau et al., 2021; Laing, 2022). Though many social services and hospice care facilities faced diminished programming during the pandemic, an American study of a social wellness program for adults with intellectual and developmental disabilities found that participants responded positively to a virtual therapeutic horticulture pilot program (Ryzhikov, 2021). A study of prison gardening programs suggests the pandemic led to the cessation of gardening activities across many correctional facilities, and the shutdown of research projects on gardening programs in these contexts (Jauk-Ajamie and Blackwood, 2022; Jauk et al., 2022). The differences in gardening practices between institutional and household settings highlights another way in which the benefits of gardening during the pandemic were not equally experienced.

4. Research vignettes: Studies of gardening during the pandemic

We build off our literature review with three vignettes of research conducted by individuals from the authorship team; research conducted at different scales, sites and applying different methods. The snapshots include: i) a local case study in Denver, US (Denver Urban Gardens, 2023), ii) a national survey of over 9000 pandemic gardeners in Australia led by Sustain: The Australian Food Network (Donati and Rose, 2020), and iii) an international online survey of 3743 participants led by academics in the United States, Germany and Australia (detailed methods and results in Marsh et al., 2021; Egerer et al., 2022; Kingsley et al., 2022). To add to the richness and detail of these snapshots of pandemic gardening, we incorporate discussion of relevant grey literature and qualitative data (Creswell, 2009; Paez, 2017). These vignettes allow us to explore the opportunities and limitations of pandemic gardening within the broader context of the converging crises facing many communities and governments today and illustrate how gardens in diverse settings contribute overcome food insecurity, provide crucial health, wellbeing and even biodiversity benefits for people across social and cultural settings and support social cohesion. The first vignette highlights the role of civil society organizations in increasing participation in gardening to address food security whereas the two final vignettes spotlight the health, wellbeing, ecological and social benefits of pandemic gardening.

4.1. A local perspective: The Grow-a-Garden Program in Denver, US

Denver Urban Gardens (DUG) has been fighting food insecurity and promoting community connections since 1985. DUG operates 190 community gardens in metro Denver, offers educational resources and skill-building opportunities and provides access to seeds and seedlings. During the pandemic, DUG worked closely with its landowner partners to implement personal safety measures and keep the community gardens open. DUG’s Grow-a-Garden program pivoted during the COVID-19 pandemic, so it could continue to offer individuals, families, and community groups the resources they needed to garden under different conditions, adding the opportunity to grow food at home.

Building on the Grow-a-Garden program, DUG, in partnership with Sprouts’ Healthy Community Foundation and Botanical Interests, introduced and gifted 800 To-Grow Boxes to residents during the pandemic, from 2020 to 2021, which included a beginner’s garden kit with seeds, seedlings, and a bilingual Plant Care Guide to illustrate how to grow veggies and herbs in a 3 m x 3 m plot for a family of four. The To-Grow Box program reached an estimated 22,563 people during the pandemic. Through this program, DUG worked with its 210 volunteers to distribute 48,000 seedlings and 29,000 seed packets. DUG also leveraged support from key community stakeholders in the food relief and urban agriculture sector to expand the reach and impact of the



Fig. 1. Pictures of the To Grow Box program supplies during COVID-19. (Denver Urban Gardens, 2023 – Photo Credit Niko Kirby).

program. Fig. 1

According to Lara Fahnestock, Senior Director of Gardens, “*The To-Grow boxes and the Grow a Garden Program were really impactful, a great way for individuals and families to spend time outside and connect while growing their own fresh food. They were available for both backyard and community gardeners*”. Of those who completed a follow-up post-season survey on the To-Grow Box program impact, 40% self-identified as new to gardening. The To-Grow Box program led to improvements in self-efficacy for individuals to cultivate food for their families (75%), reduced food spending (69%), increased consumption of fruits and vegetables (60%), increased time outdoors (85%), and overall improvements in health and wellbeing (68%) (The Denver Post, 2020; Denver Urban Gardens, 2023). Moreover, 30% of recipients said they would not have grown a vegetable garden without the program. One recipient of a To-Grow Box during COVID-19 reflected the multifunctional benefits of edible gardening at both an individual and community level:

“I’m able to grow food that reduces my grocery bill. I’m also able to eat healthier, teach my children gardening skills, and provide a small amount of produce for friends and neighbors. Some of the people I give produce to are elderly and disabled on fixed income, so it really helps all of us.”

4.2. A national perspective: Pandemic gardening in Australia

Sustain: The Australian Food Network is a national sustainable food systems organization that ran an online pandemic gardening survey between June and July 2020. Forced to cancel its third national Urban Agriculture Forum, due to lockdowns and border closures, Sustain worked in collaboration with a steering group from the urban agriculture sector to refocus its energies on a survey to understand more about what edible gardening meant to people during the pandemic. The survey was widely promoted via a prominent media personality and was disseminated through the membership lists of a national gardening club and community gardens networks in Australia, resulting in over 9000 responses. This vignette reports on findings published in a report, and data from over 25,000 qualitative comments within the survey.

A quarter of respondents reported their gardening activities significantly increased during the pandemic and 37% reported somewhat of an increase; only 3% stated that their gardening decreased during the pandemic. Consistent across age and household income, 72% of respondents reported that gardening benefits their mental health and wellbeing. Qualitative comments consistently underscored the substantial benefits of pandemic gardening for food security, dietary diversity and mental health.

These mental health benefits took many forms. Sharing excess produce or plants with neighbors provided an opportunity to build social connection, even when socially distanced. Many gardeners commented that edible gardening relieved anxiety by reducing the need to visit the

shops and extending the budget. A profound sense of connection with ecological systems featured as a common theme. As one gardener commented, “It’s given me pleasure and sanity – plants don’t talk back but grow and show a great deal of love and affection” (Aged 75+, 20+ years gardening). While long-term gardeners commented their mental health benefited from gardening long before the pandemic, others described how the disruption of the pandemic enabled new temporalities to emerge that felt more attuned to the natural world:

“In a year where things feel like they’ve been put on pause, the inexorable growth of our vegetables has been a sweet and quiet lesson in motion. A sense of things carrying on.” (Aged 25–34, gardening less than a year)

The experience of gardening as deeply therapeutic and healing was another recurrent theme. Many respondents described gardening as “grounding”, a “happy place”, the “best medicine” or “tonic” for the soul that excites the senses. These sentiments were particularly powerful in the face of other acute life stressors unrelated to the pandemic, including chronic illness or bereavement, as noted by these gardeners:

“I lost my husband last year and within the month, my father also passed away. My garden saved me from ‘drowning’ in grief... For me, the month of ‘lockdown’ was the most peaceful and healing time. I played in my garden from early morning till twilight. It was heaven on earth!” (Aged 65–74, 10–20 years gardening)

“Gardening has literally been a life saver having struggled through PTSD and then the Covid-19 epidemic. I can’t express enough the healing that comes from gardening. It gives you a purpose to get up each day and a sense that you’re needed to keep something that’s living, alive.” (Aged 55–64, 5–10 years gardening)

Others situated their gardening practice within the broader context of climate change, as a means for enacting more sustainable ways of eating and living, even if their gardening practices do not lead to self-sufficiency. One gardener described the garden as her ecological legacy:

“I hope to leave the world a better place because of it. Three years ago it was grass. Now it’s a diverse, resilient, rich place to be, to grow. I’m focusing on the soil - and all the universe that lives within it. We all need to live with this as our foundation.” (Aged 55–64, 1–5 years gardening)

The ways in which gardeners experience the garden as an extension of their own body and a microcosm of their connection to broader ecological dynamics may explain why gardening provoked anxiety for some. For example, some renters expressed anxieties and frustrations about gardening that extended beyond the context of the pandemic. Many renters wanted to grow more of their own food, but landlords who prohibit food growing posed significant constraints, as this gardener explains:

“[W]e have enough space to grow vegetables for 8 people (we are a household of 4) however our landlord will not allow us to develop vegetable patches. Currently we are confined to growing vegetables mostly in a potted garden and whatever existing garden beds. If we had the freedom to use wasted space on our property we could not only reduce the financial pressure we are feeling we could definitely help others.” (Aged 45–54, gardening 5–10 years)

Many gardeners called for the creation of more community gardens to ensure renters have better access to space for growing food.

4.3. An international online pandemic gardening survey

A research team from the US, Germany and Australia conducted an online pandemic gardening survey between June to August 2020. Capturing data from 3743 participants, the study aimed to understand if and how COVID-19 changed gardening practices and behaviors. The following section summarizes the themes generated by the qualitative component of the research analysis. Using previously unpublished elements of the data, we highlight six themes revolving around wellbeing and social benefits, food systems, the love of gardening, changes to garden practices and challenges associated with pandemic gardening.

Many participants described the wellbeing benefits of pandemic gardening as stemming from a way of controlling their life and distracting themselves in uncertain times, allowing some individuals to deal with their grief. Time in the garden provided a connection with nature that empowered people, enhanced mental health and increased a sense of self-sufficiency, as one quote emphasized:

“We are living in a very stressful, depressing, confusing climate. My main focus has been to stay healthy mentally, which I’m able to do through gardening. It’s rewarding and uplifting, even when you fail. I believe it is a good way to face all the negative energy... Patience is truly something you start to understand deeper through gardening, and the world needs a lot of that right now. They’re valuable because they are a good learning tool even when schools aren’t in session, they’re entertainment when we can’t go to our favorite events, and food when we’re looking for something to eat. Gardens are priceless.” (USA, aged 25–34, gardened for 1–5 years)

Reflecting on the social benefits of pandemic gardening, participants explained how gardening enabled intergenerational connectedness of networks which ultimately led to more engaged and less isolated communities. This engagement took the form of increased social connections, volunteering, and local conversations with greater emphasis on equity, sustainability and social justice, as reflected by a gardener in the UK:

“Gardening has provided a channel for connecting with my community. A group chat was set up for my road and we have discovered that many of us have a love of gardening. We have enjoyed swapping tips and plants and have supported local nurseries by making bulk orders” (UK, aged 45–54, gardened more than 10 years)

Study participants also mentioned that food systems changed leading to shifts in their gardening practices. Growing anxieties about food (in) security and failing food systems associated with supply chain concerns prompted some participants to engage in food cultivation with more urgency and seriousness. A quote that epitomized this theme was:

“I have always enjoyed growing food but it took on a whole new level of importance during the pandemic. As income was slashed the money I saved from growing fresh produce became important. We felt so lucky to have fresh produce at hand as we could easily go 2 weeks on pantry staples and our garden without needing to risk exposure at a shop.” (Australia, aged 35–44, gardened more than 10 years)

Others, however, engaged in pandemic gardening purely because

they loved this leisure time activity which provided much pleasure, gratitude, and appreciation for getting more time in their gardens. As a participant in Germany explained:

“COVID-19 has reminded me of how much joy I get from being in the garden...” (aged 45–54, gardened more than 10 years)

Participants, however, clearly emphasized that pandemic gardening was different to gardening during other periods. They mentioned having more time at home enabled the creation of new garden spaces that had been previously neglected. Gardens allowed for a safe outdoor activity when mobility was restricted. This increased time and lack of mobility meant people turned to new sources of information, such as online environments, and shifted their approach to their gardening practice. This was perceived as both an opportunity and challenge to participants. A quote highlighting the positives included:

“Sometimes trying to juggle work, commuting and the other social commitments has resulted in the garden being left to its own devices. This time of social distancing and staying home has enabled more relaxed planning for the garden and gardening.” (Australia, aged 55–64, gardened more than 10 years)

Although most participants in the survey emphasized the benefits associated with pandemic gardening, there were clear challenges. Participants discussed government restrictions like physical distancing requirements, inequalities in garden access, fear of catching COVID-19, increased stress associated with increased responsibility, less money, lack of help and supply shortages, which reduced ability to garden in some circumstances.

5. Key insights

The pandemic made visible the ways in which the global food system “relies upon and reproduces acute inequalities of risk, vulnerability, hunger, wealth and power” (Hinkson and Stead, 2022: 4). The three vignettes illustrate different responses to these risks. For example, civil society organizations such as DUG responded to the risks of food insecurity presented by the pandemic by taking concrete action to support more equitable access to the resources needed to grow food. Survey respondents also reflected on these inequalities while responding at a more individual or household level to food system disruptions by growing food. However, the pandemic revealed how the global food system is “itself inherently disruptive—of human lives and flourishing, of relationships between people, places and ecologies” (Hinkson and Stead, 2022: 4). We can see how disruptions associated with the pandemic have rendered visible the precarious spatial and temporal configurations that characterize global food supply chains. During this social and systemic disruption, the pandemic amplified the potential of the garden as a space for ecological and social connection, restoration, nourishment, and therapy, but also the challenges that urban gardening has to face since ever, such as uncertain land use, competing land use claims. While significant differences in gardening practices may exist globally during COVID-19, an increase in gardening practices was clear and, for the most part, experienced as important and beneficial by many gardeners.

The research on pandemic gardening offers insights into the potential of gardening as a strategy for individual and collective resilience: a means to calm anxiety, an opportunity for therapeutic contact with nature, to spend time outdoors, to build deeper social and ecological connections, and as a source of food security in the face of supply chain disruptions and loss of income. Perhaps more importantly, gardening practices emerged as a largely self-organized psychosocial intervention within the broader context of an existential crisis, related not just to the pandemic, but also to climate change, the long-term impact of which remains unknown.

However, despite the proliferation of research on pandemic gardening, a limitation is the lack of coordination and consistency in data and measures, creating challenges in drawing meaningful

comparisons across contexts and between studies. In part, this issue may be due to the fact that many researchers around the globe were responding quickly to the pandemic as it unfolded, with limited opportunities for a more coordinated approach. Future research could focus on improving this reliability, coordination, and increased attention to how cultural differences and lockdown conditions, geography, socio-economic position, gender, age, and so forth impacted people's gardening practice.

6. Call to action

The evidence documenting the benefits of pandemic gardening underpins our call to strengthen the role of gardening in relevant urban planning, public health and environmental management policies. This section proposes a few priority areas for policy action.

Firstly, we identify a need to embed gardening in public health policies on the basis that gardening brings substantial benefits to mental health and community wellbeing, both within and outside periods of acute crisis. This necessitates a focus on ensuring that isolated and marginalized populations already facing systemic inequalities can access gardening spaces through programs and resourcing that make them viable in the long-term. While policy makers at all levels of government face competing needs and interests that can stymie effective policy action there is evidence with effective advocacy and evidence this can be overcome. The example of tobacco regulation demonstrates that public health policy barriers can be overcome through strong evidence-building, political lobbying, social mobilization of cross-sectoral actors including civic society and policy coalitions and the reframing of critical public health issues to reduce prevalence rates (Friel, 2021; Flor et al., 2021).

Secondly, targeted programs to support more equitable access to gardening as a public health measure would benefit from a stronger and more explicit strategic policy integration between urban planning, affordable housing, open space and food security initiatives. This includes tenancy laws that support security of housing tenure and public housing developments that integrate gardening spaces, resources and programs for low-income residents as a means for reducing social isolation and strengthening community connection. Similarly, homeowner associations could introduce more flexible codes to improve owners' ability to garden beyond standardized and repetitive landscaping designs. Community development approaches and strong community partnerships are important to embedding gardening as a public health policy intervention in other related policy domains.

Thirdly, we argue for an integration of gardening in risk management and resilience planning and policies designed to protect critical infrastructure and urban systems including food supply chains. The importance of gardening in providing healthy food to disadvantaged groups during COVID-19 highlights the need to view public and private spaces for growing food as critical urban infrastructure. There are further opportunities to integrate gardeners and gardening into urban forest policies to reduce extreme heat and air pollution, capture stormwater runoff and provide other nature-based solutions for mitigating the impacts of climate change and creating more liveable cities (Blay-Palmer et al., 2014; Kingsley et al., 2021). Clark et al. (2021): 1 point to how the "centrality, fragility, and invisibility of urban food infrastructure" became acutely evident during the pandemic. The benefits of edible gardening during and beyond the pandemic present an argument for resourcing edible gardens as vital community infrastructure alongside roads, parks, sewerage and energy networks to address the continued issue surround supply chain issues that continue to push food prices up. This would involve municipalities and institutions (including councils, healthcare settings and universities) investing in community/allotment gardening through funding, spatial planning and land availability, alongside supporting access to low-cost seeds and plants and integrating gardening programs with local planning strategies. We believe that community development approaches and building stronger

partnerships will increase the ability to address health inequalities.

Lastly, we call for strong training and resourcing for school gardens and gardening education to develop a multi-generational set of skills around food growing and gardening as well as support for non-school gardening activities that can serve as informal environmental education within the broader community. Greater integration of gardening across the education sector could improve nutrition outcomes for school children, advance ecological literacy, cool school playgrounds, bolster nature interactions, and improve climate change responses. Bridging gaps between education and aged care could promote cross-generational understanding, foster empathy, and reduce social isolation and loneliness. We recognize that teachers and schools are constrained by time and funding. However, we have seen recent inroads in education policy such as the resourcing of 150 "bush kinders" by the Victorian government (Australia) in recognition of the value of nature-based early childhood education, demonstrating that change is possible with sufficient political will (Speldewinde, 2023).

7. Conclusion

This narrative review of the pandemic gardening literature provides a broad overview of the different forms of pandemic gardening and how food system disruptions and anxieties about food insecurity intersected with gardening practices and initiatives. It highlights the social dimensions and health and wellbeing benefits of gardening during this time of crisis. Our three vignettes foreground the role of civic society in advocating and/or encouraging gardening, the importance of gardening for individual and community wellbeing and the challenges that come with it. Collectively, these findings point to interdisciplinary avenues for future research and invite cross-cutting dialogue and contributions from other scholars about what might be learned from these pandemic gardening practices in the context of deepening social, ecological and economic injustice.

The pandemic has strengthened calls for more localized food systems within community, policy and academic domains (Spencer, 2020; Ilieva et al., 2023). This presents both an opportunity for governments and communities to embed gardening into policy frameworks and interventions. However, just as the impacts of the pandemic have been inequitably distributed, so too are the benefits of gardening. More gardening in itself will not address the converging geopolitical, social and ecological crises that continue to unfold around us. This highlights the need for a research agenda that, not only evaluates policy action to ensure it is equitable and monitored effectively, but that enables stronger integration of edible gardening with other areas of policy action. By creating stronger policy links with public health, housing policy, urban planning and education we can address inequities and strengthen community food infrastructure for the benefit of all.

CRediT authorship contribution statement

JK was involved in leading the drafting, correspondence, and conceptual development of this review paper. JK, KD, JL, NS, CB, JV, SC and PM were part of the lead authorship group which met regularly and edited the document a number of times. LD, NR, RF-K, AvdB, GM, AO, XF, TA-B, AB, BL, ME, PM, PP, TS, KA, KN, TG and JB met with the lead authorship team a number of times and edited the manuscript frequently over a long period of time. All authors significantly contributed to this manuscript, have read and approved the manuscript in its current form.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

- Alaimo, K., Beavers, A.W., Crawford, C., Snyder, E.H., Litt, J.S., 2016. Amplifying health through community gardens: a framework for advancing multicomponent, behaviorally based neighborhood interventions. *Curr. Environ. Health Rep.* 3, 302–312.
- Altieri, M.A., Companioni, N., Cañizares, K., Murphy, C., Rosset, P., Bourque, M., Nicholls, C.L., 1999. The greening of the “barrios”: urban agriculture for food security in Cuba. *Agric. Hum. Values* 16 (2), 131–140.
- Anggita S.T., Irham and Waluyati L.R. (2021) The impact of the COVID-19 pandemic on urban farming household income in Yogyakarta City. In: *The First International Conference on Assessment and Development of Agricultural Innovation*, 24th of September, 2021.
- Astell-Burt, T., Feng, X., 2021. Time for ‘green’ during COVID-19? Inequities in green and blue space access, visitation and felt benefits. *Int. J. Environ. Res. Public Health* 18 (5), 2757.
- Astell-Burt, T., Hartig, T., Putra, I.G.N.E., Walsan, R., Dendup, T., Feng, X., 2022. Green space and loneliness: a systematic review with theoretical and methodological guidance for future research. *Sci. Total Environ.* 22, 157521.
- Basarir, A., Al Mansouri, N.M.N., Ahmed, Z.F.R., 2022. Household attitude, preferences, and willingness to have home garden at time of pandemics. *Horticulturae* 8, 56.
- Bassett, T.J., 1981. Reaping on the margins: a century of community gardening in America. *Landscape* 25 (2), 1–8.
- Basu, M., DasGupta, R., Kumar, P., Dhyani, S., 2021. Home gardens moderate the relationship between Covid-19-induced stay-at-home orders and mental distress: a case study with urban residents of India. *Environ. Res. Commun.* 3 (10), 105002.
- Birky J. (2009) *The Modern Community Garden Movement in the United States: Its Roots, its Current Condition and its Prospects for the Future*. USF Tampa Graduate Thesis and Dissertation. Available at: (<https://digitalcommons.usf.edu/etd/1860/>) (Accessed 15 December 2022).
- Blay-Palmer, A., Renting, H., Dubbeling, M., 2014. Understanding the City Region Food System: Planning for a More Food Secure and Resilient City. RUAF Foundation.
- Caputo, S., Schoen, V., Blythe, C., 2023. Productivity and efficiency of community gardens: case studies from the UK. *Land* 12 (1), 238.
- Caskie, P., 2000. Back to basics: household food production in Russia. *J. Agric. Econ.* 51 (2), 196–209.
- Cattivelli, V., 2022. Social innovation and food provisioning initiatives to reduce food insecurity during the Covid-19 pandemic. *Cities* 131, 104034.
- Cattivelli, V., 2023. Review and analysis of the motivations associated with urban gardening in the pandemic period. *Sustainability* 15 (3), 2116.
- Cerda, C., Guenat, S., Egerer, M., Fischer, L.K., 2022. Home food gardening: benefits and barriers during the COVID-19 pandemic in Santiago, Chile. *Front. Sustain. Food Syst.* 6, 841386.
- Clarke, S., Varshavskaya, L., Alasheev, S., Karelina, M., 2000. The myth of the urban peasant. *Work, Employ. Soc.* 14 (3), 481–499.
- Clark, J.K., Conley, B., Raja, S., 2021. Essential, fragile, and invisible community food infrastructure: The role of urban governments in the United States. *Food Policy* 103, 102014.
- Clouse, C., 2022. The resurgence of urban foraging under COVID-19. *Landscape* 47 (3), 285–299.
- Cohen, N., 2016. Urban Agriculture as a response to the great recession. In: France, R.L. (Ed.), *Integrated Urban Agriculture, Precedents, Practices, Prospects*. Green Frigate Books, Faringdon, pp. 331–352.
- Corley, J., Okely, J.A., Taylor, A.M., Page, D., Welstead, M., Skarabela, B., Redmond, P., Cox, S.R., Russ, T.C., 2021. Home garden use during COVID-19: Associations with physical and mental wellbeing in older adults. *J. Environ. Psychol.* 73, 101545.
- Cortez, S., Diekmann, L., Egerer, M., Kingsley, J., Lin, B., Marsh, P., Ossola, A., 2022. California: UC agriculture resources. *Gard. COVID-19: Exp. Gard. World*.
- Creswell, J.W., 2009. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, third ed. Sage Publications, Inc.
- Cullen, W., Gulati, G., Kelly, B.D., 2020. Mental health in the COVID-19 pandemic. *QJM: Int. J. Med.* 113 (5), 311–312.
- Daněk, P., Sovová, L., Jehlička, P., Vávra, J., Lapka, M., 2022. From coping strategy to hopeful everyday practice: changing interpretation of food self-provisioning. *Sociol. Rural.* 62 (3), 651–671.
- Denver Urban Gardens (2023) *Denver Urban Gardens: Gardening in Community. Let's Grow Together*. DUG. Available at: (<https://dug.org/>) (accessed 6 December 2022).
- Donati K., and Rose N. (2020) ‘Every seed I plant is a wish for tomorrow’: Findings and Action Agenda from the 2020 National Pandemic Gardening Survey. Melbourne: Sustain: the Australian Food Network. (<https://sustain.org.au/projects/pandemic-gardening-survey-report/>).
- Du Toit, M.J., Rendón, O., Cologna, V., Gilliers, S.S., Dallimer, M., 2022. Why home gardens fail in enhancing food security and dietary diversity. *Front. Ecol. Evol.* 10, 804523.
- Egerer, M., Lin, B., Kingsley, J., Marsh, P., Diekmann, L., Ossola, A., 2022. Gardening can relieve human stress and boost nature connection during the COVID-19 pandemic. *Urban For. Urban Green.* 68, 127483.
- Feng, X., Astell-Burt, T., 2022. Perceived qualities, visitation and felt benefits of preferred nature spaces during the COVID-19 pandemic in Australia: a nationally-representative cross-sectional study of 2940 adults. *Land* 11 (6), 904.
- Fjaestad, S.L., Mackelprang, J.L., Sugiyama, T., Chandrabose, M., Owen, N., Turrell, G., Kingsley, J., 2023. Associations of time spent gardening with mental wellbeing and life satisfaction in mid-to-late adulthood. *J. Environ. Psychol.* 87, 101993.
- Flor, L.S., Reitsma, M.B., Gupta, V., Ng, M., Gakidou, E., 2021. The effects of tobacco control policies on global smoking prevalence. *Nat. Med.* 27, 239–243.
- Friel, S., 2021. Redressing the corporate cultivation of consumption: releasing the weapons of the structurally weak. *Int. J. Healthy Policy Manag.* 10 (12), 784–792.
- Gaynor, A., 2006. *Harvest of the Suburbs: An Environmental History of Growing Food in Australian cities*. UWA Publishing, Perth.
- Ginn, F., 2012. Dig for victory! New histories of wartime gardening in Britain. *J. Hist. Geogr.* 38 (3), 295–305.
- Glover, T.D., 2022. Playing with the City: Leisure, Public Health, and Placemaking During COVID-19 and Beyond. In: Gammel, I., Wang, J. (Eds.), *Creative resilience and COVID-19: Figuring the everyday in a pandemic*. Routledge, New York, pp. 157–165.
- Gripper, A.B., Nethery, R., Cowger, T.L., White, M., Kawachi, I., Adamkiewicz, G., 2022. Community solutions to food apartheid: a spatial analysis of community food-growing spaces and neighborhood demographics in Philadelphia. *Soc. Sci. Med.* 310, 115221.
- Gulyas, B.Z., Edmondson, J.L., 2021. Increasing city resilience through urban agriculture: challenges and solutions in the Global North. *Sustainability* 13 (3), 1465.
- Hardman, M., Larkham, P.J., 2014. *Informal Urban Agriculture: the Secret Lives of Guerrilla Gardeners*. Springer, Verlag.
- Hansman, C.A., 2022. We're all in this together? Reflections on inequity during tumultuous times. *N. Dir. Adult Contin. Educ.* (173–174), 9–19.
- Helphand, K., 2014. Reflections on defiant gardens: making gardens in wartime. In: Tidball, K.G., Krasny, M.E. (Eds.), *Greening in the Red Zone: Disaster, Resilience and Community Greening*. Springer, pp. 215–222.
- Herath, V.K., 2021. *Masters of environmental sciences, policy and management thesis, erasmus mundus. Sustain. Urban home Gard. enhancing Food Secur.: a Study Sri Lanka COVID-19 pandemic*.
- Herrmann, M., 2015. The modern day victory garden. *Procedia Eng.* 118, 647–653.
- Hinkson, M., Stead, V., 2022. Introduction: Beyond Global Supply Chains. In: Stead, V., Hinkson, M. (Eds.), *Beyond Global Food Supply Chains*. Palgrave Macmillan, Singapore. https://doi.org/10.1007/978-981-19-3155-0_1.
- Ilieva, R.T., Fraser, K.T., Cohen, N., 2023. From multiple streams to a torrent: a case study of food policymaking and innovations in New York during the COVID-19 emergency. *Cities* 136, 104222.
- Irons, R., 2020. Quarantine: lockdown and the global disruption of intimacies with routine, clock time, and the intensification of time-space compression. *Anthropol. Action* 27 (3), 87–92.
- Jauk, D., Gill, B., Caruana, C., Everhardt, S., 2022. Systemic inequality, sustainability and COVID-19 in US prisons: a sociological exploration of women's prison gardens in pandemic times. In: Aladuwa, S., Wejnert, B., Alagan, R. (Eds.), *Systemic Inequality, Sustainability and COVID-19*. Emerald Publishing, pp. 185–209.
- Jauk-Ajamie, D., Blackwood, A., 2022. “I grow every day, like plants.” An evaluation of a gardening program for women in a residential community corrections setting. *Women Crim. Justice* 1–24.
- Joshi, N., Wende, W., 2022. Physically apart but socially connected: lessons in social resilience from community gardening during the COVID-19 pandemic. *Landscape Urban Plan.* 223, 104418.
- Kingsley, J., Diekmann, L., Egerer, M.H., Lin, B.B., Ossola, A., Marsh, P., 2022. Experiences of gardening during the early stages of the COVID-19 pandemic. *Health Place* 76, 102854.
- Kingsley, J., Egerer, M., Nuttman, S., Keniger, L., Pettitt, P., Frantzeskaki, N., Gray, T., Ossola, A., Lin, B., Bailey, A., Tracey, D., Barron, S., Marsh, P., 2021. Urban agriculture as a nature-based solution to address socio-ecological challenges in Australian cities. *Urban For. Urban Green.* 60, 127059.
- Laborde, D., Martin, W., Swinnen, J., Vos, R., 2020. COVID-19 risks to global food security. *Science* 369 (6503), 500–502.
- Laing, B., 2022. Designing with Worms: Getting Creative in the Kitchen Garden for Learning Outcomes. Symposium of Australian Gastronomy, Bendigo, Australia, pp. 8–11. May 2022.
- Lal, R., 2020. Home gardening and urban agriculture for advancing food and nutritional security in response to the COVID-19 pandemic. *Food Secur.* 12 (4), 871–876.

- Lawson, L., 2005. *City Bountiful: A Century of Community Gardening in America*. University of California Press, California.
- Lehberger, M., Kleih, A.-K., Sparke, K., 2021. Self-reported well-being and the importance of green spaces – a comparison of garden owners and non-garden owners in times of COVID-19. *Landsc. Urban Plan.* 212, 104108.
- Lewis, T., 2012. “There grows the neighbourhood”: green citizenship, creativity and life politics on eco-TV. *Int. J. Cult. Stud.* 15 (3), 315–326.
- Lin, B.B., Egerer, M.H., Kingsley, J., Marsh, P., Diekmann, L., Ossola, A., 2021. COVID-19 may plant the seeds for a greener, healthier future. *Front. Ecol. Environ.* 19 (9), 491–493.
- Litt, J.S., Alaimo, K., Harrall, K.K., Hamman, R.F., Hébert, J.R., Hurley, T.G., Leiferman, J.A., Kaigang, L., Villalobos, A., Coringrato, E., Payton, M., Glueck, D.H., 2023. Effects of a community gardening intervention on diet, physical activity, and anthropometry outcomes in the USA (CAPS): an observer-blind, randomised controlled trial. *Lancet Planet. Health* 7 (1), e23–e32.
- Manzo, L.K.C., Minello, A., 2020. Mothers, childcare duties, and remote working under COVID-19 lockdown in Italy: cultivating communities of care. *Dialog. Hum. Geogr.* 10 (2), 120–123.
- Marsh, P., Diekmann, L.O., Egerer, M., Lin, B., Ossola, A., Kingsley, J., 2021. Where birds felt louder: the garden as a refuge during COVID-19. *Wellbeing, Space Soc.* 2, 100055.
- Marques, P., Silva, A.S., Quaresma, Y., Manna, L.R., Neto, N.M., Mazzoni, R., 2021. Home gardens can be more important than other urban green infrastructure for mental well-being during COVID-19 pandemics. *Urban For. Urban Green.* 64, 127268.
- McClintock, N., 2014. Radical, reformist, and garden-variety neoliberal: coming to terms with urban agriculture’s contradictions. *Local Environ.* 19 (2), 147–171.
- McCartney, K., Wood, G., Gabbert, K., Warner, M., Tompkins, N.O., 2022. Home gardening resurgence during COVID: motivations and perceived benefits of participating in Grow This! Health Promot. Pract. <https://doi.org/10.1177/15248399221102919>.
- Mead, B.R., Davies, J.A.C., Falagán, N., Kourmpetli, S., Lui, L., Hardman, C.A., 2021. Growing your own in times of crisis: the role of home food growing in perceived food insecurity and well-being during the early COVID-19 lockdown. *Emerald Open Res.* 3, 7. <https://doi.org/10.35241/emeraldopenres.14186.2>.
- Mercado, R.E., Mercado, J., 2021. The level of interest and attitude of the local community in home gardening during COVID-19 pandemic: an assessment. *J. Exp. Agric. Int.* 43 (9), 55–59.
- Mejia, A.P., Bhattacharya, M., Nigon-Crowley, A., Kirkpatrick, K.R., Katoch, C., 2020. Community gardening during times of crisis: Recommendations for community-engaged dialogue, research, and praxis. *J. Agric., Food Syst. Community Dev.* 10 (1), 1–7.
- Milbourne, P., 2021. Growing urban public spaces: community gardening and the making of new environments of publicness in the city. *Urban Stud.* 58 (14), 2901–19.
- Millard, J., Sturla, A., Smutná, Z., Duží, B., Janssen, M., Vávra, J., 2022. European food systems in a regional perspective: a comparative study of the effect of COVID-19 on households and city-region food systems. *Front. Sustain. Food Syst.* 6, 844170.
- Mollineau, W., Simonette, G., Hewitt-Bradshaw, I., 2021. School gardens in the Republic of Trinidad and Tobago: potential and possibilities. *Int. J. Innov. Sci. Res. Rev.* 3 (6), 1385–1389.
- Mullins, L., Charlebois, S., Finch, E., Music, J., 2021. Home food gardening in Canada in response to the COVID-19 pandemic. *Sustainability* 13, 63056.
- Mushangwe, S., Astell-Burt, T., Steel, D., Feng, X., 2021. Ethnic inequalities in green space availability: evidence from Australia. *Urban For. Urban Green.* 64, 127235.
- Music, J., Large, C., Charlebois, S., Mayhew, K., 2022. Gardening from the ground up: a review of grassroots governance and management of domestic gardening in Canada. *Local Environ.* 27 (8), 1046–1058.
- Niala, J.C., 2020. Dig for vitality: UK urban allotments as a health-promoting response to COVID-19. *Cities Health* 5 (S1), S227–S231.
- Niles, M.T., Wirkkala, K.B., Belarmino, E.H., Bertmann, F., 2021. Home food procurement impacts food security and diet quality during COVID-19. *BMC Public Health* 21, 945.
- Norwood, M.F., Lakhani, A., Fullagar, S., Maujean, A., Downes, M., Byrne, J., Stewart, A., Barber, B., Kendall, E., 2019. A narrative and systematic review of the behavioural, cognitive and emotional effects of passive nature exposure on young people: evidence for prescribing change. *Landsc. Urban Plan.* 189, 71–79.
- Novo M.G. and Murphy C. (2000) Urban agriculture in the city of Havana: A popular response to a crisis. In: Bakker N, Dubbeling M, Gündel S, Sabel-Koshella U, de Zeeuw H and Feldafing, ZEL (eds) Growing cities, growing food. Urban agriculture on the policy agenda. Germany: Deutsche Stiftung für Internationale Entwicklung, Zentralstelle für Ernährung und Landwirtschaft Feldafing, pp. 329–346.
- Nyman, M., 2019. Food, meaning-making and ontological uncertainty: exploring ‘urban foraging’ and productive landscapes in London. *Geoforum* 99, 170–180.
- O’Brien, A., 2020. Australia’s multicultural communities are feeding hundreds during the coronavirus shutdown. SBS N. 4. May, 2020.
- Odeh, R., Diehl ERM, Nixon, S.J., Tisher, C.C., Klempner, D., Sonke, J.K., Colquhoun, T. A., Li, Q., Espinosa, M., Perdomo, D., Rosario, K., Terzi, H., Guy, C.L., 2022. A pilot randomized controlled trial of group-based indoor gardening and art activities demonstrates therapeutic benefits to healthy women. *PLOS ONE* 17 (7) e0269248.
- Okvat, H.A., Zautra, A.J., 2014. Sowing seeds of resilience: community gardening in a post-disaster context. In: Tidball, G.K., Krasny, M.E. (Eds.), *Greening in the Red Zone: Disaster, Resilience and Community Greening*. Springer, pp. 73–90.
- Paez, A., 2017. Gray literature: an important resource in systematic reviews. *J. Evid. Based Med.* 10 (3), 233–240.
- Partalidou, M., Anthopoulos, T., 2015. Urban allotment gardens during precarious times: from motives to lived experiences. *Sociol. Rural.* 57 (2), 211–228.
- Perera, T.G.P., Wickramaarachchi, N.C., Karunaratne, H.M.P., Munasinghe, L.M., Rupasinghe, K., 2022. COVID-19 lockdown home gardening in the Western Province of Sri Lanka. *J. Soc. Sci. Humanit. Rev.* 6 (2), 79–105.
- Perks, L.G., Gatchet, A.D., Gatchet, R.D., 2022. The need for seed: news framing of the pandemic gardening boom. *Environ. Commun.* 16 (4), 550–562.
- Pulighe, G., Lupia, F., 2020. Food first: COVID-19 outbreak and cities lockdown a booster for a wider vision on urban agriculture. *Sustainability* 12 (12), 5012.
- Purwanto, U.K., Yaumidin, C.I., Yuliana, E., Nurjati, E., Rahmayanti, B.D., Cahyono, Novandra, R., 2022. Urban farming and food security: household’s adaptive strategy to COVID-19. *IOP Conf. Ser.: Earth Environ. Sci.* 892, 012070.
- Rahimi-Ardabili, H., Feng, X., Nguyen, P.Y., Astell-Burt, T., 2022. Have deaths of despair risen during the COVID-19 pandemic? A systematic review. *Int. J. Environ. Res. Public Health* 19 (19), 12835.
- Robinson, E., Boyland, E., Chisholm, A., Harrold, J., Maloney, N.G., Marty, L., Mead, B. R., Noonan, R., Hardman, C.A., 2021. Obesity, eating behavior and physical activity during COVID-19 lockdown: a study of UK adults. *Appetite* 156, 104853.
- Ronto, R., Nanayakkara, J., Worsley, A., Rathi, N., 2021. COVID-19 & culinary behaviours of Australian household food gatekeepers: a qualitative study. *Appetite* 167, 105598.
- Rose-Redwood, R., Kitchin, R., Apostolopoulou, E., Rickards, L., Blackman, T., Crampton, J., Rossi, U., Buckley, M., 2020. Geographies of the COVID-19 pandemic. *Dialog. Hum. Geogr.* 10 (2), 97–106.
- Ryzhikov K. (2021) Virtual therapeutic horticulture-a social wellness program for adults with intellectual and developmental disabilities. *ISHS Acta Horticulturae 1330: XV International People Plant Symposium and II International Symposium on Horticultural Therapies: the Role of Horticulture in Human Well-being and Social Development* (pp. 55–62).
- Samus, A., Freeman, C., Dickinson, K.J.M., Heezik, Y., 2022. Relationships between nature connectedness, biodiversity of private gardens, and mental well-being during the Covid-19 lockdown. *Urban For. Urban Green.* 69, 127519.
- Schoen, V., Blythe, C., Caputo, S., Fox-Kämper, R., Specht, K., Fargue-Lelièvre, A., Cohen, N., Ponizý, L., Fedeñczak, K., 2021. “We have been part of the response”: the effects of COVID-19 on community and allotment gardens in the global north. *Front. Sustain. Food Syst.* 5, 732641.
- Sia, A., Tan, P.Y., Wong, J.C.M., Araib, S., Ang, W.F., Er, K.B.H., 2022. The impact of gardening on mental resilience in times of stress: a case study during the COVID-19 pandemic in Singapore. *Urban For. Urban Green.* 68, 127448.
- Simon, S., 2023. The ‘covid-trigger’: new light on urban agriculture and systemic approach to urbanism to co-create a sustainable Lisbon. *Syst. Pract. Action Res.* 36, 87–109.
- Smith D. (2013) *The spade as mighty as the sword: The story of World War Two dig for victory*. London: Aurum Press. Speldevinde C (2023) *Bush Kinder turns nature novices into eco-experts*. Pursuit – The University of Melbourne. Available at: (<https://pursuit.unimelb.edu.au/articles/bush-kinder-turns-nature-novices-into-eco-experts>) (accessed 22 June 2023).
- Spencer, L., 2020. Keeping up appearances: conflicting values in state opposition to growing food in public. In: Thornton, A. (Ed.), *Urban Food Democracy and Governance in North and South*. International Political Economy Series. Palgrave Macmillan, Cham.
- Speldevinde C (2023) *Bush Kinder turns nature novices into eco-experts*. Pursuit – The University of Melbourne. Available at: (<https://pursuit.unimelb.edu.au/articles/bush-kinder-turns-nature-novices-into-eco-experts>) (accessed 22 June 2023).
- Sukhera, J., 2022. Narrative reviews: flexible, rigorous, and practical. *J. Grad. Med. Educ.* 14 (4), 414–417.
- Sunga, A.B., Advincula, J., 2021. The “plantito/plantita” home gardening during the pandemic. *Community Psychol. Glob. Perspect.* 7 (1), 88–105.
- The Denver Post (2020) *Denver Urban Gardens gives away “To-Grow Boxes”*. Available at: (<https://www.denverpost.com/2020/05/15/denver-urban-to-grow-boxes-photos/>) (accessed 28 March 2023).
- Theodorou, A., Panno, A., Carrus, G., Carbone, G.A., Massullo, C., Imperatori, C., 2021. Stay home, stay safe, stay green: the role of gardening activities on mental health during the Covid-19 home confinement. *Urban For. Urban Green.* 61, 127091–127091.
- Timmins B. (2020) *Coronavirus: Seed sales soar as more of us become budding gardeners*. In: BBC. Available at: <https://www.bbc.com/news/business-52544317> (accessed 15 December 2022).
- Turnšek, M., Gangenes Skar, S.L., Piirman, M., Thorarinsdottir, R.I., Bavec, M., Junge, R., 2022. Home gardening and food security concerns during the COVID-19 pandemic. *Horticulturae* 8 (9), 778.
- United Nations Sustainable Development Group. (2020). *Sustainable Development Goals Report*. Available at: (<https://www.un.org/en/desa/sustainable-development-goals-report-2020>) (accessed 19 December 2022).
- Vittuari, M., Bazzocchi, G., Blasioli, S., Cirone, F., Maggio, A., Orsini, F., Penca, J., Petruzzelli, M., Specht, K., Amghar, S., Atanasov, A.-M., Bastia, T., Bertocchi, I., Coudard, A., Crepaldi, A., Curtis, A., Fox-Kämper, R., De Menna, F., 2021. Envisioning the future of European food systems: approaches and research priorities after COVID-19. *Front. Sustain. Food Syst.* 5, 642787.
- Wahaj, Z., Alam, M.M., Al-Amin, A.Q., 2022. Climate change and COVID-19: shared challenges, divergent perspectives, and proposed collaborative solutions. *Environ. Sci. Pollut. Res.* 29, 16739–16748.
- Wirkkala, K.B., Niles, M.T., Belarmino, E.H., Bertmann, F., 2023. The fruits of labor: home food procurement and mental Health in the time of COVID-19. *J. Hunger Environ. Nutr.* 18 (3), 450–469.

Wolff, R.D., 2020. The sickness is the system: when capitalism fails to save us from pandemics or itself. *Democr. Work*.

World Health Organization. (2022). UN Report: Global hunger numbers rose to as many as 828 million in 2021. In: *WHO*. Available at: [https://www.who.int/news/item/](https://www.who.int/news/item/06-07-2022-un-report-global-hunger-numbers-rose-to-as-many-as-828-million-in-2021)

06-07-2022-un-report-global-hunger-numbers-rose-to-as-many-as-828-million-in-2021 (accessed 19 December 2022).

Wu, C.-F., Chou, L.-W., Huang, H.-C., Tu, H.-M., 2022. Perceived COVID-19-related stress drives home gardening intentions and improves human health in Taiwan. *Urban For. Urban Green.* 78, 127770.