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Health & Place 76 (2022) 102854

Contents lists available at ScienceDirect

Health and Place

journal homepage: www.elsevier.com/locate/healthplace

Experiences of gardening during the early stages of the COVID-19 pandemic

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ARTICLE INFO

Keywords:
Qualitative research
Wellbeing
COVID-19
Garden

ABSTRACT

Gardening has the potential to improve health and wellbeing, especially during crises. Using an international survey of gardeners (n = 3743), this study aimed to understand everyday gardening experiences, perspectives and attitudes during early stages of the COVID-19 pandemic in 2020. Our qualitative reflexive thematic and sentiment analyses show that during the first months of the COVID-19 pandemic, gardening seemed to create a safe and positive space where people could socially connect, learn and be creative. Participants had more time to garden during the pandemic, which led to enhanced connections with family members and neighbours, and the ability to spend time in a safe outdoor environment. More time gardening allowed for innovative and new gardening practices that provided enjoyment for many participants. However, our research also highlighted barriers to gardening (e.g. lack of access to garden spaces and materials). Our results illustrate the multiple benefits of gardening apparent during COVID-19 through a lens of the social-ecological model of health.

1. Introduction

The COVID-19 pandemic has shifted ecological, economic, health and social dimensions of society, to the extent that some conclude it has "shattered our world" (Lewis 2020: p. 3). A consequence of this upheaval has been the exposure of significant health inequities resulting not only from COVID-19's direct biophysical impacts on human health, but also from broader factors such as food insecurities and limited access to safe greenspaces or social support systems (Abrams and Szefler 2020; Geary et al., 2021; Zavaleta-Cortijo et al., 2020). Yet, somewhat ironically, this upheaval offers opportunities to address these inequities by improving social and environmental determinants of health. Opportunities include increasing access to greenspaces (or biodiverse environments and green/blue infrastructure) and fostering the development of resilient food supply chains (Lambert et al., 2020; Geary et al., 2021; Samuelsson et al., 2020; Ugolini et al., 2020; Kleinschroth and Kowarik 2020; Dushkova et al., 2021; Haas et al., 2021; Theodorou et al., 2021).

One form of greenspace, gardening has received heightened attention during the pandemic. Gardening loosely encompasses the combination of (a) a set of activities centred on cultivating and stewarding plants, (b) a natural space, and (c) a setting for social interactions. Kingsley and colleagues (2021, p. 2) broadly define gardening "as the production (including processing and marketing) of food, flowers, fibre, feed and herbs on land (and water)". Gardening includes a diverse set of practices, which range from individual activities to communal ones, which take place at various scales and through different management structures. Garden typologies (e.g., McClintock, 2014) include residential, allotment, guerrilla, collective, institutional, non-profit or commercial for-profit gardens.

Applying a socio-ecological model of health, gardening and its multifaceted impacts can be seen as an important health intervention. Health benefits arise at the intersection between ecological, human and

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https://doi.org/10.1016/j.healthplace.2022.102854
Received 29 June 2021; Received in revised form 22 June 2022; Accepted 23 June 2022
Available online 30 June 2022

non-human systems (for an example of the application of this theoretical framework to community garden research, see Kingsley et al., 2019). As Alaimo et al. (2016) theorize, through the act of gardening people become involved in "intrapersonal, interpersonal, and environmental processes" with the potential for health-promoting outcomes (Alaimo et al., 2016, p. 303). Some of the benefits of gardening can include feelings of self-efficacy and competence (Alaimo et al., 2016). The interaction with others that occurs through gardening can increase social interaction and support (e.g., Kingsley et al., 2020) and foster deeper civic engagement (e.g., Diekmann et al., 2020). Through direct engagement with the physical world, gardeners also build attachment to place; experience "overall feelings of joy, pride, purpose, peace, and awe" and report reduced stress (Alaimo et al., 2016, p. 305). Through all these processes, gardens shape key determinants holistically of physical and mental health: diet, physical activity, community connections, stress levels, and connection to nature, which can lead to therapeutic benefits (Genter et al., 2015; Marsh et al., 2018; Ong et al., 2019); improvements in overall physical health (Park et al., 2017; Bail et al., 2018; Litt et al., 2017; Soga et al., 2017a,b; Howarth et al., 2020) and psychological wellbeing (van den Berg and Custers, 2011; Clatworthy et al., 2013; Cipriani et al., 2017; Chalmin-Pui et al., 2020).

Several studies have noted a "global garden boom" during the COVID-19 pandemic, triggered in part by people seeking contact with nature and community (Atkinson 2020; Lin et al., 2021). Other research has suggested people turned to gardening during the pandemic to address food security, enhance social connections, reduce stress, build resilience and foster food sovereignty (Donati and Rose 2020; Lal 2020; Loker and Francis 2020; Mejia et al., 2020; Pulighe and Lupia 2020; Langemeyer et al., 2021; Egerer et al., 2022). Theodorou et al. (2021) found that gardening during the COVID-19 pandemic lowered psychological distress in gardeners from multiple countries in the Global North.

While the literature on gardening during times of crisis suggests that gardening can be a coping mechanism for stress, enhance political change, and reinvigorate cities, previous studies have focused on disasters (e.g., hurricanes) that have been shorter in duration and more geographically bounded than the COVID-19 pandemic (Kato et al., 2014; McVey et al., 2018; Shimpo et al., 2019; Barthel and Isendahl 2020). As such, most work focuses on case studies and there is little evidence as to how a protracted, global crisis might impact gardening, and people's perspectives, attitudes and experiences of gardening; and in turn the benefits that result. The COVID-19 pandemic provides an opportunity to investigate these experiences.

Applying a socio-ecological model of health, this study explores qualitative data to understand people's daily gardening experiences during the early part of COVID-19, and the impacts of the practices and attitudes as the global health crisis unfolded. We posed the following research questions:

1 How did people's gardening experiences change during the early stages of the COVID-19 pandemic?
2 To what extent did COVID-19 impact people's perspectives and values about gardening?

2. Methods

This study examined results from a global online survey to investigate gardening experiences and the significance gardeners attached to gardening during the COVID-19 pandemic. Here we focus on the qualitative analysis of the survey's open-ended questions. A qualitative descriptive design (Bradshaw et al., 2017) was chosen to understand the survey's four open-ended questions, namely:

- *Why did you decide to garden this year?* [This question was asked only of participants gardening for the first time during the pandemic]
- Has COVID-19 changed how you think about the value of gardens for you and your community? Please explain.
- Is there anything else you would like to tell us about how COVID-19 has impacted the way you garden or your ability to garden?
- Who or what has helped or provided extra support to you with gardening during Covid-19? Please tell us more about this.

The survey was administered between May and August of 2020 when most countries were experiencing, or had experienced, their first and in some cases second lockdown. Participants were recruited through social media promotion (via Twitter, Linkedin and Facebook), targeted emails to gardening networks and newsletters, which focused on, but were not limited to Australia, USA and Germany (based on the researchers' home locations). To facilitate participation in this study the survey was translated into English, German, Spanish and Vietnamese. *Qualtrics. XM* was used as the online platform to administer the survey so that people could easily use their mobile or computer devices to participate.

It should be acknowledged that during this three-month period, gardeners in different parts of the Global North experienced variations in seasons (e.g., in the northern hemisphere it was the peak summer gardening period, while in the southern hemisphere it was the middle of winter) as well as the severity of the lockdowns and pandemic, which could influence motivations for and experiences of gardening. Furthermore, it is important to recognise that differences exist between countries that participated in this study, for example in urban density, availability of land, housing styles, access to community and home garden spaces, food security and other ways that COVID-19 impacted those places. Despite these variations, gardener interest in gardening, as measured by online search activity, was largely synchronised across the globe with the first lockdown experienced (Lin et al., 2021).

All participants of the survey consented via a Plain Language Statement (supplementary material) that provided ethics information and the agreement that the participant was over 18 years old at the start of the survey. Ethics for this research was independently approved from two universities because of the global nature of the survey from Swinburne University of Technology Human Research Ethics Committee (Project ID: 3031) and the University of California Davis Institutional Review Board (Project ID: 1602882–1).

After data processing, 3743 survey responses were selected for analyses (see Appendix A for a breakdown of the demographics for each qualitative question). The qualitative data were analysed by three of the authors, experts in qualitative research methods (blinded). Each coded the data individually, then the group met to reflect and modify the themes and sub-themes to find a consensus. During four online meetings, the researchers discussed these codes through an interactive process by applying a reflexive thematic approach (Braun and Clarke 2019). Codes were discussed in these meeting and then further clustered into themes. In this way, the qualitative data was analysed systematically, avoiding the inconsistencies in the coding and themes leading to unsubstantiated claims (Nowell et al., 2017). These themes were then further analysed by four of the co-authors (blinded) to ensure they accurately reflected the data. Based on the team discussions, modifications were made to support the refinement of themes and to avoid any unsubstantiated claims. This reflexive and iterative process enhanced intercoder trustworthiness (Elo et al., 2014).

Quantitative descriptive information such as gender, location, year of birth and gardening experience were collected and connected with the qualitative datasets to provide context in the results section. To demonstrate the diversity of survey responses, each quote in the results section is from a unique individual.

In addition to the thematic analysis process, we undertook a sentiment analysis using Nvivo (version 12) of all open-ended questions. This approach is often used when there is a large volume of data to review, to mine participants' opinions and attitudes towards an issue, and to take 'into account unforeseen factors' and text (Sinnott et al., 2016; Ma et al., 2018; Zunic et al., 2020). Sentiment analysis is defined as "automatically determining the valence (positive and negative dimension) of a piece of text" (Sinnott et al., 2016: p. 357). Although sentiment analysis

is mainly used to analyse social media and online materials (Pratama and Ratno, 2017), the authors believed it would be a valuable in this instance because the survey and data recruitment occurred online, via social media and with a high volume of participants. Sentiment analysis converts qualitative data into quantitative data by automatically coding themes (Ma et al., 2018). Undertaken by the lead author, the sentiment analysis allowed the team to compare them against the reflexive thematic analysis results. Sentiment analysis has limitations, such as its potential difficulty placing subjective language into categories; for example, time could be interpreted in a range of ways (Ma et al., 2018). Nonetheless, the authors used this to help understand a particular aspect of the data that was then expanded upon through the reflexive thematic analysis techniques. The sentiment analysis findings need to be considered with caution, as a partial snapshot of the fuller qualitative study.

2.1. Limitations

In addition to the limitations of sentiment analysis, there are further limitations to the use and translation of this research. Firstly, although this research provides an in-depth snapshot of gardening experiences during COVID-19, it is not representative of people's long-term engagement with gardening and the systemic changes that the COVID-19 pandemic might have introduced in this practice (Ossola et al., 2018). Secondly, the survey was only translated into four languages and distributed exclusively online, which may have limited people's participation in the survey. Finally, COVID-19 restrictions limited our ability to conduct interviews in person, our sample attracted people who actively decided to engage with gardening (and our survey), therefore excluding people who were not interested in either gardening or in completing surveys.

3. Findings

In the context of lockdowns and other disruptions to daily life, study participants reflected on their experiences with and within the garden. Our analysis generated four themes:

- **More time:** Participants had more time to spend gardening. For many, being forced to stay at home during the pandemic led to heightened appreciation of and more time in gardens, which felt like a safe and secure space.
- **New barriers to gardening:** Participants lacked access to seeds and seedlings because of limited supply and higher demand. For a subset of participants, access to communal, school and even home gardening spaces was restricted, forbidden or avoided. These changes increased the difficulty of maintaining garden spaces. Participants were also concerned about personal safety at their food store, nurseries or in communal gardens.
- **Modified and innovative practices:** Participants changed their gardening practices during COVID-19. Some of these changes were motivated by participants' desire to garden in ways that would have a positive impact on their community and the planet, e.g., planting extra food or creating habitat for wildlife. Sub-themes in this section revolve around opportunities to learn and be creative in the garden during the pandemic.
- **Cultivating relationships through the garden:** Gardening took on new significance in people's lives as gardens became places where people interacted and were outdoors during lockdowns (especially with family members), instead of at work or in other social settings.

A subset of participants reported that the pandemic had little to no impact on their gardens because they were already avid and long-time gardeners. As one participant described, she had always had a "green thumb" and "always used gardening for relaxation and closeness to nature" (Germany, 1984; female, gardened 10+ years). Many experienced gardeners (participants who had gardened for 10 years or more) expressed that they had always placed a high value on their gardens for food, promoting biodiversity and environmental impacts. In the following section, we present the findings in more detail, under their thematic category headings.

3.1. More time to garden during the pandemic

For study participants, one of the defining features of gardening during the early COVID-19 pandemic was having more time to spend in their gardens. In the sentiment analysis, 'time' was the third most common theme, mentioned 103 times, with the three most common codes being: 1) free time, 2) extra time, and 3) leisure time. As open-ended responses revealed, pandemic-related changes to work, travel/mobility, and social or leisure activities opened up time to spend in the garden. Typically, participants were stuck in place because they had lost jobs or hours at work, were working from home, and/or could no longer travel or participate in extracurricular activities.

> *"Before COVID-19, I travelled to care for my mom 2 weeks out of every 8. I had no time to garden … now that I cannot travel … I have planted a vegetable garden for the first time in 5 years. #silverlining"*

(USA, 1959; female, gardened 10+ years).

Participants frequently noted that an outcome of the extra time spent gardening was better care for the garden. With newfound time to garden, they reported being able to do more garden planning, to catch up on deferred maintenance, and to implement new projects. Participants observed that they had more time to weed, to water, to attend to pests ("for example, crush potato beetles during my break time"), and to care for plants. As one gardener explained, "Covid-19 and being furloughed from work gave me the opportunity to physically expand my garden and spend more time tending to my plants" (USA, 1975; female, gardened 10+ years). There was an acknowledgment that gardens "flourished and bloomed due to the extra time" (India, DB N/A, female, gardened 5–10 years). People were proud of what they had accomplished with these new opportunities to garden, such as "creating a pollinator garden" (Canada, 1964; female, gardening again after break).

More time in the garden also lead to greater attunement to and appreciation of the garden. With more time to spend in their gardens, participants were "more mindful of the day to day changes in the garden … the rhythm of the seasons is more apparent" (USA, 1953; female, gardened 10+ years). This extra time gardening was associated with stress reduction, maintaining "sanity," and other physical and mental health benefits. It allowed for therapeutic benefits with participants explaining the deep connection they got from gardening and being "able to pop out and do tasks throughout the day, or just stand there and look and breathe" (South Africa, 1969; female, gardened 10+ years).

Whilst concerns about being exposed to COVID-19 were widespread and affected how participant undertook their day-to-day life, gardens became a safe haven for many. Participants who gardened for food perceived their produce to be safer and meant they did not need to be present at places like shops and supermarkets where they could catch COVID-19 from others. Similarly, some study participants also mentioned feeling concerned about visiting garden centres/nurseries and were avoiding them because of the risks of contracting COVID-19. Many preferred to buy materials online and have them delivered home to their homes. The idea of a safe space came up as the fourth most common theme in the sentiment analysis through the word 'space' mentioned 95 times with the most common codes relating to: 1) safe space, 2) using space, and 3) healthy space.

It is also noteworthy that for a subset of participants, time for gardening became even scarcer during the early months of the pandemic. These gardeners wrote that they had less or no time to garden because of work demands (e.g., in medical professions) or increased care-giving responsibilities for children or sick family members. This

lack of time to garden was epitomised in the following quote:

> "*In terms of my own garden I have not been able to … do the amount of work needed as my free time is spent caring for my mother who has dementia … her carers have not been able to come in*" (United Kingdom, 1974, female, gardened 10+ years).

3.2. New barriers to gardening

While more time for gardening was generally viewed positively, other pandemic changes created obstacles for gardeners.

3.2.1. Supplies

Many participants noted that it was hard to buy seeds and get compost, soil, mulch, and other gardening supplies. As one gardener wrote, "I had a very difficult time getting seed. They were not always available locally and when I tried to order, they were only filling orders for commercial growers or were out of stock …. I had never experienced anything like it and I am 80" (USA, 1939; female, gardened 10+ years). As a result of these shortages, some participants mentioned that they could not find the plants or varieties they wanted, so they were forced to select unfamiliar or less preferred varieties. Because of time spent searching for seeds and plants or backorders for these products, participants commented that there was a delay in receiving garden materials. Others found that seed and plant prices were higher or that quality was sometimes lower. Participants recognised supplies were down because of people's increased interest in gardening, which they saw mainly as a positive development. Some who were unable to go to their garden centres for supplies missed the "emotional lift" of touring their local nurseries.

3.2.2. Difficulty maintaining communal gardens

Some community gardeners were frustrated that they lost or had restricted access to their sites during lockdowns. As one gardener explained, what this meant in her communal garden was "the group was restricted from meeting" (Australia, 1966; female, gardened 10+ years) and maintaining common areas. While new COVID-19 rules for community gardens varied considerably and complete garden closures were not frequently mentioned by study participants (Cortez et al., 2022), they caused deep frustration when they occurred:

> *"86 adults could not get into their garden plots; the county closed the nurseries, leaving almost no way to get seeds … What I depended on to have a crop was taken away. Gardening brings stability and peace"*

(USA, 1955; female, gardened 10+ years).

Participants reflected that this led to garden spaces looking less loved, behind schedule, and less inclusive to diverse gardeners. This was often associated with COVID-19 restrictions being hard to decipher especially when language was a barrier, and sometimes reduced trust in community.

Alternatively, a subset of participants were fearful of contracting COVID-19 in communal gardens. One participant explained her reluctance to attend her verge garden because she felt it was "dangerous" and people were not "respectful" of her space. Another participant highlighted this impact: "none of us could gather … my circle of friends traditionally take turns working in each other's gardens, and as "women of a certain age" we do not feel safe to do that anymore" (USA, 1951; female, gardened 10+ years). Another participant similarly explained their fear to visit their local community garden (even though most were not affected):

> *"I worry about coming into contact with other gardeners … who do not always follow safety guidelines. Some days the park next to the garden has been crowded to the point that I would skip visiting … I now fear contact with others"*

(USA, 1972; female, gardened 10+ years).

At community and school gardens, it became harder to get help when needed because of new rules. Without this support, people struggled to manage larger gardens, especially where volunteers typically helped with various projects and tasks:

> "I am the volunteer garden coordinator and caretaker. When school shut down … I was allowed a key to access the very large vegetable garden … I have been able to water and maintain it. However, usually I have the help of dozens of parent volunteers … so there is always too much to do" (USA, 1972, female, gardened 10+ years).

It is important to note that while gardening for some was worrisome for some participants, it was more common for participants to report that they enjoyed the opportunity to connect with others, outside, that their gardens offered. This was evident in the sentiment analysis of positive and negative comments associated with gardening which identified 390 responses were 'very negative'; 687 were 'moderately negative'; 1382 were 'moderately positive'; and 458 were 'very positive'.

3.3. Modified and innovative practices

Study participants noted that spending more time in their gardens and/or needing to work around supply challenges gave them the opportunity to experiment with new gardening techniques and plants. The most common word in the sentiment analysis was 'garden' itself (mentioned 430 times) with the most common associated code being "garden project" relating to activities people undertook while spending more time in their gardens.

3.3.1. Opportunities to learn and be creative

Participants were trying new techniques, being more daring, and had time to learn new skills during COVID-19 lockdowns. Some participants became more creative out of necessity:

> "*Before I would just go and buy the supplies that I need but due to the limits of these supplies … I have been using whatever I have around the house*" (USA, 1998, female, first time gardener).

People tried growing new plants (especially from seeds) and undertook new projects. One participant mentioned "I have become more creative with succulents and making arrangements in pots and I am making a fairy garden for my grandchildren" (Australia, 1961; female, gardened 1–5 years). Many participants reflected that they slowed down to consider how old management methods could be more environmentally sustainable.

3.3.2. Creative cultivation

During COVID-19, some participants re-evaluated what they wanted to grow. They mentioned shifting the balance between ornamental, habitat, and edible plants in their gardens given their interests in food production, habitat creation and biodiversity conservation, sustainability, and creating beauty. The sentiment analysis captured a widespread interest in edible plants and food production. The second most common theme in the sentiment analysis was food (mentioned 235 times) with the three most mentioned codes being: 1) getting food, 2) local food systems, and 3) food production. The fifth most common code was plants, mentioned 93 times, with the most common codes being, 1) medicinal plants, 2) edible plants and 3) vegetable plants. Some participants explained they grew more flowers for aesthetic pleasure:

> *"I always grow my herbs and my veggies but this year I had time to expand my flowers! Flowers bring joy and a brightness to my life"*

(USA, 1974; female, gardened 10+ years).

Other participants shifted from growing flowers to edibles, so they could produce more foods for themselves or others. Some participants

had totally new gardening experiences:

> *"I did something this year that goes against all of my grain … I planted a Covid victory garden blending vegetables for the first time in my strictly annual and perennial bed!"*

(USA, 1963; female, gardened 10+ years).

For many survey participants, this period in the garden allowed people to focus and plan out a project effectively. Two participants reflected on their extra time to garden:

> *"We have found more time to consider our garden … tending the veggie patch is better embedded into my routine. We have also reflected on the 'feral' plants in our garden and are now transitioning some of the plantings from invasive species to native and drought resistant plants to aid biodiversity and be kinder to our environment"* (Australia, 1962, female, gardened 10+ years).

> *"The time to invest in and experience the garden has provided a virtuous circle. We added a micro pond and a frog visited within days … a woodpecker visit our aged apple tree even though our garden is very small and in an urban area. There has also been more time to observe bees, butterflies and other insects which has prompted me to think about more wildlife-friendly gardening"* (United Kingdom, 1982, female, gardened 1–5 years).

For some it was purely about having the time to garden and get into the "rhythm of learning" required to grow a productive garden. Others mentioned the extra time allowed them to connect to "the lovely bees and butterflies and nurturing nature" (USA, 1960; female, first time gardener) and appreciated "the opportunity to get away from screens" (USA, 1988; female, gardened 1–5 years). Some participants reported a change in the value they placed on connecting with nature, self-sustainability or to fix "supply chain issues … [and] to foster community spirit" (Australia, 1982; female, gardened 10+ years). The ability to improve gardens was often mentioned as satisfying through activities like weeding, planting, and developing new garden spaces.

3.4. Cultivating relationships through the garden

Freeing up time allowed many families to bond, exchange knowledge and connect with each other because they were required to stay home and therefore were less involved in other leisure-based activities in the wider community. Thus, many participants' families were 'forced' – in a positive way - to socialise together within the garden.

> "The garden is a family garden. This is where I exchange ideas about gardening with my mother and grandmother. COVID-19 freed up time … so that we could see each other more often in the garden and learn a lot from each other" (German, 1995, female, gardened 1–5 years).

Participants also mentioned taking advantage of this time to be outside with their children when all else was cancelled. One participant highlighted:

> "Gardening has always been my solo activity, but now that my family has time, they have been helping … My garden has become our garden and I am happy to share" (USA, DB N/A, female, gardened 10+ year)

Some participants acknowledged how this extra time in the garden with their families had strengthened the experience, enjoyment and helped create a nicer outdoor space. This allowed participants to share hobbies with their loved ones:

> *"My husband has always been a keen gardener and I thought I hated it. But … I started helping him out … and really enjoyed it"* (Australia, 1971, female, first time gardener).

Additionally, participants described how these new or deeper social connections in the garden could extend beyond the immediate household and out into their communities. Gardening made participants feel more connected to their neighbours:

> "*I snuck in some salad greens at my mums house (she has a large native and ornamental garden with lawns). She is now keen on growing a few salad veges and finds it rewarding. I tackled a large native verge planting at my house … Also made an effort to check in with neighbours and socialise (safely) with neighbours on the front verge"* (Australia, 1967, male, gardened 10+ years).

People noticed that "the garden has provided a welcome sight to neighbours and passer-by" (Australia, 1970; female, gardened 10+ years) and made people more "proactive [in] … reaching out to each other" (USA, 1975; female, gardened 1–5 years) in their community to share advice and produce.

But sometimes the reverse was the case. Some community gardeners were forced to deal with issues they felt they were not equipped for (e.g., kitchen scraps being dropped off by local neighbours because composting services were not working which put huge burdens on community garden volunteers). Few participants mentioned missing their friends in the garden and feeling alone as social events and garden spaces were restricted. People missed sharing produce, learning together and socialising with like-minded people.

4. Discussion

Our analysis of study participants' experiences during the early months of the COVID-19 pandemic generated important findings about the role gardening played during this time. As people's physical and social worlds contracted during the early months of the COVID-19 pandemic, these substantial changes to daily life extended into the garden. With more time to garden but fewer supplies, people took on new projects and deferred maintenance while experimenting with new gardening techniques and plants. With fewer social outlets and more fear of being around others—particularly in enclosed spaces—gardening became a relatively safe space for social activity or a haven to be alone. Many study participants reported that the extra time that COVID-19 pandemic afforded them in their gardens helped them cope with pandemic restrictions or fears through relaxation, access to the outdoors, and social connection with family, friends, and neighbours. These findings align with a socio-ecological understanding of health: gardening had diverse and holistic impacts. These findings are consistent with the evidence of multifaceted gardening impacts in non-pandemic conditions (Kingsley et al., 2019; de Bell et al., 2020).

What seems to be a common thread to our findings is the social importance of gardening during this period for individuals, families and communities. This study shows the garden space moving from an individual space to an outlet and safe environment to share time and experiences with others so that, as one participant described, "*my* garden has become *our* garden." Even though we recognise there are barrier to accessing the garden over this time the attitude to gardening was predominantly positive. Indeed, it seems that gardens, and the acts of gardening, provided a significant social outlet when the world for some was isolating or shrinking because of COVID-19 restrictions. At an individual level, participants felt proud about improving their garden spaces. Sharing gardening experiences as a hobby seemed to strengthen family ties and relationships, supporting the gardening literature around gardening increasing social capital. This was specific to bonding social capitals where close networks had the space to rely, support and learn from each other (Kingsley et al., 2020). For some gardeners, the garden space helped to create or deepen social connections during the pandemic. This is consistent with the literature that highlights that gardening has diverse social and community benefits and acts as an escape from stresses even in non-pandemic times (Alaimo et al., 2010; Veen et al., 2016; Shostak and Guscott 2017; Cumbers et al., 2018; Scott

et al., 2018; Kingsley et al., 2020). However, this sentiment seemed to be amplified during this period in our results.

Some participants also noted the extra time gardening allowed them to focus their efforts on increasing food security, on addressing environmental issues, and creating connections with nature and a better environment. This supports Richardson and colleagues' (2020) research that indicates greater involvement in activities in nature, like gardening, leads to stronger conservation beliefs. Along with gardening enhancing peoples' mainly positive experiences in green spaces it could be viewed as a possible social determinant of health and support especially during crises like COVID-19.

With more time to try new techniques and be creative in their garden spaces, participants modified their gardening practices. This trend appeared to occur not only because participants spent more time gardening but also out of necessity as people had to think out-of-the-box due to the lack of seeds and materials early in the COVID-19 pandemic. Gardeners reported incorporating diverse plant types, such as medicinal, edible and vegetable plants as well as flowers and other ornamentals for their beauty and habitat value. Participants' comments about experimenting with or expanding what they planted highlight some of the rich and diverse gardening practices going on during COVID-19, which warrant further exploration. This was evident by the most common code in the sentiment analysis being 'garden projects' which led to multiple benefits including creativity, self-efficacy, and deeper concern for others and the local environment.

4.1. Gardens promote social-ecological health during Covid-19 pandemic

The multifunctional benefits of gardening for community, physical health and psychological wellbeing have been documented before the COVID-19 pandemic (Soga et al., 2017a,b; Howarth et al., 2020; de Bell et al., 2020; Chalmin-Pui et al., 2020). Evidence indicates the drivers for pre-COVID gardening include a safe place to connect with nature, respite, love of gardening, physical activity, growing fresh food, educational attainment, social interactions, creating community, social-ecological justice, and catalysing new food movements (Nordh et al., 2016; Kingsley et al., 2019; Palar et al., 2019; Cepic et al., 2020). The experiences of participants in our study show these positive benefits continued during COVID-19 and may have been strengthened during this period as gardeners had space to relax in nature and connect with people at a deeper level (Marsh et al., 2021).

4.2. Future directions

We found mixed responses among survey participants on how the crises changed the way people gardened or valued garden spaces. While some more experienced gardeners reported little change to gardening activity during the COVID-19 pandemic, others stated that the pandemic restricted their gardening all together. Here, future research could determine how sociodemographic background or social context influences the presence of or lack of barriers to gardening. Furthermore, future work could investigate the relationship between feelings of safety in gardens and motivations to garden with an eye to creating more inclusive gardens that can help address health inequities. Research could document if and how gardening is maintained or forgotten as people return to work and school away from their homes. At the very least a follow up study should be undertaken as gardening experiences are continuing to evolve as we learn to live with the COVID-19 pandemic globally.

Although this paper has reviewed some of these issues, larger and randomized population-based data would provide a more complete understanding of pandemic gardening practices. Countries are now 'learning to live' with COVID-19, so it is important for future research to examine if and how gardening can support communities through this pandemic and beyond.

5. Conclusion

For many people and communities, gardening during the COVID-19 pandemic was a source of support as they dealt with the changing conditions of lockdowns. Gardening has multiple pathways for improving health and well-being, many of which helped gardeners with some of the challenges of COVID-19: isolation, stress, anxiety. On a practical level it increased people's social connections which facilitated their ability to cope, connect, share and be happy during the COVID-19 pandemic. It gave people something positive to focus on in hard times, be it completing a project, improving sustainability or building community.

The findings generated by our research show that attitudes towards gardening were mainly positive during the COVID-19 pandemic and have the potential to be health promoting. By strengthening support for and equitable access to gardens, gardening has the potential to mitigate food insecurity, enhance greenspaces, be a positive determinant of health and provide social supports to address health inequities. The experiences of gardeners during the pandemic reinforce the idea of gardening as an effective nature-based solution that addresses health, wellbeing, climate change and social challenges in our cities (Kingsley et al., 2021). Gardening goes well beyond the individual impacting ecosystems, human and non-human determinants of health alike in a holistic way.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.healthplace.2022.102854.

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