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Mental health and well-being in times of COVID-19: A mixed-methods study of the role of neighborhood parks, outdoor spaces, and nature among US older adults

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ABSTRACT

The role of parks and nature to support well-being during the COVID-19 pandemic is uncertain. To examine this topic, we used mixed-methods data collected in April–May 2020 from US adults aged ≥ 55 in the COVID-19 Coping Study. We quantitatively evaluated the associations between number of neighborhood parks and depression, anxiety, and loneliness; and conducted qualitative thematic analysis of participants' outdoor experiences. Among urban residents, depression and anxiety were inversely associated with the number of neighborhood parks. Thematic analysis identified diverse engagement in greenspaces that boosted physical, mental, and social well-being. The therapeutic potential of outdoor and greenspaces should be considered for interventions during future epidemics.

1. Introduction

Exposure to residential greenspaces, including parks, gardens, and nature is associated with better physical and mental health. Although there is some variation across studies, most have reported that active or passive interaction with natural environments was associated with lower risk of stress, depression, and anxiety (de Keijzer et al., 2020; Gascon et al., 2016; Roberts et al., 2019; Twohig-Bennett and Jones, 2018). Based on the therapeutic landscapes concept, meaningful interactions with greenspaces may have healing effects that promote physical, social, and psychological well-being (Bell et al., 2018; Gesler, 1992). Access to therapeutic greenspaces may be particularly important for older adults, who may rely on them to increase their physical activity, combat social isolation, and slow functional decline (Mossabir et al., 2021; Wiles et al., 2012). The needs, desires and behaviors of older adults tend to differ from younger people in various ways, including their relationships with outdoor environments (Finlay et al., 2015;

Schmidt et al., 2019). Finlay et al. (2015) found that green and blue spaces (e.g., lakes and rivers) were sites for healing and rehabilitation for older adults, and locations to connect spiritually with deceased loved ones. Moreover, older participants valued parks as places to interact with friends, family, neighbors, and strangers.

The COVID-19 pandemic has caused state and local lockdowns, limitations on movement and gatherings, and employment/financial constraints (National Conference of State Legislatures, 2021; Sekar and Cornell, 2020). As many indoor spaces where older adults gathered were suddenly inaccessible or unsafe (e.g., gyms, churches, senior centers), outdoor spaces became increasingly relevant in people's daily lives (Yan et al., 2021). To date, several studies have assessed how exposure to parks or other greenspaces influences mental health outcomes during the COVID-19 pandemic, but most of this research is in younger populations (Derks et al., 2020; Dzhambov et al., 2021; Geng et al., 2021; Grima et al., 2020; Heo et al., 2021; Larson et al., 2022; Lesser and Nienhuis, 2020; Levinger et al., 2021; Mitra et al., 2020; Pouso et al.,

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2021; Soga et al., 2021; Suzuki et al., 2020; Tomasso et al., 2021; Young et al., 2022). A multinational survey of 6,000 participants from 77 countries found that participants under tight lockdowns who reported more exposure to nature were less likely to have symptoms of depression and anxiety during the pandemic than those with less nature exposure (Pouso et al., 2021). Among Tokyo residents, greater exposure to greenspaces or window views during the pandemic was associated with decreased symptoms of depression, anxiety and loneliness (Soga et al., 2021). Although this study found that older age was associated with lower prevalence of mental health conditions, they did not assess the impact of greenspace exposure within age groups. In the US, a survey study showed that feelings of nature deprivation during the pandemic were associated with lower levels of reported wellbeing, but all participants were recruited from dense urban areas and 67% were 54 years or younger (Tomasso et al., 2021).

The potential of parks, nature, and other outdoor experiences to support mental health and well-being among older adults since the COVID-19 pandemic onset is unknown. Using a mixed-methods approach, we assessed the relationship between neighborhood parks and mental health outcomes among US older adults and examined qualitative responses about outdoor engagement to better understand these relationships. While the main focus of our paper is the relationship between neighborhood parks and well-being, we also considered alternative outdoor experiences in our qualitative analysis. Our findings may expand understanding of the role of therapeutic landscapes experiences during epidemics and other public health crises and inform interventions to support aging populations.

2. Methods

The COVID-19 Coping Study is a longitudinal mixed-methods study of US adults aged ≥ 55 years (Kobayashi et al., 2021). Participants were recruited between April and May 2020 using online multi-frame non-probability sampling. Adults from 50 US states, the District of Columbia, and Puerto Rico completed an online baseline questionnaire ($N = 6,938$). Questions collected quantitative and qualitative data about health and sociodemographic characteristics, mobility aids, housing conditions, residence zip code, COVID-19 morbidity and mortality, self-isolation, changes in daily behaviors, ways of coping, self-rated memory, and general health (Finlay et al., 2021b). The questionnaire also collected information on mental health outcomes including depressive symptoms, anxiety symptoms, and loneliness. The University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board approved the study protocol (HUM00179632), and all participants provided informed consent.

To analyze the data, we selected a priori a parallel convergent mixed-methods approach (Creswell and Plano Clark, 2011; Supplementary Fig. 1). Quantitative and qualitative data were analyzed separately, and the results were then paired to identify areas of convergence and divergence. With this approach, quantitative and qualitative data may complement, supplement, or even diverge from each other. Each approach is detailed below.

2.1. Quantitative approach

For the quantitative portion of our analysis, we included participants who completed the baseline questionnaire and provided a valid zip code ($n = 6,913$; $>99\%$). For the models of each outcome, we excluded participants who were missing information on the outcome or any of the covariates. The final sample sizes for each outcome were as follows: depression: $n = 6,661$; anxiety: $n = 6,609$; and loneliness: $n = 6,551$.

2.1.1. Measures

Our exposure of interest was the number of neighborhood parks near participants' residences. Although park access is inconsistently defined in the literature, the number of parks in a given area has often served as a

proxy for this measure (Bancroft et al., 2015; Cohen et al., 2016; de Keijzer et al., 2020; Gianfredi et al., 2021; Zhang et al., 2019). We used self-reported zip codes as proxies for residential neighborhoods, as these were the smallest geographic unit collected from participants. We matched participants' zip codes to their corresponding US Census 2020 Zip Code Tabulation Area (ZCTA) using the National Neighborhood Data Archive (NaNDA) (Chenoweth and Khan, 2020). We then obtained the number of parks and park areas within each ZCTA as of 2018 from NaNDA (Clarke et al., 2020). For our analysis, we operationalized the number of neighborhood parks (per ZCTA) in four categories (No parks, 1–5 parks, 6–10 parks, and >10 parks) based on the skewed distribution of the data and preliminary analyses (Supplementary Table S4).

We examined three mental health outcomes: (1) presence of depressive symptoms evaluated with the 8-item Center for Epidemiological Studies-Depression (CES-D) scale, (2) anxiety symptoms evaluated with the 5-item Beck Anxiety Inventory (BAI), and (3) loneliness evaluated with the 3-item UCLA loneliness scale (Fisher et al., 2005; Lewinsohn et al., 1997; O'Shea et al., 2021; Wilke and Straits, 2005). Based on previously used cut-off points, participants were considered to screen positive for symptoms of depression, anxiety, and loneliness, if they scored: ≥ 3 on the CES-D, ≥ 10 on the BAI, and ≥ 6 on the UCLA loneliness scale, respectively (Kobayashi et al., 2021).

We included additional variables that may confound the association between park access and mental health: age (continuous), sex (female, male), race and ethnicity (non-Hispanic white, non-Hispanic Black, Hispanic, non-Hispanic other race), pre-COVID-19 employment status (self-employed/employed full time, employed part-time, homemaker/student/unemployed, retired), relationship status (never married, divorced or separated, widowed, married or in a relationship), home building type (house or townhouse, apartment or condominium, other), housing tenure (owned outright, owned with mortgage, rented at market value, subsidized or rent free/other), self-rated health (poor/fair, good/very good/excellent), use of any physical mobility aid (yes, no), and history of any chronic disease (yes, no; including high blood pressure, diabetes, heart disease, asthma, chronic obstructive pulmonary disease, cancer). To account for neighborhood-level differences, we adjusted by median housing value and urban/rural status of the ZCTA using data from the 2015–2019 American Community Survey and the 2010 Census, respectively (Manson et al., 2021). For this analysis, a neighborhood was considered urban (U) if 0% of the blocks within the ZCTA were labeled as rural by the Census and considered suburban/rural (SU/R) otherwise. Mean population density was 7,310 and 760 people/miles² for urban and suburban/rural ZCTAs, respectively. Finally, we assessed whether urban/rural status of the neighborhood modified the association between number of parks and mental health outcomes.

2.1.2. Quantitative analysis

The associations between the number of parks and each mental health outcome were modeled separately. We estimated prevalence ratios (PR) and 95% confidence intervals (CIs) using Generalized Linear Models (GLM) with a Poisson distribution, a logarithmic link function and robust standard errors (Zou, 2004), adjusted for the previously mentioned covariates. To assess effect modification by urban/rural residential status, we included an interaction term between urban/rural residential status and the number of parks, and conducted post-estimation chi-squared tests to assess statistical significance ($\alpha = 0.05$). As a sensitivity analysis, we examined whether quartiles of park area (instead of the number of parks) were associated with mental health outcomes among all participants and stratified by urban/rural status. All quantitative analyses were conducted using Stata 16.0 (College Station, Texas).

2.2. Qualitative approach

We analyzed open-ended baseline survey responses from 767

participants related to their experiences, attitudes, and behaviors about engagement with the outdoors during the pandemic (Finlay et al., 2021b). Responses were obtained from the following questions: 'Are you taking any strategies that have been helping you to cope with the COVID-19 (coronavirus) pandemic? Please describe them below', and 'Is there anything else that you would like to tell us about your experiences during the COVID-19 pandemic?' Based on previous therapeutic landscapes literature (Bell et al., 2018; Mossabir et al., 2021; Taheri et al., 2021), the authors developed a list of keywords associated with nature and outdoor spaces/emplaced-activities to screen for relevant entries. Our search strategy included the following terms: animal, beach, bike, biking, bird, deer, field, flower, forest, garden, green, hike, hiking, lake, nature, ocean, outdoor, outside, park, path, plant, river, run, sea, stream, swim, trail, tree, view, walk, water, wildlife, woods. We consulted outside colleagues with differing perspectives and from different fields to ensure that we had not missed relevant search terms.

2.2.1. Qualitative analysis

We organized qualitative data for analysis in NVivo 12 and applied Braun and Clarke's (2006) six steps of thematic analysis. First, authors GB, VG, and JF read through all material for familiarization. Second, authors independently generated initial categories and themes (Guzmán et al., 2021), met to compare interpretations and develop a draft coding structure. After independently testing the code on the same text, GB, VG, and JF met to refine the codebook. These meetings included critical discussion of our positionalities and potential biases given prior experiences, assumptions, and life contexts. The analytical team was all-female, internationally located, and representative of three racial/ethnic identities. Third, VG coded all material. JF reviewed the coding for consistency and completeness. Fourth, all authors reviewed coded material to share major takeaways. Fifth, we finalized the definitions for categories and themes, and sixth, we wrote up the analyses. We enhanced methodological rigor through multiple strategies, including peer debriefing, negative case analysis, and clear audit trails (Marshall and Rossman, 2016).

3. Results

3.1. Quantitative findings

Among participants included in the quantitative analysis, 64% were female, 84% were non-Hispanic white and the average age was 67 years old (Table 1). Half of participants were retired (52%), two-thirds were married or in a relationship (66%), and most lived in a house or townhouse (80%). In terms of neighborhood, 64% of participants lived in suburban or rural zip codes, and more than half (54%) had over 10 parks in their neighborhood while 7% had none (Table 1). On average, participants had 18 parks in their ZCTA, and a mean park area of 4.5 miles² which represented 6.6% of the ZCTA area. Additional details of the park distribution are included in Supplementary Table S4.

Overall, there were no associations between the number of neighborhood parks and the prevalence of depression, anxiety, or loneliness (Fig. 1 and Supplementary Table S1; p-values for trend: 0.84, 0.53, and 0.36, respectively). For each outcome, Fig. 1 shows the adjusted PRs and 95% CIs for each park category compared to having no parks in the neighborhood. We found some evidence that the urban/rural status of the neighborhood modified the association between the number or parks and prevalence of anxiety, but not depression or loneliness (p-value for interaction: 0.02, 0.11, and 0.44, respectively). When stratified by urban/rural status, an increasing number of parks was inversely associated with the prevalence of depression among urban residents (p-value for trend: 0.04). Individual comparisons between park categories within this group supported this association: compared to urban residents in areas without any parks, urban residents who had 1-5 parks in their neighborhood were 26% less likely to report symptoms of depression (PR = 0.74; 95% CI: 0.56–0.99); those who had 6-10 parks were 29%

Table 1

Characteristics of participants included in the quantitative and qualitative subsamples.

	Quantitative sub-sample (n = 6,661 ^a)		Qualitative sub-sample (n = 767)		Sample differences p-value
	N	% (sd)	N	% (sd)	
Neighborhood parks (mean, sd)	18.0	19.5	21.1	21.6	<0.01
No parks	492	7.4	61	8.0	0.02
1-5 parks	1,309	19.7	123	16.0	
6-10 parks	1,278	19.2	134	17.5	
>10 parks	3,582	53.8	445	58.0	
Urban/rural status					
Suburban and rural	4,286	64.3	509	66.4	0.23
Urban	2,375	35.7	258	33.6	
Age (mean, sd)	67.3	7.9	67.3	7.1	0.80
55–64	2,755	41.4	291	37.9	<0.01
65–74	2,668	40.1	364	47.5	
75+	1,238	18.6	112	14.6	
Gender identity					
Male	2,413	36.2	165	21.5	<0.01
Female	4,248	63.8	602	78.5	
Racial/ethnic identity					
Non-Hispanic white	5,624	84.4	717	93.5	<0.01
Non-Hispanic Black	369	5.5	15	2.0	
Hispanic	334	5.0	15	2.0	
Other	334	5.0	20	2.6	
Pre-COVID-19 employment					
Self-employed/full-time	1,963	29.5	218	28.4	<0.01
Employed part-time	621	9.3	82	10.7	
Homemaker/unemployed	622	9.3	45	5.9	
Retired	3,455	51.9	421	54.9	
Relationship status					
Single, never married	554	8.3	41	5.3	<0.01
Single, divorced/separated	1,095	16.4	134	17.5	
Single, widowed	637	9.6	64	8.3	
Married or in a relationship	4,375	65.7	525	68.4	
Home building type					
House/townhouse	5,310	79.7	631	82.3	0.11
Apt/condominium	1,099	16.5	107	14.0	
Other	252	3.8	26	3.4	
Home tenure					
Owned outright	3,117	46.8	414	54.0	<0.01
Owned with mortgage	2,426	36.4	275	35.9	
Rented at market value	769	11.5	52	6.8	
Subsidized or rent free/Other	349	5.2	25	3.3	
Self-rated health					
Poor	155	2.3	4	0.5	<0.01
Fair	785	11.8	38	5.0	
Good	2,102	31.6	185	24.1	
Very good	2,550	38.3	346	45.1	
Excellent	1,069	16.0	194	25.3	
Use of any physical mobility aid					
No	6,096	91.5	725	94.5	<0.01
Yes	565	8.5	23	3.0	
History of any chronic disease^b					
No	2,185	32.8	302	39.4	<0.01
Yes	4,476	67.2	465	60.6	

^a This table shows the analytical subsample for models of depression symptoms; the analytical subsample for anxiety symptoms was 6,609 and for loneliness symptoms 6,551. The distributions for each variable within the anxiety and loneliness subsamples were similar to those presented here.

^b Chronic disease includes any diagnosis of high blood pressure, diabetes, heart disease, asthma, chronic obstructive pulmonary disease, cancer.

less likely to report depression (PR = 0.71; 95% CI: 0.53–0.94), and those who had more than 10 parks were 32% less likely to report depression (PR = 0.68; 95% CI: 0.52–0.90; Fig. 1, Table S1). Although the estimates were not statistically significant, urban residents who had 6-10 parks in their neighborhood and those who had more than 10 parks were also less likely to screen positive for anxiety when compared to urban residents with no parks in their neighborhood (PR = 0.70, 95% CI:

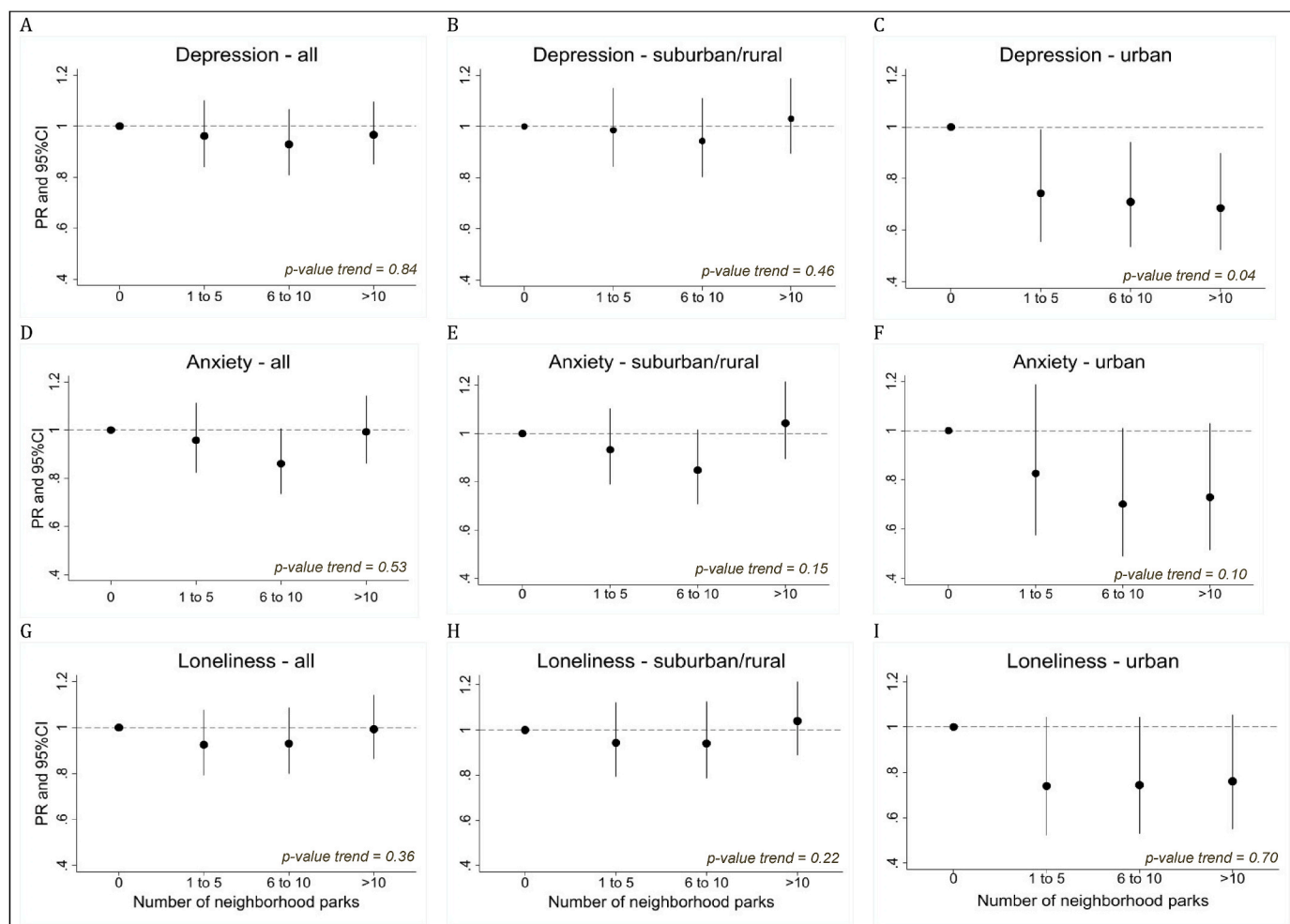


Fig. 1. Associations between the number of neighborhood open parks and mental health outcomes. Panels A to C show the prevalence ratios (PRs) and 95% confidence intervals (CIs) for the associations between the number of neighborhood parks and depression in the overall sample (Panel A), among suburban/rural residents (Panel B), and urban residents (Panel C). Panels D to F show the corresponding results for anxiety, and Panels G to I show the corresponding results for loneliness. Models were adjusted for age, sex, race/ethnicity, employment, marital status, home tenure, building type, mobility aid, self-rated health, history of any chronic disease and median housing value for the ZCTA. The dashed horizontal line at 1 indicates the null (reference) value for the PRs.

0.49–1.01; PR = 0.73, 95% CI: 0.52–1.03, respectively). In contrast, we did not find evidence of this downward trend between the number of parks and mental health outcomes among participants who lived in suburban and rural areas (Fig. 1, Table S1). When considering park area as a measure of outdoor exposure, there was no evidence of an association with mental health outcomes among any participants (Supplementary Table S2).

3.2. Qualitative findings

Among participants included in the qualitative analysis ($n = 767$), almost all were non-Hispanic white (94%), 78% were female, and the average age was 67 years old (Table 1). Over half of participants were retired (55%), two-thirds were married or in a relationship (68%), 66% of participants lived in suburban or rural zip codes, and more than half (58%) had over 10 parks in their neighborhood while 8% had none. We identified three overarching and interrelated themes related to contact with nature and outdoor spaces during the first wave of the pandemic: (1) New and adapted activities with nature and outdoor landscapes during COVID-19, (2) Motivations to seek therapeutic encounters: a means-to-an-end and an-end-in-itself, and (3) Extrinsic barriers and enablers to take part in nature and outdoor activities. An overview of each theme and illustrative quotes are shown in Table 2.

Theme 1. New and adapted activities with nature and outdoor landscapes during COVID-19

3.3. Physical activities

Outdoor fitness activities were the most widespread type of activity mentioned by participants. For many, walking was a new element of their routines, while for others it was modified to longer distances and/or higher frequencies. James (61 y, U), for instance, stated: “I exercise outdoors everyday but have made sure I take long hikes more often.”

Some participants who were regular walkers commented on the shift in landscapes related to their outdoor activities during the pandemic. For instance, when asked about her strategies to cope, Susan (60 y, SU/R) mentioned: “Walking in nature (though state parks were just closed, so I have been going to county parks and nature preserves).” Careful consideration given to the best place and time for fitness activities outdoors was apparent in many responses. Judy (71 y, U), for instance, stated she was power walking in “very open places”, while Carmen (61 y, U) wrote she was walking outdoors “for short periods at times when few people are around.”

Cycling and running were also mentioned as physical activities in which participants engaged outdoors. Helen (64 y, U), for example, noted: “I run 4–5 times a week and we get out on the beach every day and walk the dogs. It would be much harder if I could not exercise or get

Table 2
Qualitative thematic analysis framework.

Themes	Description	Subthemes	Illustrative quotes ^a
New and adapted activities with nature and outdoor landscapes during COVID-19	Responses indicating new or adapted activities that took place in outdoor settings and/or provided contact with nature during the pandemic	Physical activities (e.g., walking, running, cycling)	Rob (69 y, U): "I do much more daily walking as long as weather allows. I take three-mile walks or greater every day. It energizes and relaxes me at the same time." George (70 y, U): "I am doing a pretty strenuous power walk for 45 min almost every morning at daybreak around the neighborhood before too many people are up."
		Purposeful outdoor projects (e.g., gardening, yard work, photography)	Anna (60 y, SU/R): "I have been trying to fill what generally would be my work hours with things around the house that have not had enough attention (...). The spring has been mild, so I have been spending a lot of extra time tending to my flower garden." John (63 y, SU/R): "Being a photographer, I have been taking long walks in the woods with cameras, shooting wildlife, birds mostly! It takes my mind off of the state of the world right now and the huge loss of life."
		Passive activities (e.g., contemplation, listening to nature sounds)	Louise (58 y, SU/R): "I'm trying to find joy in each day. This may even be a good cup of coffee or a pretty bird outside."
Motivations to seek therapeutic encounters: a means-to-an-end and an end-in-itself	Responses indicating rationale to engage in outdoor activities (drive) and/or perceived outcomes from outdoor engagement. Particular attention is given to possible overlaps of multiple outcomes and a spectrum of motivations comprising interactions as a means-to-an-end or an-end-in-itself.	Physical well-being	Patricia (57 y, SU/R): "The disruption to our daily routine of exercise (members of a gym) resulted in an extreme lack of motivation to do anything which lasted for 4 weeks. Once we worked through the initial fear (which included very unhealthy snacking) and the weather improved, we got back to our daily walking at least."
		Mental well-being	Minnie (69 y, U): "I've started planting my vegetable garden; that has been difficult due to my physical limitations, but it feels useful/productive as well as providing outdoor physical activity. I also planted some flowers, which feels cheerful."
		Social well-being	Barbara (62 y, SU/R): "For myself, speaking with everyone I pass on my daily walk makes me feel more connected. The nice thing to come out of this is that neighbors take the time to chat if even for a moment. People offer to help to one another which is heartening."
Extrinsic barriers and enablers to take part in nature and outdoor activities	Responses indicating extrinsic factors that hindered or facilitated contact and/or enjoyment of outdoor and nature activities during the COVID-19 pandemic.	Weather	Martha (75 y, SU/R): "I am grateful for being active and living in [Arizona]. The weather is beautiful, and it allows me to be outside mindful of social isolation."
		Neighborhood/living community characteristics (including social, natural and built environmental characteristics)	Nancy (68 y, U): "I feel lucky that I live in a not so dense area and people are begin very respectful of personal space and keeping at least 6 feet apart."
		Household characteristics	Edna (70 y, U): "I am also thankful that our house has two, private outdoor spaces (attached deck with grill and table and a large roof deck). Being able to get outside without a mask to enjoy fresh air is key to my mental well-being!"

^a Names in quotes correspond to participant pseudonyms, followed by their age at time of data collection, and household location in an urban (U) or suburban/rural (SU/R) area.

outdoors." While Helen was likely a regular runner before the pandemic, for others these activities were new and adapted to the public health efforts to contain the spread of the virus. As in the case of David (74 y, SU/R) who shared: "I ride my bicycle at least 12 miles a day - new behavior for me (with a mask in place)."

3.4. Purposeful outdoor projects

Multiple scales of gardening and outdoor projects acted as substitutes for activities that were disrupted by the pandemic and played an instrumental role in helping people to "keep busy." Doris (70 y, SU/R), for instance, specified a few projects that acted as major diversions, including micro-tending 5 indoor plants sometimes on an hourly basis. A few participants expressed quests for "coming up with new projects" (Jacob, 68 y, SU/R) or "thinking of more ways of improving the garden"

(Raymond, 68 y, SU/R). Other purposive projects comprised artistic endeavors such as taking photographs of scenery or wildlife (Table 2).

3.5. Passive activities

Passive activities in which participants engaged with nature or outdoor spaces included listening to birdsong, watching wildlife through their windows or noticing nature through the passing of seasons and growing elements like flowers and mushrooms. Rose (69 y, SU/R), for instance, described she found herself being "more attentive to nature and moments of delight." Similarly, Grace (62 y, U) stated that to cope with the pandemic she was deliberately choosing to notice something beautiful in her surroundings each day – including citrus blossoms and birdsong. For a few participants, the contact with nature was an intrinsic component of their outdoor activities, so that their routes were

deliberately adapted to encounter pleasant landscapes. Debra (56 y, U), for instance, elaborated: “I’m still going out for walks, looking for flowering trees to walk past”.

Other passive activities like reading a book outside, having a warm drink in the garden, or sitting in an outdoor setting provided a structure to daily routines. A few also mentioned driving as an activity to benefit from some outdoor contact during the pandemic. For instance, Jennifer, (56 y, SU/R) shared “going for a motorcycle ride and going for a car ride. All to make me feel like I am free from 4 walls and the television.”

Theme 2. Motivations to seek therapeutic encounters: a means-to-an-end and an end-in-itself

3.6. Physical well-being

Outdoor activities were perceived as an opportunity to maintain fitness and physical well-being. Participants, such as Michael (73 y, U), further elaborated how this engagement was incorporated into their coping strategies to make up for previous routines in enclosed spaces such as gyms and recreation centers: “Creating a new routine and following it - more prayer and walking, replaces structured physical activity and social contact due to closure of gym”. A few other participants hinted that putting in place outdoor routines was not straightforward. Louise (59 y, U) for instance, referred: “I am trying to push myself to take a walk everyday, and to encourage my teenager and my mom (who doesn’t live with me) to do the same”. Fitness goals established during the pandemic emerged among respondents who mentioned variable distances and routines they were aiming to achieve, sometimes unprecedentedly. Carol (63 y, U), for example, made a goal of walking at least 26.2 miles per week, while Gabriel (66 y, U) gave himself a challenge to hike 100 miles in April, something he had never attempted before. Participants also took part in outdoor activities as a tool to achieve other physical benefits. Rose (65 y, U), for example, engaged in walking and yard work to feel tired and improve her sleep.

3.7. Mental well-being

Contact with nature also enabled well-being by alleviating stress and anxiety, and promoting positive emotions and feelings of restoration. Mabel (87 y, SU/R), for instance, mentioned: “I try to keep a positive attitude all the time and walking outside helps.” For Angela (69 y, SU/R) finding ways to structure outdoor routines was associated with achieving satisfaction: “I am trying to be more active outside. It makes me happy and I get a lot done.” Although many participants considered purposive outdoor projects as an enjoyable activity, for others they were merely a way of filling time and regaining some control over their daily routines. Donna (66 y, SU/R), for instance, stated:

I feel like time is wasting right now - and that things are slipping through my fingers. We are trying to do house projects and clean out closets and plant more than usual. But it is a matter of keeping busy - not necessarily enjoying these projects.

In contrast, Emma (62 y, SU/R) reflected on the opportunity to gain a sense of accomplishment: “Getting projects started and completed around the house and yard that I usually don’t get a chance to do. Enjoy getting the feeling of being caught up for once.” Ruth (62 y, SU/R) and Manuel (78 y, SU/R) also provided insights into how working outdoors provided respite. For Ruth, it meant an opportunity to spend some time “away from the news”, while for Manuel it represented a chance to disengage from public health recommendations:

Living on 10 acres in a rural area gives my wife and I an opportunity to spend several hours outside each day, weather permitting, working garden and maintenance projects. We don’t have to wear masks or gloves so we don’t even think about the coronavirus during these outdoor sessions.

Focusing on nature also provided feelings of comfort among certain participants. Edith (63 y, U), for instance, found herself spending as much time as possible out in the woods, bird watching and hiking, to which she added: “Seeing life go on as normal in the environment is reassuring.”

3.8. Social well-being

Although several participants engaged with the outdoors as a solo activity, it was considered by many as an opportunity to bond with others. For some, this meant engaging in a deeper relationship with those within the same living space. Alice (68 y, SU/R), for instance, mentioned “I’ve been bonding a lot with my husband watching sunsets and gardening.” Significantly, outdoor spaces also provided opportunities for people to engage with others outside their household. Interactions with neighbors at a safe physical distance were mentioned as a source of solace, an opportunity to connect and express solidarity. This social contact was facilitated by most people ‘being in the same situation’ and spending more time in their local areas. Rita (69 y, SU/R), for instance, referred: “Fortunately, it is spring, and I can spend a lot of time in my garden and talking (from 6 ft apart) to neighbors who are also outdoors.” In some instances, like for Mildred (75 y, SU/R), participants relied on communication with neighbors “in lieu of my usual contact with friends and associates.” Nonetheless, a significant number of participants continued to meet with friends or family in outdoor environments and perceived this as a safe activity as long as they could maintain a 6-foot distance. Amy (62 y, SU/R), for example, mentioned: “I try to walk with a friend (safely) about 3 times a week. The exercise and the bitch session are very helpful, but [I’m] still very depressed.”

Moreover, a small number of participants continued to engage in group activities taking place outdoors, as in the case of Larry (73 y, SU/R), who continued attending Alcoholics Anonymous socially distanced meetings in outdoor environments. Minute social interactions, such as waving or smiling, were significant contributors to coping in numerous responses. In the case of Maria (80 y, SU/R), this was associated to a feeling of purpose and routine, as she advised:

Make a rule to stand outside on your front porch, lawn or area and say hello to one person outside your home each day. Neighbor, mailman, garbage pickup person, child(ren) walking by, dog walkers ... doesn’t matter. Paste a smile on your face, ask how they’re doing, remind them to stay safe. Do this every day!

Other examples of how participants contributed to their communities in relation to outdoor activities include picking up litter on their walks and building a shared sense of community. For instance, Linda (75 y, U) stated:

I have started a project I call ‘a photo a day’ where I photograph things in my neighborhood that reflect neighbors coping with chalk messages on sidewalks, posting poems in front of their houses, placing some whimsical ornaments in their yards. I then post them each day on Facebook and text them to my family. [I’m] living in Portland where there are a lot of fun and weird things to photograph. This activity keeps me out walking, connected with neighbors and family, and is creative.

Many interactions in outdoor settings also involved non-human interactions with natural elements or animals (sometimes pets or wildlife). For instance, Julia (66 y, SU/R) stated: “I am in a rural area, so I wander around outside, interact with wildlife and birds. Catch the sun coming up, wave it off as it goes down.” For many dog owners, maintaining outdoor activities was embedded in their routines and facilitated their coping mechanisms by providing a sense of continuity to everyday life, and a source of companionship and humor. Kathleen (76 y, SU/R), for instance referred:

For me being out in nature and working in the garden makes all the difference, also something very important is the company of my dog. He really makes a huge difference in my life. I rarely feel alone, it's having another living being to care for and he makes me laugh each day.

Theme 3. Extrinsic barriers and enablers to take part in nature and outdoor activities

3.9. Weather

Participants perceived weather as a major factor influencing their outdoor engagements. Particularly, warmer temperatures and longer days were considered enablers to spending time in outdoor activities. Possibly because the timing of the first wave of the pandemic coincided with the seasonal change from winter to spring in many areas in the US, participants pointed out that the weather improvement meant they could now spend more time enjoying walks around their neighborhood and gardening. Other participants noted that they choose to stay indoors and cited cold, wind, and rain as primary barriers. However, a few participants also mentioned they would engage in walking “everyday rain or shine” (Betty, 66 y, U) or an appreciation of being able to take walks “between freezing weather and lots of rainy days” (Kenneth, 65 y, SU/R).

3.10. Neighborhood and community characteristics

Participants recognized the location of their households influenced the accessibility to natural resources. Some explicitly mentioned they felt fortunate to be able to isolate in proximity to nature and/or surrounded by beautiful landscapes. Living in low-density suburban or rural areas was perceived as an advantage to experience less disruption in daily routines. Lisa (62 y, SU/R), for example, referred: “I live in a rural area where isolating doesn't feel so unusual and my health is good.” Low levels of population density were also considered by many participants as enablers to enjoy the outdoors. Mark (67 y, SU/R), for instance shared:

I'm fortunate to live in a suburban area outside a relatively small town, so it has been easy to get outside while maintaining appropriate distance from other people (...) if I were here by myself, or living in a crowded urban area, it would be an entirely different situation.

In comparison, Rebecca (56 y, U) described her experience living in the ‘epicenter of the epicenter’, where feelings of anxiety were fueled by a constant exposure to unwelcome sounds from ambulances and helicopters. The behavior of other people sharing public spaces was also mentioned as a relevant factor influencing outdoor activities. People adhering to the restrictions and behaving respectfully were perceived as enablers. Karen (68 y, U), for example, noted: “I feel lucky that I live in a not so dense area and people are being very respectful of personal space and keeping at least 6 feet apart.” In contrast, participants who perceived that others were not wearing masks in public reported that this made it “difficult to be outside”, as well as feeling uneasy when they came across people who were not physically distancing. Cynthia (69 y, U) noticed how other antisocial behaviors could negatively affect an otherwise positive experience outdoors:

I love the fresh air, the lack of traffic, and not having to ask that the music be turned down (or off) when we go out to eat. On the whole, our neighbors practice social distancing very well while going for walks, but some youngsters think bicycles on the sidewalk have the right-of-way [sic].

A few other participants mentioned how they adapted their routes to meet “fewer walkers and fellow bikers” when outside. Ronan (62 y, U)

emphasized that as a cyclist, his planning included places to avoid people but also had to consider where he could cycle safe from traffic. Ethel (65 y U), who is a regular walker and adjusted her routine by “getting up earlier to beat the people out onto our road to walk,” also highlighted that the limited number of public spaces created a conflict between different users:

My main form of exercise is walking 6 days a week. I have lived here 30 years and have never seen the people who are out there now crowding our neighborhood with themselves, dogs, kids on scooters/bikes all over the street. It pisses me off. I miss the quiet. And space. [sic]

Moreover, an additional barrier mentioned by a few participants to engage in outdoor activities during the first wave of the pandemic was the closure of third places to stop for food or toilet facilities. Thomas (61 y, U), for instance, stated “I miss being able to go for long walks because of not being able to go into stores to get food and drink.”

3.11. Household characteristics

Participants often attached feelings of gratitude to being able to access household elements that enabled outdoor contact, such as decks, balconies, yards, and gardens. Since several participants were sheltering-in-place or isolating, these spaces were their only source of outdoor engagements, and had an influential role in their well-being. Gladys (87 y, SU/R), for instance, wrote:

Since I self-isolated on March 2nd, I just take it one day at a time and go about my daily business as usual. I have not stepped out of my front door since then, but I continue to walk outside my back yard to water my plants and get fresh air.

Participants also shared their appreciation towards nice views, light and fresh air in their home, so many made a point of opening blinds and windows to be able to enjoy these.

3.11.1. Mixed-methods triangulation

In the overall sample, we did not observe a statistical association between the number of neighborhood parks and mental health outcomes. There were few specific mentions of parks in the qualitative results, consistent with the lack of association in the quantitative analysis. Instead, participants shared broader perceptions of relevant landscapes, multi-scalar experiences, and engagement with nature, such as neighborhood walkways, gardens, yards, and views from household windows. These meaningful outdoor experiences differed from formal neighborhood parks in definition and scale: as small as a window view and as large as a motorcycle drive. Participants generally perceived that access to green and blue spaces and multi-sensory exposure to nature (e.g., hearing birdsong, watching wildlife, tending to plants) contributed to their well-being. In addition to boosting mental health, participants also described perceived physical and social health benefits such as being able to maintain fitness, establish a routine and interact with others at a safe distance.

When we stratified the statistical analyses by urban/rural status, we observed that greater access to parks was associated with decreased prevalence of depression and anxiety among urban participants only. The qualitative results further elucidated differing perceptions and exposure to nature by level of urban density. Suburban and rural participants shared feeling fortunate to live in areas with ample open space available that facilitated being outside without worrying about social distancing or infection risk. They were able to engage with nature without relying on public parks, which may help explain the lack of a significant association in this group. In contrast, urban dwellers may have greater reliance on public parks for active and passive nature engagement, as suggested by our quantitative findings, but there were still relatively few specific mentions of parks in their open-ended responses.

4. Discussion

This mixed-methods study of US adults aged ≥ 55 from across the nation provides evidence on the roles of parks, nature, and outdoor landscapes in supporting their mental health and well-being during the early months of the COVID-19 pandemic. In times of crisis, such as the COVID-19 pandemic, we found that individuals perceived and engaged with greenspaces and other outdoor landscapes in heterogeneous ways and through diverse activities at varying scales. Our results show a predominance of everyday natural enclaves present in the household and nearby community areas (e.g., private gardens, neighborhood walks), with limited mentions of 'extraordinary' therapeutic landscapes (e.g., large national parks). This pattern of responses is influenced by the public health restrictions in place in the US during data collection, which included lockdown measures, shelter-in-place recommendations, closure of third spaces and travel restrictions (National Conference of State Legislatures, 2021; Sekar and Cornell, 2020; Volencic et al., 2021).

Our results indicate that older adults' experiences of nature and well-being during the pandemic are intrinsically connected to their social and environmental context. For instance, we found differences between the use and opportunity to access nature between rural, suburban, and urban participants. Consistent with other studies conducted in urban areas during the pandemic (Grima et al., 2020; Pouso et al., 2021; Tomasso et al., 2021), findings suggest that the number of neighborhood parks may be associated with depression and anxiety among urban dwellers, but not suburban/rural residents. While previous studies point towards improved mental and physical health as neighborhood greenspace increases, the association between the number of parks and well-being is unclear (de Keijzer et al., 2020). A study in Hong Kong found that, while tree cover was associated with higher levels of quality of life, the number of parks had the opposite relationship (Zhang et al., 2019). This indicates that the therapeutic value of greenspaces can be found across multiple scales and environmental features beyond parks themselves and that park characteristics (e.g. amenities, maintenance status, accessibility) may be more influential than the number of parks (Cohen et al., 2010, 2016; Kaczynski et al., 2008). Furthermore, some participants expressed a sense of relief from simply being outdoors without explicit mentions of green or other natural spaces. This suggests that the therapeutic potential of outdoor environments may even extend beyond natural landscapes during pandemic times. Similarly, participants' qualitative responses included very few explicit mentions of parks while suburban/rural dwellers expressed newfound advantages of larger private land ownership and low-density areas. Our findings support conclusions from a study of older adults in France demonstrating that rural participants were less likely to report symptoms of anxiety, depression, and feelings of imprisonment during COVID-19 lockdowns than people from urban areas (Pérès et al., 2021). The differences observed by urban/rural status may be further explained by higher population density and limited opportunities to access private outdoor areas in urban settings.

Findings from this study reinforce Conradson's (2005) assertion of therapeutic landscapes as relational experiences that involve a complex set of transactions between a person and their environment. In this relational perspective, individuals may perceive the same landscape in divergent ways, and an individual's experience may shift across time. This includes ephemeral characteristics such as seasonality and weather changes (Brassley, 2007; Finlay, 2018; Palang et al., 2007). As described in our *extrinsic barriers and enablers to take part in nature and outdoor activities* theme, seasonality uncovers ambiguities in therapeutic experiences and deep-rooted connections between human health and nature. For instance, poor weather may diminish physical, mental, and social well-being while participants are isolated at home during the pandemic, while spring can be associated with opportunities to be more active and observe wildlife and more people outside.

Previous research on the temporality of therapeutic landscapes experiences has also focused on individual transitions such as changes in

caregiving roles, disease onset and progression, residence changes, or retirement and bereavement (English et al., 2008; Freeman et al., 2019; Meijering et al., 2017; Parry et al., 2004; Williams, 2002). Evidence in times of shared collective trauma, such as natural disasters and public health crises is still lacking. During COVID-19, sudden changes in spatial relationships were prevalent as public health restrictions were put in place. A myriad of shifts in participant's everyday spaces, mobilities and socialities occurred at an unprecedented pace, so interactions had to be (re)negotiated. For instance, as participants sought to adapt their routines to reduced areas and closure of third places (Finlay et al., 2019), certain local characteristics emerged as well-being enablers while other places that were previously therapeutic were no longer so. The unprecedented collectivity of spatial disruption created opportunities for older people to rediscover their neighborhoods and build a sense of community. However, conflict between diverse types of users (e.g., crowd avoidance) highlights the need to develop more public spaces with equitable access for people of all ages and abilities (Levinger et al., 2021).

Life-experiences, individual beliefs and sensorial attunements significantly influence the role of nature and outdoor landscapes for older individuals during the pandemic. Previous studies indicate that affinity to nature is often shaped during early childhood experiences (Bell et al., 2014). However, our findings suggest that personal awareness about outdoor landscapes as a well-being resource can also emerge in later life when individuals face disruption of day-to-day structures and emplaced routines. Favorable configurations (i.e., accessible outdoor spaces with desirable characteristics) in face of such disruptions can enhance well-being benefits. Macro-ecological factors also shape therapeutic encounters by determining what is socially and culturally accepted as a 'positive' coping strategy: an agreeable way to make use of newfound time or contribute to society amid shared hardship. For instance, evidence indicates that collective turns to nature and outdoor landscapes may be influenced by long-standing understandings of the supportive role of nature, as well as recent media portrayals (Atkinson, 2020; Mcmillen et al., 2016; van den Berg et al., 2010).

Beyond socio-cultural influences, taking part in nature- and outdoor-based activities was formulated as enacting a routine and a sense of agency (Moore, 2016) within an otherwise volatile situation. Emerging evidence indicates that proactive coping strategies, such as purposeful outdoor projects, can trigger individual agency which has been associated with positive well-being outcomes during COVID-19 (Finlay et al., 2021a; Fullana et al., 2020; Tuason et al., 2021). Participants' rationale for engaging with nature and natural landscapes are examples of adaptive agency (Bell et al., 2014, 2016; Wiles et al., 2009). In these instances, individuals intentionally modified their behaviors to maximize outdoor and natural landscapes benefits in their social, physical and mental well-being, while minimizing the risk of infection. As such, the changes observed in older individual's relationships with natural and outdoor landscapes during the pandemic can be considered as a result from interactions between momentary shifts (i.e., closure of third spaces), cyclical changes (i.e., seasons and ephemeral conditions) and progressive individual transitions (i.e., life-course identity and sense of agency). Further studies should examine if the therapeutic effect of encounters discovered during the pandemic persists as restrictions ease.

Our results also contribute to the understanding of the role of household enablers to access the outdoors including gardens, views, and neighborhood characteristics, such as walkability, and openness of public spaces (Corley et al., 2021; Guzman et al., 2021; Hino and Asami, 2021; Tomasso et al., 2021). Contrary to our initial expectations, formal parks did not play a critical role in promoting well-being -in the quantitative or qualitative analysis-, but participants did mention nature. In some cases, participants expressed a sense of relief from simply being outdoors without explicitly mentioning nature, green, blue, or white spaces, as previously discussed in the therapeutic landscapes literature (Bell et al., 2018; Mossabir et al., 2021; Taheri et al., 2021).

However, evidence indicates that there are considerable disparities

for older people in the US to access these enablers based on race, ethnicity, income, dwelling type and health status (Dobson, 2021; Levinger et al., 2021; Malani et al., 2021). Further interventions seeking to promote older people's well-being should consider built and natural environment infrastructures that enable equal access to nature for individuals with diverse types of backgrounds, needs, health status and mobility capacities.

4.1. Strengths and limitations

There are important limitations to note. This online study launched during the first upswing of the pandemic and did not include people who may have been too sick to participate, such as those who were hospitalized with COVID-19, and those without internet/computer access (Kobayashi et al., 2021). Additionally, data collection early in the pandemic (and without pre-pandemic data) may not capture the fluid relationship between older adults and outdoor spaces over time as the pandemic and public health restrictions evolved and is unable to make pre-post pandemic comparisons. Men, racial and ethnic minority groups, and those with high school education or less were under-represented in this sample relative to the general population. Qualitative respondents were more likely than quantitative participants to be white, female, younger, healthier, married/in a relationship and own a house, all of which were associated with mental health outcomes (Supplementary Table S3). This limited our ability to analyze diverse experiences and perspectives by varying life circumstances and societal axes of power (e. g., age, gender, race, ethnicity, disability). To protect participants' privacy, we did not collect addresses or other geolocated data which precluded us from performing additional analyses such as geographically weighted regression. Instead, in the quantitative analysis, zip codes were used as a proxy for neighborhoods, but their boundaries may not accurately capture actual park access and perceived outdoor experiences. Additionally, the most updated national park data available through NaNDA is from 2018 which excludes information on recent changes, closures (particularly pandemic-related closures), or maintenance status of the park. Our binary categorization of urban/rural status of the zip code may not appropriately describe the structure of participants' neighborhoods. As the qualitative results suggested, people may engage with non-park landscapes such as private patios, gardens, and yards; street landscaping and greenery; and rural landscapes. Our qualitative results are derived from two open-ended questions not directly asking about engagement with parks or outdoor spaces, which limited deep case-oriented analysis in the current study (Boddy, 2016). The list of keywords was not exhaustive; participants could have discussed therapeutic engagement with outdoor spaces not captured by our search parameters, such as "sky". Depth of qualitative responses was additionally limited by the online survey format because we could not probe participants for further inquiry.

Strengths of this study include its timeliness of data collection, large sample size, extensive quantitative and qualitative survey data, and use of validated mental health screening scales. Our data collection occurred early in the COVID-19 pandemic during a period of immense social, economic, political, and public health upheaval. As such, it allowed us to understand how older adults maintained a sense of well-being through varied therapeutic landscape encounters during an unprecedented crisis when public health restrictions limited movement in many public spaces and outside the home. The wide age range, national coverage, and geographic diversity of participants accounts for a breadth of aging experiences and enhance the generalizability of our findings. The combination of quantitative and qualitative analytical approaches deepens understanding of the complex relationship between nature and human health.

5. Conclusion

This study uniquely highlights the importance of outdoor

engagement for older adults during a global public health crisis. Access to small greenspaces, private gardens, and other natural environments promoted the mental health and well-being of older adults and contributed to their coping mechanisms during the first wave of the COVID-19 pandemic. These results may inform future public health and urban planning efforts to focus on creating small-scale outdoor spaces for residents beyond formal parks. Furthermore, targeted programming such as collective community garden opportunities, gardening tool lending by libraries and senior centers, and birdwatching and photography classes may support physical, mental, and social well-being among older adults. Opportunities for those less mobile or physically vulnerable might include organized scenic drives, re-orienting furniture to maximize window views, indoor potted plants, and opening windows to feel the fresh air and enjoy listening to birdsong or rain.

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Data statement

The COVID-19 Coping Study data are publicly available at The Inter-university Consortium for Political and Social Research (ICPSR) COVID-19 data repository: <https://www.openicpsr.org/openicpsr/project/131022/version/V1/view>.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.healthplace.2022.102813>.

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