Parks in Pandemics: Assessing the Role of Urban Green Space in the Age of COVID-19

Daisy Knobloch

ABSTRACT

In March 2020, most of the world had been struck by the COVID-19 virus. In response to resultant widespread closures of indoor venues and higher transmission risk indoors, outdoor activities grew in popularity. This led to urban green spaces (UGS), such as public parks, becoming havens for activities outside of the home. However, as more urban residents have altered their relationships with their local green spaces, concerns have arisen about the capacity of parks to accommodate these new conditions. In this study, I use a mixed-methods approach to examine how urban green space use and perception has changed during the COVID-19 pandemic in the San Francisco Bay area. Specifically, I explore individual changes in urban green space use frequency, park facility uses, and park quality under changing conditions. Surveys, park inventories, and satellite analysis were used. I found that the perceived value of urban green space has increased; that green spaces are being used primarily for exercise, social gatherings, and mental health; and that most urban green spaces are not adequately meeting the new and changing demands of visitors during the COVID-19 pandemic. As more of the U.S. population becomes vaccinated, and the State of California and local governments commence re-opening efforts, local governments should potentially prepare to address a permanently increased demand for urban green space resources, as the value that had been placed on urban green space has increased.

KEYWORDS

Public health, environmental justice, urban planning, landscape architecture, parks and recreation

INTRODUCTION

Public urban green spaces (UGS) are vital to the public health and social success of cities. Green spaces have a long, notable history in urban communities worldwide (Grinde and Patil 2009). Green space is valuable for its extensive social and health benefits (Chen et al. 2009, Swanwick et al. 2003). In fact, lack of access to parks and other green spaces can have detrimental effects on the health and prosperity of communities (Wolch et al. 2014). The ability of urban green space to serve multiple needs makes it extremely valuable to a wide range of community members. It can be used for recreation, social gatherings, community food production, as an attraction, and can provide a peaceful public space to those needing one (Zhou and Rana 2011, Rosol 2010). These positive effects of green space in urban environments can shape a city's culture and environment (Swanwick et al. 2003, Wolch et al. 2014). Often, public green spaces have been considered low-priority politically and economically (Swanwick et al. 2003), but since the start of the COVID-19 pandemic and restrictions on gathering indoors, green spaces have been receiving increased media coverage and recognition.

The COVID-19 pandemic has forced a shift in the public's relationship with the American city. Prior to pandemic closures, social groups would congregate in crowded venues, such as bars and restaurants. Many individuals would primarily exercise in indoor gyms as well. However, most non-essential indoor businesses have had extremely limited operations in California. As unemployment rates rise due to pandemic-related layoffs, the rates of mental health issues and suicide are expected to grow as a result (Kawohl and Nordt 2020, Torales et al. 2020). Because of the mental health benefits of green space, the lower risk of COVID-19 transmission outdoors, and facilities for outdoor exercise and recreation at public parks, urban green space is exceptionally valuable during the COVID-19 pandemic (Slater et al. 2020). Despite growing attention to overcrowded parks in cities like San Francisco and New York, not much is explicitly known about how pandemic conditions have shifted U.S. perspectives of the value of and need for green space. The COVID-19 virus and coronavirus disease has rapidly altered the everyday habits of urban inhabitants. Existing knowledge of the disease and how it is affecting populations worldwide is rapidly growing, but often uncertain in nature. Most information on the relationship between COVID-19 and outdoor spaces and parks is based on data and research prior to the pandemic, as there is little to no primary literature addressing how COVID-19 has altered human relations with

the outdoors and green space.

Natural and built landscape features in urban green spaces dictate how these spaces can be used by the public. Certain uses and benefits may be limited by the landscape elements present. Urban green spaces provide a public venue for exercise (Richardson et al. 2013) but depending on the type of exercise or recreation desired, the facilities available at an urban green space could be either attractive or deterring. Certain activities, such as running and hiking, are only suitable in large parks with trail systems. Likewise, urban green spaces can provide a range of mental health benefits (Alcock et al. 2014, Engemann et al. 2019), but such benefits may not be as substantial if the vegetation is not healthy (Engemann et al. 2019), if there is a lack of biodiversity (Wood et al. 2018), or if there is relatively low canopy cover (Astell-Burt and Feng 2019). Similarly, large parks, especially those with dense canopy cover can mitigate the urban heat island effect, lowering temperatures within the green space and in the surrounding area (Doick et al. 2014). A green space lot that expands over multiple city blocks with many large trees is more likely to provide substantial heat mitigation benefits than a small treeless lawn will (Doick et al. 2014, Aram et al. 2019). Some urban green spaces serve certain roles better than others. Although there are many services urban green spaces offer, green spaces can vary in perceived quality (Gunnarson et al. 2017), and such benefits are only available if the spaces are accessible. Not all green spaces are public and/or equitably distributed (Wolch et al. 2014).

Urban green spaces are not always available or accessible to the communities that need or demand it the most. For example, racial minorities, people with disabilities, and low-income households are more likely to suffer from psychiatric illness while simultaneously having less green space around the place they live on average (Wolch et al. 2014). In some cities, parks are unevenly distributed throughout the city and are often in places that are difficult to access and not densely populated (Oh and Jeong 2007, Artmann et al. 2019). In addition to geographic distance, physical barriers such as poorly maintained sidewalks and road work closures may make parks less physically accessible, especially to elderly and disabled populations (Artmann et al. 2019). Despite general good intentions, urban "greening" efforts in underserved communities often leads to unintended gentrification, otherwise known as the "urban green space paradox" (Wolch et al. 2014). Although demand for green space can change over time, COVID-19 has led to some urban parks in the San Francisco Bay Area being more crowded than what was considered standard before, and cuts to public transit service may limit perceived accessibility to green spaces,

especially those that do not live near sources of it.

This study seeks to understand how the COVID-19 pandemic has affected the relationship between urban dwellers and green space. Utilizing individual surveys and green space inventories, it asks (1) how have individuals altered the ways and amount they interact with green space? (2) How are individuals interacting with urban green space landscape features during this period? and (3) Is there adequate green space to meet the changing demand and space necessities?

History of urban green space significance

Urban green spaces have almost always been important fixtures in cities worldwide. Most cities plant and maintain trees along streets and within communities to improve the urban environment (Grinde and Patil 2009). The appeal of nature has led society to adapt urban areas to have planned-out greenery. Green space was incorporated in some of the first European hospitals, as it was assumed to have healing properties (Grinde and Patil 2009). Mostly, these motives were spiritual and aesthetic (Forrest and Konijnendijk 2005). Patrons of green spaces value "more natural" and consequently aesthetically pleasing landscapes in terms of personal enjoyment and well-being (Sang et al. 2016). However, in the 19th century, urban green spaces began to be valued more and consequently studied due to its role in helping individuals escape poor air quality from industrial pollution in Europe. This caused a surge in the development of new parks (Swanwick et al. 2003). As urbanization continued worldwide, the importance of green patches scattered throughout a city became increasingly important and valuable (Barthel et al. 2005).

More recently, questions about urban green space have increased in complexity as the high-density city has increased in popularity, the field of urban planning has expanded, and evidence of green space-related social and economic benefits have arisen (Swanwick et al. 2003). The structure of some cities reflects these societal changes. For example, in Hangzhou, China, older sections of cities often lack green space, while newer developments that have been well-planned tend to incorporate green space (Wolch et al. 2014). In Hangzhou, as well as Seoul, South Korea, the often older, central, and denser areas of the cities tend to have less green space, while less-dense, outer-lying areas of the cities are greener (Wolch et al. 2014, Oh amd Jeong 2007). This supports the notion that, as cities and societies change over time, the fabrics of cities do as well due to the constant shifting of the use of and demand for green space throughout history.

General health benefits of green space

Green spaces provide well-explored benefits to the overall health and well-being of communities. In urban environments these benefits can be especially important. Living in an urban community can change how an individual processes stress. Urban residents are also typically more prone to anxiety disorders (Lederbogen et al. 2011). In addition, urban low-income communities are more likely to be affected by environmental pollution, psychiatric illness, and many physical illnesses (Stronks et al. 1998, Wolch et al. 2014). Urban green space can directly and indirectly support the health of urban residents, who are more likely to need help than their rural and suburban counterparts. Physical activity is considered vital for both physical and mental health, and public parks alongside some other public green spaces provide free, outdoor, exercise opportunities (Swanwick et al. 2003). Activities can range from high to low intensity, which is partially dependent on available facilities and personal preference.

Urban green spaces also provide direct mental health benefits. There is lower psychiatric illness prevalence in greener urban areas and spending time in natural areas results in restorative effects (Alcock et al. 2014, Engemann et al. 2019). In general, more green space exposure is associated with better, or improved mental and emotional health (Astell-Burt and Feng 2019).

Not only do natural patches within a city help individual health, but these spaces can provide widespread environmental benefits. Green corridors in the urban landscape create natural breaks between the built environment, which can be beneficial to human health. Trees are capable of filtering certain pollutants, which contribute to cleaner urban air (Nowak et al 2006). Heavily vegetated green spaces provide heat mitigation benefits if the space is large enough, which is a public health benefit, especially in the face of climate change (Doick et al. 2014, Wolch et al. 2014). Green space's cooling effects are especially valuable to unhoused urban residents.

Measures of green space quality

It is difficult to objectively measure the quality and characteristics of green space. This study does use some methods that have been created as best practices specifically for the given pandemic conditions, as well as some pre-established methods. All study methods are situated

within and influenced by existing literature on urban, and non-urban green spaces. Green spaces are complex and changing social and natural ecosystems, so many studies opt for a holistic approach to avoid reduction of complexity and to account for confounding factors. These mixed-methods of measuring quality and accessibility include guided interviews that ask for personal perceptions and objective geospatial information (Artmann et al. 2019), quantifying aesthetic and non-aesthetic values of green spaces (Chen et al. 2009), objective measurements of quality using GIS, such as size (Hillsdon et al. 2006), and observing a change in use and perception following a park renovation through both quantitative and qualitative survey questions (Cohen et al. 2009). By using a variety of measures that consider the many factors that affect green spaces, researchers in this field hope to collect clearer and more thorough data, leading to more accurate conclusions.

COVID-19 in California

The COVID-19 pandemic has had worldwide consequences and, in the U.S., particularly, the direct and indirect effects of the virus have been difficult to control. In March 2020, many U.S. state, county, and city governments put forth shelter-in-place orders, allowing individuals to only leave the home for essential activities (Slater et al. 2020). In California, many parks were closed to the public, or open only to locals. While many parks have reopened to some capacity, many facilities remain closed. COVID-19, a respiratory virus, is less likely to spread outdoors than indoors. When outdoors, transmission is considered only high-risk when the infected are closer than 6 feet apart, are not wearing face coverings, or are having any type of prolonged contact (Slater et al. 2020).

COVID-19 has led to business closures and consequent rising unemployment rates, which can lead to declining mental health and heightened rates of suicide (Kawohl and Nordt 2020, Slater et al. 2020). Rising unemployment rates have historically been accompanied by rising suicide rates (Kawohl and Nordt 2020). Mental health issues are further exacerbated by COVID-19 because quarantining at home is likely to have negative effects on mental health (Slater et al. 2020, Torales et al. 2020). Healthcare professionals and those with a history of mental illness are especially susceptible to declining mental state (Torales et al. 2020). The CDC recommends that in an outdoor context, to put emphasis on physical distance, rather than social isolation, to curb the detrimental health effects of complete social isolation.

Physical activity may help limit the damage caused by coronavirus disease (Slater et al. 2020). However, many gyms (and similar establishments) remain closed or minimally operative in high-risk California counties (Slater et al. 2020). Even with safety precautions in place, many patrons might feel unsafe returning to an indoor establishment and may not have the space or means to exercise in their home.

The San Francisco Bay Area has been shown to be a leader in pioneering actions regarding COVID-19 including stay-at-home-orders and other legislation. However, the region has still been extremely affected by the virus. Due to an increase in outdoor gatherings, in May 2020, the city of San Francisco painted circles on the lawns of several of its parks as a reminder to physically distance (Keeling 2020). However, the city of San Francisco is still encouraging residents through its website to exercise outdoors when possible, to stay safe during the pandemic.

When the necessary precautions are taken, exposure to green space can help safely alleviate some of the issues that the COVID-19 pandemic has inflicted on individuals such as increased stress, poor mental health, less physical activity, and social isolation. However, individuals who are disabled, have health issues that make contracting COVID-19 high-risk, or do not live near green space may not have ideal access to urban green space. Consequently, it is important to understand relations between urban residents and green space in a tumultuous pandemic with no clear end, even with the support of vaccines and mask-wearing efforts.

METHODS

Study organization

I assembled the study into three distinct data collection methods for a multifaceted approach. Data collection was based in the urban areas of the San Francisco Bay Area, located in Northern California, and bordering the Pacific Ocean. The nine counties investigated have a population of nearly 8 million. San Francisco, Oakland, and Berkeley combined have a population of about 1.4 million (U.S. Census Bureau 2019). All data was collected in January and February 2021, prior to widespread vaccine distribution.

To determine the complex and changing relationship between urban residents and their local green spaces, I created an online survey through Qualtrics XM, open to residents of all urban

residents of counties that are geographically in contact with the San Francisco Bay This includes Solano, San Francisco, Alameda, Contra Costa, Santa Clara, San Mateo, Marin, Napa, and Sonoma counties. The survey disqualified any individual who did not meet both requirements. The survey contained four different sections which reflected the study questions: general behavior change, use and interaction, accessibility and satisfaction, and demographics. I recruited participants through direct outreach in the field, social media, and email. Participation was voluntary and there was no direct incentive for participation.

To complement survey results, I conducted an observational inventory of 22 public parks in the cities of San Francisco, Oakland, and Berkeley. Parks were selected randomly out of a pool of 30 parks of interest. This was added to the study because self-responding surveys alone tend to bias participants who do not use urban green space regularly (Artmann et al. 2019). All parks were surveyed from a single, unmoving, point of view for collecting the number of green space users, the percent wearing masks, and the different types of green space activities taking place. I then took an inventory of all the parks' features, separated by natural and manmade categories, by walking through the entire park. "Features present" refers to whether a feature appeared, or not at all (i.e., if a feature appeared 8 times, it would still be counted as 1 feature). However, the appearance of activities does correspond to the number of people who were partaking in a certain activity or activity category.

I utilized Google Earth Pro-derived data to supplement the observational data with relevant information pertaining to park size and public perception. The observational inventories took place at the parks in the table below.

Table 1. Urban parks selected for inventory

Berkeley	Oakland	San Francisco
Aquatic	Bushrod	Alamo Square
Cedar Rose	Dimond	Buena Vista
Codornices	Eastshore	Mission Dolores
Glendale La Loma	Lakeside	Panhandle
Grove	Pine Knoll	
Indian Rock	Snow	
Live Oak		
Ohlone East		
Ohlone West		
San Pablo		
Strawberry Creek		
Willard		

Quantifying green space interaction frequency

The first section of the online survey focused on how individuals have changed the amount of time they have spent in green space during the pandemic, how personal lives have been affected, and the relationship between the two. There was no field or software-based data collection associated with change in green space interaction, unlike the rest of the study. This section asked participants to rank their local green space use both prior to the pandemic and on average for the duration of the pandemic.

Changes in green space use were assessed using multiple software programs through visualizations and statistical analyses. I used Microsoft Excel to clean and organize the survey data, and to complete simple calculations before running it through RCommander for statistical analysis. Each descriptive ranking of green space use, ranging from "Never" to "Almost every day", was converted to a numerical value 1-6 respectively. For each participant, there were two values, one representing use before COVID-19, and one representing average use during the

pandemic. I then created a relative change index by subtracting the "before" value from the "after value". A positive value therefore meant that the time spent in green space had increased, a negative value meaning use had decreased, and a 0 signified no change. The larger the absolute value of the number, the greater the magnitude of change. A single-sample t-test was executed to determine if the mean of these values was statistically significant compared to the null hypothesis of the relative score ($\mu = 0$). To determine why people were spending more or less time in urban green spaces, multiple t-tests were calculated in RCommander. For each test, the relative change was tested for association with the yes/no responses for each participant's response to the following questions about how COVID-19 has affected them: (1) Were you regularly going to a gym that closed due to COVID-19?, (2) Have you felt your mental health declining since March 2020?, (3) Have you felt socially isolated?, (4) Have you lost your job or faced financial hardship?, and (5) Have you struggled with the health consequences of COVID-19 personally or through someone close to you? For these calculations, $\alpha = 0.05$.

Assessing facilities use and activities

To determine how urban green spaces and their natural and manmade features were being used during the COVID-19 pandemic, the online survey results and park inventories were both employed. The second section of the online survey inquired about individual use and interaction with green spaces. The relative change index was also used in the analyses. I conducted a two-sample t-test to determine if change in park use was associated with valuing natural or social values of green spaces more. The guided-interview style questions regarding why individuals spend time in green spaces and COVID-19 related changes were qualitatively observed and analyzed without statistical tests.

I observed the park inventory data to indicate which features were the most and least common in public parks, which activities were most common during pandemic conditions, and how well park visitors were complying with mask and physical-distancing recommendations. The few analyses I chose for the park inventory data were selected to show the relationship between the features of parks and how the spaces were being used related to COVID-19 related changes. I calculated several regressions with combinations of variables from the park inventories and Google Earth analyses. These included (a) park size and percent wearing masks, (b) park popularity and percent wearing masks, (c) natural features and mask wearing, (d) park size and

percent adequately distanced, (e) park size and percent active visitors.

Assessing Accessibility and Quality

Park accessibility and park quality were analyzed in relation to COVID-19, using the online survey, inventories, and Google Earth data. This section inquired about accessibility and satisfaction regarding urban green spaces, as well as the facilities and features within them. Most of the survey data related to this question was open-ended and not statistically analyzed. Statistical methods I employed included a single chi-squared test of independence for the relationship between participants' main form of transportation and whether they visited a green space outside of their city.

To examine the relationships between in-park observations related to park popularity, accessibility, demand, and facilities, the following correlations were calculated: (a) Park popularity and park size, (b) Park popularity and total natural features, (c) Park popularity and total built features, (d) Park popularity and likely deterrents (such as litter, encampments, and traffic noise), (e) Park popularity and transportation availability, (f) Park popularity and distance to the nearest green space.

RESULTS

Survey demographics

The demographics of surveyed individuals were fairly representative of the Bay Area residents. Of the 88 Bay Area residents who completed the online survey, 69.9% were women, 25.3% were men, and 3.6% were non-binary or preferred another identity. The remaining percentage declined to state (Table 2). The study represented 21 Bay Area cities, with 50.6% of responses living in the cities where I took park inventories (Oakland, San Francisco, Berkeley). Other cities included Concord, Fairfield, Hayward, San Jose, San Leandro, Vallejo, Alameda, San Ramon, Martinez, Benicia, Napa, Brentwood, Dublin, Castro Valley, San Rafael, Morgan Hill, El Cerrito, and Albany. The average age range for the survey participants was 35 through 44 years old (Table 3). The race and ethnicities of participants were diverse and generally representative of

the Bay Area, as well as the income brackets (Table 4, Table 5). Given that the population of the San Francisco Bay Area is home to 7.75 million individuals and an assumption that 80% of the population lives in urban areas (U.S. Census Bureau 2019), this sample size is consistent with a general margin of error of about 8.8% using a 90% confidence interval.

Table 2. Gender identity of survey respondents

Gender Identity	Percentage of responses
Woman	69.9%
Man	25.3%
Non-binary	2.4%
Other	1.2%
Decline to State	1.2%

Table 3. Age categories of survey respondents.

Age	Percentage of responses
Under 18	3.61%
18-24	36.14%
25-34	9.64%
35-44	9.64%
45-54	27.71%
55-64	10.84%
64-75	2.41%
75+	0%
Prefer not to say	0%

Table 4. Race and ethnicity of survey respondents. Participants could select more than one choice, meaning the total of these percentages will be greater than 100%

Race/Ethnicity	Percentage of respondents
White	61.4%
Black or African American	3.4%
American Indian or Alaska Native	2.3%
Asian	20.5%
Hispanic or Latino	14.8%
Native Hawaiian or Pacific Islander	1.1%
Other	1.1%
Prefer not to say	1.1%

Table 5. Income categories of survey respondents.

| Annual income	Percentage of responses
$0	2.41%
$1 to $9,999	8.43%
$10,000 to $24,999	6.02%
$25,000 to $49,999	15.66%
$50,000 to $74,999	12.05%
$75,000 to $99,999	10.84%
$100,000 to $149,999	13.25%
Greater than $150,000	21.69%
Prefer not to say	9.64%

Change in green space use amount

Following the initial COVID-19 outbreaks, the 88 surveyed Bay Area residents have, on average, not spent more nor less time in urban green space than prior to the pandemic. The average relative score was -0.26 (Figure 1). This was not a statistically significant difference (t = -1.672,

df = 87, p-value = 0.098). I found no statistically significant change associated with the stressors of financial/unemployment struggles, lost gym use, mental health decline, or social isolation according to the t-tests used (respectively; t = -1.331, df = 55, p-value = 2.004; t = 0.122, df = 34, p-value = 0.904; t = -0.210, df = 78, p-value = 1.991; t = -0.171, df = 41, p-value = 2.020) (Figure 2). 65.9% of respondents informed us of likely having variability in their green space use during the COVID-19 pandemic, meaning that they had uneven temporal distribution of use. Most participants experienced a decrease in mental health and/or feelings of social isolation (Table 6).
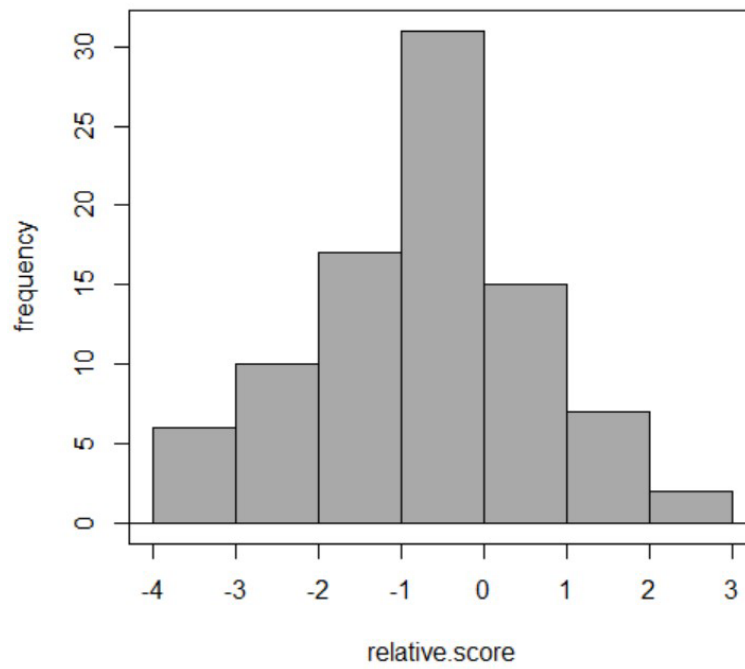
Figure 1. Frequency of relative scores. A negative score indicates a decrease in green space use since the start of the Pandemic, while a positive value indicates an increase.

a)

b)

c)

d)
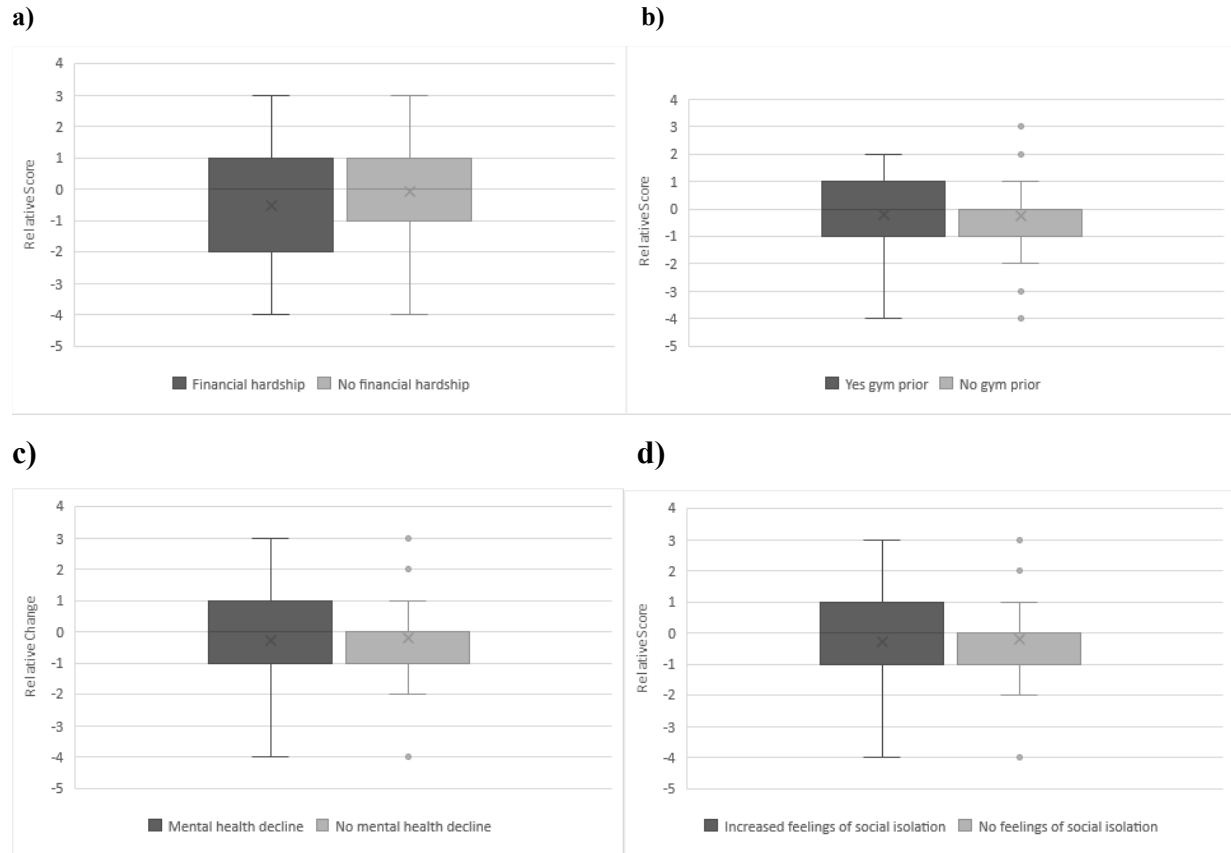
Figure 2. Frequency of relative scores. (a) for those who faced financial hardship or layoffs, (b) for those who faced gym closures, (c) for those who faced declining mental health, (d) for those who faced feelings of social isolation. A negative score indicates a decrease in green space use since the start of the Pandemic, while a positive value indicates an increase.

Table 6. Situations related to COVID-19. Participants could select more than one choice, meaning the total of these percentages will be greater than 100%

Common COVID-19 related circumstances	Percentage of respondents
Was regularly visiting an indoor gym, which closed due to COVID-19	25.0%
Had been faced with financial hardship (general)	28.4%
Laid-off	20.5%
Had felt socially isolated	73.9%
Had felt mental health declining	59.1%
Personally affected by COVID-19 disease	46.6%

Observed and derived green space use

Survey results

There was no significant difference in green space use change between natural and social preferences (t = 0.112, df = 54, p-value = 2.005). The natural aspects of urban green spaces were preferred by 69.4% of survey participants, while the other 30.6% preferred the social value they offer. I found no difference between each preference group's pre-covid use or post-covid use either. Participants desired, or needed, green space for a variety of activities (Table 7). One participant noted, as a text entry option, that their local green space was a necessity for their dog getting enough exercise. All other participants selected one or more of the built-in survey choices or chose not to answer. The most frequently selected reasons why participants stated that they visited green spaces were: to support their own mental well-being, and that it gave them an opportunity to leave home. 67 participants chose to elaborate on their answers, describing how their needs have changed, or their ability to meet their needs have changed, regarding urban green space use during the pandemic (Table 8). 12 respondents indicated that they had felt like COVID-19 had affected their habits and needs. On the contrary, 15 stated that their habits and needs had not changed significantly. Notable responses include mentions of specific activities, such as: "I am a high school cross country coach. Being able to condition outdoors has been very beneficial to the team and to me. I also spend more time outdoors in my personal life. Gardening for instance.";

reflections of perceived value: "I feel like I'm valuing outdoor spaces a lot more; although I liked going outside pre-pandemic, it seems like something I try not to take for granted now and especially enjoy when I do get to go outside."; and explanations of shifting needs: "There has been a definite increase of desire to spend time in green spaces due to the isolation and repetition of being indoors at home all the time.". Many responses also mentioned distress regarding more individuals spending time in the green spaces that they had frequented prior to the pandemic.

Table 7. Urban green space uses motives. Participants could select more than one choice, meaning the total of these percentages will be greater than 100%

Participants motives for urban green space use	Percentage of respondents
To spend time with friends (relatively safely)	60.2%
Spiritual reasons	11.4%
Provides place for children to play	11.4%
Exercise	67.0%
Mental well-being	77.2%
Privacy	5.7%
Nature exposure	69.3%
To escape urban heat	9.1%
To leave home/residence	67.0%
Other	1.1%

Table 8. How COVID-19 has affected green space users' habits and needs. Text responses grouped according to topics addressed.

Reasons for change in UGS use or perception	Number of related responses
Increased needs from urban green spaces	5
Fear of catching COVID in parks	5
Greater desire to leave home	4
Parks/spaces are less enjoyable than before, more difficult to meet needs as a result	4
Gym closures increased use	1
Necessary for relaxation	1
Helps break up COVID-19-related monotony	5
Exercising more often	1
Increased perceived value	5
Concerns over accessibility	2

Inventory results

Inventory data revealed a variety of park uses and levels of mask wearing. A total of 1062 individuals were observed in the 22 parks surveyed. Most activities were recorded, except in Mission Dolores park, where crowding was too intense to successfully record details. The most common activities taking place in the parks observed were playing sports with others, socializing, and eating (Table 9). On average, 30% of park-goers were involved in active endeavors, such as sports. About 54% of all park visitors were observed partaking in social activities. Mask-wearing percentage ranged from 0% at Buena Vista Park in San Francisco, to 96% at Strawberry Creek Park in Berkeley. The divide between successful physical distancing was even more divided. While Ohlone park (West) had 100% visitor distancing, Snow park in Oakland fell short with 0% keeping adequate distance. Note that data collection methods did not attempt to distinguish between household and non-household groups, so results may be misleading. Mask-wearing in parks had a likely negligible correlation with park size ($r = -0.20$) The popularity of, or demand for, specific parks was not correlated with mask wearing percentage ($r = -0.03$), nor were park size and physical distancing ($r = 0.03$), nor park size and percent of visitors active ($r = -0.03$).

However, mask wearing was moderately associated with the number of natural features, such as trees and waterways within a given park ($r = 0.37$). Alamo Square and Mission Dolores parks were not included in any park popularity-related analyses due to their number of visitors being significant outliers. 59% of the parks observed had adequate space to accommodate the activities taking place with social distancing. Basketball courts and playgrounds were the most commonly overcrowded facilities.

Table 9. Park activities total counts. Contains each activity category and the overall counts for each. For park-specific counts, see appendix.

| Activity	Total observed
Eating	95
Playing music	6
Intimacy / Dates	20
Walking	46
Soft Exercise (i.e., stretching, yoga)	7
Using phone	11
Socializing / Talking	198
Smoking	2
Dog care	54
Supervising child	70
Child playing	91
Multi-person sports	220
Reading	8
Skating (includes skateboarding and roller skating)	4
Dancing	17
Moderate/intense exercise	41
Reflective or viewing	20
Art or writing	4
Resting or napping	30
Vendor / selling	2
General celebration	20
Unspecified or irrelevant	15

Demand factors and satisfaction

Survey results

The survey found that many people were not satisfied with, or were bored with, their local urban green spaces during the COVID-19 pandemic. Of the 88 survey participants, 50% left their city of residence during the pandemic to recreate in a non-urban green space. Of this subgroup, 59% of them did so because they felt their local, urban green spaces were not satisfactory. Factors that discouraged participants from spending time in their local green spaces were primarily related to COVID-19 (Table 10). Many respondents felt discouraged from spending time in urban green spaces due to overcrowding and a lack of COVID-19 precautions from other park users. Most survey participants reported using a private vehicle as their primary mode of transportation, but about a quarter reported other means (Figure 3). There was a significant association between use of a private vehicle and leaving the Bay Area to visit a non-urban green space ($X^2 = 4.52$, p = 0.034). Those that owned a car were more likely to recreate in green space outside of the scope of this study than those that relied on public transit, bicycling, or walking. When asked how the issues that have arisen due to COVID-19 should be remedied, there were no solutions that stood out (Table 11). However, four participants used the write-in answer tool to specifically propose more bathrooms and less bathroom closures. When asked "What do you want out of a green space?", individuals responded with answers that were concerned with, in order of frequency, nature and biodiversity, safety, peace and quiet, relaxation, sociability, clean facilities, trails, recreation, scenery, ecosystem services, bathrooms, and accessibility.

Table 10. The effect of potential visitor deterrents on urban green space users. Participants could select more than one choice, meaning the total of these percentages will be greater than 100%.

Urban green space potential deterrent	Percent of respondents with use discouraged by deterrent
Unclean facilities	6.8%
Lack of COVID-19 precautions by other visitors	50%
Overcrowding	54.5%
Lack of parking	12.5%
Lack of public transit	9.1%
Lack of nearby green space	9.1%
General safety concerns	28.4%
Facilities closures	21.6%
COVID-19 rules, regulations	33.0%
Other	6.8%
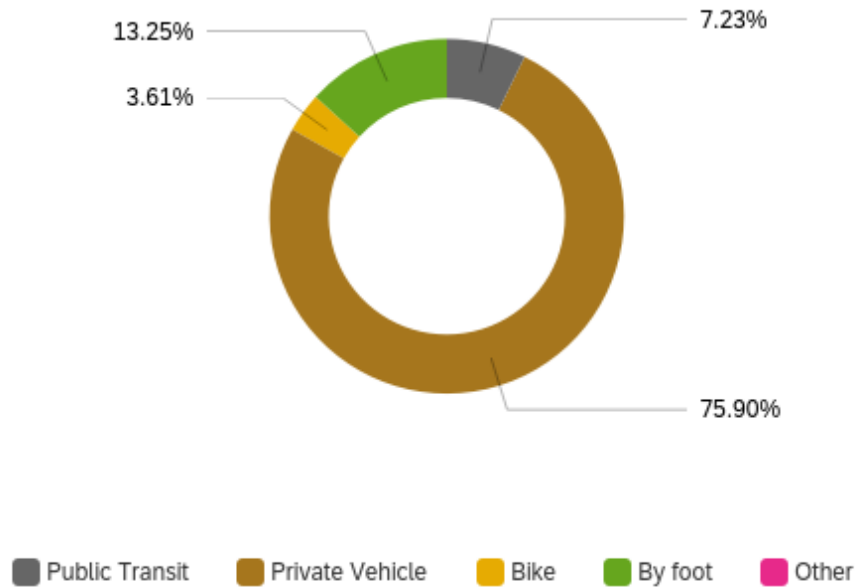
Figure 3. Primary means of transportation of survey respondents.

Table 11. Potential remedies for pandemic green space use. Specifically, what features would make urban residents more likely to use their green spaces and/or more comfortable in the green spaces they already visit. Participants could select more than one choice, meaning the total of these percentages will be greater than 100%.

Potential or proposed remedy	Percent of respondents more likely to use space with remedy
Signs promoting distancing and masks	33.0%
Social distancing circles (such as chalk or paint)	28.4%
Less restrictions on facilities	12.5%
More restrictions of facilities	3.4%
Expansion of existing green spaces	37.5%
More facilities for mixed use	23.8%
Crime deterring strategies	9.1%
Staff onsite during peak use	17.0%
Hand sanitizer or hand-washing stations	47.7%
Additional parking	1.1%

Inventory results

The results from the park inventories, in terms of accessibility and popularity are extremely varied. The popularity of parks, based on a stagnant visual radius, ranged from 4 visitors at Pine Knoll park in Oakland, to approximately 260 at Mission Dolores park in San Francisco (a major outlier that was left out in most analyses). On average, parks had about 13 built facilities. The most common built facilities were waste receptacles and benches, which 91% of observed parks had. This was followed by playgrounds (82%), paved trails and restrooms (77%), and picnic tables (73%). The least common built facilities were pools, mailboxes, skate parks, disc golf courses, and fountains, which all only had a single occurrence. Park popularity was weakly correlated with the number of natural features present in a park ($r = -0.219$), such as wildlife, ponds, trees, and designated nature areas. Additionally, popularity of a given park was also weakly associated with the total number of built features ($r = 0.272$). There was a moderate correlation between availability of transportation (including buses, BART, and parking) and park popularity ($r = -0.389$). I observed no significant relationship between park popularity and park size ($r = 0.016$), park

popularity and likely deterrents (r = 0.031), and park popularity and distance to nearest green space (r = 0.037).

DISCUSSION

Results and analysis showed that the impact of COVID-19 on use and perception was mixed. My hypothesis that the public's relationship with and perception of urban green space had shifted significantly during the COVID-19 pandemic was true in some cases, but false in others. Personal perceived value of urban green space typically increased, but average use had little overall change. Despite survey results showing no increase in use, many parks and their facilities were overcrowded. Most individuals in these spaces were socializing or exercising, both activities that the COVID-19 pandemic had made more difficult to achieve. Some survey participants also noted that more individuals using their local green spaces had discouraged them from recreating. Many mentioned that cities should prioritize expanding urban green spaces due to increased demand. Despite some discrepancies, there is overwhelming qualitative evidence that the COVID-19 pandemic prompted changes in behavior, perception, and green space demand due to the COVID-19 pandemic and related changes. Families and individuals have changed their habits and are using green space with an emphasis on meeting social and physical needs, with new perspectives on green spaces.

Changes in use frequency and perception

Though there was no significant difference in green space use frequency before and during the pandemic, most survey responses indicated a positive change in perception, valuing green spaces more than before. Many respondents also noted that they were concerned about becoming infected with COVID-19 at urban green spaces, or that they had safety concerns about using public green spaces alone. These observations lead me to conclude, that while perception may have changed, a lack of accessibility and safety of green public spaces likely deterred individuals from green space visitation and utilization. There was a non-significant decrease, which if significant would have been consistent with existing work which explains, despite an increased appreciation for public parks after a major change, use tends to decline due to indirect factors (Cohen et al.

2009). Several individuals who reported a decrease in green space use frequency indicated a desire to recreate in green spaces, but noted personal barriers that prevented it. Lack of transit options, decreased mental health, and lack of safety were top reasons for decreasing use. These findings were consistent with the existence of a pandemic-related global mental health crisis (Torales et al. 2020). Many individual responses noted that the ability to social distance and be in a place where most people were wearing masks was a major concern, so it is likely that safety fears deterred individuals who otherwise would have increased their use. While existing studies argue that safety alone does not make a park more desirable, this data was collected prior to pandemic safety-concerns, and instead focused on safety not-related to infectious disease (Cohen et al. 2009). The change in reopening may have also influenced green space use. Most respondents noted that they definitely experienced a major shift in green space use during the length of the pandemic, meaning that a certain season or period in restrictions was extremely valuable for outdoor time but later, may have decreased in importance.

Green space activities and motivations

Urban green space is being used for a diverse variety of activities, even in pandemic conditions, but not with consistent safety precautions. The field and survey results detailing how and why people use urban green space suggests no significant single result, but instead show that green spaces are important because of the variety of uses they offer. Some activities were short-lived and passive, such as using a park as a quiet place to take a phone call, or eating takeout while social distancing. Conversely, some park guests would spend hours playing sports, celebrating birthdays, napping in the sun, or a combination of pursuits. Field observations of green space activity showed high levels of social and physical/athletic activities in the field, but personal uses in survey results indicated more complex desires to use urban green space, overwhelmingly so for mental health. 80% of survey respondents reported that they visited urban green spaces for mental health benefits, which is difficult to compare to the field results because activities for mental wellness can manifest differently person to person and tend to overlap with both exercise and social activities. Varied use of parks, with emphasis on natural elements and escaping the stressors of urban life is consistent with public green space finding in the U.K. in the early 2000s (Swanwick et al. 2003).

Compared to existing research that reports generally low levels of physical activity in parks, my inventory data shows a higher percentage of people partaking in active pursuits than sedentary (Hamilton et al. 2017). This indicates that there may have been a significant shift in behaviors due to COVID-19 related gym closures. However, social activities were still the most common green space use type recorded. Even prior to the pandemic, urban green spaces contributed heavily to social interaction (Rasidi et al. 2012). However, it is rare that studies of this nature are conducted in the U.S., so any estimate of past social interaction in San Francisco parks may be highly inaccurate based on data from other countries. Overlaps between these two categories did exist, including team sports, children playing, walking while talking, and often dancing. These overlaps were reflected in the results, as they were extremely common. The overlaps between the social, metal, and physical health benefits of urban green spaces reflected in my findings highlight the ability to meet multiple needs at once in urban green spaces. In addition, many survey participants noted an increased desire to spend time in urban green spaces since the start of the pandemic, often for reasons related to mental, social, and physical well-being. Some reported that the pandemic had been detrimental for their general well-being, but that urban green space was one of the few things that could break up the monotony and stress of working from home and social isolation. For individuals in non-ideal living situations, green spaces may be the only places to be outside of one's home during COVID-19 restrictions and closures

Park accessibility and quality

Many survey respondents left their cities of residence to recreate in non-urban green spaces, and the majority did no because of lack of satisfaction with local green spaces. However, leaving to recreate outside of the Bay Area was strongly associated with ownership of a functional private vehicle as a primary means of transportation. Those who relied on public transit, bicycling, or walking did not have the same opportunities to access quality green space outside of the Bay Area region. Reasons behind feeling unsatisfied with local urban green space was mostly related to COVID-19, including feeling unsafe in crowded spaces around individuals not following safety precautions. Many participants complained of noise in urban green space, explaining that the ideal green space would be natural, ecologically diverse, peaceful, and quiet. In urban spaces, the natural value of parks may be overshadowed by crowding, traffic noise, pollution, crowding, built

features, littering, and vandalism. These deterrents were present in almost all parks surveyed and were likely a major reason behind high levels of urban park dissatisfaction.

Parks with parking or adjacent public transit tended to be more popular than parks that did not have these transportation features, suggesting that accessibility to green space may be a major determinant of whether an individual/family will patronize a park or not. Many of these more accessible parks, such as Lakeside park in Oakland and Mission Dolores park in San Francisco, were significantly more crowded than others. Often facilities would be crowded to a point where social distancing was not possible, suggesting that improving park accessibility would help make urban parks safer in terms of disease spread. Existing knowledge suggests that long-term, large-scale planning is the best tool to ensure park accessibility equitably (Fan et al. 2017). Most survey participants noted the desire of green space expansions in their cities, which, while sounding ideal in comparison to other fixes, is disputed by previously published studies due to quality and gentrification concerns (Wolch et al. 2014, Rasidi et al. 2012). Parks being nearby to other parks did not influence the popularity/crowdedness of the park, which is backed up by a study conducted, which concluded that although there may be nearby green spaces, often people will opt for one further away due to personal reasons or preferences (Artmann et al. 2019). The number of park facilities was slightly correlated with park popularity, but not conclusively. Existing findings show that facilities and quality of facilities at parks are not what attract visitors, but the social activities and events taking place in the spaces (Cohen et al. 2009). Since many events and social activities are cancelled due to COVID-19, it is possible that park visitors are now more interested in park facilities and quality than before, but not overwhelmingly enough to result in a strong correlation.

Limitations and future directions

Major limitations of the study included a disproportionately higher percentage of women represented in the online survey and a relatively small sample size. However, past data suggests that women tend to use green space more, which could relate to inherent interest in study participation, hence the disparity (Zhou and Rana 2011). A larger scale study as well as more supplementary data on the percentage of residents living in urban neighborhoods would be beneficial to get a more accurate representation of the geographical and social diversity of the San Francisco Bay Area. The study was also limited by the inability to institute controls for field

collections, such as weather. The 22 inventories were collected over the course of two months, which was a strength of the study due to temperature having a range of only 5 degrees Celsius. However, the weather varied from completely overcast to sunny, and some data was collected 1-2 days after rainfall, which could potentially limit activities on fields.

In the future more specific studies should be conducted to gain a smaller-scale insight of how parks are being used, such as solely examining accessibility of urban parks, or canopy cover and associate park use. In terms of COVID-19, surveys could be used to help determine the long-term impacts of green space use, after the major events of COVID-19, inquiring about potential long-term shifts in behavior. Interested parties may also investigate how public and private green space differ, or how owning a private green space (i.e., backyard, shared courtyard) may change perception and demand for urban green spaces.

Broader implications

This paper fills the vital gap of knowledge related to how major decision-makers should manage urban green spaces in response to COVID-19. It also provides information helpful for future decisions involving public health and urban planning. As the San Francisco Bay Area population recovers from the effects of COVID-19 alongside mass vaccination efforts, some shifts in green space use may return to their previous states. However, health, economic, and unemployment downturns associated with COVID may have long-lasting effects (Wachter 2020). It is still uncertain if and how urban communities will revert "back to normal" and to what extent. Despite this study's focus on COVID-19 impacts, it also highlights wants and needs of communities not necessarily related to COVID-19. Because the difference in use frequency was not statistically significant, many of the accessibility and facilities requests for improvement may have likely been presented had this study been focused on park quality only. From the data we see that green spaces are busy, often loud, and often difficult to access. These qualities, or lack thereof, would likely deter individuals from using green spaces regardless of pandemic conditions. Therefore, the maintenance and development of urban green spaces within urban planning should be focused on to provide adequate and equitable public access to green spaces designed to accommodate multiple uses. However, it is a complex and difficult task to quantify and analyze the many factors that contribute to the quality of an urban green space, so more research may be

needed before these directions are taken (Cohen et al. 2009).

The strong responses within the survey results asking for park improvements suggest a proposed increase in public opinion and public funding of green spaces. Urban green spaces are very often underfunded and low priority politically, but are vital in communities (Swanwick et al. 2003). A possible solution to involve more communities in the urban park planning process could be direct community involvement and governance of both public and private green space. Often there are not enough funds allocated within cities to upkeep large areas of urban green space, which can be remedied by community-based action such as creating community gardens (Rosol 2010). As cities become denser and the demand for housing is likely to increase, it is important that the value of green space is factored into planning (Swanwick et al. 2003). In addition, city planners and developers should be aware that greening neighborhoods can tend to make property values increase, which can lead to displacement and gentrification. This "eco-gentrification" can occur despite motives to improve underserved communities, which is why a "just green enough" approach is encouraged (Wolch et al. 2014). To improve the green spaces in cities, local governments should hold open comment periods, encourage community involvement and leadership, and vigilantly assess equity concerns.

REFERENCES

Alcock, I., M. P. White, B. W. Wheeler, L.E. Fleming, and M. H. Depledge. 2014. Longitudinal effects on mental health of moving to greener and less green urban areas. Environmental Science and Technology 48:1247-1255.

Aram, F., E. Higueras García, E. Solgi, and S. Mansournia. 2019. Urban green space cooling effect in cities. Heliyon 5.

Artmann, M., C. Mueller, L. Goetzlich, and A. Hof. 2019. Supply and Demand Concerning Urban Green Spaces for Recreation by Elderlies Living in Care Facilities: The Role of Accessibility in an Explorative Case Study in Austria. Frontiers in Environmental Science 7.

Astell-Burt, T. and X. Feng. 2019. Association of urban green space with mental health and general health among adults in Australia. Journal of the American Medical Association 2(7): e198209.

Barthel, S., J. Colding, T. Elmqvist, and C. Folke. 2004. History and Local Management of a Biodiversity-Rich, Urban Cultural Landscape. Ecology and Society 10.

Chen, B., O. A. Adimo, and Z. Bao. 2009. Assessment of aesthetic quality and multiple functions of urban green space from the users' perspective: The case of Hangzhou Flower Garden, China. Landscape and Urban Planning 93:76–82.

Cohen, D. A., D. Golinelli, S. Williamson, A. Sehgal, T. Marsh, and T. L. McKenzie. 2009. Effects of Park Improvements on Park Use and Physical Activity: Policy and Programming Implications. American Journal of Preventive Medicine 37:475–480.

Doick, K. J., A. Peace, and T. R. Hutchings. 2014. The role of one large greenspace in mitigating London's nocturnal urban heat island. Science of The Total Environment 493:662–671.

Engemann, K., C. B. Pedersen, L. Arge, C. Tsirogiannis, P. B. Mortensen, and J. Svenning. 2019.
Residential green space in childhood is associated with lower risk of psychiatric disorders from adolescence into adulthood. Proceedings of the National Academy of Sciences of the United States of America 116: 5188-5193.

Fan, P., L. Xu, W. Yue, and J. Chen. 2017. Accessibility of public urban green space in an urban periphery: The case of Shanghai. Landscape and Urban Planning 165: 177-192.

Forrest, M., and C. Konijnendijk. 2005. A History of Urban Forests and Trees in Europe. Pages 23–48 in C. Konijnendijk, K. Nilsson, T. Randrup, and J. Schipperijn, editors. Urban Forests and Trees: A Reference Book. Springer, Berlin, Heidelberg.

Fox, J. and M. Bouchet-Valat. 2020. Rcmdr: R Commander [Computer software]. R package version 2.7-1.

Grinde, B. and G. G. Patil. 2009. Biophilia: does visual contact with nature impact on health and well-being?. International Journal of Environmental Research and Public Health 6(9): 2332–2343.

Google. 2020. Google Earth Pro [Computer software]. Earth version 7.3.3. Mountain View, CA.

Gunnarsson, B., I. Knez, M. Hedblom, and Å. O. Sang. 2017. Effects of biodiversity and environment-related attitude on perception of urban green space. Urban Ecosystems 20:37–49.

Hamilton, K., A. T. Kaczynski, M. L. Fair, and L. Lévesque. 2017. Examining the Relationship between Park Neighborhoods, Features, Cleanliness, and Condition with Observed Weekday Park Usage and Physical Activity: A Case Study. Hindawi 2017.

Hillsdon, M., J. Panter, C. Foster, and A. Jones. 2006. The relationship between access and quality of urban green space with population physical activity. Public Health 120:1127–1132.

Kawohl, W., and C. Nordt. 2020. COVID-19, unemployment, and suicide. The Lancet Psychiatry 7:389–390.

Keeling, B. 2020, May 22. Mimicking Brooklyn, four SF parks adopt social distancing circles. https://sf.curbed.com/2020/5/22/21266247/san-francisco-parks-social-distancing-circles-coronavirus.

Lederbogen, F., L. Haddad, and A. Meyer-Lindenberg. 2013. Urban social stress--risk factor for mental disorders. The case of schizophrenia. Environmental Pollution (Barking, Essex: 1987) 183:2–6.

Nowak, D. J., D. E. Crane, and J. C. Stevens. 2006. Air pollution removal by urban trees and shrubs in the United States. Urban Forestry & Urban Greening 4:115–123.

Oh, K. and S. Jeong. 2007. Assessing the spatial distribution of urban parks using GIS. Landscape and Urban Planning 82: 25-32.

Qualtrics. 2020. Qualtrics [Computer software]. Provo, UT.

R Development Core Team. 2020. R: a language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

Rasidi, M.H., N. Jamirsah, and I. Said. 2012. Urban Green Space Design Affects Urban Residents' Social Interaction. Procedia - Social and Behavioral Sciences 68: 464-480

Richardson, E. A., J. Pearce, R. Mitchell, and S. Kingham. 2013. Role of physical activity in the relationship between urban green space and health. Public Health 127:318–324.

Rosol, M. 2010. Public Participation in Post-Fordist Urban Green Space Governance: The Case of Community Gardens in Berlin. International Journal of Urban and Regional Research 34:548–563.

Sang, Å.O., I. Knez, B. Gunnarsson, and M. Hedblom. 2016. The effects of naturalness, gender, and age on how urban green space is perceived and used. Urban Forestry & Urban Greening 18.

Slater, S. J., R.W. Christiana, and J. Gustat. 2020. Recommendations for Keeping Parks and Green Space Accessible for Mental and Physical Health During COVID-19 and Other Pandemics. Preventing Chronic Disease 17.

Stronks, K., H. D. van de Mheen, and J. P. Mackenbach. 1998. A higher prevalence of health problems in low income groups: does it reflect relative deprivation? Journal of Epidemiology and Community Health 52:548–557.

Swanwick, C., N. Dunnett, and H. Woolley. 2003. Nature, Role and Value of Green Space in Towns and Cities: An Overview. Built Environment (1978-) 29:94–106.

Torales, J., M. O'Higgins, J. M. Castaldelli-Maia, and A. Ventriglio. 2020. The outbreak of COVID-19 coronavirus and its impact on global mental health. International Journal of Social Psychiatry 66:317–320.

U.S. Census Bureau. 2019.

Wachter, T. von. 2020. Lost Generations: Long-Term Effects of the COVID-19 Crisis on Job Losers and Labour Market Entrants, and Options for Policy*. Fiscal Studies 41:549–590.

Wood, E., A. Harsant, M. Dallimer, A. C. de Chavez, R. R. C. McEachan, and C. Hassal. 2018. Not all green space is created equal: biodiversity predicts psychological restorative benefits from urban green space. Frontiers in Psychology 9:2320.

Wolch, J. R., J. Byrne, and J. P. Newell. 2014. Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough.' Landscape and Urban Planning 125:234–244.

Zhou, X. and M. P. Rana. 2011. Social benefits of urban green space. Management of Environmental Quality 23(2): 173-189.

APPENDIX: ADDITIONAL PARK INVENTORY DATA

Park name	City	Day	Temperature (°C)	Weather
Alamo Sq	SF	Sunday	16	Clear
Aquatic	Berkeley	Saturday	16	Cloudy
Buena Vista	SF	Sunday	16	Clear
Bushrod	Oakland	Saturday	16	Sunny, Some Clouds
Cedar Rose	Berkeley	Saturday	14	Sunny, Wet
Codornices	Berkeley	Saturday	14	Mostly Cloudy, Wet
Dimond	Oakland	Sunday	17	Clear
Eastshore	Oakland	Sunday	17	Sunny, Some Clouds
Glendale La Loma	Berkeley	Saturday	14	Mostly Cloudy, Wet
Grove	Berkeley	Saturday	16	Sunny, Some Clouds
Indian Rock	Berkeley	Saturday	12	Mostly Cloudy, Wet
Lakeside	Oakland	Sunday	17	Sunny, Some Clouds
Live Oak	Berkeley	Saturday	14	Sunny, Wet
Mission Dolores	SF	Sunday	16	Clear
Ohlone East	Berkeley	Saturday	13	Sunny, Wet
Ohlone West	Berkeley	Saturday	13	Sunny, Wet
Panhandle	SF	Sunday	16	Clear
Pine Knoll	Oakland	Sunday	17	Sunny, Some Clouds
San Pablo	Berkeley	Saturday	16	Cloudy
Snow	Oakland	Sunday	17	Sunny, Some Clouds
Strawberry Creek	Berkeley	Saturday	18	Clear

Willard	Berkeley	Saturday	16	Sunny

Park name	Visitor Count	% Masked	% Distanced	Adequate Space?
Alamo Sq	125	41.60	8.00	No
Aquatic	39	43.59	43.59	Yes
Buena Vista	8	0.00	75.00	Yes
Bushrod	52	15.38	92.31	Yes
Cedar Rose	30	43.33	66.67	No
Codornices	69	82.61	5.80	No
Dimond	26	69.23	92.31	Yes
Eastshore	56	21.43	10.71	No
Glendale La Loma	13	30.77	69.23	Yes
Grove	38	39.47	23.68	No
Indian Rock	21	80.95	0.00	No
Lakeside	42	23.81	26.19	Yes
Live Oak	25	40.00	64.00	Yes
Mission Dolores	260	46.15	0.00	No
Ohlone East	11	36.36	63.64	Yes
Ohlone West	15	26.67	100.00	Yes
Panhandle	44	59.09	52.27	Yes
Pine Knoll	4	75.00	50.00	Yes
San Pablo	68	8.82	29.41	No
Snow	33	51.52	0.00	Yes
Strawberry Creek	28	96.43	3.57	Yes
Willard	55	30.91	49.09	No