

Article

Urban Parks as Green Buffers During the COVID-19 Pandemic

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Abstract: In many parts of the world, concerns about the COVID-19 pandemic and city quarantine policy have led to a general decline in the physical and mental health of residents due to insufficient social interaction. These adverse effects can cause potential public health risks. Ways to alleviate the adverse impact of the pandemic and meet social interaction needs must be widely addressed. This survey was conducted from 1–5 April 2020; it collected 386 responses from residents of Chengdu, China, during the pandemic based on an online survey questionnaire. The results indicate that most of the residents believe their health status is poor, and that they do not experience adequate social contact with others. Most of the respondents indicated no difference in mental health, while a few reported differences in their physical health and social interaction levels. Visiting urban parks can significantly improve overall health and assist in meeting individuals' social interaction needs. Although residents have reduced the frequency of visits during the pandemic, even once a week can be beneficial. This paper emphasizes the critical role of urban parks during the pandemic period from the perspective of the urban building environment. The conclusion affirms that urban parks and large outdoor, open spaces can provide residents with a place for safe outdoor activities and social interaction in a green environment during a pandemic, as well as serve as a buffer area to maintain favorable health and quality of life.

Keywords: COVID-19; pandemic; quarantine; health; urban parks; green buffer

1. Introduction

Human society and cities can suffer from various crises at any time, such as floods, earthquakes, tsunamis, volcanic eruptions, fires, and environmental pollution [1]. With the development of transportation and human migration, pandemics have become another form of global crisis. In the past half-century, humans have suffered from the H5N1 virus [2], Cholera [3], Ebola virus disease [4], SARS [5], and other large-scale epidemics. Each pandemic has had a tremendous negative impact on human society. COVID-19 is a respiratory disease that first emerged in Wuhan City, in the Hubei Province of China, on 31 December 2019, and poses a global public health concern [6]. On 30 January 2020, the World Health Organization (WHO) declared COVID-19 an international public health emergency [7]. Reducing personal contact is a central measure against the spread of this disease. Thus, many countries have implemented quarantine policies on domestic cities to prevent the spread of infection [7–9]. According to existing research, the prevalence of COVID-19 and urban quarantine strategies have drastically altered residents' normal lives and caused a variety of adverse effects [8].

In terms of mental health, strict quarantine measures are believed to cause panic and fear among urban residents [10]. Specifically, the continuous spread of the pandemic over a long period

will undoubtedly cause more widespread fear and bring about negative emotions such as fear and anxiety [11]. Studies indicate that people in quarantine are more prone to developing various symptoms of psychological disorders, such as stress, depression, emotional fatigue, and insomnia [12]. A study from Italy reported that more than half of its respondents reported different degrees of depression, anxiety, and stress during the urban quarantine period [13]. Moreover, mental health care cannot be effectively implemented because distance from others must be maintained, which leads to a significant decline in the mental health state of residents [9]. Concerns about the health care system and quarantine may become sources of anxiety, while communication between health care professionals and residents can enhance trust and effectively reduce anxiety [14]. Besides, false information and rumors can lead to stigma and to residents experiencing negative emotions such as shame and fear [11]. It should also be noted that the adverse effects of the pandemic on people's mental health may be long-term, such as posttraumatic stress disorder [7] and increased risk of suicide [15].

Maintaining physical health has always been a central focus of urban public health. Generally, residents are advised to perform the proper amount and frequency of exercise every week to maintain their health. Kerr et al. (2012) suggested that the elderly should maintain 150 min of moderate-intensity physical activity or 75 min of vigorous physical exercise each week [16]. Walking is one of the most common forms of exercise. A study on Korean women reported that outdoor walking for approximately one hour three times a week could significantly improve cardiopulmonary function, flexibility, and emotional state, thus, enhancing health [17]. Walking is also considered the most common weight-bearing exercise. Any amount of walking consumes energy. Thus, long-term walking can effectively control weight and enhance bone strength [18]. During urban quarantines due to the pandemic, residents' outings are limited, and gymnasiums are closed. Therefore, sports and outdoor activities are reduced [6,19], while sedentary behavior may increase. Such behavior can cause potential health risks, such as obesity [20], dementia [21], depression [22], and insomnia [23].

Social connecting/interaction is an essential daily behavior of urban residents, and has been shown to be positively correlated with better health, well-being, and quality of life [24]. However, urban quarantine policy has resulted in significant limitations to residents' social behavior because they are restricted from entering public places and must keep a certain distance from others and avoid physical contact [9]. This decrease in social behavior will lead to an increase in social isolation and loneliness, and have a negative impact [25]. Kaźmierczak believes that the reduction of social support for vulnerable groups and the increasing degree of social disorders are due to the deterioration of neighborhood social ties [26]. Although the development of communication technology has reduced the possibility of face-to-face contact, face-to-face communication is more important for people who do not use social networks [26].

Many researchers have reported the positive effects of urban parks. It is generally believed that urban green spaces (including parks) provide a wide range of ecosystem services, which can help people to cope with many diseases and improve their quality of life and health status [27]. Specifically, stress has a negative impact on psycho-physiological health, and leisure experiences in green environments such as parks improve these negative mood states [28]. Sturm and Cohen reported a positive link between urban parks and mental health, and residents within 400 m walking distance from the park reported better perceived mental health [29]. Visiting urban parks and a green environment can effectively improve mental health [30] and reduce anxiety [31]. In addition, people who visit a park regularly are more likely to report good health than those who do not [32]. Urban parks provide a space and opportunities for different outdoor activities and encourage different factions of the population (such as different ages, ethnic groups, and socio-economic groups) to engage in sports activities. A survey in developing countries indicated that frequent park visits also reduce health problems and improve life satisfaction [33]. These opportunities for participation are believed to help improve the health of visitors [34]. The above evidence underscores the effectiveness of urban parks in improving mental and physical health. Additionally, parks provide a social environment for residents and promote social interaction [35]. Vegetation in parks is considered a key component of neighborhood spaces. Trees and

grass attract residents to the outdoors and create social opportunities [36]. Visiting parks can facilitate the development of friendship between residents in the community and promote active and passive leisure activities, such as chatting and walking [37]. Children and adolescents also prefer to play and socialize with friends in the park, which is very important for children's growth [37,38].

In summary, previous studies have discussed the positive role of urban parks [32–37]. However, discussions regarding their role under extremely stressful circumstances (such as during a pandemic) are still limited. At the same time, most existing studies have focused on the mental health of the population during a pandemic [11–14]. There are a few discussions on physical health and social interaction needs [7,9]. Therefore, the purpose of this paper is to determine: (1) residents' self-evaluation of their perceived health and social interaction levels during the quarantine period, (2) patterns of urban park visitation during COVID-19, (3) whether visiting urban parks can improve the perceived health of residents, (4) whether visiting urban parks allows residents to meet their social interaction needs during the pandemic period. Furthermore, emphasizing the role of city parks during the pandemic, management suggestions for urban green spaces are proposed.

Previous studies have indicated that the longer the quarantine period, the greater the impact on mental health, showing higher levels of avoidance behavior and anger [39]. Also, facilities such as gymnasiums cannot be utilized due to the risk of infection during quarantine, resulting in further deterioration of health [40]. Simultaneously, the decrease in daily social behavior and physical contact with others can lead to depression and a sense of isolation [39]. Therefore, this study proposes that urban parks, as large outdoor open spaces, can provide residents with a green social environment in which to engage in safe outdoor activities during city quarantines, serving as a buffer zone to maintain good health and quality of life.

2. Materials and Methods

2.1. Study Location Context

The study area is located in Chengdu, Sichuan Province, China (Figure 1). Chengdu is spread over 14,335 km², and is located in the southwestern region of China (102°54'–104°53' E, 30°05'–31°26' N). Its population is 16.33 million, with an urban population of 11.94 million (as of 2018) [41]. Over the past decade, significant progress has been made in the construction of parks and varieties of green space facilities in Chengdu. Therefore, Chengdu is widely renowned as the “livable city” of China [42]. On 23 January 2020, the Chinese government gradually quarantined all cities in China to prevent the scale of infection from expanding. Aside from daily work, residents were restricted from going out. On 26 February 2020, the Chengdu Municipal Government lowered pandemic prevention and control levels from level 1 to level 2 [43]. At the same time, Chengdu began to issue health cards, and residents marked as “healthy” were allowed to go out for activities [44], and could go to parks in the city.



Figure 1. The location of the study area and distribution of urban parks in Chengdu.

2.2. Study Design and Participants

We used an anonymous online questionnaire for five days (1–5 April 2020). The questionnaire was released through WeChat, and participants were encouraged to share it with more residents. This paper explains the positive role of urban parks during the COVID-19 pandemic period. The criteria for participating in this questionnaire were as follows: (1) living in Chengdu during the outbreak; (2) having used a city park in the last month, and (3) being at least 18 years old. The questionnaire was developed in Chinese and divided into four parts: (a) social demographic characteristics; (b) patterns of urban parks visitation (i.e., weekly visit frequency, duration of each visit, preferred time of visit, time spent in the park, and activities); (c) self-assessment of physical and mental health and social interaction level (employing self-report [45]); and (d) perceived effects of using city parks (i.e., “using urban parks improves my physical health”, “using urban parks improves my mental health”, “visiting urban parks allows me to meet my social interaction needs”, self-report). The questions were checked and revised by three doctoral students of related disciplines to ensure that the investigation purpose of the paper was adequately incorporated. A total of 673 people clicked on the questionnaire, while 386 were submitted (no questionnaire was abandoned). The final sample size was 386. Participants could view the study details at the top of the questionnaire; there was no compensation for participating. The research was approved by the Local Ethics Committee of the College of Landscape Architecture, Sichuan Agricultural University, China.

2.3. Statistical Analysis

For the statistical analysis, IBM SPSS (Statistical Product and Service Solutions) Statistics Version 20 (IBM Corp., Armonk, NY, USA) was used to perform a descriptive analysis. Concurrently, one-way ANOVA (analysis of variance) was used to determine whether there were differences in self-assessment among different populations. Additionally, we used Hayes (2017) PROCESS macro version 3.4 to conduct six mediation analyses [46] to explore our problems more clearly. Statistical significance in this section was considered to be $\alpha = 0.05$. Finally, we used the results of qualitative research to discern general visitation patterns (i.e., time spent traveling from home to the park, duration of visit, preferred visit time, frequency of recent use, and activities) in order to provide insights into the management and use of urban parks during the pandemic.

3. Results

3.1. Sociodemographic Characteristics

Regarding the socio-demographic characteristics of the respondents, participation by females (58.3%) was higher than by males (41.7%) (Table 1). The \pm respondents were principally distributed between 18 and 35 years of age and were primarily students (23.3%) and staff (28.8%), and mostly well-educated (with one college degree). The income of the respondents was mainly distributed in the groups of ≤ 2000 (27.7%), 2001–5000 (30.6%), and 5001–10,000 (28%) RMB per month. The number of unmarried and married respondents was similar to that of the socio-demographic data of the city's total population (data source: <http://www.cdstats.chengdu.gov.cn/>). In summary, respondents were more likely to be female and younger, with a higher proportion of respondents aged 18–35; a smaller proportion of respondents was older than 75. Also, participants were often better educated, i.e., 57% of people choose “college” and 24.6% “graduate” to describe their education status.

Table 1. Socio-demographic characteristics of respondents.

Demographic	Variable	N	Percentage (%)	Percentage of Chengdu (%)
Gender	male	161	41.7	49.61
	female	225	58.3	50.39
Age	18–35	262	67.9	29.63
	36–59	114	29.5	35.12
	60–74	9	2.3	9.2
	>75	1	0.4	3.01
	≤ 2000	107	27.7	-
Income/month	2001–5000	118	30.6	-
	5001–10,000	108	28	-
	10,001–15,000	29	7.5	-
	$\geq 15,001$	24	6.2	-
Marital	married	193	50	65.4
	unmarried	193	50	34.5
Education	primary school	26	6.7	33.07
	high school	45	11.7	56.34
	college	220	57	6.9
	graduate	95	24.6	0.16
	civil servant	26	6.7	-
Occupation	medical personnel	10	2.6	-
	police	3	0.8	-
	teacher	42	10.9	-
	student	90	23.3	-
	staff	111	28.8	-
	self-employment	54	14	-
	retired	15	3.9	-
	unemployment	17	4.4	-
others	18	4.7	-	

3.2. Pattern of Urban Park Visitation

Visitation patterns were divided into five parts, i.e., time spent traveling from home to the park (Figure 2a), length of visit (Figure 2b), preferred visit time (Figure 2c), frequency of recent use (Figure 2d), and activities (Figure 3). The results indicate that more than half of the residents preferred to visit parks nearest to their homes, and the time spent traveling to parks was usually no more than 10 min; that is, visiting a park in their neighborhood was usually the first choice [29]. This may be related to the government's recommendation that residents try to minimize going out, because a

study has shown that traveling behavior in public spaces may lead to a potential risk of infection [47]. According to the results, during the pandemic, 176 (45.6%) respondents said that the duration of their visit in the park was 31 min to 1 h, while 78 (20.2%) reported visit times exceeding 1 h. We deleted one option (i.e., >4 h) because no respondents selected it, which indicates that 4 h seemed to be a threshold. In addition, most residents preferred to leave for the park in the afternoon or evening; 49 people (12.7%) preferred to leave before 9 am, and 13 (3.3%) chose to visit the park at noon. Overall, the numbers of people visiting the park in the morning, afternoon, and evening were similar. A study of visit patterns for the Hong Kong City Park by Mak and Jim (2019) reported the same results [48]. Finally, the weekly visit frequency of residents seemed to be at a low level. A total of 250 (64.8%) visited the park only one day a week, 58 (15%) visited occasionally, and 78 (20.2%) reported visiting almost every day. This result is different from previous studies. In normal times, most residents would visit urban parks more frequently [26,48], while during the pandemic, reduced visits may be due to the wish to reduce outdoor travel. Also, we inquired about the types of activities that residents engaged in in the park recently. According to the results (Figure 3, note, multiple responses), most residents chose “Take a walk” (268), “Accompanying family members” (87), and “To be in nature” (93), followed by “Jogging” (27), “Cycling” (21), “Photography” (22), “Walking dogs” (22), “others” (34). Finally, a few responded “Picnic” (9), “Meet friends” (8), and “Use fitness equipment” (6).

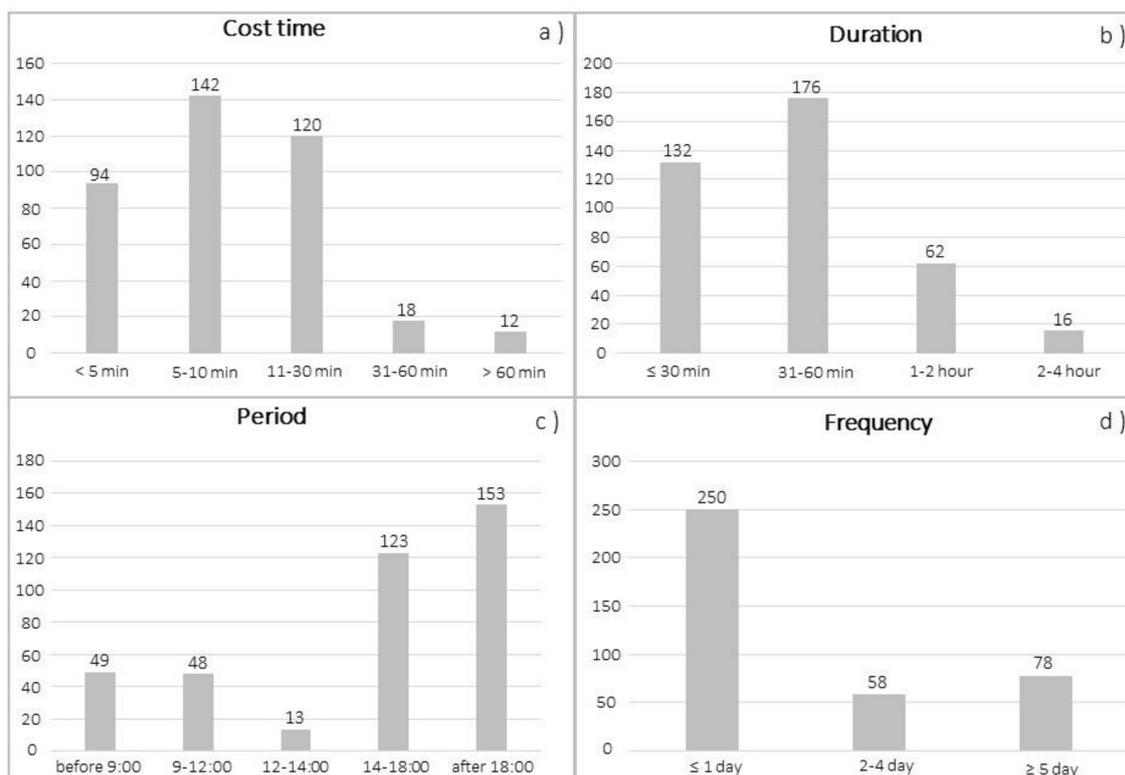


Figure 2. Urban park visitation patterns during the pandemic. (a) Cost time. (b) Duration. (c) Period. (d) Frequency.

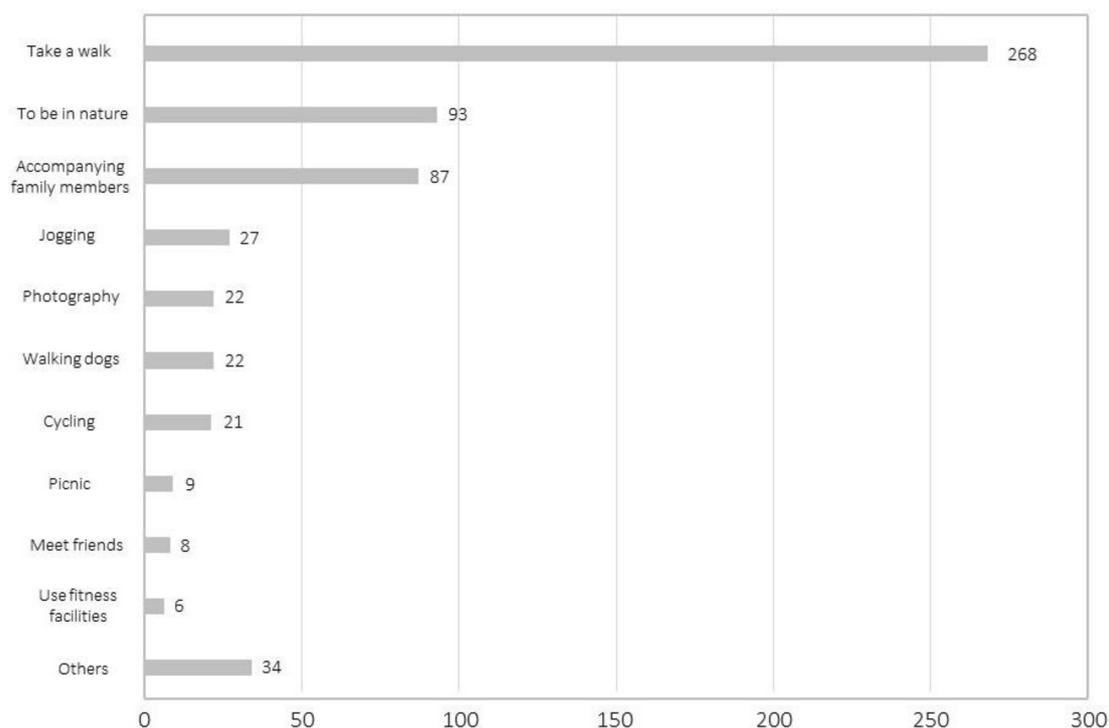


Figure 3. Activities in urban parks (multiple responses).

3.3. Self-Assessment of Physical and Mental Health, and Social Interaction Level

Due to the restrictions of urban quarantine policies, face-to-face interviews could not be used, so an online questionnaire was adopted. At the same time, studies on physical and mental health and social interaction status have proven that self-reporting is a feasible method [24,45,49]. Therefore, a 5-level Likert scale was used for self-assessment of residents (physical health level, mental health level; 1 = very poor, 5 = very good; social interaction level, 1 = not at all, 5 = completely adequate). At the same time, ANOVA was performed to examine the differences in self-assessment among different populations (Table 2). According to the results of the self-assessments, the average scores of physical health level (2.43) and social interaction level (1.59) were lower than 2.5, while the average score of mental health level (3.02) was slightly higher than 3 points. This indicates that during the pandemic period, nearly all of the respondents believed that their physical health and social interaction levels were reduced. This is reasonable, because staying at home for a long time without enough physical activity will significantly reduce the health level of the population [32]. While different from the level of physical health, most respondents rated their mental health level as normal, which is different from the results of many other studies, such as [7–9,39,50,51]. Additionally, there were no significant differences in mental health levels among different populations. This diverges from the results of previous studies [8,11]. Furthermore, our results indicate that different education levels and occupations also influence physical health and social interaction levels.

Table 2. Differences among different socio-demographic characteristics in self-assessments.

Self-Assessment	M	SD	Socio-Demographic Characteristics					
			Gender	Age	Income	Marital	Education	Occupation
physical health	2.43	1.17	0.021	0.397	0.781	3.497	2.735 *	2.11 *
mental health	3.02	0.81	0.671	0.119	0.851	0.015	1.084	1.609
social interaction	1.59	0.87	0.103	0.131	0.682	0.334	2.018	2.944 **

Values were calculated using an ANOVA. Significant differences noted in the comparison among different socio-demographic characteristics in self-assessment (* $p < 0.05$, ** $p < 0.01$).

Overall, according to the self-assessment results, the physical health and social interaction levels of most subgroups did not present significant differences, which, to a certain extent, suggests that most residents believe that their health and social interaction levels are poor. Moreover, the reported mental health levels indicated no differences among respondents, which may be due to the small size of the sample; therefore, the results of this study should be viewed with caution.

3.4. Postvisit Effects

Three items (Likert 5-level scale, 1 = strongly disagree, 5 = strongly agree) were used to examine the positive impact of visiting urban parks on interviewees (Table 3). The Cronbach's alpha coefficient of the questionnaire was 0.824, which indicates that the questionnaire has excellent reliability. According to the statistical results, most residents agreed that their physical health was effectively improved after visiting a city park (3.96 ± 1.13), and that the visit allowed them to meet their social interaction needs (4.1 ± 0.99). The response to the improvement of mental health was low (3.46 ± 1.11), but most residents still gave a positive score. A mediation model was used in the following sections for further analysis.

Table 3. Postvisit effects of respondents.

Item	Respond	N	M	SD
Visiting urban parks has improved my physical health level.	1	14	3.96	1.13
	2	22		
	3	104		
	4	72		
	5	174		
Visiting urban parks has improved my mental health level.	1	20	3.46	1.11
	2	43		
	3	150		
	4	85		
	5	88		
Visiting a city park has allowed me to meet my social interaction needs.	1	9	4.1	0.99
	2	15		
	3	76		
	4	115		
	5	171		

3.5. Mediation Analysis Results

In the last part of the analysis, we conducted six mediating analyses to explore potential impact mechanisms among variables (Figure 4). The independent variables were self-assessments of "physical health", "mental health", and "social interaction level", while the dependent variables were "improve physical health", "improve mental health", "meet social needs". Previous studies have suggested that the time and frequency of exposure significantly affect the benefits afforded by green spaces, that is, more frequent visits and more prolonged exposure have more positive effects [49,52,53]. Therefore, we introduced duration and frequency into the mediator of the model.

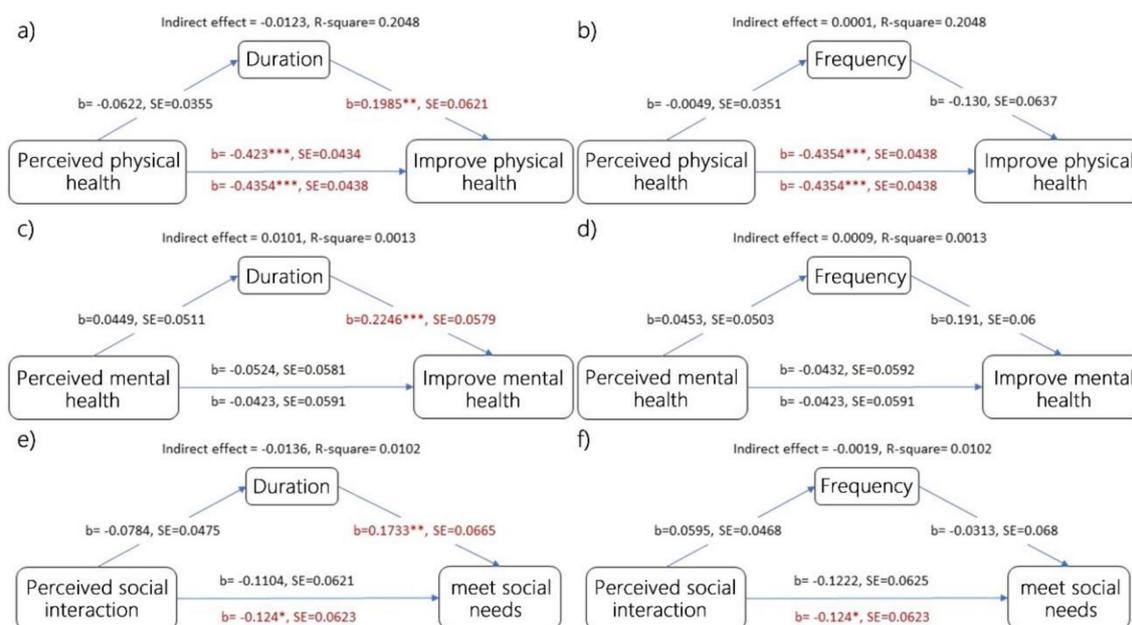


Figure 4. Mediation effects and the relationship among the variables (a–f). Note: Coefficients are standardized β s. Red figure represents a significant path. The upper value represents the direct effect; the lower value represents the total effect. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

According to the total effects of model a ($b = -0.4353, p < 0.001$) and model e ($b = -0.124, p < 0.05$), the lower the residents' perception of their physical health and social interaction level, the higher the posteffects. This demonstrates the role of urban parks during the pandemic, that is, visiting urban parks can significantly improve residents' physical health and allow them to meet their social interaction needs. The total effect of model c ($b = -0.0423, p > 0.05$) was not significant, which is consistent with the result of Section 3.4, i.e., that residents agree that visiting city parks can improve their mental health, but this improvement is not significant. Additionally, duration as a mediator significantly affected these postvisit effects, while visit frequency had no significant effect (all $p > 0.05$). Therefore, the longer the duration of each visit, the higher the level of impact. It is possible that people had deliberately reduced the frequency of their visits, as most residents said they would now visit only once a week. However, the current results still indicate that even with a low visitation frequency, lengthy visits once a week can have a significant positive impact.

Overall, the current results show that residents' self-perceived health is poor. This may be due to concerns about COVID-19 and the long period of quarantine, consistent with the results of previous studies [6–11,15]. Furthermore, according to the postvisit effects, visiting urban parks is considered to improve residents' health status significantly. Although many residents have a low level of visit frequency, weekly visits can have a significant positive impact. Therefore, it is essential to provide a safe and satisfying outdoor activity/leisure space for residents during the pandemic, enabling residents to maintain a regular visit frequency to mitigate potential health risks.

4. Discussion

Thus far, the pandemic remains prevalent throughout the world, and its adverse effects may last longer. This study surveyed 386 residents living in Chengdu via an online questionnaire, collecting data on respondents' perceived health, patterns of urban parks visitation, and self-assessment of postvisit effects. First, the results regarding visitation patterns indicated that more than half of the residents preferred to visit parks nearest to their homes, and that the time spent traveling to parks was usually no more than 10 min, that is, visiting a park in their neighborhood was usually the first choice. This may be related to the government's recommendation that residents try to minimize going out,

because a study has shown that traveling behavior in public spaces may lead to a potential risk of infection [47]. The result is helpful for the construction of future urban parks and green spaces (UGS). That is, a decentralized network of smaller green spaces would make it easier for residents to interact with nature, giving rise to physical and mental health benefits [54]. This pandemic emphasizes the importance of distributing smaller units (such as health facilities, schools, green space resources) into the urban landscape. In this way, each community in the city has equal access to urban green space resources, reducing residents' commuting time to urban parks and other UGS.

On the other hand, the environmental justice of cities is a frequently discussed topic [27]. Wolch, Byrne, and Newell (2014) reported that cities require a sufficient amount of green space, and that the sufficiency is not only the index volume and area, but also the public health interests of fair access [27]. Due to increasing urbanization, combined with a spatial planning policy of densification, more and more people will face the dilemma of having access to fewer green living environments [55]. A study on house transactions indicated that a view of a park or water leads to an increase in house prices [56]. High housing prices may polarize the use of urban parks, leaving the poor with limited access to green spaces [55], leading to a potential environmental justice dilemma. In other words, poor people lack access to green spaces and green exercise, leading to low health levels [57,58], while wealthy people use these green spaces to maintain rather than to improve their health. Whether in developed or developing countries, health inequality has always existed. Although this study did not find such a problem, 30 respondents said it took 30 to 60 min to get from home to the park, which indicates that there is still a potential issue of access to green space resources within the city. It's worth noting that these issues are magnified during a pandemic [59]. For example, the use of public transport is prohibited, and thus, most residents can only choose to visit parks in their own neighborhood. If a community is lacking available green resources, residents can only visit low-quality green space environments. The wealthy have more alternatives, such as driving further to parks or suburbs, using fitness equipment indoors, and visiting private gardens. Consequently, from the perspective of true environmental justice, it is critical to provide sufficient green spaces for all residents, rather than merely meeting a figure regarding green space area per capita. Specifically, urban managers need to pay more attention to vulnerable groups during a pandemic [59] (i.e., the elderly, disabled, unemployed, and residents of communities lacking green space resources, and with a high risk of infection) because each pandemic will make them more vulnerable.

Furthermore, 45.6% of respondents reported that they spend 31 min to one hour each time they visit an urban park, while another 20.2% reported visits of more than one hour; no respondent reported visits of longer than 4 h. In addition, most residents preferred to leave for the park in the afternoon and evening, while 49 people (12.7%) preferred to leave before 9 am, and 13 (3.3%) chose to visit the park at noon. Overall, the number of people visiting the park in the morning, afternoon, and evening was similar. Finally, the weekly visit frequency of residents seemed to be at a low level. A total of 250 (64.8%) visited the park only one day a week, 58 (15%) visited occasionally, and 78 (20.2%) reported visiting almost every day. Understanding the use patterns of residents is of great significance to the management of urban parks during the pandemic period, such as limiting the number of users during the peak visiting period, opening and encouraging residents to go to different parks for activities, and avoiding crowds. These results are of practical significance, but more studies are needed to supplement them. Specifically, some detailed surveys could be conducted to focus on residents in different areas of the city and formulate management strategies according to the number of visitors in the area. These strategies may include increasing the disinfection frequency of park facilities, using the mobile application to display the number of visitors to each park, and keeping the environment clean. Meanwhile, in some urban areas with less green space, managers could consider providing various types of green space resources (e.g., vertical gardens, green roofs, roof gardens) to reduce the burden of green space usage [60].

According to the residents' self-assessment results (Table 2), the physical health, mental health, and social interaction levels of the majority of the population revealed no significant differences between different groups. This result indicated that all residents were affected negatively during the pandemic. It seems necessary to encourage residents to visit urban parks or other green spaces, provided that they keep a safe distance from others. Different from the level of physical health, most of the respondents rated their mental health level as normal. This may be because the number of infected people in Sichuan Province has been relatively low (only 589 infected as of 29 June) [61], without causing widespread anxiety and stress, so the reported results reveal normal levels. This is consistent with the research conclusion of Zhang et al., that is, there is a linear relationship between the reported cases of death and the negative emotions of the population [7]. This reinforces the importance of keeping residents informed of the pandemic situation. In addition, although the results of this study do not suggest that the mental health level of different occupations varied by gender, they do indicate that some occupations, such as doctors and nurses, induce stress because they must have long-term contact with patients, increasing their risk of infection. At the same time, stigma and rumors also increase the pressure on these professionals, leading to depression and anxiety [8,11]. City managers need to pay attention to the mental health of these high-risk groups—ensuring that they avoid working in a stressful environment for extended periods, and arranging reasonable rest time to reduce the mental burden. Moreover, in the future, it's crucial to increase the greening level of different work areas, because natural environments can promote reduction of stress and fatigue more so than built environments [62]. These strategies can effectively improve the mental health of residents, thus, improving their work performance, and are worth considering for maintaining urban management [63].

Results also indicate that different education levels and occupations also influence a divergence in physical health and social interaction level. The results may be due to the winter vacation during urban quarantine, when all schools were closed, and many companies and public places were closed (or required to work from home) [9]. Therefore, some specific groups, such as college students and the self-employed and staff, must stay at home continuously. Long-term sedentary behavior may lead to a different perception of their own physical health levels in comparison to other groups. Besides, even cursory interactions could promote the social interaction needs of residents, such as short conversations or just saying hello [53]. Similar to the reasons mentioned above, different types of careers may lead to frequent outings, meeting others, and having some simple social interactions. In contrast, people who stay at home regularly are more likely to perceive that they are not enough social interaction. On the other hand, sample of all ages reported low levels of physical health. However, previous studies have suggested that low levels of physical health (such as lack of exercise, sedentary behavior, and reduced outdoor activities) have a stronger negative impact on the elderly [21] and children (data not collected) [20]. It has been reported that more than 30% of adults over the age of 15 are physically inactive [64], and among all causes, 9.4% of the mortality rate is related to inactivity [65]. Therefore, conducting more health surveys on these groups and encouraging them to visit urban parks can effectively reduce urban health risks.

According to the results of mediation analysis (Figure 4), visiting urban parks can significantly improve their health status and meet the social interaction needs of the population. The longer the duration of the visit, the more benefits they will experience. Simultaneously, even weekly visits can significantly improve health status, consistent with the existing research results [66]. It is worth noting that in the investigation results of activities in the park, most of the residents' responses were "Take a walk" (268) and "To be in nature" (93), while less to "Jogging" (27), "Cycling" (21) and "Use fitness equipment" (6). Therefore, just being exposed to the green environment and merely walking in the natural environment can also bring health benefits [55,67,68]. In addition, in dense city areas, urban parks are a limited and important resource because these green spaces provide places for residents to meet and socialize, and promote social interaction [24]. Amid the pandemic, people have been forbidden to touch each other and required to keep a distance, but Henning and Lieberg (1996) believed that weak social ties (such as seeing each other and saying hello) could also promote social

interaction and build neighborhood networks [69]. Therefore, to a certain extent, urban parks can provide safe social interaction places for residents, reducing loneliness and the risk of suicide [15]. Besides, the results of Model c indicate that residents' perceived mental health improvement is not significant. Consistent with the result of Section 3.4 that residents agree that visiting urban parks can improve their mental health, but this improvement is not significant. This may be because most residents have an average rating of their perceived mental health (3.02), leading to limited perceived improvement effects. On the other hand, although people are considered a positive factor in the park, the presence of others in the park during the COVID-19 pandemic can make visitors nervous and reduce the restorativeness of park visitation. Therefore, the urban parks with a large area can provide visitors with enough recreational space, effectively preventing gathering, which may reduce visitors' tension. However, the pursuit of large areas could lead to potential land waste. Thus, according to the research results of Nordh and Østby (2013), it may be a more useful strategy for green space used to create enclosed private places through vegetation (such as a small pocket park, or adding individual/group activity spaces in the park) during the pandemic [70]. This research also suggested that city managers should strengthen the management of urban parks during the pandemic (such as reasonably limiting the number of visitors, disinfecting public facilities, equipment, and avoiding crowded gatherings). Per WHO guidelines, one size fits all approaches should be avoided and daily needs of the residents should be accommodated.

This study has some limitations. This study is a cross-sectional survey, and the impact of infectious diseases may be long-term and may last for the duration of the pandemic. Therefore, it is necessary to conduct follow-up surveys at various intervals of time and in different cities. These surveys can also help city managers better understand the health level and quality of life of residents and avoid potential health risks. On the other hand, this survey contained coverage and self-selection bias in the investigated population [71]. First, it did not involve minors, and the elderly population was less involved. Besides, according to the comparison with the total population of Chengdu, the respondents are more likely to be female, which may be because women are considered to prefer natural environments and often take their children to outdoor activities in parks and other facilities [48]. Also, the sample's average education level is higher, which may be because people with a good education generally prefer to visit parks and participate in outdoor activities [72]. Second, the respondents are more likely to be younger, with a higher proportion of respondents aged 18–35, which may be because residents (e.g., older population) who could not view the online questionnaire did not participate in the survey. Third, the difference in the number of questionnaires viewed and submitted indicates that some residents may not be willing to participate in the survey on this topic. Thus, a variety of potential interviewees may have been excluded for these reasons, leading to our study results' bias. In addition, the restoration of urban parks has been proven to be related to environmental characteristics [73]. We could further study the restoration effect of different types of park environmental characteristics on the population. Finally, it is of considerable significance for urban park officials to comprehend the use of urban parks (i.e., walking, socializing, sports, etc.) during the pandemic.

5. Conclusions and Implications

With the development of human science and technology and global transportation, pandemics of various infectious diseases seem inevitable [1–5]. The outbreak of COVID-19 and city quarantine has caused a severe challenge for cities worldwide. In this study, 386 residents living in Chengdu were investigated using quantitative and qualitative methods. The results showed that residents' self-assessments of their perceived health and social interaction levels were low. According to self-reports, visiting city parks can improve physical/mental health and allow residents to meet their social interaction needs. This study highlights the critical and positive role that urban parks play as green buffer zones during a pandemic. However, while it should be noted that outdoor activities increase the risk of infection, long-term isolation may bring about more health problems [39]. Therefore, residents should set aside time for outdoor activities, wear masks, keep a distance of at least 2 m from

others, and avoid direct contact for more than 15 min [74]. If parks are too far away, residents can visit the nearest community garden/rooftop garden/sky garden [75] or other green spaces appropriate for outdoor activities. At the same time, we suggest that city managers conduct more surveys to understand the overall health statuses of residents, adopt comprehensive strategies to alleviate the negative impact of the pandemic, and reduce public health risks [6] (e.g., provide psychological counseling services by phone or online, suggest meaningful activities to occupy residents while in quarantine, encourage weekly outdoor activities incorporating protective measures, educate people concerning normal psychological impacts [12]) so as to ensure an acceptable quality of life of residents is maintained.

Finally, as an emerging research issue, broader discussions are necessary. This paper contributes from the perspective of the urban architectural environment and endorses increased multidisciplinary cooperation to fight against and alleviate the hardships caused by future pandemics. Every pandemic promotes urban reform and replanning. During the current pandemic, large-scale gatherings are prohibited, and many public facilities and buildings have been forced to close [9]. Covid-19 limits people's excursions, socializing, outdoor activities, and lifestyles. Will the pandemic change our city again? This paper cannot provide definitive answers, but there is no doubt that a virus is once again challenging the urban built-up and natural environments. How to plan urban spaces reasonably and utilize urban natural environments and green spaces to handle similar disasters, i.e., pandemics and insects (e.g., locust) and animal plagues [56], is a challenge for current urban and rural planners, architects, and landscape designers. On the other hand, the COVID-19 pandemic has had a direct bearing on the foundations of urban planning, architecture theory, and practice. Urban quarantine policies and the pandemic threaten the livability of cities. At the same time, the supply of crucial urban supplies, such as food and water, has also been placed under great pressure [76]. Scholars from different disciplines are working to alleviate the negative impact of the disaster [6–9,11,55], and interdisciplinary cooperation has become necessary. However, professional institutions of urban planning and construction have rarely participated in the discussion [55]. Therefore, although some mental health issues can be alleviated through remote psychotherapy [9], the unique role of urban parks during pandemics still needs to be emphasized, i.e., providing places for safe outdoor activities and socializing, alleviating residents' health problems at low cost, and reducing potential health risks. These psychological health, physical health, and social interaction effects of urban green spaces make them an important component of public health strategies. When we discuss existing experiences, from Howard's Garden City [77], to "green lungs" and "Emerald Necklaces" [55], it becomes evident that parks and green spaces have made great contributions to solving urban problems. In the future, planners and landscape architects need to consider the functions of city parks during pandemics. How to facilitate residents' safe visits during a pandemic has become a highly important topic of discussion. In short, no one desires another pandemic, but active preparation is always the right choice, should such an event occur again.

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