Relative importance of urban greenspace types in improving subjective health status before and during the COVID-19 pandemic

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1   **Abstract**

2   Urban greenspaces provide valuable ecosystem services to urban residents, and their benefits

3   may have functioned even better during the COVID-19 pandemic. This study aimed to

4   determine the relationship between the use of urban greenspaces and the level of human

5   subjective health (based on the subjective assessment of one's own status of social, mental,

6   and physical health) before and during the COVID-19 pandemic. An online survey was

7   conducted to explore how the frequency of use of urban greenspaces differed before and

8   during the COVID-19 pandemic and what types of urban greenspaces were associated with

9   improved human subjective health in 2019 (before COVID-19) and 2020 (during COVID-

10 19). The frequency of urban greenspace use decreased from 2019 to 2020, suggesting the

11 limited use of greenspaces during the pandemic. Furthermore, the types of urban greenspaces

12 associated with improved health in 2019 differed, to varying degrees, from those in 2020.

13 Notably, during the pandemic, greenspaces along urban streets were associated with

14 improved mental and social health. We suggest that street greenspaces be the most familiar

15 and closest greenspaces to urban residents, thereby contributing to improved human health

16 through contact with nature, even during the pandemic. Thus, our study highlights the

17 importance of urban greenspaces, especially street greenspaces, which are the closest and

18 most common to individuals, in maintaining and improving human health in this urban era.

19

20 **Keywords**: ecosystem services; human perception; street greenspace; street trees; urban

21 environment; urbanization

22

23

1. Introduction

Urban greenspaces provide a wide range of ecosystem services that improve the lives and health of individuals (Wolch et al., 2014). For example, interactions with urban greenspaces can reduce mental fatigue(Kaplan, 2001; Barton and Pretty, 2010) and provide opportunities for exercise and recreation, thereby improving physical health (Mytton et al., 2012; Schipperijn et al., 2013). Urban greenspaces are often used as places for social interaction in which individuals can communicate with others (Smith et al., 1997; Maas et al., 2009). These ecosystem services, supported by urban greenspaces, may function even better during the COVID-19 pandemic (Soga et al., 2021). Due to the high number of confirmed cases of infection and the resulting deaths, the World Health Organization (WHO) designated it as a pandemic in March 2020 (World Health Organization, 2020).

Governments in several countries have implemented various response policies to protect public health. While these measures were effective in preventing the spread of infectious diseases, they had a major negative impact on health and personal well-being (Galea et al., 2020). For example, physical activity was reduced due to the blockade of activity sites, and individuals were less likely to interact with others because they refrained from going out. Additionally, there was a sense of anxiety regarding the spread of infectious diseases. Under such constraints on anthropogenic activities during the COVID-19 pandemic, we expect that various urban greenspaces should have contributed to improving the mental, social, and physical aspects of subjective well-being and health. Understanding the relative importance of urban greenspace types in improving subjective health during COVID-19 is crucial for urban greenspace planning but has been understudied; thus, it is the focus of this study.

Previous studies have focused on changes in the frequency of the use of urban greenspaces before and during COVID-19. Using mobility information from the Google Community Mobility Report, Geng et al. (2021) revealed that the frequency of visits to urban

50 parks increased during COVID-19 compared with that before COVID-19. In contrast, Rice et

51 al. (2020) investigated outdoor recreational behavior before and during the COVID-19

52 pandemic using an online questionnaire and reported a decrease in the frequency of use of

53 urban greenspaces during the COVID-19 pandemic. Thus, previous studies have provided

54 mixed results, likely due to differences in the studied regions and methods of data collection.

55 In this study, based on an online questionnaire, we compared the frequency of use of urban

56 greenspaces during the COVID-19 pandemic with that before the COVID-19 pandemic. In

57 Japan, a state of emergency was declared several times but was substantially less restrictive

58 than the lockdown policies often introduced in Europe and the United States (Yamamoto et

59 al., 2020). Therefore, we expect that there may have been no significant change in the

60 frequency of use of urban greenspaces during the COVID-19 pandemic compared with that

61 before the COVID-19 pandemic.

62   Various types of urban greenspaces are associated with improved subjective health.

63 However, such associations are context-dependent, indicating an increasing contribution of a

64 particular greenspace during COVID-19 compared with that before COVID-19. As

65 individuals were often prohibited from sports activities due to movement restrictions during

66 COVID-19 (Venter et al., 2020), certain urban greenspace types, such as urban small pocket

67 parks, could become increasingly important for physical activity. We predicted that the

68 correlation between the visiting frequency of such urban greenspaces and subjective health

69 would be more pronounced during COVID-19 than before COVID-19. In addition, we

70 expected that urban greenspaces improve subjective mental and social health by providing

71 opportunities to mitigate the anxiety caused by the COVID-19 pandemic as well as by

72 ensuring social interactions in an open space without increasing the risk of infection with

73 COVID-19.

74 As individuals may have different purposes for visits depending on the urban greenspace

75 type, including small pocket parks, large parks, street trees, gardens, and greenspaces

76 connected to shrines and temples (Twohig-Bennett & Jones, 2018), the effects of the visiting

77 frequency of a particular greenspace on the level of subjective health differ according to the

78 focal greenspace type. Nonetheless, numerous previous studies have focused on a limited

79 type of urban greenspace, particularly urban parks (Yigitcanlar et al., 2020), or have

80 investigated the relationship between the use of urban greenspaces and subjective health

81 without specifying the type of urban greenspace (Huang et al., 2017). In this study, we

82 examined the relative importance of urban greenspace types in improving subjective health

83 during COVID-19 to provide a complementary and detailed understanding of the importance

84 of urban greenspaces.

85   We aimed to explore the relationship between the frequency of visits to urban

86 greenspace types (including small pocket parks, large parks, street trees, gardens, schools,

87 and greenspaces connected to shrines and temples) and subjective health (based on the

88 subjective assessment of one's own social, mental, and physical health status) before and

89 during the COVID-19 pandemic. Specifically, two questions were addressed using an online

90 survey. First, we examined the differences in the frequency of visits to each urban greenspace

91 type during and before the COVID-19 pandemic. Second, we examined the relationship

92 between the frequency of visits to urban greenspace types and subjective health before and

93 during the COVID-19 pandemic in 2020. As previous studies have suggested that

94 participants' social attributes and lifestyle habits are associated with their level of subjective

95 health, we considered potential confounding factors that may affect their subjective health

96 status in the analysis. For example, the frequency of smoking and drinking negatively affects

97 subjective well-being (K. Smith et al., 2016). Individuals with higher income are likely to

98 experience better subjective well-being (Adeline & Delattre, 2017). Furthermore, the

99 percentage of green cover in the participants' residential areas correlates well with their

100 general status of subjective health (Maas et al., 2006). This research sheds light on the

101 importance of various types of urban greenspaces in improving subjective health and well-

102 being under increasing uncertainty in a changing world.

103

104 **2. Materials and Methods**

105 *2.1. Study area and COVID-19 pandemic restrictions*

106 Our study area comprised 23 wards in Tokyo. Tokyo's 23 wards are the largest cities in Japan,

107 with an area spanning 627.53 km^2 and a population of approximately 9.77 million(Bureau of

108 General Affairs, 2023; Geospatial Information Authority of Japan, 2023b).

109 Residents of the 23 wards in Tokyo were forced to change their lifestyles because of the

110 COVID-19 pandemic. The first infected person appeared in Tokyo on January 23, 2020; the

111 number of infected individuals increased thereafter. The first state of emergency was declared

112 between April 7 and May 25, 2020. During the state of emergency, individuals were forced to

113 refrain from unnecessary outings, and events attracting large crowds were restricted (Tashiro

114 & Shaw, 2020). Even outside the period of the state of emergency, the Ministry of Health,

115 Labour and Welfare in Japan urged individuals to avoid the three "C"s, which refer to "closed

116 spaces," "crowded places," and "close-contact settings." This was the basic strategy used in

117 Japan to prevent cluster outbreaks. By 2023, the Japanese government decided to downgrade

118 COVID-19 to a common infectious disease.

119

120 *2.2. Online survey*

121 The survey was conducted using a structured questionnaire and an online survey system

122 provided by Rakuten Insight, Inc. Rakuten Insight is one of the largest research panels in

123 Japan, comprising approximately 2.2 million individuals registered for various services

124 provided by Rakuten groups as of April 2019. The survey was conducted by screening those

125 living in the 23 wards of Tokyo in 2021 (when the survey was conducted) and in the same

126 locations in 2019 and 2020. An online questionnaire was administered between 10:00 p.m. on

127 October 28 and 10:00 a.m. on October 29, 2021. In total, 1000 participants completed the

128   questionnaire. The survey consisted of three questions (Table 1). We inquired about the

129   participants' subjective well-being, the frequency and purpose of greenspace visits, and socio-

130   demographic attributes in 2019 (before the COVID-19 pandemic) and 2020 (during the

131   COVID-19 pandemic).

132

133   *2.2.1. Subjective Well-being Inventory (SUBI)*

134   The SUBI is not an index of medical health but a subjective assessment of one's health

135   status(Igarashi & Iijima, 2006). It was developed by WHO to measure mental, social, and

136   physical health(Tonan et al., 1995). One advantage of this is that the questionnaire is simple,

137   allowing participants to complete the survey in a short measure time. In addition, previous

138   studies have suggested that subjective well-being significantly impacts a person's quality of

139   life, which cannot necessarily be measured based on medical health status. High subjective

140   well-being can even increase survival rates, irrespective of one's medical condition, (G. A.

141   Kaplan & Camacho, 1983) and may also affect life expectancy within a few years (Kanda et

142   al., 2000). Therefore, it is used in various research fields, including psychology, sociology,

143   gerontology, medical science, public health, and nursing(Toyoshima et al., 2021; Srivastava

144   and Muhammad, 2023). The statements asked in this study followed the Japanese version

145   defined in the paper "Production of The Subjective Well-being Inventory Japanese Edition:

146   It's Reliability and Validity" (Tonan et al., 1995). The questions in the online questionnaire

147   were in Japanese, although they were translated into English for the demonstration in Table 1.

148   Six questions pertaining to mental, social, and physical health were asked. Each question was

149   rated on a five-point Likert scale (from 1 to 5) (Table 1). "Item name" represents the

150   characteristic of each question used throughout this study.

151

152   **Table 1.** Contents of the online questionnaire regarding the Subjective Well-being Inventory

153   (SUBI).

Category	Question	Item name	Answer
Q1-1. Mental health	1. Did you enjoy your life?	Life Enjoyment	"1. Strongly agree." "2. Agree." "3. Neither" "4. Disagree." "5. Strongly disagree."
	2. Did you accomplish what you wanted?	Accomplish	
	3. When faced with unexpected circumstances, did you feel confident in your ability to manage them effectively?	Manage Adversity	
	4. Were you easily upset when faced with unexpected circumstances?	Calmness	"1. Strongly disagree." "2. Disagree." "3. Neither." "4. Agree." "5. Strongly agree."
	5. Did you suffer from strong anxiety or nervousness?	Tolerance to Anxiety and Nervousness	
	6. Were you worried about the future?	Expectations for the Future	
Q1-2. Social health	1. Did you think your family, relatives, or friends would take care of you if you were seriously ill or had an accident?	Care from Others	"1. Strongly agree." "2. Agree." "3. Neither" "4. Disagree." "5. Strongly disagree."
	2. Did you think your family could help you with problems?	Help from Family	

	3. Did you think your family had a strong sense of togetherness?	Family Togetherness	
	4. Did you desire more companionship?	Friendship	
	5. Did you feel lonely because you could not visit your close friends?	Tolerance to Loneliness	"1. Strongly agree." "2. Agree." "3. Neither." "4. Disagree." "5. Strongly disagree."
	6. Did you suffer because you could not get along with other individuals?	Good Relationships	
Q1-3. Physical health	1. Did you worry about your health?	Health	"1. Strongly agree." "2. Agree." "3. Neither." "4. Disagree." "5. Strongly disagree."
	2. Did you have pain in various parts of your body?	Pain Endurance	
	3. Did you suffer from chest pulsations or palpitations?	Absence of Palpitation	
	4. Did you suffer from severe dizziness?	Absence of Dizziness	
	5. Did you easily tire?	Absence of Fatigue	
	6. Did you have trouble sleeping?	Good Sleep	

154

155 *2.2.2. Frequency and purpose of urban greenspace visits*

156 We inquired about the frequency and purpose of visiting urban greenspaces (including small

pocket parks, large parks, greenspaces along streets, gardens, schools, greenspaces connected

to shrines and temples, and other greenspaces) within a 30-min walk of their homes (i.e.,

within walking distance, approximately a 3 km radius from their homes). Urban greenspaces

were defined as any open space covered with vegetation, such as trees and herbs, except for

private properties, such as home gardens. We also defined a visit to an urban greenspace as a

visit with an exact purpose, excluding commuting to a working office or school. Thus,

participants were asked about the frequency of visits, staying time, percentage of visits per

greenspace type, and purpose for visits per greenspace type (Table 2).

Table 2. Contents of the online questionnaire regarding the frequency and purpose of urban

greenspace visits.

Question	Answer
Q2-1. How often per week did you visit urban green spaces within a 30-min walk from your home *? In this context, urban greenspaces are defined as open spaces covered with vegetation, such as trees and herbs, except for private property, such as a home garden.	(0–7) d / week
Q2-2. What is your monthly frequency of visits to the urban green space types listed below **? (1) Small pocket park (2) Large park (3) Greenspaces along streets	Participants were asked to provide an integral number to items (1)–(7) such that the total is 10.

(4) Garden (5) School (6) Greenspaces around temples and shrines (7) Other	
Q2-3. Please select the purposes for visiting each type of urban greenspace as indicated in your response to Q2-2 (multiple choices allowed)***. (1) Small pocket park (2) Large Park (3) Greenspaces along streets (4) Garden (5) School (6) Greenspaces around temples and shrines (7) Other	"1. Exercise." "2. Pet walking." "3. Playing (with children and friends)." "4. Reading." "5. Events." "6. Light meal." "7. Viewing sceneries." "8. Appreciating flora and fauna." "9. Rest." "10. Socializing." "11. Volunteer work." "12. Other (an open-ended question)."

168   * In Q2-1, participants were instructed to answer "0" if they do not visit urban greenspaces at

169   all and "1" if they visit them less than once a week but at least once a month. Participants

170   who answered 0 to Q2-1 were not presented with questions Q2-2 and Q2-3.

171   ** Supplementary explanations were provided for certain urban greenspaces to enhance

172   participants' understanding: (1) Small pocket park: small parks (generally smaller than 4 ha)

173   (Ministry of Land Infrastructure Transport and Tourism, 2008)surrounded by residential

174   areas. (2) Large park: large parks (generally larger than 10 ha) (Ministry of Land

175   Infrastructure Transport and Tourism, 2008) that can be used for relaxing, viewing sceneries,

176   playing, exercising, etc. (3) Greenspaces along streets: street trees, grass beds, and

177   shrubberies located beneath street trees (Heikkinen et al., 2023).

178   *** Urban greenspace types that were not visited by each participant in Q2-2 (urban

179   greenspace types with "0" in Q2-2) were automatically removed in Q2-3.

180

181   The frequency of visits to each urban greenspace type was calculated from the

182   responses to Q2-1(frequency of visits to urban greenspaces per week) and Q2-2 (percentage

183   of visits to each urban greenspace type). In other words, the frequency of visits to urban

184   greenspaces in general (Q2-1) was weighted by the percentage of visits to each urban

185   greenspace type.

186

187   *2.2.3. Socio-demographic and other attributes of participants*

188   Finally, we asked the participants about their basic information. Previous studies have shown

189   that subjective health is affected by participants' socio-demographic attributes, surrounding

190   environment, and lifestyle habits. To consider these confounding factors in the analysis, we

191   also asked participants for information on sex, age, income, zip code, frequency of alcohol

192   consumption, frequency of smoking, marital status, and parental status (Table 3).

193

194   **Table 3.** Contents of the online questionnaire regarding participants' attributes.

Question	Answer
Q3. What is your sex?	"1. Male." "2. Female."
Q4. What is your age?	( ) years of age
Q5. What was your annual income?	"1. No income of my own" "2. ~1,000,000 JPY." "3. 1,000,000 JPY ~ 2,000,000 JPY." "4. 2,000,000 JPY ~ 3,000,000 JPY." "5. 3,000,000 JPY ~ 4,000,000 JPY." "6. 4,000,000 JPY ~ 5,000,000 JPY." "7. 5,000,000 JPY ~ 6,000,000 JPY." "8.

	6,000,000 JPY ~ 7,000,000 JPY." "9. 7,000,000 JPY ~ 8,000,000 JPY." "10. 8,000,000 JPY ~ 9,000,000 JPY." "11. 9,000,000 JPY ~ 10,000,000 JPY." "12. 10,000,000 JPY ~ 12,000,000 JPY." "13. 12,000,000 JPY ~ 15,000,000 JPY." "14. 15,000,000 JPY+" "15. I was unaware."
Q6. What was the zip code of your place of residence?	○○○-○○○○
Q7. How often did you consume alcohol?	"1. Rarely." "2. Once a week." "3. 2–3 times a week." "4. 4–5 times a week." "5. Every day."
Q8. How many cigarettes did you smoke per day?	"1. Not a smoker." "2. 1–5 cigarettes." "3. 6–10 cigarettes." "4. 11–20 cigarettes." "5. 21–30 cigarettes." "6. 31–40 cigarettes." "7. 41 or more cigarettes."
Q9. Were you married?	"1. Yes." "2. No."
Q10. Did you have children?	"1. Yes." "2. No."

195

196   The percentage of green cover surrounding the participants' residential locations was

197 calculated based on their zip codes using ArcGIS Pro v3.1. Digital national land

198 information(Geospatial Information Authority of Japan, 2023a) and land cover data

199 (Advanced Land Observing Satellite, 2023) were used. The percentage of green cover within

200 a 3-km buffer from the center of the zip code was calculated and used in the analysis.

201

202   *2.3. Data analysis*

203   All analyses were performed using R software (version 4.2.2; R Development Core

204   Team). We used the exactRankTests, corrplot, tidyverse, magrittr, ordinal, car, and ggplot2

205   packages for the subsequent analysis and visualizations.

206

207   *2.3.1. Change in urban greenspace visitation frequency*

208   To assess the change in the frequency of visits to urban greenspaces (quantified by the

209   number of days per week: 0–7 d) from 2019 to 2020, we conducted a paired Wilcoxon

210   signed-rank test (Southon et al., 2017).

211

212   *2.3.2 Relationship between the SUBI and urban greenspace use*

213   We employed ordinal logit regression models to analyze the relationships between the

214   frequency of use of urban greenspace types (measured by the frequency of visits to urban

215   greenspaces weighted by the percentage of visits to each type of urban greenspace) and

216   subjective well-being status (assessed on a five-point Likert scale: 1 = very unhealthy, 5 =

217   very healthy). This analysis accounted for potential confounding factors, including age,

218   income, frequency of alcohol consumption, frequency of smoking, percentage of green cover

219   around participants' residential areas, marital status, parental status, and sex. Table 4 lists the

220   variables used in these models. Quantitative explanatory variables were standardized to have

221   a zero mean and unit variance prior to analysis. Correlations between the explanatory

222   variables were measured, and we confirmed that there were no multicollinearity problems

223   (the correlation coefficients for all pairs of explanatory variables were less than 0.7).

224

225   **Table 4**. List of variables used in the ordinal logit regression models.

	Variable	Type	Reference

			Category
Response variable	Ordinal scale for each SUBI	Ordinal	
Explanatory variable	Frequency of use of each urban greenspace type	Quantitative	
	Age	Quantitative	
	Income	Quantitative	
	Frequency of alcohol consumption	Quantitative	
	Frequency of smoking	Quantitative	
	Percentage of green cover around participants' residential area	Quantitative	
	Married	Categorical	No
	Children	Categorical	No
	Sex	Categorical	Female

226

227 **3. Results**

228 *3.1. Participants' characteristics*

229 In total, 1,000 participants answered the online questionnaire. Incomplete responses were

230 excluded, and 885 complete responses were used (Table 5). The study included 557 males

231 (62.9%) and 328 females (37.1%). The largest number of participants were in the 50–59 age

232 category (272 responses; 30.7%), followed by those in the 40–49 (253; 28.6%) and 30–39

233 (166; 18.8%) age categories. No individual was aged over 80 years.

234

235   **Table 5.** Characteristics of the participants in the online questionnaire.

Characteristic	Category	Ratio (%)	Number of participants
Sex	Male	62.9	557
	Female	37.1	328
Age	10–19	0.2	2
	20–29	5.0	44
	30–39	18.8	166
	40–49	28.6	253
	50–59	30.7	272
	60–69	13.1	116
	70–79	3.6	32

236

237   *3.2. Changes in urban greenspace visitation frequency before and during the COVID-19*

238   *pandemic*

239   The frequency of visits to urban greenspaces was significantly higher in 2019 than that in

240   2020 (Fig. 1; $P < 0.001$), and the number of visitors to each type of urban greenspace

241   decreased from 2019 to 2020 (Fig. 2).

242
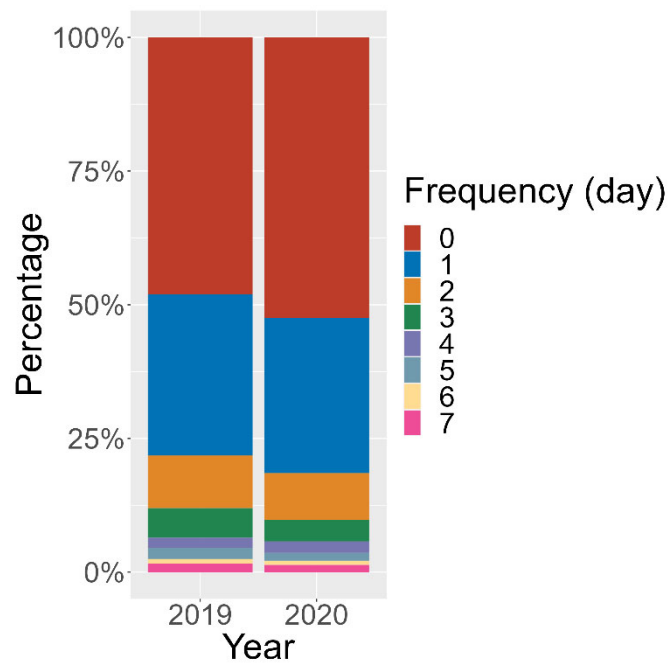
Fig. 1. Frequency of urban greenspace visitation in 2019 and 2020.
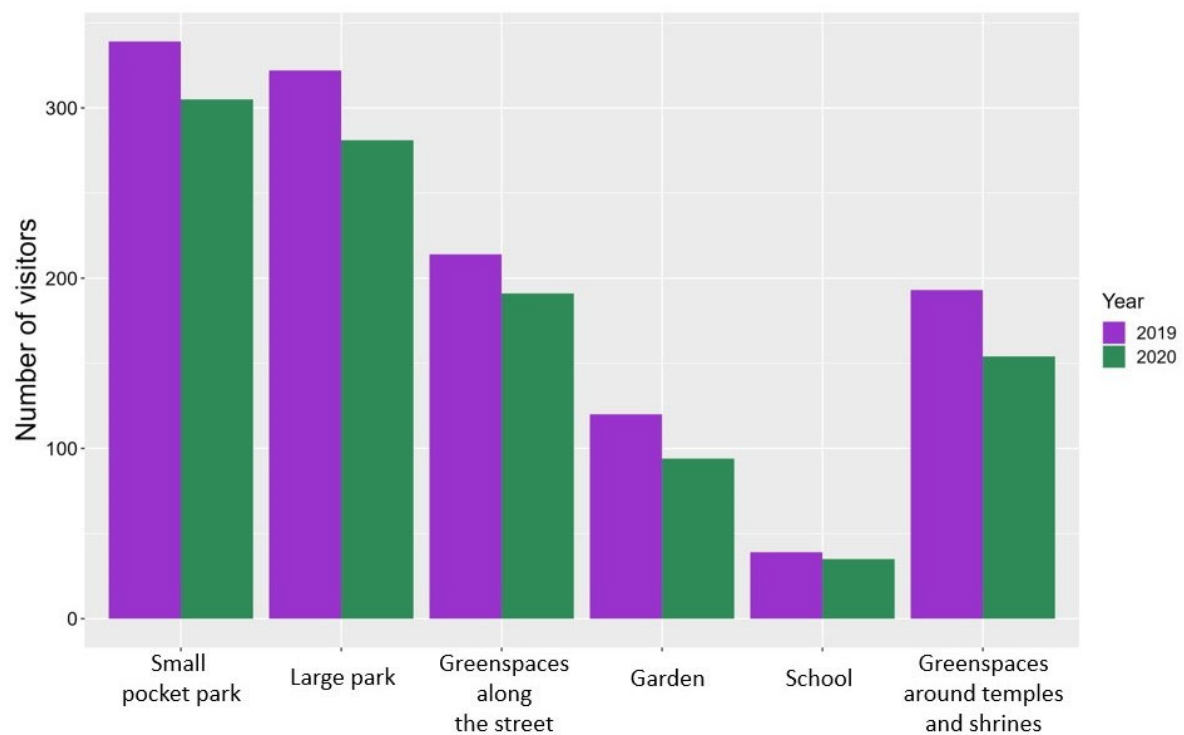
Fig. 2. Number of visitors to each urban greenspace type in 2019 and 2020.

The distribution of visitation purposes across each type of urban greenspace did not

significantly differ between 2019 and 2020 (Fig. 3). Most urban greenspace types (small

251   pocket parks, large parks, greenspaces along streets, and greenspaces around temples and

252   shrines) were predominantly visited for purposes, such as "exercise," "rest," and "viewing

253   sceneries." Many individuals visited gardens and greenspaces around temples and shrines to

254   view nature; "appreciating flora and fauna" and "viewing sceneries." A distinctive feature of

255   the purpose of school visitations was the emphasis on social interaction, particularly in

256   relation to "events" and "volunteer work," in comparison to other types of greenspaces.

257   Among all greenspace types, "pet walking" was particularly prevalent for visitations to

258   greenspaces along streets. The percentage of participants who visited urban greenspaces for

259   "light meals" or "socializing" was consistently low across the greenspace types.
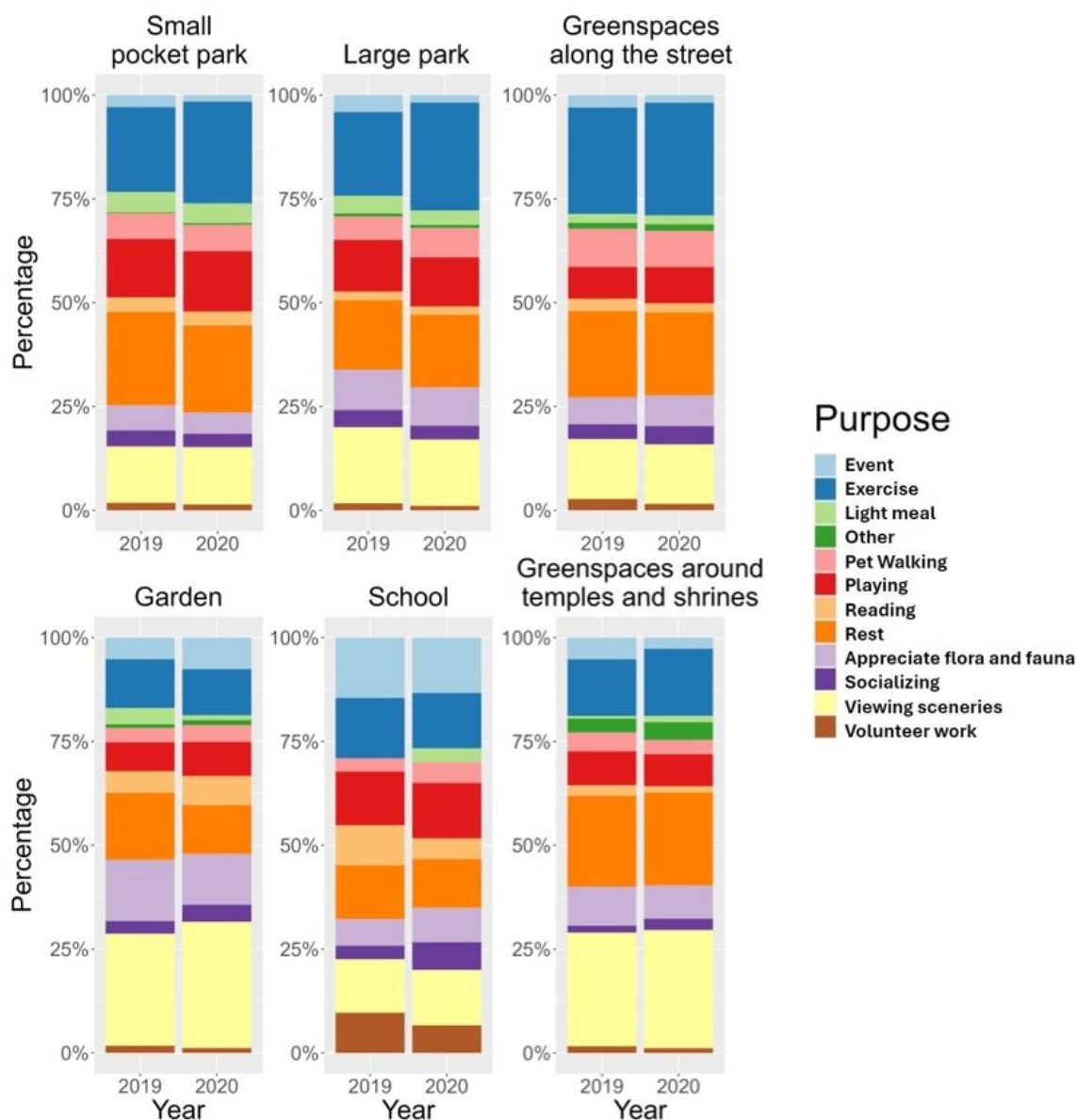
Fig. 3. Distribution of visitation purposes across each type of urban greenspace (small pocket

parks, large parks, greenspaces along streets, gardens, schools, and greenspaces around

temples and shrines).

3.3. Relationship between the SUBI and the use of urban greenspace types

Regarding the mental health and well-being categories, we observed a significant positive

correlation between the subjective well-being concerning "Life Enjoyment" and "Manage

Adversity" and the frequency of visits to greenspaces along streets (Fig. 4; Table S1).

269   Although these positive effects were detected in both 2019 and 2020, the effect size tended to

270   be greater in 2020. In 2019, the subjective well-being concerning "Tolerance to Anxiety and

271   Nervousness" and "Expectations for the Future" were significantly positively correlated with

272   the frequency of visits to school greenspaces.

273   Regarding the social health and well-being categories, we observed a significant

274   positive correlation between the subjective well-being concerning "Care from Others" and

275   "Family Togetherness" and the frequency of visits to greenspaces along streets in 2020 (Fig.

276   4; Table S1). We also revealed that the subjective well-being regarding "Friendship" was

277   significantly positively correlated with the frequency of visits to small pocket parks in 2019

278   and that to school greenspaces in 2020.

279   In the categories of physical health and well-being, we did not observe any

280   significant positive correlation between subjective well-being and the frequency of visits to

281   urban greenspace types (Fig. 4, Table S1).

282

(a) Mental health
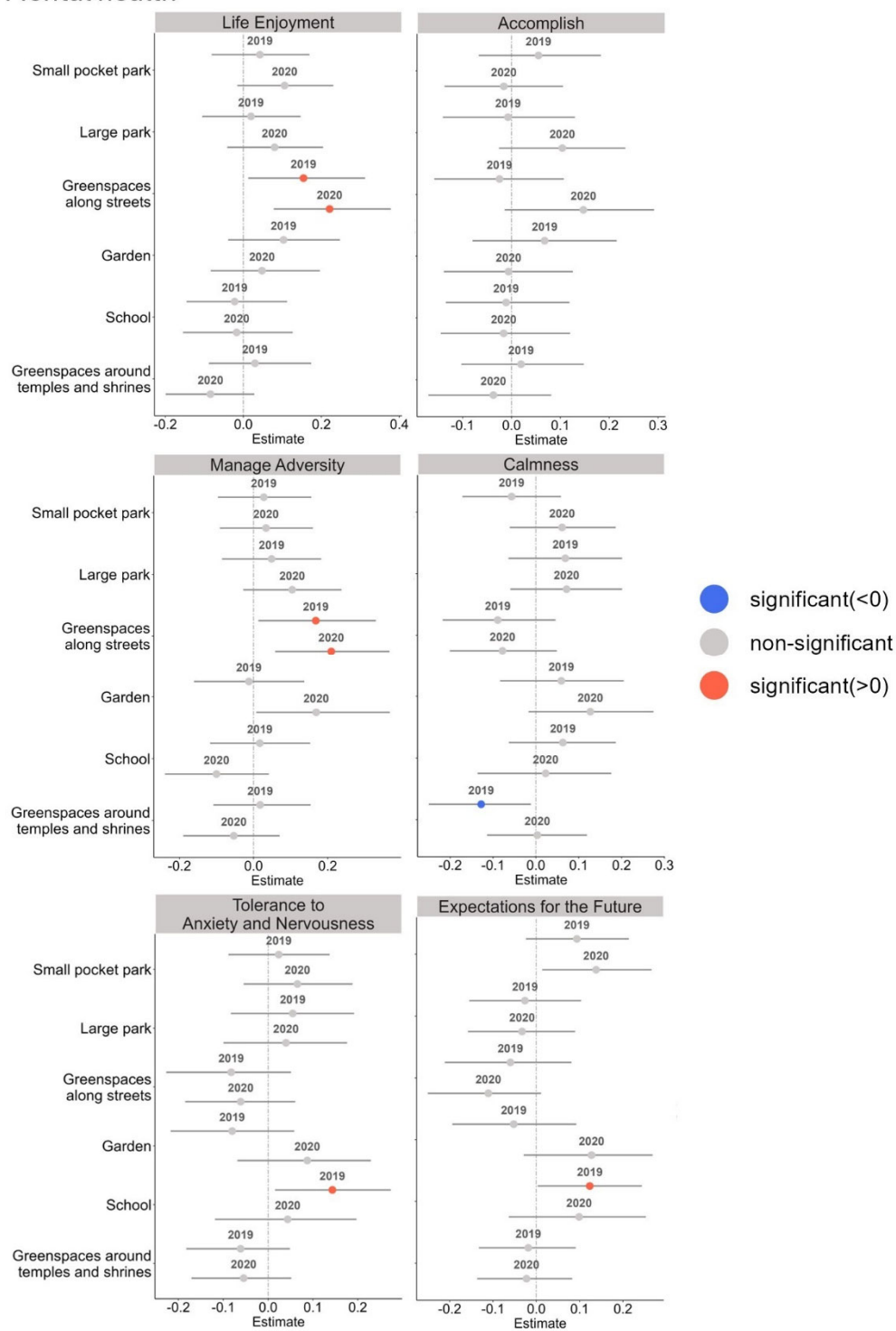
(b)Social health
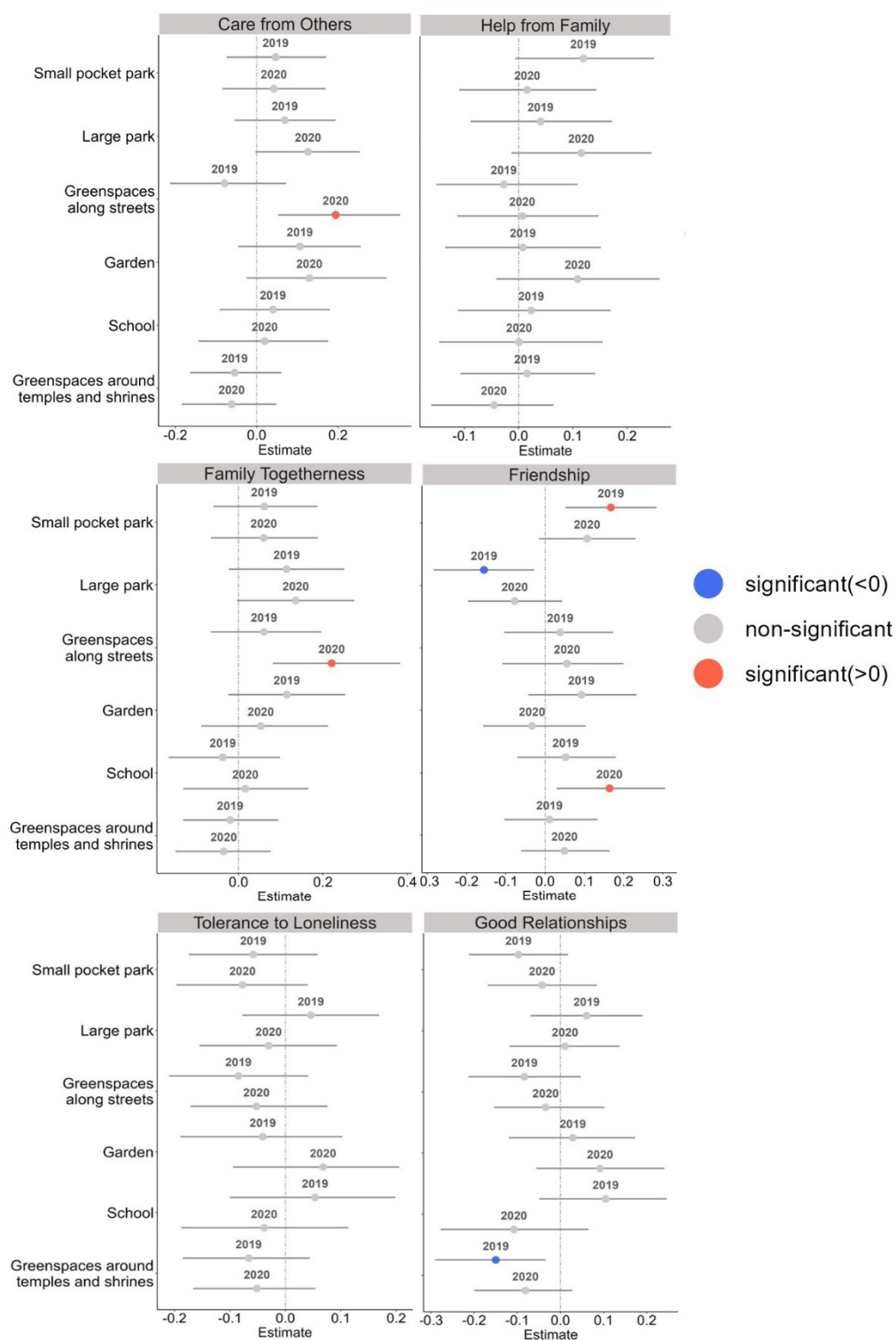
(c)Physical health
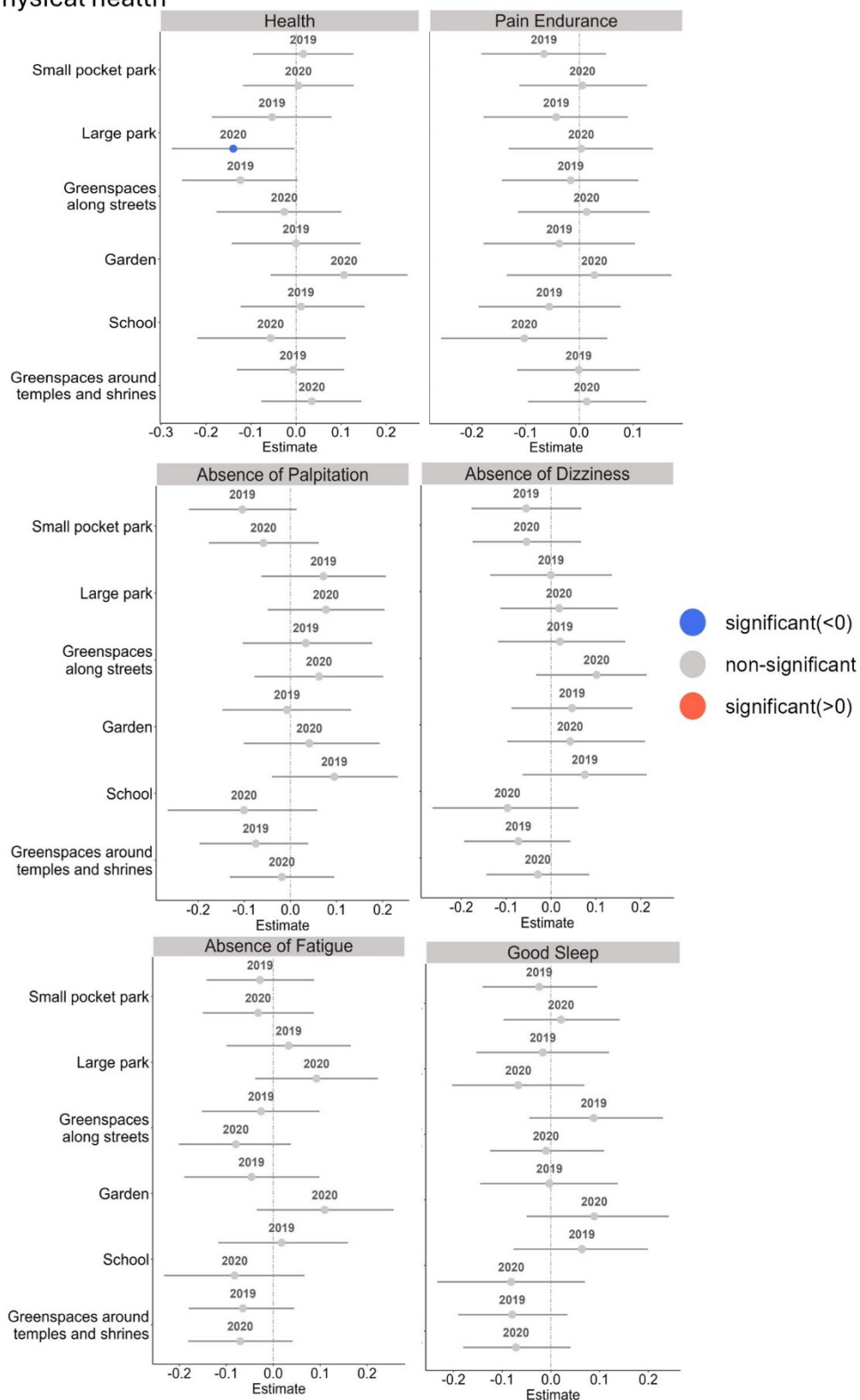
288   **Fig. 4.** Relationships between the subjective well-being scores and the frequency of visits to

289   urban greenspace types in 2019 and 2020 analyzed using ordinal logit regression models. We

290   regressed the five-point Likert scale (1 = very unhealthy, 5 = very healthy) of each measure

291   of subjective well-being against the frequency of visits to each type of urban greenspace.

292   Age, income, frequency of alcohol consumption, frequency of smoking, percentage of green

293   cover around participants' residential areas, marital status, parental status, and sex in 2019

294   and in 2020 were considered in the models. A red circle indicates a significant ($P < 0.05$)

295   positive regression coefficient, and a blue circle indicates a significant ($P < 0.05$) negative

296   regression coefficient. Bars represent 95% confidence intervals.

297 **4. Discussion**

298 *4.1. Decreased frequency of visits to urban greenspaces during the COVID-19 pandemic*

299 The frequency of visits to urban greenspaces was lower in 2020 (during the COVID-19

300 pandemic) than that in 2019 (before the COVID-19 pandemic) (Figs. 1 and 2). This is

301 consistent with the results of previous studies (Larson et al., 2021; Ugolini et al., 2021), in

302 which an online survey was used, as in our study (Geng et al., 2021; Lu et al., 2021). We

303 suggest that visitation to urban greenspaces was curtailed to varying degrees under the state

304 of emergency during the COVID-19 pandemic, which urged individuals to avoid non-urgent

305 outings. Under the state of emergency, certain urban greenspaces, such as public gardens and

306 university campuses, were enclosed with fences and gates (Yamazaki et al., 2021). Such

307 restricted use of urban greenspaces, especially during the state of emergency in 2020, may

308 have reduced the frequency of visits to urban greenspaces in 2020 compared with that in

309 2019.

310 However, previous studies (Geng et al., 2021; Lu et al., 2021) have reported contrasting

311 results. Most previous studies (Geng et al., 2021; Lu et al., 2021) that demonstrated an

312 increase in the frequency of visits to urban greenspaces after the COVID-19 pandemic

313 compared with immediately before the COVID-19 pandemic used data based on social media

314 (such as Instagram) and mobility reports (Google Community Mobility Reports) (Geng et al.,

315 2021; Lu et al., 2021). First, the number of posts on social media may have increased after

316 the COVID-19 pandemic because individuals in Japan tended to stay at home and had more

317 time to use social media (Tuck & Thompson, 2021). Accordingly, detecting the frequency of

318 visits to urban greenspaces based on social media sources may be inherently biased because

319 of differences in the number of social media posts before and after the COVID-19 pandemic.

320 Caution should be exercised when data based on mobility reports are used to compare the

321 frequency of visits to urban greenspaces. In particular, there is seasonality in the frequency of

322 visits to greenspaces; therefore, comparing such a frequency immediately after the COVID-

323   19 pandemic (in warmer climates) with that immediately before the COVID-19 pandemic (in

324   colder climates) should bias the results. In this study, participants responded to an online

325   questionnaire based on their personal circumstances in 2019 and 2020. Thus, we suggest that

326   our approach allowed us to remove these potential biases.

327

328   *4.2. Importance of urban greenspace types in improving subjective well-being and health*

329   *during the COVID-19 pandemic*

330   We found that several types of urban greenspaces were associated with improved subjective

331   well-being before and during the COVID-19 pandemic (Fig. 4; Table S1). An increased

332   frequency of visits to small pocket parks in 2019 was positively associated with subjective

333   well-being related to "Friendship" (Fig. 4). Previous studies that have examined the

334   contributions of urban parks to promoting social cohesion have suggested that individuals

335   consider urban parks as areas where they can spend time with friends and family (Peters et

336   al., 2010). Such an argument reinforces our findings, as increasing the frequency of visits to

337   small pocket parks enhanced satisfaction with friends by facilitating meetings there.

338   Nonetheless, we did not observe a positive association between the frequency of visits to

339   small pocket parks and subjective well-being regarding "Friendship" during the COVID-19

340   pandemic. It is likely that individuals refrained from visiting small pocket parks with friends

341   to prevent the spread of COVID-19.

342   Notably, the frequency of visits to greenspaces along streets was consistently

343   positively correlated with the subjective well-being regarding "Life Enjoyment" and

344   "Manage Adversity" (Fig. 4). These subjective well-being types are closely related to mental

345   health, satisfaction, and confidence in individuals' lives. Previous studies examining the

346   psychological status of individuals after a short walk along various types of urban streets

347   have demonstrated that walking along streets lined with trees improves feelings of vitality

348   more than walking along streets dominated by artificial structures (Elsadek et al., 2019). We

349   suggest that urban street trees increase positive emotions, leading to greater life satisfaction

350   and confidence (Koyata et al., 2021). Furthermore, the positive effect on these subjective

351   well-being types associated with urban street trees tended to be greater in 2020 than that in

352   2019. Interestingly, the visitation frequency to greenspaces along streets was positively

353   correlated with the subjective well-being regarding "Care from Others" and "Family

354   Togetherness" in 2020 only.

355   Elsadek et al. (2019) suggested that urban street trees not only enhance positive

356   moods but also reduce negative moods, such as tension, fatigue, confusion, and anxiety. The

357   COVID-19 pandemic is expected to have significantly impacted these negative moods (Cai et

358   al., 2021). Thus, we suggest that the mental benefits of street trees would have been more

359   pronounced in a scenario where individuals were more likely to experience negative

360   emotions, such as during the COVID-19 pandemic. Compared to other greenspace types,

361   activities, such as "pet walking" and "exercise (primarily walking and jogging)," were

362   particularly prevalent purposes for visiting greenspaces along streets (Fig. 3). While other

363   urban greenspace types were occasionally closed, especially during the COVID-19

364   emergency, urban street greenspaces should always be the closest and most common nature

365   environment to individuals (Koyata et al., 2021), thereby maintaining and improving

366   subjective well-being.

367   Finally, in 2019, the frequency of visits to school greenspaces was significantly

368   positively correlated with the subjective well-being regarding "Tolerance to Anxiety and

369   Nervousness" and "Expectation for the Future" (Fig. 4). School greenspaces are generally

370   rich in vegetation (Holt et al., 2019), and the diversity of vegetation and associated plants

371   may enhance mental health (Wolf et al., 2017). Moreover, increased green cover at school

372   sites can improve working memory and cognitive development (Dadvand et al., 2015). These

373   arguments support our findings. Nonetheless, the potential enhancing effects of school

374   greenspaces on human mental well-being may have been mitigated by the impact of the

375 COVID-19 pandemic. During the COVID-19 pandemic (in 2020), the frequency of visits to

376 school greenspaces was positively associated with the subjective well-being regarding

377 "Friendship." Considering more isolated and lonely feelings experienced during the COVID-

378 19 pandemic, the relative importance of school greenspaces (perhaps schools themselves) in

379 improving social health may become high because opportunities for social events and playing

380 with friends may be steadily provided in schools (Fig. 3).

381

382 **5. Conclusions**

383 Understanding the relative importance of urban greenspace types in improving subjective

384 health during the COVID-19 pandemic is crucial for planning urban greenspaces. Our study

385 demonstrated that the frequency of visits to urban greenspaces decreased during the COVID-

386 19 pandemic compared with that before the COVID-19 pandemic. Nevertheless, several

387 urban greenspace types could improve subjective well-being during the COVID-19

388 pandemic. By focusing on specific types of urban greenspaces rather than on urban

389 greenspaces in general, this study provides a complementary and detailed understanding of

390 the importance of urban greenspaces in our lives. Notably, green spaces along urban streets

391 were associated with improvements in several categories of mental and social health during

392 the COVID-19 pandemic. We suggest that street greenspaces be the most familiar and closest

393 greenspaces to urban residents, thereby contributing to improved human health through

394 contact with nature, even during the pandemic. Our study underscores the importance of

395 urban greenspaces, especially street greenspaces, which are the closest and most common to

396 individuals, in maintaining and improving human health in this urban era.

397

398 **Declaration of Competing Interest**

399 All authors declare no conflicts of interest.

400

401

Ethical Approval

403 This study and included questionnaire procedures met the requirements by the Ethics

404 Committee of the corresponding author's institution.

405

Data Availability

407 The data supporting the results in this paper will be archived in the data depository at the time

408 of acceptance, and the data DOI will be included.

409

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568

SUPPORTING INFORMATION

Table S1. Results of ordinal logit regression models for the relationships between the subjective well-being scores (Table 1) and the frequency of visits to urban greenspace types in 2019 and 2020. We regressed the five-point Likert scale (1 = very unhealthy, 5 = very healthy) of each measure of subjective well-being against the frequency of visits to each type of urban greenspace. Age, income, frequency of alcohol consumption, frequency of smoking, percentage of green cover around participants' residential areas, marital status, parental status, and sex in 2019 and in 2020 were considered in the models. ***$P < 0.001$, **$P < 0.01$, *$P < 0.05$.

(a) Mental health

Model	Variable	2019 (before the COVID-19 pandemic)				2020 (during the COVID-19 pandemic)			
		Estimate	Lower 95% CI	Upper 95% CI	P value	Estimate	Lower 95% CI	Upper 95% CI	P value
Life Enjoyment	Small pocket park	0.043	-0.081	0.169	0.504	0.106	-0.015	0.231	0.091
	Large Park	0.020	-0.106	0.147	0.760	0.080	-0.041	0.204	0.200
	Greenspaces along streets	0.154	0.013	0.312	0.041*	0.221	0.078	0.378	0.003**
	Garden	0.103	-0.039	0.248	0.158	0.048	-0.084	0.196	0.487
	School	-0.022	-0.145	0.112	0.729	-0.017	0.155	0.126	0.809
	Greenspaces around temples and shrines	0.030	-0.089	0.174	0.647	-0.084	-0.199	0.028	0.132

	Age	0.001	-0.135	0.137	0.990	0.089	-0.044	0.221	0.189
	Income	0.389	0.241	0.539	0.000***	0.290	0.145	0.435	0.000***
	Alcohol	0.163	0.032	0.294	0.015*	0.038	-0.089	0.165	0.559
	Smoking	-0.075	-0.200	0.050	0.238	-0.091	-0.212	0.030	0.140
	Green cover	-0.073	-0.197	0.052	0.250	-0.051	-0.174	0.071	0.408
	Marriage	0.396	0.089	0.704	0.012*	0.209	-0.098	0.517	0.183
	Child	-0.065	-0.378	0.249	0.686	-0.231	-0.539	0.076	0.140
	Sex	-0.441	-0.752	-0.132	0.005**	-0.110	-0.414	0.193	0.477
Accomplish	Small pocket park	0.055	-0.067	0.183	0.385	-0.016	-0.137	0.105	0.799
	Large Park	-0.007	-0.140	0.130	0.918	0.104	-0.026	0.233	0.114
	Greenspaces along streets	-0.025	-0.157	0.107	0.712	0.147	-0.014	0.292	0.051
	Garden	0.068	-0.080	0.215	0.367	-0.006	-0.138	0.126	0.927
	School	-0.011	-0.134	0.119	0.862	-0.016	-0.145	0.120	0.812
	Greenspaces around temples and shrines	0.020	-0.102	0.148	0.753	-0.037	-0.170	0.081	0.550
	Age	0.033	-0.101	0.168	0.627	0.119	-0.012	0.250	0.076
	Income	0.477	0.329	0.625	0.000***	0.393	0.251	0.536	0.000***
	Alcohol	0.026	-0.103	0.155	0.697	-0.063	-0.189	0.062	0.324
	Smoking	0.044	-0.082	0.170	0.494	-0.013	-0.135	0.109	0.833
	Green cover	-0.015	-0.137	0.108	0.809	-0.043	-0.166	0.080	0.493
	Marriage	0.519	0.209	0.832	0.001**	0.080	-0.228	0.389	0.610
	Child	-0.231	-0.548	0.084	0.151	-0.059	-0.368	0.250	0.709
	Sex	-0.888	-1.197	-0.581	0.000***	-0.381	-0.670	-0.083	0.012*

Manage Adversity	Small pocket park	0.028	-0.096	0.156	0.666	0.034	-0.091	0.160	0.599
	Large Park	0.049	-0.085	0.183	0.475	0.104	-0.028	0.237	0.122
	Greenspaces along streets	0.168	0.013	0.330	0.039*	0.210	0.058	0.367	0.005**
	Garden	-0.013	-0.161	0.137	0.868	0.169	0.007	0.368	0.071
	School	0.017	-0.117	0.153	0.806	-1.000	-0.239	0.041	0.159
	Greenspaces around temples and shrines	0.018	-0.109	0.154	0.785	-0.053	-0.190	0.071	0.408
	Age	0.099	-0.038	0.236	0.157	0.089	-0.045	0.223	0.193
	Income	0.465	0.314	0.618	0.000***	0.270	0.124	0.416	0.000***
	Alcohol	0.084	-0.048	0.216	0.213	0.011	-0.117	0.140	0.863
	Smoking	-0.006	-0.134	0.122	0.925	-0.001	-0.126	0.125	0.989
	Green cover	-0.089	-0.212	0.034	0.155	-0.083	-0.206	0.041	0.189
	Marriage	0.447	0.134	0.762	0.005**	0.442	0.130	0.756	0.006**
	Child	-0.117	-0.438	0.203	0.474	-0.086	-0.401	0.228	0.591
	Sex	-0.900	-1.219	-0.585	0.000***	-0.358	-0.664	-0.054	0.021
Calmness	Small pocket park	-0.057	-0.172	0.058	0.332	0.061	-0.061	0.186	0.331
	Large Park	0.069	-0.064	0.201	0.308	0.072	-0.059	0.201	0.279
	Greenspaces along streets	-0.089	-0.217	0.046	0.178	-0.078	-0.201	0.049	0.210
	Garden	0.059	-0.083	0.205	0.419	0.127	-0.017	0.275	0.069
	School	0.063	-0.063	0.187	0.316	0.023	-0.136	0.176	0.774
	Greenspaces around temples and shrines	-0.128	-0.250	-0.011	0.032*	0.003	-0.114	0.119	0.952

	Age	0.162	0.027	0.298	0.019*	0.216	0.082	0.352	0.002**
	Income	0.230	0.086	0.375	0.002**	0.270	0.128	0.412	0.000***
	Alcohol	-0.047	-0.175	0.081	0.475	-0.084	-0.210	0.042	0.193
	Smoking	0.067	-0.057	0.191	0.288	0.008	-0.115	0.130	0.904
	Green cover	-0.015	-0.133	0.104	0.806	0.073	-0.469	0.193	0.235
	Marriage	0.235	-0.070	0.540	0.131	0.124	-0.181	0.429	0.426
	Child	-0.169	-0.482	0.145	0.292	-0.249	-0.559	0.060	0.115
	Sex	-0.009	-0.312	0.295	0.956	0.030	-0.270	0.330	0.846
Tolerance to Anxiety and Nervousness	Small pocket park	0.024	-0.088	0.137	0.679	0.065	-0.054	0.188	0.289
	Large Park	0.055	-0.083	0.192	0.433	0.040	-0.100	0.176	0.572
	Greenspaces along streets	-0.082	-0.227	0.051	0.238	-0.061	-0.185	0.061	0.315
	Garden	-0.080	-0.217	0.058	0.252	0.087	-0.068	0.229	0.223
	School	0.143	0.016	0.274	0.027*	0.044	-0.118	0.197	0.589
	Greenspaces around temples and shrines	-0.061	-0.182	0.049	0.282	-0.054	-0.171	0.052	0.318
	Age	0.150	0.017	0.283	0.028*	0.275	0.141	0.409	0.000***
	Income	0.179	0.037	0.321	0.013*	0.300	0.158	0.440	0.000***
	Alcohol	0.142	0.015	0.269	0.028*	-0.007	- 0.131	0.118	0.917
	Smoking	-0.051	-0.170	0.067	0.397	-0.042	- 0.164	0.079	0.494
	Green cover	-0.003	-0.124	0.118	0.961	0.069	- 0.050	0.188	0.258
	Marriage	0.345	0.046	0.644	0.024*	0.158	-0.142	0.458	0.303
	Child	-0.172	-0.479	0.134	0.271	-0.249	-0.553	0.054	0.107

Model	Variable	Estimate	Lower 95% CI	Upper 95% CI	P value	Estimate	Lower 95% CI	Upper 95% CI	P value
Expectations for the Future	Sex	-0.157	-0.456	0.140	0.301	0.000	-0.296	0.297	0.998
	Small pocket park	0.094	-0.024	0.214	0.120	0.138	0.014	0.266	0.031*
	Large Park	-0.026	-0.155	0.104	0.690	-0.033	-0.158	0.090	0.602
	Greenspaces along streets	-0.060	-0.211	0.081	0.418	-0.111	-0.250	0.011	0.088
	Garden	-0.052	-0.194	0.092	0.474	0.128	-0.029	0.268	0.077
	School	0.123	0.003	0.243	0.041*	0.099	-0.064	0.253	0.221
	Greenspaces around temples and shrines	-0.019	-0.133	0.091	0.737	-0.023	-0.136	0.083	0.674
	Age	0.181	0.049	0.313	0.007*	0.253	0.121	0.385	0.000***
	Income	0.219	0.077	0.361	0.003*	0.290	0.149	0.432	0.000***
	Alcohol	0.062	-0.063	0.188	0.329	-0.061	-0.187	0.065	0.344
	Smoking	-0.090	-0.210	0.028	0.136	-0.101	-0.221	0.019	0.100
	Green cover	-0.121	-0.245	0.002	0.055	-0.011	-0.133	0.110	0.852
	Marriage	0.372	0.075	0.670	0.014*	0.172	-0.128	0.474	0.261
	Child	-0.196	-0.500	0.108	0.206	-0.188	-0.491	0.114	0.222
	Sex	-0.144	-0.442	0.154	0.344	0.061	-0.235	0.356	0.686

(b) Social health

Model	Variable	2019 (before the COVID-19 pandemic)				2020 (during the COVID-19 pandemic)			
		Estimate	Lower 95% CI	Upper 95% CI	P value	Estimate	Lower 95% CI	Upper 95% CI	P value
Care from	Small pocket park	0.047	-0.074	0.171	0.455	0.042	-0.084	0.170	0.512

Others	Large Park	0.069	-0.054	0.194	0.273	0.126	-0.003	0.253	0.053
	Greenspaces along streets	-0.079	-0.213	0.073	0.272	0.194	0.053	0.353	0.008**
	Garden	0.106	-0.045	0.256	0.167	0.130	-0.025	0.319	0.143
	School	0.040	-0.091	0.180	0.561	0.020	-0.143	0.176	0.808
	Greenspaces around temples and shrines	-0.054	-0.163	0.060	0.326	-0.061	-0.184	0.049	0.283
	Age	-0.051	-0.185	0.082	0.450	-0.091	-0.224	0.041	0.178
	Income	0.276	0.132	0.420	0.000***	0.169	0.028	0.312	0.019*
	Alcohol	0.044	-0.083	0.172	0.499	0.002	-0.125	0.128	0.981
	Smoking	-0.112	-0.235	0.011	0.074	-0.141	-0.265	-0.018	0.025*
	Green cover	0.095	-0.027	0.218	0.128	0.130	0.005	0.257	0.043*
	Marriage	0.794	0.492	1.098	0.000***	0.643	0.338	0.950	0.000***
	Child	0.036	-0.268	0.339	0.818	0.069	-0.235	0.373	0.658
	Sex	-0.755	-1.064	-0.447	0.000***	-0.305	-0.610	-0.002	0.049
Help from Family	Small pocket park	0.119	-0.006	0.249	0.067	0.016	-0.109	0.143	0.806
	Large Park	0.040	-0.089	0.172	0.543	0.115	-0.013	0.244	0.079
	Greenspaces along streets	-0.027	-0.152	0.108	0.674	0.007	-0.113	0.147	0.918
	Garden	0.008	-0.135	0.151	0.915	0.109	-0.041	0.260	0.129
	School	0.023	-0.112	0.169	0.747	0.001	-0.147	0.155	0.992
	Greenspaces around temples and shrines	0.016	-0.107	0.141	0.802	-0.046	-0.161	0.064	0.411
	Age	-0.098	-0.233	0.037	0.157	-0.071	-0.204	0.061	0.293

	Income	0.211	0.067	0.355	0.004**	0.205	0.062	0.349	0.005**
	Alcohol	0.036	-0.092	0.164	0.582	-0.018	-0.146	0.110	0.782
	Smoking	-0.068	-0.192	0.056	0.280	-0.082	-0.205	0.042	0.194
	Green cover	0.160	0.036	0.284	0.012*	0.125	-0.002	0.251	0.053
	Marriage	0.788	0.485	1.093	0.000***	0.764	0.454	1.076	0.000***
	Child	0.048	-0.259	0.354	0.761	0.117	-0.193	0.426	0.459
	Sex	-0.440	-0.749	-0.133	0.005**	-0.403	-0.712	-0.095	0.010*
Family Togetherness	Small pocket park	0.061	-0.060	0.187	0.330	0.060	-0.066	0.188	0.353
	Large Park	0.114	-0.022	0.251	0.101	0.136	-0.004	0.275	0.056
	Greenspaces along streets	0.060	-0.066	0.196	0.360	0.221	0.082	0.384	0.003**
	Garden	0.114	-0.024	0.253	0.104	0.053	-0.088	0.212	0.472
	School	-0.037	-0.166	0.099	0.574	0.016	-0.131	0.165	0.831
	Greenspaces around temples and shrines	-0.020	-0.131	0.094	0.723	-0.035	-0.150	0.076	0.528
	Age	-0.094	-0.228	0.040	0.170	-0.121	-0.253	0.010	0.071
	Income	0.313	0.169	0.458	0.000***	0.214	0.071	0.357	0.003**
	Alcohol	-0.055	-0.182	0.073	0.400	0.007	-0.120	0.134	0.919
	Smoking	-0.033	-0.157	0.091	0.600	-0.109	-0.233	0.015	0.086
	Green cover	0.070	-0.054	0.195	0.271	0.053	-0.069	0.175	0.398
	Marriage	0.945	0.641	1.252	0.000***	0.798	0.489	1.108	0.000***
	Child	0.057	-0.251	0.364	0.717	0.117	-0.189	0.423	0.454
	Sex	-0.440	-0.744	-0.136	0.004**	-0.263	-0.569	0.042	0.091

Friendship	Small pocket park	0.168	0.052	0.284	0.004**	0.107	-0.016	0.230	0.088
	Large Park	-0.156	-0.284	-0.028	0.017*	-0.077	-0.197	0.043	0.203
	Greenspaces along streets	0.039	-0.104	0.173	0.580	0.056	-0.109	0.200	0.478
	Garden	0.092	-0.043	0.233	0.188	-0.033	-0.158	0.103	0.603
	School	0.052	-0.071	0.180	0.408	0.164	0.030	0.306	0.020*
	Greenspaces around temples and shrines	0.011	-0.104	0.134	0.850	0.049	-0.061	0.165	0.377
	Age	-0.162	-0.295	-0.029	0.017*	-0.080	-0.212	0.051	0.230
	Income	0.044	-0.098	0.187	0.542	0.054	-0.088	0.197	0.453
	Alcohol	0.112	-0.014	0.239	0.082	0.057	-0.070	0.183	0.380
	Smoking	0.023	-0.102	0.148	0.722	0.007	-0.116	0.131	0.908
	Green cover	-0.105	-0.225	0.016	0.088	-0.090	-0.211	0.030	0.143
	Marriage	0.430	0.132	0.729	0.005**	0.134	-0.172	0.440	0.391
	Child	-0.164	-0.469	0.141	0.293	0.023	-0.284	0.329	0.885
	Sex	-0.106	-0.406	0.194	0.490	-0.082	-0.382	0.218	0.592
Tolerance to Loneliness	Small pocket park	-0.058	-0.174	0.058	0.326	-0.077	-0.197	0.041	0.199
	Large Park	0.046	-0.078	0.169	0.465	-0.030	-0.155	0.093	0.631
	Greenspaces along streets	-0.085	-0.210	0.041	0.180	-0.052	-0.171	0.076	0.393
	Garden	-0.040	-0.189	0.103	0.583	0.068	-0.095	0.209	0.354
	School	0.053	-0.100	0.198	0.476	-0.038	-0.188	0.113	0.618
	Greenspaces around temples and shrines	-0.066	-0.185	0.044	0.240	-0.052	-0.166	0.054	0.340

	Age	0.045	-0.088	0.179	0.504	0.148	0.016	0.280	0.029*
	Income	0.174	0.032	0.316	0.016*	0.154	0.014	0.293	0.031*
	Alcohol	-0.148	-0.273	-0.022	0.021*	-0.196	-0.321	-0.072	0.002**
	Smoking	-0.055	-0.177	0.067	0.376	-0.034	-0.155	0.087	0.585
	Green cover	0.080	-0.045	0.205	0.212	0.012	-0.108	0.132	0.841
	Marriage	-0.041	-0.336	0.254	0.784	-0.179	-0.481	0.124	0.246
	Child	-0.181	-0.485	0.123	0.244	-0.025	-0.329	0.279	0.871
	Sex	-0.037	-0.335	0.261	0.808	0.498	0.202	0.795	0.000***
Good Relationships	Small pocket park	-0.097	-0.212	0.017	0.095	-0.043	-0.168	0.084	0.508
	Large Park	0.061	-0.069	0.190	0.358	0.011	-0.118	0.137	0.870
	Greenspaces along streets	-0.083	-0.213	0.047	0.202	-0.034	-0.154	0.102	0.590
	Garden	0.029	-0.119	0.173	0.700	0.092	-0.056	0.241	0.195
	School	0.105	-0.049	0.246	0.154	-0.108	-0.277	0.065	0.223
	Greenspaces around temples and shrines	-0.150	-0.291	-0.034	0.018*	-0.081	-0.199	0.027	0.145
	Age	0.229	0.097	0.363	0.001***	0.229	0.097	0.361	0.001***
	Income	0.195	0.052	0.338	0.008**	0.098	-0.044	0.239	0.176
	Alcohol	-0.097	-0.223	0.030	0.135	-0.099	-0.224	0.026	0.122
	Smoking	0.012	-0.111	0.134	0.852	-0.078	-0.198	0.043	0.207
	Green cover	0.009	-0.113	0.130	0.890	0.029	-0.094	0.152	0.645
	Marriage	0.015	-0.281	0.311	0.922	0.037	-0.262	0.336	0.808
	Child	-0.157	-0.462	0.148	0.314	-0.055	-0.358	0.248	0.722
	Sex	-0.144	-0.444	0.157	0.349	0.051	-0.247	0.350	0.737

(c) Physical health

Model	Variable	2019 (before the COVID-19 pandemic)				2020 (during the COVID-19 pandemic)			
		Estimate	Lower 95% CI	Upper 95% CI	*P* value	Estimate	Lower 95% CI	Upper 95% CI	*P* value
Health	Small pocket park	0.016	-0.096	0.128	0.779	0.005	-0.118	0.128	0.933
	Large Park	-0.053	-0.187	0.079	0.431	-0.139	-0.276	-0.004	0.044*
	Greenspaces along streets	-0.123	-0.254	0.004	0.058	-0.026	-0.177	0.100	0.707
	Garden	-0.000	-0.143	0.143	0.998	0.106	-0.056	0.248	0.149
	School	0.011	-0.123	0.152	0.876	-0.057	-0.219	0.110	0.504
	Greenspaces around temples and shrines	-0.007	-0.131	0.107	0.908	0.035	-0.077	0.145	0.523
	Age	0.113	-0.245	0.020	0.095	0.045	-0.087	0.177	0.502
	Income	0.110	-0.032	0.252	0.130	0.119	-0.021	0.259	0.097
	Alcohol	0.139	0.012	0.267	0.033*	-0.062	-0.188	0.064	0.338
	Smoking	-0.019	-0.140	0.101	0.754	-0.129	-0.253	-0.005	0.041*
	Green cover	-0.088	-0.209	0.033	0.155	-0.084	-0.206	0.037	0.175
	Marriage	0.119	-0.181	0.418	0.437	0.108	-0.198	0.414	0.489
	Child	-0.153	-0.461	0.154	0.328	-0.244	-0.553	0.064	0.121
	Sex	0.093	-0.209	0.395	0.548	0.476	0.176	0.777	0.002**
Pain	Small pocket park	-0.066	-0.182	0.049	0.263	0.006	-0.112	0.126	0.924
	Large Park	-0.043	-0.178	0.090	0.529	0.004	-0.132	0.137	0.958

Endurance	Greenspaces along streets	-0.016	-0.144	0.110	0.802	0.013	-0.114	0.131	0.824
	Garden	-0.037	-0.178	0.104	0.603	0.028	-0.135	0.171	0.704
	School	-0.056	-0.187	0.077	0.401	-0.102	-0.257	0.052	0.198
	Greenspaces around temples and shrines	-0.001	-0.116	0.112	0.984	0.014	-0.095	0.125	0.800
	Age	-0.048	-0.179	0.084	0.476	0.075	-0.056	0.205	0.261
	Income	0.127	-0.013	0.268	0.077	0.182	0.042	0.323	0.011*
	Alcohol	0.105	-0.022	0.232	0.105	-0.051	-0.177	0.075	0.427
	Smoking	-0.056	-0.179	0.066	0.370	0.063	-0.059	0.185	0.314
	Green cover	0.012	-0.112	0.136	0.852	0.032	-0.087	0.154	0.597
	Marriage	-0.021	-0.319	0.277	0.891	-0.021	0.323	0.281	0.891
	Child	0.015	-0.291	0.321	0.924	-0.058	-0.363	0.247	0.711
	Sex	-0.165	-0.462	0.132	0.277	-0.080	-0.376	0.217	0.597
Absence of Palpitation	Small pocket park	-0.104	-0.220	0.013	0.078	-0.058	-0.177	0.061	0.335
	Large Park	0.072	-0.062	0.207	0.294	0.077	-0.049	0.204	0.230
	Greenspaces along streets	0.033	-0.104	0.178	0.638	0.062	-0.078	0.201	0.364
	Garden	-0.007	-0.148	0.132	0.918	0.041	-0.101	0.194	0.562
	School	0.095	-0.400	0.233	0.160	-0.101	-0.266	0.058	0.227
	Greenspaces around temples and shrines	-0.075	-0.197	0.039	0.200	-0.019	-0.131	0.095	0.741
	Age	0.099	-0.033	0.232	0.142	0.109	-0.021	0.240	0.102
	Income	0.089	-0.054	0.232	0.221	0.090	-0.052	0.232	0.215

	Alcohol	0.072	-0.054	0.198	0.262	0.009	-0.116	0.134	0.888
	Smoking	0.022	-0.101	0.146	0.726	0.056	-0.068	0.181	0.375
	Green cover	0.001	-0.119	0.123	0.982	-0.006	-0.126	0.115	0.923
	Marriage	0.048	-0.250	0.346	0.753	0.245	-0.061	0.552	0.117
	Child	-0.151	-0.457	0.156	0.336	-0.153	-0.462	0.154	0.328
	Sex	-0.333	-0.638	-0.028	0.033*	-0.146	-0.445	0.153	0.338
Absence of Dizziness	Small pocket park	-0.056	-0.178	0.067	0.371	-0.055	-0.175	0.067	0.374
	Large Park	-0.000	-0.135	0.136	1.000	0.018	-0.113	0.149	0.788
	Greenspaces along streets	0.020	-0.118	0.166	0.783	0.101	-0.034	0.248	0.142
	Garden	0.047	-0.088	0.181	0.494	0.042	-0.098	0.209	0.574
	School	0.075	-0.064	0.215	0.276	-0.097	-0.264	0.061	0.244
	Greenspaces around temples and shrines	-0.073	-0.194	0.043	0.218	-0.030	-0.144	0.084	0.602
	Age	0.140	0.007	0.273	0.039*	0.150	0.020	0.281	0.024*
	Income	0.176	0.033	0.318	0.016*	0.205	0.063	0.347	0.005**
	Alcohol	0.101	-0.025	0.228	0.117	0.041	-0.085	0.167	0.522
	Smoking	-0.050	-0.172	0.072	0.423	0.001	-0.123	0.126	0.985
	Green cover	0.070	-0.056	0.196	0.277	0.087	-0.035	0.210	0.163
	Marriage	0.097	-0.202	0.397	0.525	0.121	-0.184	0.427	0.437
	Child	-0.157	-0.465	0.151	0.319	-0.183	-0.493	0.125	0.244
	Sex	-0.280	-0.586	0.024	0.071	-0.174	-0.472	0.123	0.252
Absence of	Small pocket park	-0.028	-0.142	0.087	0.628	-0.032	-0.150	0.087	0.593

Fatigue	Large Park	0.033	-0.099	0.165	0.626	0.092	-0.038	0.223	0.165
	Greenspaces along streets	-0.026	-0.152	0.099	0.680	-0.080	-0.201	0.038	0.178
	Garden	-0.046	-0.190	0.098	0.528	0.110	-0.035	0.257	0.115
	School	0.017	-0.117	0.159	0.800	-0.082	-0.232	0.067	0.284
	Greenspaces around temples and shrines	-0.064	-0.180	0.044	0.244	-0.070	-0.181	0.041	0.199
	Age	0.179	0.048	0.310	0.007**	0.274	0.145	0.404	0.000***
	Income	0.240	0.098	0.381	0.001***	0.285	0.145	0.425	0.000***
	Alcohol	0.117	-0.008	0.241	0.066	-0.046	-0.171	0.079	0.472
	Smoking	0.000	-0.121	0.122	0.997	0.031	-0.091	0.153	0.618
	Green cover	-0.046	-0.166	0.075	0.457	-0.080	-0.200	0.040	0.190
	Marriage	0.196	-0.100	0.493	0.195	0.052	-0.249	0.354	0.734
	Child	-0.305	-0.609	-0.001	0.049	-0.153	-0.457	0.150	0.322
	Sex	-0.238	-0.537	0.060	0.118	-0.120	-0.416	0.176	0.428
Good Sleep	Small pocket park	-0.024	-0.140	0.095	0.689	0.021	-0.097	0.141	0.729
	Large Park	-0.016	-0.153	0.120	0.813	-0.067	-0.202	0.069	0.335
	Greenspaces along streets	0.088	-0.044	0.230	0.203	-0.010	-0.125	0.109	0.863
	Garden	-0.003	-0.145	0.137	0.967	0.089	-0.050	0.242	0.205
	School	0.064	-0.077	0.199	0.354	-0.081	-0.233	0.070	0.294
	Greenspaces around temples and shrines	-0.079	-0.190	0.034	0.153	-0.072	-0.180	0.040	0.187
	Age	0.029	-0.102	0.160	0.661	0.049	-0.081	0.179	0.458

Income	0.117	-0.023	0.258	0.102	0.162	0.022	0.304	0.023*
Alcohol	0.070	-0.053	0.195	0.264	0.006	-0.119	0.131	0.925
Smoking	0.007	-0.114	0.128	0.911	-0.015	-0.136	0.106	0.806
Green cover	-0.028	-0.149	0.095	0.656	-0.019	-0.140	0.101	0.747
Marriage	0.098	-0.201	0.396	0.521	0.172	-0.130	0.474	0.265
Child	-0.022	-0.326	0.281	0.885	-0.104	-0.406	0.198	0.501
Sex	-0.044	-0.344	0.255	0.771	-0.003	-0.302	0.297	0.987