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Keep Calm and Go Out: Urban Nature Exposure, Mental Health, and Perceived Value during the COVID-19 Lockdown

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Abstract: The COVID-19 pandemic has highlighted the importance of incorporating nature-based solutions in urban design, in order to create sustainable and resilient cities. Inspired by these events, the present study aims at exploring the mental health benefits of nature exposure during the outbreak. Secondly, we investigate changes in use patterns towards urban green spaces (UGS) and urban blue spaces (UBS) and whether extreme conditions, such as these of a lockdown, can lead to an increase in people's appreciation of urban nature. Through an online survey, we observed that the pandemic resulted in a decrease in the frequency of visitation to UGS/UBS ($p < 0.001$). Significant differences were found for exercise ($p < 0.001$) and socialization ($p < 0.05$) as main drivers for visiting urban nature pre- and post-lockdown. Accordingly, visitation rates for forests ($p < 0.05$), playgrounds ($p < 0.001$), and the sea ($p < 0.001$) differed significantly when comparing the two periods. In people's perception, UGS/UBS are important for the urban fabric (89%). Our structural equation model indicated that nature exposure had a beneficial effect on participants' mental health ($p < 0.001$). Pathways that explain the relationship between nature exposure and post-lockdown value were nature relatedness, motivation, and perceived importance of UGS/UBS. No mediation could be extracted for nature exposure and mental health. Our findings show the positive association between nature exposure and mental health improvement, especially in times of crisis, as well as a shift in the "value domain" towards urban nature.

Keywords: urban green spaces; urban blue spaces; COVID-19; perceived value; structural equation modeling



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1. Introduction

In December 2019, multiple incidents of respiratory diseases were reported in Wuhan, China, which were soon attributed to SARS-CoV-2 [1]. The rapid spread of the virus around the globe resulted in a public health emergency of international concern and the declaration of the coronavirus pandemic [2]. In order to reduce contagion and mortality rates almost every country adopted measures of social distancing. With the number of infections growing, the Greek government announced two national lockdowns—the first ranging from March 2020 to May 2020 and the second one from November 2020 to May 2021. The main measures adopted apart from the use of masks, concerned restriction of movement, prohibition of gatherings, and the cessation of operation of various public and private institutions. Even though these measures proved to be an important asset against the spread of the pandemic, social distancing also had a severe mental health impact: increased levels of anxiety, depression, and sleep disorders were recorded while negative feelings such as uncertainty and fear were repeatedly reported to local mental health services [3–5].

Worldwide, this health crisis, which turned into a psychological crisis [6,7], resulted in raising awareness of the role of urban nature in mitigating the impacts of COVID-19

on our wellbeing [8]. Natural environments within the urban fabric, mainly urban green spaces (UGS) and urban blue spaces (UBS) are well known for their beneficial effects on both general and mental health. Particularly, UGS results to lower blood pressure, levels of cholesterol, risks for cancer, respiratory diseases, obesity, mortality rates, and positive birth outcomes [9–15]. In terms of psychological wellbeing, UGS have restorative properties, improve cognitive function, self-esteem, reduce levels of anxiety and stress, mitigate psychological disorders, and generate positive feelings [16–30]. Additionally, they are found to enhance social wellbeing [31–33] and spiritual inspiration [34,35]. Fewer studies have shown the association of UBS with health promotion [36–38]. These places have therapeutic attributes as they contribute to lower levels of anxiety and depression, foster relaxation, restoration, feelings of vitality and satisfaction, and generally amplify wellbeing [39–48].

The relationship between UGS/UBS and health or wellbeing is explained through several mechanisms. Among them, physical activity, social cohesion, air pollution, noise, perceived stress, and restorative capacities are the most popular. Accessible and well-maintained public open spaces offer opportunities for engaging in either intense or moderate physical activity which in turn fosters general health and quality of life [49–55]. Accordingly, UGS and UBS encourage social interactions which amplify the sense of community belonging and safety [56–60]. Furthermore, they are well known for providing ecosystem services: through air temperature regulation, air quality improvement, and noise reduction they lead to both health benefits and a reduction in the sense of annoyance from our surroundings [61–64]. Another important pathway based on Ulrichs' and Kaplan's theories, is stress reduction and restoration. According to Stress Reduction Theory natural environments and their elements can help us generate positive emotions, thus limiting our exposure to stress [65–68]. On the other hand, Attention Restoration Theory supports that contact with nature contributes to recovery from spiritual and psychological fatigue or ameliorates our focus and attention, hence providing evidence that UGBS have restorative capacities that improve our mental health [69–71].

Taking the above into consideration, the present study focuses on the exploration of the mental health benefits of nature exposure during the COVID-19 pandemic. According to [72] nature exposure is determined by three key elements: intensity, frequency, and duration of exposure. [73] introduces the concept of the dose of nature while pointing out the important role of UGS provision as a prerequisite for UGS exposure. Following their paradigm, [74] applied these conceptual frames in the case of UBS along with the different types (incidental, indirect, and intentional) of interaction with urban nature that [75] distinguished. Building upon these models we enrich the current literature by examining the role of UGS and UBS as buffers during times of crisis, such as that of a pandemic. Secondly, we put emphasis on the perceived value of urban nature and highlight it as a vital domain that should be incorporated into urban planning. Particularly, in this study we seek to address whether:

- the COVID-19 pandemic has influenced urban residents' use patterns of urban green and blue spaces (UGBS)
- nature exposure helped people cope with feelings of anxiety and depression during the lockdown
- Greek citizens attach additional value to UGBS after the social restrictions they experienced and
- we can identify factors that affect the relationship between nature exposure-mental health and nature exposure-perceived value of UGS/UBS in times of crisis.

2. Materials and Methods

2.1. Study Sample

An online survey was conducted between February and April 2021 in Greece. During that time the country was under strict lockdown, so citizens were not allowed to move freely in and between municipal districts. Our total sample (N = 927) consisted of urban

citizens with permanent residency in Greece during the second nationwide lockdown. Recruitment of participants was achieved through social media (Facebook, Instagram, and LinkedIn) and the authors' personal contacts. The link to the questionnaire was also forwarded by the communication office of the University of the Aegean to other Institutes and parties. The study was carried out in accordance with the Helsinki Declaration and ethical approval was obtained by the Bioethics Committee of the University of the Aegean (3382/17 February 2021).

2.2. Online Survey

The questionnaire was divided into seven parts. The first one consisted of a brief introduction to the aims of the study. Definitions of UGS and UBS were given so a common understanding of these terms could be reached. Specifically, UGS was considered as all forms of greenery within an urban environment (e.g., parks, private or public gardens, forests, etc.) [76] and UBS as all forms of natural and artificial aquatic surfaces (e.g., sea, river, lake, fountains) [77]. Respondents were also informed about the anonymity of the survey and their right to quit at any point. Part two examined our sample's nature orientation. Derived from Wilson's 1984 [78] biophilia theory, which discusses humans' subconscious need to maintain contact with the natural environment and all forms of life due to the evolutionary process, nature relatedness describes the affective, cognitive, and experiential aspects of human–nature relationships [79]. This link is further examined in later studies which establish a causal connection between nature engagement, the feeling of belonging to the natural world, and mental health benefits [80–85]. For this reason, a short form of the Nature Relatedness Scale (NR-6) was incorporated into our survey. Each item takes values from 1 = “disagree strongly” to 5 = “agree strongly”. A total score is calculated by averaging all six items, with higher scores indicating higher levels of nature-relatedness.

Section 3 focused on the accessibility to UGS/UBS. Accessibility refers to the distance to the nearest UGS or UBS, usually measured as the Euclidian distance, spatial distance, network buffers, the time needed to reach an UGS or UBS [86–92], and subjective questions [93]. Lately, other aspects are examined as well such as physical or psychological obstacles (e.g., safety, fences, roads) and qualitative elements—mostly amenities [94–96]. In this study, we assess UGBS accessibility by incorporating the term of proximity and ease of access. Participants were asked to indicate the degree of proximity of neighborhood UGS or UBS to their residence and to evaluate the ease of access to these places. Section 4 contained information about the usage patterns of UGS and UBS. Respondents were asked to give information about the frequency and motives for visiting such places pre- and post-lockdown. Similarly, they stated the types of UGS and UBS they preferred visiting. A comparative question regarding the duration of their visits was included as well (“do you spend more time in UGS/UBS than before the pandemic outbreak”) measured on a 5-point Likert scale (1 = “much less time than before the pandemic outbreak”, 5 = “much more time than before the pandemic outbreak”).

Our samples' mental health was evaluated using the Patients Health Questionnaire—4 (PHQ-4) and the subjective question “do you believe that the quarantine negatively affected your mood and wellbeing”. PHQ-4 is a widely recognized tool assessing levels of depression and anxiety. It consists of 4 items, each scored according to the same 4-scale range (0 = “not at all”, 3 = “nearly every day”). The two first items are derived from the Generalized Anxiety Disorder-2 (GAD-2) examining signs of anxiety and the other two items from Patients Health Questionnaire-2 (PHQ-2) which studies the frequency of depressive mood. PHQ-4's total score is calculated by summing up each item. Part six examined the importance of UGBS for the urban fabric by employing a subjective question with a 5-point Likert scale (1 = “not important at all”, 5 = “extremely important”). Participants also had to state their intention of continuing visiting urban nature even after the end of the quarantine (1 = “definitely no”, 5 = “definitely yes”) and whether they attribute additional value to these places after experiencing the restrictions imposed during the lockdown (1 = “none”, 5 = “high”). Part seven of the survey focused on respondents' personal charac-

teristics. Information was given regarding their gender, age, educational background, and monthly income.

2.3. Data Analysis

The data process included descriptive statistics (mean \pm standard error—SE), frequencies (percentage %), and chi-square tests for comparing the pre-and post-lockdown visitation attitudes to UGBS. The relationship between nature exposure, mental health, and post-lockdown value, as well as the pathways that may explain these correlations, were investigated by performing structural equation modeling (SEM). Cronbach's value and exploratory factor analysis (EFA) were performed in order to verify whether our variables met the reliability and validity criteria. In more detail, our initial model contained an exogenous variable (nature exposure), two endogenous variables (mental health and post-lockdown value), and five mediators (motivation, types of UGS, types of UBS, perceived importance, and NR-6). After testing Cronbach's value and performing an EFA, two of the aforementioned mediators were excluded (types of UGS and UBS). Furthermore, in order to increase the reliability of "motivation", the items of "walking with the per" and "going out with the family" were deleted from the construct. Similarly, "ease of access" was excluded from the construct "nature exposure". Thus, our final model with all variables meeting the reliability (Cronbach's $\alpha > 0.6$ apart from variable "post-lockdown value of UGS/UBS" which comes with a Cronbach' $\alpha = 0.234$ but we find it acceptable since it is a two items construct [97]) and validity requirements are presented in Table 1. Our data do not seem to suffer from common method bias, as the total percentage of variance explained by each factor exceeds or approximates 50% in all cases.

Table 1. Reliability and Validity Measures for Conceptual Model.

Type of Variable	Variable Name	Items	Cronbach's α	% of Explained Variance
Exogenous Variable	Nature Exposure	Proximity (NE1) Frequency (NE2) Duration (NE3)	0.534	52.7
Mediators	Motivation	Exercise (M1) Walking (M2) Socialising (M3) Relaxation (M4) Contact with Nature (M5)	0.620	40.2
	NR-6 (continuous variable)	-	-	-
	Importance (continuous variable)	-	-	-
Endogenous Variable	Mental Health	PHQ-4 Item 1 (MH1) PHQ-4 Item 2 (MH2) PHQ-4 Item 3 (MH3) PHQ-4 Item 4 (MH4) Self-Reported Question (MH5)	0.880	68.1
	Post-Lockdown Value of UGS/UBS	Added Value (V1) Will Keep Visiting UGS/UBS after Lockdown Ends (V2)	0.234	56.9

The significance of our mediation analysis was determined by the use of the bootstrap test [98]. The good fit of the model was assessed by utilizing the goodness of fit index (GFI), the adjusted goodness of fit index (AGFI), the parsimonious goodness of fit index (PGFI), and the root-mean-square error of approximation (RMSEA). The closest the first

three indices are to value 1, the better the performance of our model [99,100]. On the other hand, RMSEA should take a value <0.06 [101]. A p -value < 0.05 was determined as statistically important. Statistical analysis was performed using IBM SPSS Statistics and Amos™ software (Version 22).

3. Results

3.1. Sociodemographic Characteristics

Table 2 shows the sociodemographic characteristics of our sample. The participation rate of females (69%) was much higher than that of males (29.6%). Their age was principally distributed between 18 and 28 years of age (49.5%). Most of the respondents had completed higher education (university degree—50.9%), while 25.5% indicated the category of “less than 550 €” as their monthly income.

Table 2. Participants Characteristics, N = 927, by Frequencies.

Variable Name	Items	Frequency (N)	Percentage (%)
Gender	Male	274	29.6
	Female	640	69.0
	Non Binary	6	0.6
	DK/NA	7	0.8
Age	18–28	459	49.5
	29–39	195	21.0
	40–50	160	17.3
	51–61	78	8.4
	>62	31	3.3
	DK/NA	4	0.4
Educational Background	Primary	2	0.2
	Secondary	73	7.9
	University	472	50.9
	Master	290	31.3
	PhD	90	9.7
Monthly Income	<550 €	236	25.5
	550 €–1000 €	195	21.0
	1000 €–1500 €	169	18.2
	1500 €–2000 €	51	5.5
	>2000 €	46	5.0
	DK/NA	230	24.8

3.2. Use Patterns of UGS and UBS

The majority of participants declared to have an UGS/UBS in less than 300 m. from their residence (47.1%) and easy access (33.4%) to an UGS or UBS (Table 3). Regarding the duration of visits, no major changes were observed, as 30.4% of respondents stated that they spend “about the same time” and 30.9% “more time” to UGBS in reference to the pre-lockdown period (Figure 1a). Chi-square tests showed substantial differences in terms of frequency ($p < 0.001$), motivation, and typology. Specifically, prior to the COVID-19 outbreak, 44.6% of participants visited UGBS for “three days per week” but during the quarantine, the same percentage decreased to 31.6%. In accordance, the respondents who limited their visits to “one day per week” increased from 11.9% to 22.7%. A slight increase is also seen for the category of “five days per week” (24.9% pre-lockdown and 26.9% during-lockdown) while the percentage of “seven days per week” remained at 18% (Figure 1b).

Table 3. Proximity and Ease of Access to UGS/UBS. N = 927. by Frequencies.

Variable Name	Items	Frequency (N)	Percentage (%)
Proximity	>1200 m	18	1.9
	900–1200 m	56	6.0
	600–900 m	107	11.5
	300–600 m	307	33.1
	<300 m	437	47.1
	DK/NA	2	0.2
Ease of Access	Very Difficult	45	4.9
	Difficult	110	11.9
	Neutral	158	17.0
	Easy	310	33.4
	Very Easy	298	32.1
	DK/NA	6	0.6

Walking was the main reason for visiting UGBS (70.8% pre-covid, 69.9% during lockdown). Other motives refer to exercise (31% pre-covid, 41.4% during lockdown), relaxation (57.9% pre-covid, 55.1% during lockdown), walking with the pet (16.8% pre-covid, 18.1% during lockdown), going out with family (30.2% pre-covid, 28.6% during lockdown), socializing (28.9% pre-covid, 24.8% during lockdown) and contact with nature (34.3% pre-covid, 38.3% during lockdown). From these, exercise and social interactions were the only motivations that showed significant swifts when comparing the pre- and post-covid periods (Figure 1c).

Parks and the sea were the most visited UGS and UBS both pre- and during the lockdown, however, we also found a decrease in visitation of each one of these types. Sea dropped about 23% ($p < 0.001$), playgrounds 6% ($p < 0.001$), forests 4% ($p < 0.05$), groves, parks, and rivers 2%, lakes 1%, while no changes were found for private gardens (Figure 1d,e).

3.3. NR-6 and Mental Health

With regards to NR-6, our sample scored a mean of 3.81 ± 0.02 indicating a relatively high connectedness to nature. The results for PHQ-4 show moderate signs of poor mental health (4.54 ± 0.11). If examined separately, GAD-2 and PHQ-2 do not suggest symptoms of anxiety or depression (2.29 ± 0.06 and 2.24 ± 0.06). On the other hand, when participants were asked to self-evaluate the impacts of the quarantine on their mood and wellbeing, almost 75% of the responses falls between “moderately”, “much”, and “very much” (Table 4).

3.4. Importance of UGS/UBS

Eighty-nine percent of respondents consider UGS and UBS as “extremely important” for the urban fabric. Furthermore, 80% of them attach either “moderate” or “more” value to these places due to the events of the pandemic. Similarly, the majority of our sample (76.6%) stated that they will keep visiting places of urban nature even after the lockdown ends (Table 5).

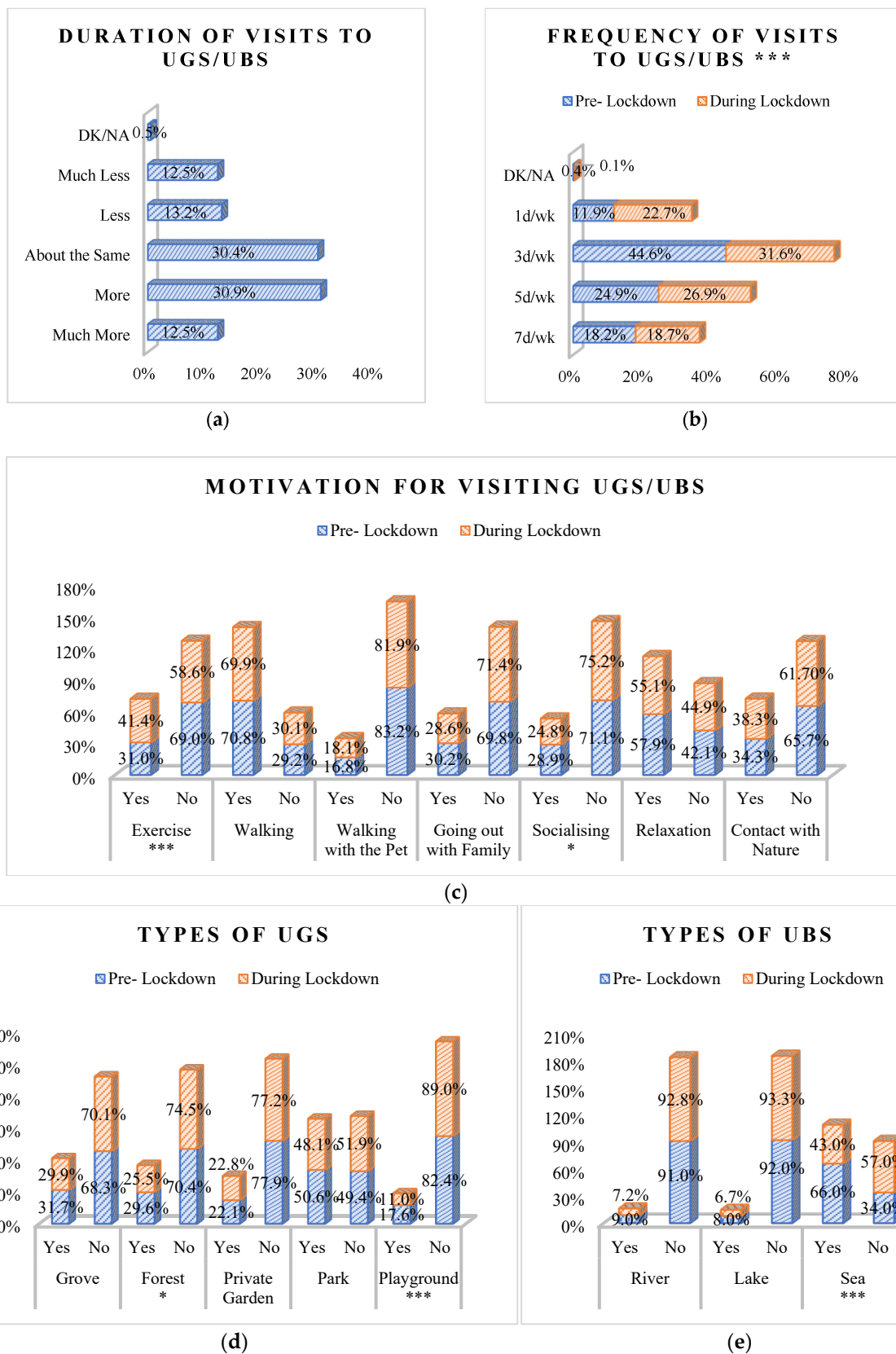


Figure 1. Use Patterns of UGS/UBS pre- and during the lockdown. (a) Duration of visits to UGS/UBS; (b) Frequency of visits to UGS/UBS; (c) Motivation for visiting UGS/UBS, (d) Types of UGS; (e) Types of UBS, d/week: days per week, N = 927, * $p < 0.05$, *** $p < 0.001$ by Frequencies and Chi-square tests.

Table 4. Mental Health and Nature Relatedness. N = 927. By Descriptive Statistics and Frequencies.

Variable Name	Items	Mean		Frequency	Percentage
		Statistic	Std. Error	N	%
PHQ-4 Total Score		4.54	0.11		
	GAD-2	2.29	0.06		
	PHQ-2	2.24	0.06		
NR-6 Total Score		3.81	0.02		
Self-Reported Question	Not at All			43	4.6
	A Little			191	19.5
	Moderately			233	25.1
	Much			237	25.6
	Very Much			232	25
	DK/NA			1	0.1

Table 5. Importance of UGS/UBS and Attached Value. N = 927. by Frequencies.

Variable Name	Items	Frequency (N)	Percentage (%)
Importance of UGS/UBS	Not At All	1	0.1
	A Little	1	0.1
	Moderately	11	1.2
	Much	89	9.6
	Extremely	825	89.0
Attached Value	None	9	1.0
	Low	6	0.6
	Neutral	156	16.8
	Moderate	375	40.5
	High	364	39.3
	DK/NA	17	1.8
Will Keep Visiting UGS/UBS	Definitely No	3	0.3
	Probably No	9	1.0
	Neutral	43	4.6
	Probably Yes	158	17.0
	Definitely Yes	710	76.6
	DK/NA	4	0.4

3.5. Nature Exposure, Mental Health, and Post-Lockdown Value

The statistics run for determining the performance of our model indicate an overall good fit: GFI = 0.923, AGFI = 0.899, PGFI = 0.703, and RMSEA = 0.062. A significant, negative direct effect was found from nature exposure to mental health ($-0.169, p < 0.001$). Positive, direct, and significant associations were observed between nature exposure, motivation, NR-6, and perceived importance ($0.407, p < 0.001, 0.128, p < 0.001, 0.122, p < 0.01$), and post-lockdown value of UGS/UBS and our mediators (motivation: $0.421, p < 0.001$, NR-6: $0.497, p < 0.001$, perceived importance: $0.553, p < 0.001$). Regarding the relationship between nature exposure and mental health, no mediation was found. On the contrary, motivation, importance, and NR-6 fully mediate the relationship between UGS exposure and the post-lockdown value of urban nature. The total indirect effect of the exogenous variable on the post-lockdown value was set at $0.303 (p < 0.05)$. Significant direct effects were also found from socio-demographic characteristics to mental health. Particularly, education and age were negatively correlated with mental health ($-0.070, p < 0.05, -0.280, p < 0.001$), while gender was positively associated with the same variable ($0.192, p < 0.001$). As a result, the lockdown had a severe impact on the wellbeing of those with a lower educational level, of a younger age, and females. The total effects of nature

exposure on mental health were determined at -0.146 ($p < 0.05$) while the same statistic for nature exposure on post-lockdown value was set at 0.405 ($p < 0.05$) (Figure 2).

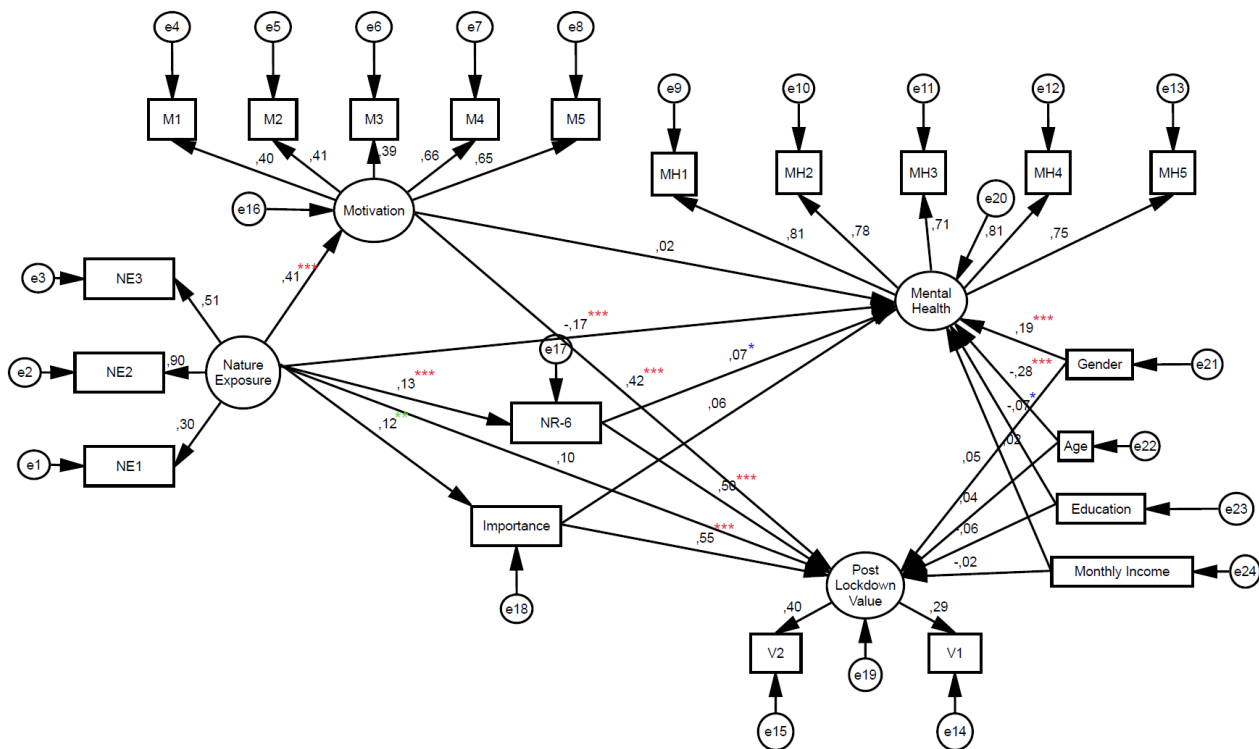


Figure 2. Path diagram of structural equation model along with standardized estimates and levels of significance, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. A significant level of * $p < 0.05$ is indicated by the blue color, ** $p < 0.01$ by the green color, and *** $p < 0.001$ by the red color.

4. Discussion

This study investigated the effects of UGBS exposure on people's mental health during the pandemic and their perceptions regarding the value of these places. We firstly evaluated the use patterns of Greek citizens towards urban nature both pre- and during the pandemic and found that even though most respondents indicated that their residents were situated less than 300 m from an UGS or UBS and generally easy access to them, the frequency of their visits was decreased. The decline in frequency can be characterized as severe as 22.7% of participants visited neighborhood urban nature once per week, vs. a percent of 11.9% in the pre-pandemic period. This drop in demand for natural places is in line with some research [102–109] but not with others [110–118]. It is also considered an expected outcome given that the online survey was conducted during a period of strict quarantine in Greece and people avoided places where social crowding was observed in the past. Accordingly, each type of UGS and UBS showed a decrease in terms of use and visitation, a fact also verified by Google Mobility Report which shows that mobility trends for places such as parks, plazas, and public gardens dropped about 13% compared to February of 2019 [119]. In the same context, the time spent in open natural spaces was the same as the pre-covid levels or slightly increased.

Taking the above into consideration is suggested that local decision-makers in urban planning promote the role of UGS and UBS as nature-based solutions that improve residents' mental health. It is evident that emphasis should be given to the diversity of UGS/UBS depending on spatial availability. Dense urbanicity is a common obstacle for urban planners which could be overcome through the utilization of alternative solutions such as pocket parks or small scaled neighborhood gardens [120]. However, the trends for lower visitation of these places during the quarantine should not be overlooked. Urban green and blue

infrastructure should be designed in order to prevent the spread of contagious diseases. Based on the COVID-19 experience “traffic separation” measures such as lane markings or separate corridors for walking, cycling, or running are proposed as solutions for the avoidance of crowding [121]. Nonetheless, the focus should be placed on other reasons that explain them besides the fear of the virus contagion. The qualitative attributes and the types of UGS and UBS are elements that might need improvement in order to attract more citizens. For example, since exercise and socializing were highlighted as important motivations for visiting outdoor natural places (an additional 10% and 4% respectively) [102,106,114,122], UGBS should be designed in a manner that covers these needs and facilitates recreational activities. Suggestions towards that direction include the incorporation of sporting facilities or outdoor gym equipment, facilities that would enable the hosting of arts or cultural events, and food/beverage services. Furthermore, empirical research is needed to identify the existence of obstacles, inequalities, and exclusions in the access and use of urban nature here in Greece [123].

Our structural equation analysis indicated that UGBS exposure was negatively associated with mental health at a significant level, suggesting that urban nature consists an important health resource for urban residents, especially in a time of crisis such as that of a pandemic. These findings are confirmed by the previous literature that examines the beneficial effects of natural outdoor spaces on mental health during the COVID-19 [33,68,103,106,124–134] and the key role that proximity [135–144] and use patterns such as frequency and duration of visits play for achieving better wellbeing [145–148]. We also found positive and significant correlations between nature exposure, motivation, the importance of urban nature, and NR-6 which are verified by the previous literature [149–156]. The association between nature-relatedness and higher levels of mental fatigue was not unexpected as similar outcomes have been observed by [157], while [158–160] have noted that nature-connectedness is not effective in preventing mental illness through the diminishment of negative emotions, rather it improves our wellbeing through the generation of positive feelings. Furthermore, it is not surprising that people with higher nature-relatedness, who lack contact with the natural environment as a result of the cessation of free mobility during the quarantine, cope with feelings of anxiety and sadness.

Motivation, nature-relatedness, and perceived importance of UGBS could not be identified as mediators of the association between nature exposure and mental health. The past literature has highlighted the mediating role of activities performed in open environments and nature connectedness, however, the majority of these studies used either single mediation models or examined the items of motivation separately [161–176]. The perceived importance of urban nature was rarely treated as a possible pathway.

Demographic characteristics and socioeconomic status are significant predictors of the manifestation of psychological disorders. Possible reasons behind this are that our sample was dominated by females, respondents of the “18–28” age group, and the higher educational level (holding a University degree). Nevertheless, we recognize that younger populations (mainly students), faced greater difficulties in terms of mental distress during the pandemic because they are generally in a higher demand for socialization [128]. Similarly, the World Health Organization [177] has suggested since 2001 that odd ratios for the likelihood of depressive symptoms or stress-related diseases are higher in females than males.

The coronavirus has influenced peoples’ perceptions concerning the value of urban nature. The former is mainly financially measured, and most studies attribute the importance of UGS and UBS based on economic assessment tools [178,179], the willingness of citizens to pay for their qualitative maintenance [180–182] or the monetary value that surrounding houses acquire when built close to them [183,184]. Other studies focus on the value of ecosystem services or cultural ecosystem services of UGS and UBS [185–195]. In our study, we used self-reported measurements and found that respondents attach more value to urban nature in comparison to the pre-covid period, same as [114,196–199]. Moreover, UGBS exposure during the quarantine has led to a higher appreciation of urban nature

with nature relatedness, motivation, and subjective importance of UGS/UBS mediating this relationship. Positive links of all our mediators and dependent/independent variables were identified as well, indicating that nature experiences influence peoples values towards UGS/UBS [188,200] and that the higher the importance of nature for people's perception, the more they recognize their benefits [201,202]. This shift to the value domain, observed by [192,203–205] as well, may be reflective of the quarantine limiting our options for other destinations, therefore resulting in a spark of interest in outdoor recreation. Thus, we firmly suggest that future research further examines the appreciation of urban nature in the post-coronavirus era and that perceptions and values attached to urban nature are incorporated into urban planning and management.

5. Strengths and Limitations

This is one of the first studies in Greece to address the mental health benefits of UGS and UBS during the COVID-19 pandemic, as well as possible shifts regarding their use. The survey was conducted while participants were under strict lockdown and "stay-at-home" orders which increases the authenticity of our results. The inclusion of the perceived value of UGS as an outcome variable and mediators generally understudied in the current literature are additional strengths of our study. Furthermore, by performing SEM we were able to assess complex associations of our variables and investigate our hypothesis using a single conceptual model. We also focused on the intentional use of urban nature, while many studies consider the indirect or incidental. Lastly, our findings highlight the interconnection of green-blue infrastructure to the Sustainable Development Goals 2030. Due to their environmental and social/psychological benefits, UGS and UBS are directly linked with SDG 11.7 which emphasizes the adequate provision of urban nature for the wellbeing or social development of urban residents, and SDG 3 whose targets focus on healthy lives and the promotion of wellbeing for all, at all ages [206]. Most importantly, the events of the COVID-19 pandemic have strengthened the connection of outdoor open spaces with SDG 3.4 (fight communicable diseases), as green-blue areas are expected to be redesigned in order to face the challenges of airborne spread diseases.

We recognize that our survey comes with some limitations as well. Firstly, this is a cross-sectional study hence our observations may not be applicable in the long-term. Therefore, follow-up research is to be conducted and investigate if these results last in the post-pandemic period. Moreover, we only measured the intensity of nature exposure based on respondents' subjective experiences—frequency, duration, and perceived distance—without using objective measurements. These self-reported measurements might offer biased estimates, however, as this study addressed participants from all over Greece it was not feasible to use geospatial data in order to verify the existing neighborhood UGS and UBS. On the other hand, perceived distance is an important measure as it reflects the level of individuals awareness of neighborhood UGS and UBS [40]. Additionally, we did not distinguish between UGS and UBS, therefore we could not assess the separate effects of these types of urban nature on mental health and the value respondents attach to them. Moreover, our sample was dominated by females, respondents with high educational levels, and the age group of "18–28". This can be attributed to the fact that females have higher environmental conscience, tend to prefer natural environments and are more likely to participate in relevant surveys [207,208], the fact that the University of the Aegean helped with the recruiting process and that older people are not familiar with the internet, thus they could not fill our online questionnaire. Similarly, people over 62 years of age are under-represented in our sample. However, the demographic items utilized in the statistical analysis as explanatory control variables in structural equation modeling, ensure a robust result, since from a statistical point of view, the demographic items utilized in the statistical analysis as explanatory variables include an adequate number of responses in all of their levels, ensuring a robust model fit and parameter(s) estimation. Defending the quality of the data from online surveys [209] argue that if a participating population is large enough, the problem of representativeness may be overstated. Finally, we

suggest that the associations of NR-6-mental health and age-mental health are interpreted with caution due to their low correlations which might negate the significance of these results.

6. Conclusions

This study has provided empirical data that UGS and UBS are key resources for urban sustainability and act as buffers for stressful experiences during the COVID-19 pandemic. We can also conclude that the personal importance that people attribute to natural spaces changes in times of social crisis [114]. These findings reinforce the current literature which supports that the pandemic provoked a shift in our relationship with public open spaces with similar demographics or other shared characteristics. As an increased need for alternative means for combating mental illness has emerged, future research should incorporate UGS at the center of the rethinking process of urban planning [210].

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