Restoration in mental health after visiting urban green spaces, who is most affected? Comparison between good/poor mental health in four European cities

Alessia Grigoletto [a], Stefania Toselli [b,*], Wilma Zijlema [c,d,e], Sandra Marquez [c,d,e], Margarita Triguero-Mas [f], Christopher Gidlow [g], Regina Grazuleviciene [h], Magdalena Van de Berg [i], Hanneke Kruize [j], Jolanda Maas [i], Mark J. Nieuwenhuijsen [c]

[a] Department of Biomedical and Neuromotor Sciences, University of Bologna, 40126, Bologna, Italy
[b] Department for Life Quality Studies, University of Bologna, 47921, Rimini, Italy
[c] Centre for Research in Environmental Epidemiology (CREAL), ISGlobal, Carrer del Dr.Aiguader, 88, 08003, Barcelona, Spain
[d] Department of Medicine and Life Sciences, Universitat Pompeu Fabra (UPF), 08002, Barcelona, Spain
[e] CIBER Epidemiologia y Salud Publica (CIBERESP), 08003, Barcelona, Spain
[f] Mariana Arcaya's Research Lab, Department of Urban Studies and Planning, Massachusetts Institute of Technology, Cambridge, MA, 02139, USA
[g] Centre for Health and Development, Staffordshire University, Leek Road, Stoke-on-Trent, ST4 2DF, UK
[h] Department of Environmental Science, Vytauto Didžiojo Universitetas, 44248, Kaunas, Lithuania
[i] Department of Public and Occupational Health, Institute for Health and Care Research, VU University Medical Centre (VUMC), 1007, Amsterdam, the Netherlands
[j] National Institute for Public Health and the Environment, 3720 BA, Bilthoven, the Netherlands

ARTICLE INFO

ABSTRACT

Several mechanisms have been proposed to explain the association between green space and health, and one of these is the restoration theory, based on the idea that it is possible to increase mental health and decrease stress visiting a natural environment. The aims of the present study were to understand what activities are most related to restoration and if these are the same for people with poorer and better mental health. A questionnaire was administered in four European cities and data about restoration outcomes, type of activity carried out in green spaces and mental health were collected and analyzed. A cross sectional design was used and total of 3134 respondents participated to the questionnaire. The restoration experience was measured with the restoration outcome score, and the mental health was evaluated with a subscale related to mental health of the Medical Outcome Short Form. Participants were divided in two groups according to mental health score. A multiple regression analysis was performed to investigate the association between mental health, type of activity and restoration. The cities showed a similar trend in the association between restoration and type of activity performed in green environment. People with poorer mental health seem to be more sensitive to the positive effect of visiting the green environment and restoration was more evident in these people than in those with better mental health. At the same time, the type of activity was less evident in people with better mental health, and they seemed to be less influenced by the visiting of green space. Green prescription is important for the entire population: people with poorer mental health could have important restorative effects and people with better mental health could continue to protect their well-being using green space.

1. Introduction

There is increasing interest in the use of green spaces and in its connection with human health. This is particularly important considering the growing urbanization; in fact, it is expected that by 2030 three out of five people worldwide will live in an urban area (*World Urbanization Prospects - Population Division - United Nations*, 2018). Cities are usually relatively nature-poor due to the great range of competing land-use (Lin et al., 2014) or, are areas in which urban natural spaces face considerable development pressure (Jim, 2004). The natural

outdoor environments might help to reduce the negative impacts of some factors (such as air, and noise pollution) which characterize urban settings (Basagaña et al., 2011; Hoek et al., 2013; Selander et al., 2009; Shanahan et al., 2015; Wolf and Robbins, 2015). In addition, the exposure to, and the interaction with nature have a role in long-lasting psychological benefits (Kaplan & Kaplan, 1989; Sacker and Cable, 2006; Ulrich et al., 1991). Several mechanisms are used to explain the beneficial effects of natural environment on health, probably there are multiple and potentially synergistic (Hartig et al., 2003). They are: (a) Attention Restoration theory, as a stress reduction, (b) opportunity to perform physical activity by promoting leisure walking, walking through the space when running errands, active place and sports (Dzhambov and Dimitrova, 2014; Sallis et al., 2016; Shanahan et al., 2015; Wolf and Robbins, 2015), (c) enhancement of social interaction and improved social cohesion in the community (de la Barrera et al., 2016; Koohsari et al., 2015; Lachowycz and Jones, 2013), (d) mitigation of exposure to potentially harmful environment, such as noise or air pollution (Hartig et al., 2003; Nieuwenhuijsen, et al., 2014), (e) stimulation of development in children and stimulation of personal development and a sense of purpose (Hartig et al., 2003; Ministerie van Volksgezondheid, 2004), (f) improved functioning of the immune system (Egorov et al., 2017).

In this study, we decided to focus on restoration theory. Attention Restoration Theory has been proposed to explain the mental health benefits of exposure to the natural environment, and it is one of the less studied meachnism to explain this relationship. In particular, Attention Restoration Theory affirms that the benefits of interaction with nature are due to cognitive benefits, and effortless charms (Kaplan & Kaplan 1989). The theory identifies four qualities that contribute to a restorative experience: fascination, extent, being away, and compatibility (Kaplan & Kaplan, 1989), which are described as person-environment interaction (Kaplan, 2001). Fascination means that there is something in the surroundings that capture one's attention in a non-exhaustive, restorative way (Kaplan & Kaplan, 1989). Extent implies that the environment should have coherent scope such that one feels like being in a whole other world (Kaplan & Kaplan 1989). Then, being away indicates to be mentally detached from everyday worries and problems (Kaplan & Kaplan, 1989). Finally, compatibility is linked to the environment match with person's current needs to support restoration (Kaplan & Kaplan, 1989). From this explanation, it would be better if people had an active role in the restoration process, to facilitate the experiences, than to be a passive recipient of some pre-determinant restorative insights (Kaplan & Kaplan, 1989; Kaplan, 2001). Restoration could proceed when the person-environment interaction helps to gain psychological or geographical distance from usual context, immersion in a coherent physical or conceptual environment, and attention without effort (. Korpela et al., 2008). This theory is based on the idea that it is possible to improve mental health by counteracting stress and increasing the ability to focus and concentrate. Emerging evidence around improvements in the cardiovascular and respiratory system is promising and provides some basis for observations linking better health with time spent in nature. Type and quality of the environment has been linked to the degree of connection with nature and the psychological effects on individuals (Kaplan & Kaplan, 1989). The restoration outcomes score (ROS) was developed based on Attention Restoration Theory by Korpela & Ylén (Korpela and Ylén, 2009). to measure restoration outcome in adults after exposure to nature (Hartig et al., 1998; Staats et al., 2003). ROS is based on the theory that exposure to nature helps individuals relax, increases physical activity, eliminates unwanted thoughts and improves attention and vitality (Kaplan & Kaplan, 1989). The ROS comprises items which cover relaxation and calmness, attention restoration, clearing one's thoughts, subjective vitality, and self-confidence. There are several studies which used the Restoration Attention Theory, but the results are not conclusive. Some studies focused more on the time of exposure, and they found positive effects from exposure time ranging from 40 s to 55 min (Berman et al., 2008; Berto, 2005; K. E. Lee

et al., 2015; Pilotti et al., 2015). Lin et al. (2014) found that focusing on natural features enhance attention and restoration. A similar effect on improved restoration has been shown over longer period in interventions studies (Duvall, 2011; Lymeus et al., 2018). The two studies suggested that to be engage in walking in natural environment was linked to be expertise less frustration at the end of the study, and to have a day-to-day replenishment of cognitive resources. Despite the evidence, in our knowledge, no previous study analyzed restoration linked to different types of activities, such as relaxing or play with children. In addition, no previous studies have assessed the association between restoration and amental health. For this reason, the aims of the present study were to answer the following questions:

a) Which activities carried out in green space are most related to restoration?
b) Are these activities the same for people with poor and good mental health?

Since different activities may have direct effects on emotional states, it is possible that one or more of them will have a greater impact on restoration. Data analysis were gathered as part of the Positive Health Effects of the Natural Outdoor Environment in Typical Populations in different Regions in Europe (PHENOTYPE) project that aimed to investigate the influence of the natural outdoor environment on human health and well-being (Nieuwenhuijsen et al., 2014a,b). The questionnaire to calculate the restoration was collected in a large sample of adults in four European cities using a large comparable approach.

2. Methods

2.1. Study design

A cross-sectional design was used. An extensive description of the study design can be found in Nieuwenhuijsen et al. (2014a,b). This study was based on adults who participated to the PHENOTYPE project. Data were collected in four European cities: Barcelona (Spain), Doetinchem (the Netherlands), Kaunas (Lithuania) and Stoke-on-Trent (the United Kingdom) (Nieuwenhuijsen et al., 2014). The four cities offer diverse study areas in terms of size, population density, climate and land cover (Smith et al., 2017). Barcelona, the largest city (1.6 million inhabitants) is a densely built city (population density 16000 inhabitants/km^2) and has a Mediterranean climate. Doetinchem, the smallest city, (56000 inhabitants) has a much lower population density (706 inhabitants/km^2) and has a moderate maritime climate. Kaunas (319000 inhabitants) has a humid continental climate and has a population density of 2046 inhabitants/km^2. Stoke-on-Trent (363000 inhabitants) has a population density of 1194 inhabitants/km^2 and has a moderate maritime climate. Greenness and access to natural environment varies per city. In general, Doetinchem being the greenest city with the best natural environment access, and Barcelona the least green city with poorest natural environment access (Smith et al., 2017). Survey data were collected from residents of 30 neighborhoods per city. These neighborhoods were selected on the basis of their variability in socioeconomic status and access to the natural environment. A random sample of 30–35 adults (age range 18–75 years) in each neighborhood was invited to participate in the survey. Response rates were 46.9% in Barcelona, 8.4% in Doetinchem, 21.3% in Kaunas, and 36.9% in Stoke-on-Trent. The final sample contained approximately 1000 respondents per city. Data were collected by means of a face-to-face questionnaire administered at respondents' residences during May–November 2013. In Kaunas (Lithuania), data were collected using a postal questionnaire. The study was conducted in accordance with the Declaration of Helsinki. Ethical approvals were obtained from the relevant bodies of each institution and all respondents provided written informed consent before taking part.

2.2. Collection of study population data

A face-to-face questionnaire survey was used to collect the study population data. Most questions were derived from existing and validated indices and others were tailored to the specific objectives of the PHENOTYPE study. The survey was developed in English and then translated into Dutch, Spanish, and Lithuanian. The questionnaire was developed as an oral interview of 30–60 min. All the questions used in the present analysis referred to the green space most used and visited by participant, identified by asking participants to "please list the name, location and approximate distance from your home of the green/blue environment that you visit or use most often".

2.3. Restorative outcomes score

Restorative experiences were measured with the ROS (Korpela and Ylén, 2009). The scale includes nine items. According to previous measures and findings on restorative outcomes (Hartig et al., 1998; Staats et al., 2003), three items reflect attention restoration ('I feel calmer', 'I feel restored and relaxed', 'I get new enthusiasm and energy for my everyday routines'). One item reflects attention restoration ('My concentration and alertness clearly increase'), two items reflect clearing one's thoughts ('I forget everyday worries', 'My thoughts are cleared and clarified'), other two items reflect subjective vitality ('I gain vitality', 'I get trust for each new day') and the last one item reflected self-confidence ('My self-confidence improves'). The response scale included not at all, a little, somewhat, much and very much.

2.4. Type of activity

The type of activities and the frequency with which they were carried out were used as independent variables. The question, which referred to the most often visited green space, was: "How often do you use the natural environment you visit most often for the following activities?" The activities proposed were: "walking, cycling or doing sport", "picnic", "meeting family or friends", "walk or play with children", "experiencing tranquility" and "personal relaxation". For every activity, the frequency indicators included never, seldom, sometimes, often and very often.

2.5. Mental health

Mental health was used as a possible modifier in the relationship between restoration and the type of activity. This variable was assessed with the Medical Outcome Study Short Form (SF-36) mental health subscale (van den Berg et al., 2016a; Ware 2000; Ware and Sherbourne, 1992). The SF-36 mental health subscale is a validated and widely used questionnaire to assess mental wellbeing. In the present study we used the subscale of mental health, which is composed by five questions about how the respondent felt in the last four weeks. The questions are: Have you been a very nervous person? Have you felt so down in the dumps nothing could cheer you up? Have you felt calm and peaceful? Have you felt downhearted and blue? Have you been a happy person? The possible answers were six: all of the time, most of the time, a good part of the time, some of the time, a little of the time and none of the time. A sum score was calculated by summing all items together. If two out of five items were missing, these missing values were replaced by the average of other items. If more than two items were missing, no sum score was calculated. Then, summed scores were transformed into a scale from 0 to 100, according to guidelines (Ware 2000; Ware and Sherbourne, 1992). Higher scores reflect better mental health. The subscale has been shown to be a reliable and valid measure of mental health (Ware 2000). Finally, the median of the combined sample was considered as a discriminant for dividing people of the entire sample with poorer and better mental health.

2.6. Covariates

Based on previous literature, some a priori covariates were selected: gender (Rossi et al., 2015; Sallis et al., 2016; Toohey et al., 2013), age (Rossi et al., 2015; Sallis et al., 2016; Toohey et al., 2013), education completed (Rossi et al., 2015; Sallis et al., 2016; Toohey et al., 2013), marital status (van den Berg et al., 2016a), living with children (van den Berg et al., 2016a) and neighborhood socioeconomic status (SES). In addition, the appeal of the place, the length of stay and the frequency of the visits to the environment that participants visit or use most often (the frequency indicators were seldom or never, once per month, 2/3 time a month, once per week, 2/3 time per week, every day) were also considered as covariates.

2.7. Statistical analysis

Descriptive statistics were used to characterize the study population and are shown for the pooled sample and by city. Depending on the type of variables, the one-way ANOVA, chi-squared test and the Kruskall-Wallis test were performed to see the difference in variance by city of residence. The aims of the present study were double: understand which activities carried out in green space are most related to restoration and understand if these activities are the same for people with 'poorer and better mental health'. So, to investigate these association a multiple regression analysis was performed. The multiple regression was performed twice. The first time the entire population was considered together, then, the model was adjusted for the covariates described previously, and finally, the population was stratified by mental health. As the PHENOTYPE study was designed to include cities with regional, social, and cultural differences, also the city-specific multilevel was analyzed. Analyses were based on a part of the complete cases. The total sample was 3599, but our sample was 3134 because we chose to exclude people that did not answer at all the questions about the kind of activity done in the green urban space or they did not indicate if they had a most visited place. All the analyses were performed in STATA 14.2 (StataCorp, 2015).

3. Results

3.1. Population characteristics

Table 1 shows the sociodemographic characteristics for the combined sample and for each city. The sample consisted of 3134 respondents from the four cities (Barcelona n = 848, Doetinchem n = 833, Kaunas n = 739, Stoke-on-Trent n = 714). Respondents had a mean age of 51.67 (SD 15.81), but it differed among the cities. In all the cities, the percentage of women was higher than the percentage of men. Stoke-on-Trent represented an exception because women and men were equally represented (357 women and 357 men).

The participants of the different cities showed remarkable differences in each socio demographic characteristics considered (p-value <0.001). The majority of the participants had a high education (50.98% in the combined sample) and the results were similar among the cities, except for Stoke-on-Trent, in which the 62.48% of participants had a medium education level. People from Doetinchem and Stoke-on-Trent had the better financial situation: 52.78% in Doetinchem and 51.16% in Stoke-on-Trent said that they were "comfortable". Instead, in Kaunas, only the 23% were "comfortable", but at the same time Kaunas showed the lowest percentage of people that "cannot make ends meet" (4.69%). Due to these differences, subsequent analyses were always carried out for the combined sample and then separately for each city.

3.2. Covariates and type of activity

Table 2 shows the descriptive characteristics for the covariates and of the type of activities. The Chi-squared test showed statistically

Table 1
Description of the sociodemographic characteristics of the participants in a cross-sectional sample of 3134 adults in four European cities and divided by the four cities.

	Combined sample	Barcelona	Doetinchem	Kaunas	Stoke-on-Trent	P value
N	3134	848	833	739	714	
Age (years: median, IQR)	52 [16]	44 [16]	56 [12]	61 [13]	45 [16]	<0.001
Gender						<0.001
Male N (%)	1406(44.86)	399(47.05)	360(43.22)	290(39.24)	357 (50.00)	
Female N (%)	1728(55.14)	449(52.95)	473(56.78)	449(60.76)	357 (50.00)	
Missing N	*0*	*0*	*0*	*0*	*0*	
Education level						<0.001
Low N (%)	174(5.58)	118(13.96)	8(0.96)	12(1.62)	36 (5.14)	
Medium N (%)	1354(43.44)	327(38.70)	394(47.36)	195(26.39)	438(62.48)	
High N (%)	1589(50.98)	400(47.34)	430(51.68)	532(71.99)	227(32.38)	
Missing N	*17*	*3*	*1*	*0*	*13*	
Income						<0.001
Low N (%)	959(30.60)	300(35.38)	262(31.45)	180(24.36)	217(30.39)	
Medium N (%)	1192(38.03)	277(32.67)	326(39.14)	348(47.09)	241(33.75)	
High N (%)	983(31.37)	271(31.96)	245(29.41)	211(28.55)	256(35.85)	
Missing N	*0*	*0*	*0*	*0*	*0*	
Money situation						<0.001
Cannot make ends meet N (%)	306(10.39)	100(12.30)	141(17.11)	31(4.69)	34(5.26)	
Have enough to get along N (%)	1431(48.59)	417(51.29)	254(30.83)	478(72.31)	282(43.59)	
Comfortable N (%)	1208(41.02)	296(36.41)	429(52.06)	152(23.00)	331(51.16)	
Missing N	*189*	*35*	*9*	*78*	*67*	
Family composition						<0.001
Alone N (%)	507(16.24)	58(6.87)	189(22.69)	131(17.77)	129(18.22)	
With partner without children N (%)	1081(34.63)	202(23.93)	379(45.50)	291(39.48)	209(29.52)	
With children younger than 12 years N (%)	507(16.24)	172(20.38)	125(15.01)	37(5.02)	173(24.44)	
With children older than 12 years N (%)	515(16.50)	109(12.91)	126(15.13)	161(21.85)	119(16.81)	
Other N (%)	512(16.40)	303(35.90)	14(1.68)	117(15.88)	78(11.02)	
Missing N	*12*	*4*	*0*	*2*	*6*	
Marital status						<0.001
Married/registered together N (%)	2022(64.93)	536(63.81)	544(65.38)	497(67.25)	445(63.30)	
Living apart together N (%)	151(4.85)	18(2.14)	71(8.53)	25(3.38)	37(5.26)	
Divorced/separated N (%)	941(30.22)	286(34.05)	217(26.08)	217(29.36)	221(31.44)	
Missing N	*20*	*8*	*1*	*0*	*11*	

P-value refers to one way ANOVA for the age variable and refers to chi-squared test for the other variables.

significant differences between the cities in all the covariates and type of activities.

The largest part of the participants visited the green space for one or 2 h (38.84%) and two/three times per week (28.78%). It is possible to notice that no one from Barcelona, Doetinchem and Stoke-on-Trent said to visit the green urban space "seldom or never" and a very small percentage (2.65%) reported staying in the natural environment for less than 10 min. The participation in the activities differed across cities.

"Sport" had the highest percentage of the answer "often" in the combined sample, and for the same answer it achieved the 47.30% in Doetinchem. "Picnic" was the least practiced activity (63.88% of the answer 'never' in the frequency indicators), in particular this happened in Doetinchem (78.39% of the answer 'never' in the frequency indicators); the lowest percentage of never was (26.52) in Kaunas. Participants from Doetinchem and Stoke-on-Trent showed the lowest percentage for the answer "never" (52.22 and 43.84% respectively) for the activity "Meet family/friends", while people from Kaunas presented the highest percentage. In the combined sample "Walk and play with children" the answer 'never' had a highest percentage. And regards "Tranquility", it had a higher percentage of answers "sometimes" for the combined sample (35.16%) than "personal relaxing" (24.25%). People from Stoke-on-Trent had a higher percentage of answers "never" (39.98%) or the item "personal relaxing" than people from Kaunas (10.96%).

3.3. Restoration and mental health

Table 3 shows the median score of restoration score and the median score of mental health, for the combined sample and for each city separately. The Kruskall-Wallis test was performed and statistically significant differences were found both for the restoration and the mental score among the results of the cities. People from Doetinchem

showed the higher statistically significant score of mental health while people from Barcelona and Kaunas the lowest. On the contrary, respondents from Doetinchem had the lowest score of restoration (11) and those from Stoke-on-Trent the highest (21).

3.4. Relationship between restoration and the type of activity

The combined sample and city-specific samples showed different associations between the restoration and the type of activity (Table 4). In the combined sample, the activities linked to the social cohesion ("picnic" and "meeting family/friends") and to the reduction of stress ("tranquility" and "personal relaxing") were associated with higher restoration. In particular, "Picnic" and "meet family or friends" presented a high significant association ($p < 0.001$) for all the frequency indicators. Considering the results of the cities individually, several differences emerged.

In Barcelona sample no statistically significant association was observed between restoration and "sport", "meet family or friends" or "walk and play with children". Indeed, a significant association ($p < 0.05$) were observed with "picnic" (with seldom and often), "tranquility" (from sometimes to very often) and "personal relaxing" (for all the frequency indicators).

In Doetinchem sample a significant association ($p < 0.05$) was observed with "sport" (for often and very often), "picnic" (for seldom and very often), "tranquility" (from sometimes to very often) and "personal relaxing" (for often and very often).

In Kaunas sample the highest number of statistically significant associations were observed. In fact, there were significant association ($p < 0.05$) for all the type of activities. "Picnic" showed a statistically significant association for all the frequency indicators, while "sport", "meet family or friends" and "personal relaxing" presented statistically significant association for the three frequency indicators sometimes, often,

Table 2

Descriptive characteristics in a cross-sectional sample of 3134 adults in four European cities and divided by the four cities for the functionality of the place, the length of stay, the frequency of the visits, and the kind of activity. People were asked to think and answer questions about the green space they most used and visited. The quality and functionality of the green space were calculated using the question about the appeal of the place (seven items evaluated from 1 to 5), and about the importance of the presence of some features (seven items evaluated from 1 to 5).

N	Combined sample	Barcelona	Doetinchem	Kaunas	Stoke-on-Trent	P value
	3134	848	833	739	714	
Quality of the place	32.02 ± 4.92	30.79 ± 5.46	33.91 ± 4.01	30.90 ± 4.97	32.50 ± 4.35	<0.001
Missing N	*46*	*7*	*25*	*0*	*14*	
Functionality of the place	12.07 ± 2.04	11.91 ± 2.26	12.55 ± 1.82	11.84 ± 2.04	11.99 ± 1.94	<0.001
Missing N	*45*	*8*	*20*	*0*	*17*	
Length of stay						<0.001
Less than 10 min N (%)	83(2.65)	29(3.42)	28(3.36)	9(1.22)	17(2.39)	
11–30 min N (%)	356(11.37)	83(9.80)	136(16.33)	58(7.85)	79(11.10)	
30 min to 1 h N (%)	816(26.06)	194(22.90)	267(32.05)	173(23.41)	182(25.56)	
1–2 h N (%)	1216(38.84)	372(43.92)	294(35.29)	232(31.39)	318(44.66)	
2 h or more N (%)	660(21.08)	169(19.95)	108(12.97)	267(36.13)	116(16.29)	
Missing N	*3*	*1*	*0*	*0*	*2*	
Frequency of visits						<0.001
Seldom or never N (%)	19(0.61)	–	–	19(2.57)	–	
Once per month N (%)	334(10.68)	82(9.70)	89(10.68)	73(9.88)	90(12.68)	
2-3 time a month N (%)	611(19.54)	148(17.51)	172(20.65)	149(20.16)	142(20.00)	
Once per week N (%)	569(18.20)	156(18.46)	145(17.41)	150(20.30)	118(16.62)	
2-3 time per week N (%)	900(28.78)	239(28.28)	242(29.05)	200(27.06)	219(30.85)	
Every day N (%)	694(22.19)	220(26.04)	185(22.21)	148(20.03)	141(19.86)	
Missing N (%)	*7*	*3*	*0*	*0*	*4*	
Sport						<0.001
Never N (%)	252(8.04)	120(14.15)	11(1.32)	39(5.28)	82(11.48)	
Seldom N (%)	183(5.84)	51(6.01)	15(1.80)	73(9.88)	44(6.16)	
Sometimes N (%)	604(19.27)	143(16.86)	57(6.84)	212(28.69)	192(26.89)	
Often N (%)	1203(38.39)	283(33.37)	394(47.30)	292(39.51)	234(32.77)	
Very often N (%)	892(28.46)	251(29.60)	356(42.74)	123(16.64)	162(22.69)	
Missing N	*0*	*0*	*0*	*0*	*0*	
Picnic						<0.001
Never N (%)	2002(63.88)	660(77.83)	653(78.39)	196(26.52)	493(69.05)	
Seldom N (%)	443(14.14)	89(10.50)	94(11.28)	176(23.82)	84(11.76)	
Sometimes N (%)	451(14.39)	67(7.90)	56(6.73)	231(31.26)	84(11.76)	
Often N (%)	165(5.23)	18(2.12)	19(2.28)	95(12.86)	33(4.62)	
Very often N (%)	73(2.33)	14(1.65)	11(1.32)	41(5.55)	7(0.98)	
Missing N	*0*	*0*	*0*	*0*	*0*	
Meet family/friends						<0.001
Never N (%)	1059(33.79)	230(27.12)	435(52.22)	81(10.96)	313(43.84)	
Seldom N (%)	474(15.12)	89(10.50)	128(15.37)	160(21.65)	97(13.59)	
Sometimes N (%)	870(27.76)	219(25.83)	148(17.77)	301(40.73)	202(28.29)	
Often N (%)	520(16.59)	210(24.76)	94(11.28)	137(18.54)	79(11.06)	
Very often N (%)	211(6.73)	100(11.79)	28(3.36)	60(8.12)	23(3.22)	
Missing N	*0*	*0*	*0*	*0*	*0*	
Walk or play with children						<0.001
Never N (%)	987(31.49)	292(34.43)	307(36.85)	140(18.94)	248(34.73)	
Seldom N (%)	343(10.94)	84(9.91)	93(11.16)	118(15.97)	48(6.72)	
Sometimes N (%)	729(23.26)	145(17.10)	162(19.45)	243(32.88)	179(25.07)	
Often N (%)	687(21.92)	190(22.41)	167(20.05)	171(23.14)	159(22.27)	
Very often N (%)	388(12.38)	137(16.16)	104(12.48)	67(9.07)	80(11.20)	
Missing N	*0*	*0*	*0*	*0*	*0*	
Tranquillity						<0.001
Never N (%)	365(11.65)	103(12.15)	52(6.24)	28(3.79)	182(25.49)	
Seldom N (%)	266(8.49)	104(12.26)	48(5.76)	50(6.77)	64(8.96)	
Sometimes N (%)	798(25.46)	207(24.41)	137(16.45)	253(34.24)	201(28.15)	
Often N (%)	1102(35.16)	279(32.90)	345(41.42)	280(37.89)	198(27.73)	
Very often N (%)	603(19.24)	155(18.28)	251(30.13)	128(17.32)	69(9.66)	
Missing N	*0*	*0*	*0*	*0*	*0*	
Personal relaxing						<0.001
Never N (%)	844(26.93)	121(14.27)	333(39.98)	81(10.96)	309(43.28)	
Seldom N (%)	442(14.10)	109(12.85)	143(17.17)	105(14.21)	85(11.90)	
Sometimes N (%)	760(24.25)	217(25.59)	132(15.85)	254(34.37)	157(21.99)	
Often N (%)	740(23.61)	246(29.01)	134(16.09)	226(30.58)	134(18.77)	
Very often N (%)	348(11.10)	155(18.28)	91(10.92)	73(9.88)	29(4.06)	
Missing N	*0*	*0*	*0*	*0*	*0*	

P-value refers to the chi-squared test.

very often. Finally, "walk and play with children" recorded statically significant association for two frequency indicators (sometimes and very often) and "tranquility" for only one frequency indicator (very often).

In Stoke-on-Trent sample no statistically significant association was shown with the activity "sport" but a significant association (p < 0.05)

was observed from seldom to very often for "meet family or friends". Instead, "tranquility" and "personal relaxing" presented statistically significant associations only for three frequency indicators (sometimes, often and very often).

Table 4 showed the results of the multiple regression. "Never" was

Table 3
Restoration outcome score (5 lowest score, 45 highest score), calculated using the nine items included in the scale proposed by Korpela & Ylén, 2009), and the mental health score, calculate with the Medical Outcome Study Short Form (SF-36) mental health subscale (0 lowest score, 100 highest score), in a cross-sectional sample of 3134 adults in four European cities and, divided by the four cities.

	Combined sample	Barcelona	Doetinchem	Kaunas	Stoke-on-Trent	P value
N	3134	848	833	739	714	
Restoration score (median, IQR)	17 [13]	18 [14]	11 [9]	18 [10]	21 [13]	<0.001
Missing N (%)	*74*	*9*	*0*	*0*	*64*	
Mental health (median, IQR)	76 [20]	72 [24]	84 [12]	72 [24]	76 [24]	<0.001
Missing N (%)	*0*	*0*	*0*	*0*	*0*	

P-value refers to the Kruskall-Wallis test.

the comparison group.

3.5. Multiple regression and stratification by mental health

Table 5 presents the results of the multiple regression performed for all the population of the combined sample and of the four cities. In Appendix A it is possible to see the tables for the multiple regression stratified by mental health.

3.5.1. Combined sample

In the combined sample a significant association (p < 0.05) was observed for all the different kinds of activities for the poorer mental health (Table 5). "Sport" presented a high association (p < 0.001) for the frequency indicators often and very often. "Picnic" and "walk and play with children" had a significant association (p < 0.05) for all the frequency indicators. Finally, "meet family or friends", "tranquility" and "personal relaxing" showed a high association (p < 0.001) for three frequency indicators, from sometimes to very often.

The situation was different when we considered the subsample categorized as 'better mental health'. In this group, there were no statistically significant associations linking restoration score with "sport" and "walk and play with children". "Picnic" presented an association with all the frequency indicators, from 1.78 of seldom (95%CI 0.75, 2.80) to 5.76 of very often (95%CI 3.53, 7.99).

3.5.2. Barcelona

Barcelona had a similar trend to the combined sample (Table 6 Appendix A). The association between the type of activity and mental restoration was more apparent in the subsample categorized as 'poorer mental health' compared to the 'better mental health' subsample. For those with poorer mental health, activities related to the reduction of stress ("tranquility" and "personal relaxing") were associated with higher restoration scores. In the 'better mental health' subsample, only the activity "tranquility" was associated with higher restoration scores.

3.5.3. Doetinchem

Doetinchem had more people with a better mental health (523) than those with poorer mental health (267). The association between the type of activity and mental health was more apparent in the 'poorer mental health' subsample (Table 7 Appendix A). For people with 'poorer mental health', the activities "sport", "and "tranquility" were associated with higher restoration score. Meanwhile, in the 'better mental health' subsample the activities related to the reduction of stress ("tranquility" and "personal relaxing") were associated with higher restoration score.

3.5.4. Kaunas

Participants from Kaunas showed big differences between who had poorer and who had better mental health (Table 8 Appendix A). In fact, the subsample with 'poorer mental health' presented a more apparent association between the type of activity and mental health. For those people, the activities "picnic", "meet family or friends", "walk and play with children" and "tranquility" were associated with higher restoration score. For the 'better mental health' subsample, only the activities "picnic" and "personal relaxing" were associated with higher restoration

score.

3.5.5. Stoke-on-trent

People from Stoke-on-Trent with 'poorer mental health' showed a more apparent association between the type of activities and mental health. In fact, for this subsample, the activities "meet family or friends", "tranquility" and "personal relaxing" were associated with a higher restoration score. For the 'better mental health' subsample, the activity "walk and play with children" was negatively associated with mental health for the frequency indicator seldom and sometimes.

4. Discussion

The goal of the present study was to investigate restoration after visiting green urban space in people with better and poorer mental health and explore mental health as a potential effect modifier. We found that the activities "picnic", "meet family or friends", "tranquility" and "personal relaxing" in urban space were associated with restoration. These associations varied between the four cities. For examples, participants from Kaunas showed the highest number of statistically significant association between restoration and the different type of activity. Participants from Barcelona presented statistically significant association between the social activities and ROS. Indeed, people from Doetichem showed statically significant association for the activities linked to relaxation ("tranquility" and "personal relaxation"). Finally, association between the type of activity and restoration varied according to the participants' mental health. In general, participants with poorer mental health showed more significant associations and for more frequency indicators than participants with better mental health. It is possible that people with better mental health need to spend less time in green space, due to their mental health conditions, and this less time is enough for them to continue to have a good mental health. At the same time, it is possible that people with poorer mental health need to spend more time, and to practice a larger variety of activities to have the same restorative effects of people with better mental health.

We found a statistically significant association between the restoration and the kind of activity carried out in the urban green space and statistically significant differences between the four cities involved in the study. For example.

4.1. Combined sample

In the combined sample, the activities linked to the social cohesion ("Picnic" and "meeting family or friends'') and to the relaxation ("tranquility" and "personal relaxing") showed statistically significant association with the ROS after visiting the green urban space. In particular, "Picnic" and "meet family or friends" presented statistically significant association for all the frequency indicators, for people with poorer mental health. This could mean that activities related to socialization and social cohesion definitely affect restoration, even if these activities are performed infrequently. This is in line with previous studies that suggest natural environments may promote positive social interactions (Kuo et al., 1998; Maas et al., 2009). In addition, social interaction and the improvement of social cohesion in the community is

Table 4

Association between activities in green spaces and restoration outcome score in a cross-sectional sample of 3134 adults in four European cities. Negative values of the coefficient mean a negative association between the variables, the value of the coefficients is linked to the power of the association (higher is the value, higher is the association).

Type of activity	Combined sample		Barcelona		Doetinchem		Kaunas		Stoke-on-Trent	
	β (95%CI)	p	β (95%CI)	p	β (95%CI)	p	β (95%CI)	p	β (95%CI)	p
Sport										
Never										
Seldom	−0.29 (−2.00, 1.42)	0.737	−1.93 (−4.89, 1.03)	0.202	3.03 (−1.17, 7.22)	0.157	1.50 (−1.76, 4.74)	0.367	0.51 (−3.22, 4.25)	0.788
Sometimes	0.60 (−0.74, 1.93)	0.380	0.93 (−1.22, 3.09)	0.395	1.25 (−1.97, 4.47)	0.445	**2.99 (0.45, 5.53)**	**0.021**	−1.29 (−3.55, 0.98)	0.265
Often	1.19 (−0.10, 2.48)	0.071	1.66 (−0.19, 3.51)	0.079	**3.78 (1.03, 6.54)**	**0.007**	**3.48 (0.41, 6.56)**	**0.026**	−0.51 (−3.09, 2.07)	0.697
Very often	**2.29 (0.84, 3.74)**	**0.002**	2.27 (−0.23,4.76)	0.079	**5.09 (2.30, 7.87)**	**<0.001**	**5.77 (0.41, 6.56)**	**0.002**	0.35 (−2.25, 2.95)	0.792
Picnic										
Never										
Seldom	**1.74 (1.06, 2.41)**	**<0.001**	**1.92 (0.52, 3.01)**	**0.007**	**1.80 (0.62, 2.97)**	**0.003**	**2.06 (0.71, 3.40)**	**0.003**	0.77 (−0.77, 2.30)	0.328
Sometimes	**3.02 (2.26, 3.77)**	**<0.001**	1.90 (−0.07, 3.87)	0.058	1.70 (−0.41, 3.81)	0.115	**4.27 (3.18, 5.36)**	**<0.001**	**1.69 (0.10, 3.27)**	**0.037**
Often	**2.96 (1.96, 3.97)**	**<0.001**	**4.40 (2.24, 6.56)**	**<0.001**	1.79 (−0.43, 3.81)	0.114	**3.73 (2.05, 5.41)**	**<0.001**	1.49 (−1.22, 4.19)	0.281
Very often	**7.25 (5.16, 9.33)**	**<0.001**	2.23 (−1.99, 6.45)	0.300	**3.78 (1.42, 6.13)**	**0.002**	**11.02 (8.65, 13.39)**	**<0.001**	**5.51 (0.61, 10.41)**	**0.028**
Meet family or friends										
Never										
Seldom	**1.61 (0.78, 2.44)**	**<0.001**	1.98 (0.04, 3.92)	0.046	**1.81 (0.69, 2.93)**	**0.002**	1.39 (−0.50, 3.28)	0.049	**2.45 (0.53, 4.37)**	**0.012**
Sometimes	**1.85 (1.11, 2.59)**	**<0.001**	1.00 (−0.63, 2.64)	0.229	1.02 (−0.10, 2.05)	0.052	**3.44 (1.52, 5.37)**	**<0.001**	**1.92 (0.17, 3.68)**	**0.032**
Often	**2.61 (1.52, 3.70)**	**<0.001**	0.91 (−1.39, 3.22)	0.438	0.87 (−0.67, 2.42)	0.268	**5.44 (3.14, 7.75)**	**<0.001**	**3.50 (1.38, 5.63)**	**0.001**
Very often	**4.40 (2.77, 6.04)**	**<0.001**	1.87 (−0.56, 4.30)	0.112	1.37 (−1.36, 4.09)	0.326	**9.00 (5.57, 12.43)**	**<0.001**	**5.27 (1.09, 9.44)**	**0.013**
Walk and play with children										
Never										
Seldom	0.47 (−0.51, 1.44)	0.348	1.56 (−0.13, 3.26)	0.081	1.02 (−0.33, 2.38)	0.140	−0.07 (−2.33, 2.19)	0.950	−1.04 (−4.20, 2.13)	0.521
Sometimes	0.75 (0.05,1.45)	0.050	0.95 (−0.22, 2.12)	0.112	**1.44 (0.46, 2.43)**	**0.004**	**1.77 (0.13, 3.42)**	**0.034**	**−2.38 (-4.29, -0.47)**	**0.015**
Often	0.70 (−0.13, 1.54)	0.100	1.31 (−0.52, 3.28)	0.160	0.42 (−0.67, 1.52)	0.450	1.64 (−0.27, 3.54)	0.092	−1.35 (−3.10, 0.40)	0.130
Very often	0.92 (−0.30, 2.13)	0.140	0.20 (−2.42, 2.81)	0.883	0.93 (−0.52, 2.38)	0.207	**4.02 (1.25, 6.79)**	**0.004**	−0.40 (−2.77, 1.98)	0.742
Tranquility										
Never										
Seldom	−0.28 (−1.53, 0.97)	0.660	0.78 (−1.26, 2.81)	0.434	0.87 (−1.46, 3.20)	0.464	−0.96 (−4.08, 2.17)	0.550	−1.49 (−4.45, 1.47)	0.324
Sometimes	**2.02 (0.94, 3.09)**	**<0.001**	**2.37 (0.51, 4.23)**	**0.013**	**1.81 (0.05, 3.56)**	**0.044**	0.79 (−2.09, 3.67)	0.591	**2.39 (0.30, 4.49)**	**0.025**
Often	**3.60 (2.35, 4.85)**	**<0.001**	**5.10 (3.04, 7.15)**	**<0.001**	**4.27 (2.56, 5.98)**	**<0.001**	1.52 (−2.15, 5.20)	0.417	**3.25 (0.82, 5.68)**	**0.009**
Very often	**5.12 (3.66, 6.57)**	**<0.001**	**7.73 (4.96, 10.49)**	**<0.001**	**4.52 (2.41, 6.63)**	**<0.001**	**4.64 (1.36, 7.93)**	**0.006**	**4.54 (1.25, 7.83)**	**0.007**
Personal relaxing										
Never										
Seldom	0.71 (−0.14, 1.55)	0.100	**2.19 (0.35, 4.02)**	**0.019**	0.19 (−1.07, 1.50)	0.764	1.56 (−0.75, 3.87)	0.185	−0.22 (−2.01, 1.58)	0.814
Sometimes	**1.84 (1.13, 2.55)**	**<0.001**	**2.45 (0.90, 4.00)**	**0.002**	0.41 (−0.52, 1.34)	0.387	**3.07 (1.11, 5.03)**	**0.002**	**2.22 (0.82, 3.62)**	**0.002**
Often	**3.38 (2.58, 4.18)**	**<0.001**	**4.42 (2.52, 6.31)**	**<0.001**	**1.94 (0.91, 2.97)**	**<0.001**	**5.05 (3.01, 7.09)**	**<0.001**	**2.95 (1.30, 4.60)**	**<0.001**
Very often	**5.70 (4.49, 6.90)**	**<0.001**	**5.95 (3.68, 8.21)**	**<0.001**	**3.60 (1.97, 5.22)**	**<0.001**	**9.74 (7.10, 12.38)**	**<0.001**	**6.14 (3.24, 9.04)**	**<0.001**

Model was adjusted by age, education, neighborhood SES, perceived income, household composition, marital status, with random intercept at neighborhood level. β = regression coefficient; CI = confidence interval.

Table 5
Association between activities in green spaces and restoration outcome score, stratified for the mental health score, in a cross-sectional sample of 3134 adults in four European cities.

N	Poorer mental health ≤76		Better mental health >76	
	1452		1316	
Type of activity	β (95%CI)	p	β (95%CI)	p
Sport				
Never				
Seldom	0.76 (−0.83, 2.35)	0.347	−1.13 (−4.29, 2.04)	0.485
Sometimes	1.32 (−0.06, 2.70)	0.060	−0.41 (−3.05, 2.24)	0.764
Often	2.25 (0.92, 3.59)	**<0.001**	0.46 (−2.17, 3.09)	0.733
Very often	3.90 (2.23, 5.56)	**<0.001**	1.15 (−1.53, 3.84)	0.400
Pic nic				
Never				
Seldom	1.54 (0.61, 2.47)	**0.001**	1.78 (0.75, 2.80)	**<0.001**
Sometimes	3.04 (2.01, 4.07)	**<0.001**	2.54 (1.30, 3.79)	**<0.001**
Often	3.31 (1.82, 4.79)	**<0.001**	2.47 (0.64, 4.30)	**0.008**
Very often	8.36 (5.22, 11.51)	**<0.001**	5.76 (3.53, 7.99)	**<0.001**
Meet family or friends				
Never				
Seldom	1.50 (0.38, 2.62)	0.009	1.29 (−0,04, 2.61)	0.057
Sometimes	1.88 (0.88, 2.88)	**<0.001**	1.37 (0.33, 2.41)	**0.010**
Often	2.87 (1.36, 4.37)	**<0.001**	1.84 (0.45, 3.23)	**0.009**
Very often	5.42 (3.22, 7.62)	**<0.001**	2.92 (0.88, 4.97)	**0.005**
Walk and play with children				
Never				
Seldom	1.74 (0.52, 2.97)	**0.005**	−1.11 (−2.53, 0.31)	0.126
Sometimes	1.75 (0.90, 2.61)	**<0.001**	−0.61 (−1.72, 0.50)	0.284
Often	1.47 (0.28, 2.67)	**0.015**	−0.17 (−1.27, 0.93)	0.764
Very often	2.03 (0.20, 3.85)	**0.030**	−0.22 (−1.64, 1.21)	0.765
Tranquility				
Never				
Seldom	1.08 (−0.57, 2.72)	0.199	−1.45 (−3.46, 0.57)	0.159
Sometimes	3.03 (1.65, 4.42)	**<0.001**	0.65 (−1.13, 2.44)	0.474
Often	4.57 (3.02, 6.12)	**<0.001**	2.94 (1.27, 4.62)	**0.001**
Very often	6.84 (4.91, 8.78)	**<0.001**	4.21 (2.31, 6.11)	**<0.001**
Personal relaxing				
Never				
Seldom	0.74 (−0.39, 1.88)	0.199	0.81 (−0.50, 2.11)	0.225
Sometimes	2.19 (1.08, 3.29)	**<0.001**	1.10 (0.09, 0.73)	**0.033**
Often	3.60 (2.29, 4.91)	**<0.001**	3.09 (2.00, 4.18)	**<0.001**
Very often	6.72 (4.88, 8.56)	**<0.001**	5.00 (3.55, 646)	**<0.001**

Model was adjusted by city, age, sex, education, neighborhood SES, perceived income, household composition, marital status, with random intercept at neighborhood level. β = regression coefficient; CI = confidence interval.

one of the different types of mechanisms proposed to explain the beneficial effects of the green environment (de la Barrera et al., 2016; Hong et al., 2018; Koohsari et al., 2015; Lachowycz and Jones, 2013). Our findings for the combined sample was in line with previous studies (van den Berg et al., 2016b; White et al., 2013) which showed a higher vitality and restoration in persons that went to green space with companions. Instead, activities more linked to the relaxation suggest that the frequency was more important than the activity in and of itself. Previous studies have shown that short-term exposure to forests, urban parks, gardens and other natural environments reduces stress and depressive symptoms, restores attention fatigue, increases self-reported positive emotions and improves self-esteem, mood and perceived mental and

physical health (Aerts et al., 2018; Bosch, 2017; W. Y. Chen and Jim, 2008; I. Lee et al., 2017). These results are important because they highlight the importance of how people perceive the use and the benefits of the green space. It could be a "safe place" in which people can stay and relax without other problems or thoughts. In conclusion, for people with poorer mental health seem that is not so important the type of activity done in the green urban space. The most effective aspect is the use of this kind of environment.

Regarding people with better mental health, "walk and play with children'' did not show a strong association with the restorative score. This is in line with other studies. In particular, White et al. (2013) found that being with children was associated with lower restoration than being alone. The presence of children tended to reduce the extent of restoration experienced. While spending time with children may have many benefits, it is not necessarily a relaxing/restorative activity (White and Dolan, 2009). The feeling of restoration remained lower also for visits to the playing field, even without the presence of children (White et al., 2013). The activity "sport" showed a statistically significant association only for the frequency indictor very often. Korpela et al. (2008) found that physical activity was among the potential determinants of the restorative experiences (. Korpela et al., 2008), but White et al. (2013) found that doing sport was not better than simply walking for the levels of restoration (White et al., 2013). Even if the beneficial effects of the physical activity are well established, with strong evidence of the relative reduction of risk of mortality, it is not a factor known to facilitate restoration experience. Korpela et al. (2014) in their study presented the importance of experiencing calmness, getting new spirit and vitality, forgetting everyday worries and gaining faith in tomorrow during nature-based recreation (Korpela et al., 2014). According to our data, the sport practice helps to do this only if people do it very often.

Looking at the results of the cities individually which differed in characteristics that can influence the restoration, the mental health and the attitude towards green urban spaces key, several differences emerged. It is important remember that the four European cities offer diverse study areas in terms of size, population density, climate, and land cover, that could have influenced the results of the study (Kruize et al., 2020; Smith et al., 2017). Barcelona was the largest city (1.6 million inhabitants), and it is also the densely built city, with a population density of 16000 inhabitants/km^2. Due to these conditions, Barcelona is also the city with poorest natural environment access and has the longest distance from the green urban space for the citizens. These aspects could influence the use and the perception that dwellers have of the natural environment. Instead, Doetinchem is the smallest city, with 56000 inhabitants and a population density of 706 inhabitants/km^2 but is the greenest city with the best natural environment access. In the study by Kruize et al. (2020), authors analyzed several differences in the use and presence of natural environment and green urban space in the four cities. They found that almost 90% of participants from Stoke-on-Trent and Doetichem had their own garden, while in Barcelona only the 10.4% of participants had a garden. The 62.1% of people from Kaunas had a balcony or patio, and the 42.4% had a communal garden to use. In addition, in Kaunas, more than half of the people owned a dog, which was a far higher proportion than in the other cities, and which may stimulate people to use the green urban spaces. The 28.1% of people from Barcelona had a leisure time elsewhere or were usually to spent weekend elsewhere, and this data could influence the use and the perception of green urban spaces. In addition, also the climate could influence the use and the perception of green urban space (Ho et al., 2022). Highest and lowest temperature could discourage the use of natural environments. For example, Barcelona has a dry climate, with mild and wet winters, relatively warm and dry summers, and generally with long periods of sunshine throughout most of the years (Rodríguez Algeciras and Matzarakis, 2016). Long periods of sunshine could improve the possibility to use the green urban space, but at the same time, the hot temperature or the wet winters could discourage people to go outdoors to pass their leisure time.

4.2. Barcelona below there are the results discussed depending on the city

Participants from Barcelona showed no statistically significant association between the ROS and "sport", "meet family or friends" or "walking and play with children". This can be related with the characteristics of the city itself. In fact, Barcelona was the largest city, and it is a densely built city (population density 1600 inhabitants/km^2)). In addition, Barcelona is the least green city and has the longest distance from the most used green space for the citizens. Maybe for these reasons people prefer to meet family and friends or to do sport in other kinds of places, such as bars or non-natural open space, such as squares. In Barcelona the satisfaction with the quality and amount of the green space was lower than the other cities (Kruize et al., 2020). But at the same time, the restoration score showed a statistically significant association with the activities of "tranquility" and "personal relaxing". This can be due to the fact that Barcelona is the busiest city, so people's restoration could be really benefited from being able to escape from the busy Barcelona urban life. For this reason, green spaces in the city, even if they are not particularly appreciated, were used to relax and they significantly influence the restoration experience.

4.3. Doetinchem

Doetinchem was the smallest and greenest city (56000 inhabitants), with the best access to green space and, in addition, with the joint highest percentage of daily visits (37.8%, as Kaunas). Maybe for this wide/large exposure to green urban space, Doetinchem participants had the lowest score of restoration (11.22, SD 7.15). People from Doetinchem could have a greater habit to use and to see the green space and so they do not feel as restored as the participants from other cities after visiting this kind of environment. This could be fact that everyone had a quite high access to urban green space, and this could reduce the opportunity to see differences in restoration between people. In Doetinchem a statistically significant association was observed with the activity "sport" and "personal relaxing" carried out both "often" and "very often" This could mean that these two kinds of activities influence restoration scores, but only when they are done consistently. This is in accordance with Korpela et al. (2009), which reported that the physical activity and natural experiences were among the potential determinants of the restorative experiences (Korpela and Ylén, 2009). Due to the bigger amount of green in the city, people could have more possibility to perform outdoor physical activity or to relax.

4.4. Kaunas

People from Kaunas reported the joint highest percentage of daily visits to green urban space (37.8%, as Doetinchem). This could be linked to the higher sensitivity of the residents of most Northern countries: they usually paid more attention to community parks and to increase awareness to people to use them (Chen et al., 2020). For example, in Denmark a nationwide survey suggested that 43.0% of adults visit green space every day and 91.5% of them visit green space at least once a week (Schipperijn et al., 2010).

4.5. Stoke-on-trent

People from Stoke-on-Trent had the lowest percentage (14.6%) of daily visits, and they also visited green space further away in the city and outside the city less frequently than people from the other cities. At the same time, people from this city have the highest restoration score (20.19, SD 8.74). Apparently, people who visit green spaces more frequently for activities get notable restoration benefit compared with those who do not. However, people from Stoke-on-Trent could have a bigger passive or today exposure through which they could get restoration benefits. This is in line with the results of the combined sample.

4.6. Stratification for mental health

Mental health was used as a modifier of the relationship between the restoration and the type of activity carried out in the green urban spaces. Several studies showed beneficial association between the natural outdoor environment exposure and mental health (Astell-Burt et al., 2014; Carter & Horwitz, 2014, de Vries et al., 2013; McEachan et al., 2016, van Dillen et al., 2012). They found that population mental health could benefit from environmental interventions aiming to increase public contact with natural environment (Triguero-Mas et al., 2017). A study found that the use of green space generates mental health benefits regardless of the level of intensity, duration or type of the green activity undertaken (Pretty et al., 2007). This could be an important aspect, and it could be in line with the results of the present study. In fact, looking at the stratification for the mental health score, there were some differences between people with a better and a poorer mental health. People with poorer mental health showed more statistically significant association and for more frequency indicators between the kind of activity done in the green urban space and the restoration score. In the combined sample all the kinds of activity presented statistically significant and a positive coefficients. Participants with poorer mental health from the different cities showed some differences in the relationship between the kind of activities and the ROS, but they presented a similar trend. In general, people with poorer mental health showed more significant associations and for more activity than people with good mental health. The combined sample showed no significant association for two kinds of activity (sports and walk and play with children) encouraging the idea that it does not matter the activity that people done in green spaces, but the important thing is their use. Regarding these results, it seems that every kind of activity done by people with poorer mental health influences the score of restoration. It could mean that people with poorer mental health were more sensitive to the effects of using the green urban space and so they could be more sensitive also to the feeling of restoration after visiting a green urban space. Several studies have found positive effects of green prescription, in which health professional carried out different types of activities in forest or other kind of natural environment, to help people with mental health problems or psychiatric disorder (Nordh et al., 2009; Pretty et al., 2007; Sahlin et al., 2015). It seems that more mentally fragile subjects could have more beneficial effects due to the contact with green urban space or natural environment. A possible explanation of this result could be link to the rumination (Bratman et al., 2015). Rumination could be define as a prolonged and often maladaptive attentional focus on the cause and consequences of emotions, most often negative emotion (Nolen-Hoeksema, 1991). It has been shown that rumination predict the onset of depressive episodes, as well as other mental disorders (Nolen-Hoeksema, 1991, 2000). On the contrary, positive or neutral distraction has been shown to decrease rumination if the distraction is engrossing to maintain the shift of attention into the distracting stimuli (Nolen-Hoeksema et al., 2008). So, it could be that people with better mental health have the tendency to have less rumination than people with poorer mental health. Or also, people with better mental health could have a more immediate effect when they visit green urban space, and for this reason they need less time in this type of environment.

5. These aspects are not so clear, even because usually the population with mental health problems disorders or problems were analyzed. Instead, the sample of the present study had generally a medium level of mental health. Further studies to understand better this relationship are needed. Conclusion

We found a statistically significant association between restoration and the activities linked to the social cohesion (as "picnic") and the reduction of stress (as "personal relaxation") in the combined sample. In addition, we found statistically significant differences between the four cities. The four cities showed different frequencies of statistically

significant association, but they had the same trend. In fact, in all the cities people with poorer mental health showed more statistically significant associations with the kind of activity performed in the green urban space; they seem to be more sensitive to the positive effect of visiting the green environment. On the contrary, people with better mental health seem to be less influenced by the visiting of green urban space, maybe due to their mental health situation. Therefore, the green prescription will be important for all the people, especially those with poorer mental health. Green prescription means have advice from health professional to be more active, and improve diet, which is strongly linked to nature-based activities, such as local walking for health scheme, community gardening, and food-growing projects. In addition, this type of activities could also carry out in forest or other kind of natural environment, and they are important for the psychological treatments, as an alternative or a supplement medical treatment of mental health problems or psychiatric disorder. At the same time, people with better mental health have to continue to use this kind of environment in order to protect their well-being. Overall, these analyses support the evidence that green urban spaces have an important influence in the creation and in the maintenance of mental health.

Credit author statement

Alessia Grigoletto: Conceptualization, Investigation, Writing – original draft preparation. Stefania Toselli: Supervision, writing-reviewing, and editing. Wilma Zijlema: Conceptualization, Visualization, Supervision. Sandra Marquez: Software, Methodology. Margarita Triguero-Mas: Supervision, writing-reviewing, and editing. Christopher Gidlow: Validation, writing-reviewing, and editing. Regina Grazuleviciene: Data curation, writing-reviewing, and editing. Magdalena Van de Berg: Supervision Hanneke Kruize: Supervision Jolanda Maas: Data curation Mark J. Nieuwenhuijsen: Visualization, Supervision, Methodology

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.envres.2023.115397.

References

Aerts, R., Honnay, O., Van Nieuwenhuyse, A., 2018. Biodiversity and human health: mechanisms and evidence of the positive health effects of diversity in nature and green spaces. Br. Med. Bull. 127 (1), 5–22. https://doi.org/10.1093/bmb/ldy021.

Astell-Burt, T., Mitchell, R., Hartig, T., 2014. The association between green space and mental health varies across the lifecourse. A longitudinal study. J. Epidemiol. Community Health 68 (6), 578–583. https://doi.org/10.1136/jech-2013-203767.

Basagaña, X., Sartini, C., Barrera-Gómez, J., Dadvand, P., Cunillera, J., Ostro, B., Sunyer, J., Medina-Ramón, M., 2011. Heat waves and cause-specific mortality at all ages. Epidemiology 22 (6), 765–772. https://doi.org/10.1097/EDE.0b013e31823031c5.

Berman, M.G., Jonides, J., Kaplan, S., 2008. The cognitive benefits of interacting with nature. Psychol. Sci. 19 (12), 1207–1212. https://doi.org/10.1111/j.1467-9280.2008.02225.x.

Berto, R., 2005. Exposure to restorative environments helps restore attentional capacity. J. Environ. Psychol. 25 (3), 249–259. https://doi.org/10.1016/j.jenvp.2005.07.001.

Bosch, M. van den, 2017, Marzo 29. Natural Environments, Health, and Well-Being. Oxford Research Encyclopedia of Environmental Science. https://doi.org/10.1093/acrefore/9780199389414.013.333.

Bratman, G.N., Hamilton, J.P., Hahn, K.S., Daily, G.C., Gross, J.J., 2015. Nature experience reduces rumination and subgenual prefrontal cortex activation. Proc.

Natl. Acad. Sci. USA 112 (28), 8567–8572. https://doi.org/10.1073/pnas.1510459112.

Carter, M., Horwitz, P., 2014. Beyond proximity: the importance of green space useability to self-reported health. EcoHealth 11 (3), 322–332. https://doi.org/10.1007/s10393-014-0952-9.

Chen, C., Luo, W., Li, H., Zhang, D., Kang, N., Yang, X., Xia, Y., 2020. Impact of perception of green space for health promotion on willingness to use parks and actual use among young urban residents. Int. J. Environ. Res. Publ. Health 17 (15). https://doi.org/10.3390/ijerph17155560.

Chen, W.Y., Jim, C.Y., 2008. Cost–benefit analysis of the leisure value of urban greening in the new Chinese city of Zhuhai. Cities 25 (5), 298–309. https://doi.org/10.1016/j.cities.2008.06.002.

de la Barrera, F., Reyes-Paecke, S., Harris, J., Bascuñán, D., Farías, J.M., 2016. People's perception influences on the use of green spaces in socio-economically differentiated neighborhoods. Urban For. Urban Green. 20, 254–264. https://doi.org/10.1016/j.ufug.2016.09.007.

de Vries, S., van Dillen, S.M.E., Groenewegen, P.P., Spreeuwenberg, P., 2013. Streetscape greenery and health: stress, social cohesion and physical activity as mediators. Soc. Sci. Med. 94, 26–33. https://doi.org/10.1016/j.socscimed.2013.06.030.

Duvall, J., 2011. Enhancing the benefits of outdoor walking with cognitive engagement strategies. J. Environ. Psychol. 31 (1), 27–35. https://doi.org/10.1016/j.jenvp.2010.09.003.

Dzhambov, A.M., Dimitrova, D.D., 2014. Urban green spaces' effectiveness as a psychological buffer for the negative health impact of noise pollution: a systematic review. Noise Health 16 (70), 157–165. https://doi.org/10.4103/1463-1741.134916.

Egorov, A.I., Griffin, S.M., Converse, R.R., Styles, J.N., Sams, E.A., Wilson, A., Jackson, L.E., Wade, T.J., 2017. Vegetated land cover near residence is associated with reduced allostatic load and improved biomarkers of neuroendocrine, metabolic and immune functions. Environ. Res. 158, 508–521. https://doi.org/10.1016/j.envres.2017.07.009.

Hartig, T., Evans, G.W., Jamner, L.D., Davis, D.S., Gärling, T., 2003. Tracking restoration in natural and urban field settings. J. Environ. Psychol. 23 (2), 109–123. https://doi.org/10.1016/S0272-4944(02)00109-3.

Hartig, T., Lindblom, K., Ovefelt, K., 1998. The home and near-home area offer restoration opportunities differentiated by gender. Scand. Hous. Plann. Res. 15 (4), 283–296. https://doi.org/10.1080/02815739808730463.

Ho, J.Y., Goggins, W.B., Mo, P.K.H., Chan, E.Y.Y., 2022. The effect of temperature on physical activity: an aggregated timeseries analysis of smartphone users in five major Chinese cities. Int. J. Behav. Nutr. Phys. Act. 19 (1), 68. https://doi.org/10.1186/s12966-022-01285-1.

Hoek, G., Krishnan, R.M., Beelen, R., Peters, A., Ostro, B., Brunekreef, B., Kaufman, J.D., 2013. Long-term air pollution exposure and cardio- respiratory mortality: a review. Environ. Health 12, 43. https://doi.org/10.1186/1476-069X-12-43.

Hong, A., Sallis, J.F., King, A.C., Conway, T.L., Saelens, B., Cain, K.L., Fox, E.H., Frank, L.D., 2018. Linking green space to neighborhood social capital in older adults: the role of perceived safety. Soc. Sci. Med. 207, 38–45. https://doi.org/10.1016/j.socscimed.2018.04.051.

Jim, C.Y., 2004. Green-space preservation and allocation for sustainable greening of compact cities. Cities 21 (4), 311–320. https://doi.org/10.1016/j.cities.2004.04.004.

Kaplan, R., Kaplan, S., 1989. A Psychological Perspective, vol. 6.

Kaplan, S., 2001. Meditation, restoration, and the management of mental fatigue. Environ. Behav. 33 (4), 480–506. https://doi.org/10.1177/00139160121973106.

Koohsari, M.J., Mavoa, S., Villanueva, K., Sugiyama, T., Badland, H., Kaczynski, A.T., Owen, N., Giles-Corti, B., 2015. Public open space, physical activity, urban design and public health: concepts, methods and research agenda. Health Place 33, 75–82. https://doi.org/10.1016/j.healthplace.2015.02.009.

Korpela, K., Borodulin, K., Neuvonen, M., Paronen, O., Tyrväinen, L., 2014. Analyzing the mediators between nature-based outdoor recreation and emotional well-being. J. Environ. Psychol. 37, 1–7. https://doi.org/10.1016/j.jenvp.2013.11.003.

Korpela, K.M., Ylén, M.P., 2009. Effectiveness of favorite-place prescriptions: a field experiment. Am. J. Prev. Med. 36 (5).

Korpela, K.M., Ylén, M., Tyrväinen, L., Silvennoinen, H., 2008. Determinants of restorative experiences in everyday favorite places. Health Place 14 (4), 636–652. https://doi.org/10.1016/j.healthplace.2007.10.008.

Kruize, H., van Kamp, I., van den Berg, M., van Kempen, E., Wendel-Vos, W., Ruijsbroek, A., Swart, W., Maas, J., Gidlow, C., Smith, G., Ellis, N., Hurst, G., Masterson, D., Triguero-Mas, M., Cirach, M., Grażulevičienė, R., van den Hazel, P., Nieuwenhuijsen, M., 2020. Exploring mechanisms underlying the relationship between the natural outdoor environment and health and well-being—results from the PHENOTYPE project. Environ. Int. 134, 105173 https://doi.org/10.1016/j.envint.2019.105173.

Kuo, F.E., Sullivan, W.C., Coley, R.L., Brunson, L., 1998. Fertile ground for community: inner-city neighborhood common spaces. Am. J. Community Psychol. 26 (6), 823–851. https://doi.org/10.1023/A:1022294028903.

Lachowycz, K., Jones, A.P., 2013. Towards a better understanding of the relationship between greenspace and health: development of a theoretical framework. Landsc. Urban Plann. 118, 62–69. https://doi.org/10.1016/j.landurbplan.2012.10.012.

Lee, I., Choi, H., Bang, K.-S., Kim, S., Song, M., Lee, B., 2017. Effects of forest therapy on depressive symptoms among adults: a systematic review. Int. J. Environ. Res. Publ. Health 14 (3), 321. https://doi.org/10.3390/ijerph14030321.

Lee, K.E., Williams, K.J.H., Sargent, L.D., Williams, N.S.G., Johnson, K.A., 2015. 40-second green roof views sustain attention: the role of micro-breaks in attention restoration. J. Environ. Psychol. 42, 182–189. https://doi.org/10.1016/j.jenvp.2015.04.003.

Lin, B.B., Fuller, R.A., Bush, R., Gaston, K.J., Shanahan, D.F., 2014. Opportunity or orientation? Who uses urban parks and why. PLoS One 9 (1). https://doi.org/10.1371/journal.pone.0087422.

Lymeus, F., Lindberg, P., Hartig, T., 2018. Building mindfulness bottom-up: meditation in natural settings supports open monitoring and attention restoration. Conscious. Cognit. 59, 40–56. https://doi.org/10.1016/j.concog.2018.01.008.

Maas, J., van Dillen, S.M.E., Verheij, R.A., Groenewegen, P.P., 2009. Social contacts as a possible mechanism behind the relation between green space and health. Health Place 15 (2), 586–595. https://doi.org/10.1016/j.healthplace.2008.09.006.

McEachan, R.R.C., Prady, S.L., Smith, G., Fairley, L., Cabieses, B., Gidlow, C., Wright, J., Dadvand, P., van Gent, D., Nieuwenhuijsen, M.J., 2016. The association between green space and depressive symptoms in pregnant women: moderating roles of socioeconomic status and physical activity. J. Epidemiol. Community Health 70 (3), 253–259. https://doi.org/10.1136/jech-2015-205954.

Ministerie van Volksgezondheid, W. en S. (2004, giugno 9). *Nature and Health. The influence of nature on social, psychological and physical well-being—Advisory report—The Health Council of the Netherlands* [Publicatie]. Ministerie van Volksgezondheid, Welzijn en Sport. https://www.healthcouncil.nl/documents/advisory-reports/2004/06/09/nature-and-health.-the-influence-of-nature-on-social-psychological-and-physical-well-being.

Nieuwenhuijsen, M.J., Kruize, H., Gidlow, C., Andrusaityte, S., Antó, J.M., Basagaña, X., Cirach, M., Dadvand, P., Danileviciute, A., Donaire-Gonzalez, D., Garcia, J., Jerrett, M., Jones, M., Julvez, J., Kempen, E. van, Kamp, I. van, Maas, J., Seto, E., Smith, G., et al., 2014. Positive health effects of the natural outdoor environment in typical populations in different regions in Europe (PHENOTYPE): a study programme protocol. BMJ Open 4 (4), e004951. https://doi.org/10.1136/bmjopen-2014-004951.

Nolen-Hoeksema, S., 1991. Responses to depression and their effects on the duration of depressive episodes. J. Abnorm. Psychol. 100 (4), 569–582. https://doi.org/10.1037//0021-843x.100.4.569.

Nolen-Hoeksema, S., 2000. The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. J. Abnorm. Psychol. 109 (3), 504–511.

Nolen-Hoeksema, S., Wisco, B.E., Lyubomirsky, S., 2008. Rethinking rumination. Perspect. Psychol. Sci.: A Journal of the Association for Psychological Science 3 (5), 400–424. https://doi.org/10.1111/j.1745-6924.2008.00088.x.

Nordh, H., Grahn, P., Währborg, P., 2009. Meaningful activities in the forest, a way back from exhaustion and long-term sick leave. Urban For. Urban Green. 8 (3), 207–219. https://doi.org/10.1016/j.ufug.2009.02.005.

Pilotti, M., Klein, E., Golem, D., Piepenbrink, E., Kaplan, K., 2015. Is viewing a nature video after work restorative? Effects on blood pressure, task performance, and long-term memory. Environ. Behav. 47 (9), 947–969. https://doi.org/10.1177/0013916514533187.

Pretty, J., Peacock, J., Hine, R., Sellens, M., South, N., Griffin, M., 2007. Green exercise in the UK countryside: effects on health and psychological well-being, and implications for policy and planning. J. Environ. Plann. Manag. 50 (2). Art. 2.

Rodríguez Algeciras, J.A., Matzarakis, A., 2016. Quantification of thermal bioclimate for the management of urban design in Mediterranean climate of Barcelona, Spain. Int. J. Biometeorol. 60 (8), 1261–1270. https://doi.org/10.1007/s00484-015-1121-8.

Rossi, S.D., Byrne, J.A., Pickering, C.M., 2015. The role of distance in peri-urban national park use: who visits them and how far do they travel? Appl. Geogr. 63, 77–88. https://doi.org/10.1016/j.apgeog.2015.06.008.

Sacker, A., Cable, N., 2006. Do adolescent leisure-time physical activities foster health and well-being in adulthood? Evidence from two British birth cohorts. Eur. J. Publ. Health 16 (3), 332–336. https://doi.org/10.1093/eurpub/cki189.

Sahlin, E., Ahlborg, G., Tenenbaum, A., Grahn, P., 2015. Using nature-based rehabilitation to restart a stalled process of rehabilitation in individuals with stress-related mental illness. Int. J. Environ. Res. Publ. Health 12 (2), 1928–1951. https://doi.org/10.3390/ijerph120201928.

Sallis, J.F., Cerin, E., Conway, T.L., Adams, M.A., Frank, L.D., Pratt, M., Salvo, D., Schipperijn, J., Smith, G., Cain, K.L., Davey, R., Kerr, J., Lai, P.-C., Mitáš, J., Reis, R., Sarmiento, O.L., Schofield, G., Troelsen, J., Van Dyck, D., et al., 2016. Physical activity in relation to urban environments in 14 cities worldwide: a cross-sectional study. Lancet (London, England) 387 (10034), 2207–2217. https://doi.org/10.1016/S0140-6736(15)01284-2.

Schipperijn, J., Ekholm, O., Stigsdotter, U.K., Toftager, M., Bentsen, P., Kamper-Jørgensen, F., Randrup, T.B., 2010. Factors influencing the use of green space: results from a Danish national representative survey. Landsc. Urban Plann. 95 (3), 130–137. https://doi.org/10.1016/j.landurbplan.2009.12.010.

Selander, J., Nilsson, M.E., Bluhm, G., Rosenlund, M., Lindqvist, M., Nise, G., Pershagen, G., 2009. Long-term exposure to road traffic noise and myocardial infarction. Epidemiology 20 (2), 272–279. https://doi.org/10.1097/EDE.0b013e31819463bd.

JE Ware SF-36 Health Survey Update: Spine. (s.d.)2000. Recuperato 6 ottobre 2021, da https://journals.lww.com/spinejournal/Citation/2000/12150/SF_36_Health_Survey_Update.8.aspx.

Shanahan, D.F., Fuller, R.A., Bush, R., Lin, B.B., Gaston, K.J., 2015. The health benefits of urban nature: how much do we need? Bioscience 65 (5), 476–485. https://doi.org/10.1093/biosci/biv032.

Smith, G., Cirach, M., Swart, W., Dèdelè, A., Gidlow, C., van Kempen, E., Kruize, H., Grażulevičienė, R., Nieuwenhuijsen, M.J., 2017. Characterisation of the natural environment: quantitative indicators across Europe. Int. J. Health Geogr. 16 (1), 16. https://doi.org/10.1186/s12942-017-0090-z.

Staats, H., Kieviet, A., Hartig, T., 2003. Where to recover from attentional fatigue: an expectancy-value analysis of environmental preference. J. Environ. Psychol. 23 (2), 147–157. https://doi.org/10.1016/S0272-4944(02)00112-3.

Toohey, A.M., McCormack, G.R., Doyle-Baker, P.K., Adams, C.L., Rock, M.J., 2013. Dog-walking and sense of community in neighborhoods: implications for promoting regular physical activity in adults 50 years and older. Health Place 22, 75–81. https://doi.org/10.1016/j.healthplace.2013.03.007.

Triguero-Mas, M., Donaire-Gonzalez, D., Seto, E., Valentín, A., Martínez, D., Smith, G., Hurst, G., Carrasco-Turigas, G., Masterson, D., van den Berg, M., Ambròs, A., Martínez-Íñiguez, T., Dedele, A., Ellis, N., Grazulevicius, T., Voorsmit, M., Cirach, M., Cirac-Claveras, J., Swart, W., et al., 2017. Natural outdoor environments and mental health: stress as a possible mechanism. Environ. Res. 159, 629–638. https://doi.org/10.1016/j.envres.2017.08.048.

Ulrich, R.S., Simons, R.F., Losito, B.D., Fiorito, E., Miles, M.A., Zelson, M., 1991. Stress recovery during exposure to natural and urban environments. J. Environ. Psychol. 11 (3), 201–230. https://doi.org/10.1016/S0272-4944(05)80184-7.

van den Berg, M., van Poppel, M., van Kamp, I., Andrusaityte, S., Balseviciene, B., Cirach, M., Danileviciute, A., Ellis, N., Hurst, G., Masterson, D., Smith, G., Triguero-Mas, M., Uzdanaviciute, I., de Wit, P., van Mechelen, W., Gidlow, C., Grazuleviciene, R., Nieuwenhuijsen, M.J., Kruize, H., Maas, J., 2016a. Visiting green space is associated with mental health and vitality: a cross-sectional study in four european cities. Health Place 38, 8–15. https://doi.org/10.1016/j.healthplace.2016.01.003.

van den Berg, M., van Poppel, M., van Kamp, I., Andrusaityte, S., Balseviciene, B., Cirach, M., Danileviciute, A., Ellis, N., Hurst, G., Masterson, D., Smith, G., Triguero-Mas, M., Uzdanaviciute, I., de Wit, P., van Mechelen, W., Gidlow, C., Grazuleviciene, R., Nieuwenhuijsen, M.J., Kruize, H., Maas, J., 2016b. Visiting green space is associated with mental health and vitality: a cross-sectional study in four european cities. Health Place 38, 8–15. https://doi.org/10.1016/j.healthplace.2016.01.003.

van Dillen, S.M.E., de Vries, S., Groenewegen, P.P., Spreeuwenberg, P., 2012. Greenspace in urban neighbourhoods and residents' health: adding quality to quantity. J. Epidemiol. Community Health 66 (6), e8. https://doi.org/10.1136/jech.2009.104695.

Ware, J.E.J., Sherbourne, C.D., 1992. The MOS 36-ltem short-form health survey (SF-36): I. Conceptual framework and item selection. Med. Care 30 (6), 473–483.

White, M.P., Dolan, P., 2009. Accounting for the richness of daily activities. Psychol. Sci. 20 (8), 1000–1008. https://doi.org/10.1111/j.1467-9280.2009.02392.x.

White, M.P., Pahl, S., Ashbullby, K., Herbert, S., Depledge, M.H., 2013. Feelings of restoration from recent nature visits. J. Environ. Psychol. 35, 40–51. https://doi.org/10.1016/j.jenvp.2013.04.002.

Wolf, K.L., Robbins, A.S.T., 2015. Metro nature, environmental health, and economic value. Environ. Health Perspect. 123 (5), 390–398. https://doi.org/10.1289/ehp.1408216.

World Urbanization Prospects—Population Division—United Nations. (s.d.). 2018, Recuperato 20 novembre 2020, da https://population.un.org/wup/.