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ARTICLE

Factors associated with changes in subjective well-being immediately after urban park visit

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ABSTRACT

This study aimed to explore the amenable factors contributing to the improvement in subjective well-being (SWB) immediately after a short-term visit to an urban park in an uncontrolled condition. Ninety-four park visitors from three urban parks completed a short questionnaire evaluating SWB (with two components: affect and life satisfaction) immediately before and after their park visit. In addition, their level of physical activity was tracked by wearing an accelerometer during the park visit. Results indicated a significant improvement in SWB, affect, and life satisfaction scores of park visitor participants from before and after their visit. Duration of park visit was bivariately associated with SWB scores, and independently associated with the improvement in life satisfaction scores, controlling for parks and age, after the visit; a 20.5-min park visit predicted the highest overall accuracy (64%) improvement in life satisfaction. It is recommended that design of the park space should attract visitors to stay for at least 20 min in the park.

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Introduction

Urban green space is defined as publicly accessible open areas covered with natural vegetation, a definition that includes parks within city boundaries (Schipperijn et al. 2013). Urban parks have been recognized as key neighborhood places that provide residents with opportunities to experience nature and engage in various activities. Through contact with the natural environment and engagement in health-promoting and/or social and recreational activities in parks, users experience physical and mental health benefits such as stress reduction and recovery from mental fatigue (Abraham et al. 2010; Konijnendijk et al. 2013; Kondo et al. 2018; Twohig-Bennett and Jones 2018). Residents who reported they used urban parks regularly exhibited higher scores in well-being and life satisfaction and lower scores in psychological distress and anxiety (Konijnendijk et al. 2013; Honold et al. 2014; Coldwell and Evans 2018). Therefore, urban parks are viewed as valuable contributors to the promotion of public health.

A growing body of evidence suggests that individuals who engage in a short-term visit (e.g. less than a couple hours) to an urban park also experience physiological and psychological restorative benefits. These benefits include enhancement in well-being (increase in positive affect and decrease in negative affect), reduction in emotional stress, and relief from mental fatigue (Mayer et al. 2009; Haluza et al. 2014; McMahan and Estes 2015; Kondo et al. 2018). In addition, several systematic reviews support the synergistic beneficial effect of engaging in

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short-term physical activity in a natural environment when comparing different experimental conditions, including in urban parks, on the enhancement of well-being (Barton and Pretty, 2010; Bowler et al. 2010; Thompson Coon et al. 2011).

However, it is unclear whether the improvement in well-being after a short-term visit to an urban park is attributed to physical activity or nonphysical restorative activities such as social interaction, physical presence within the natural environment (i.e. some form of passive/sedentary activity), or a combination of different activities. Studies have investigated the impact of physical activity in a natural environment (i.e. green exercise) on the improvement of mental health outcomes (Bowler et al. 2010; Thompson Coon et al. 2011), but few examine what amenable contributing factors (e.g. activity intensity during a park visit, duration of visit, or both) lead to an improvement in mental health after a short exposure to natural green spaces such as urban parks. The purpose of this study is to explore what factors contribute to the change (i.e. improvement) in subjective well-being (SWB; including affect and life satisfaction) immediately after a short-term visit to a neighborhood urban park in an uncontrolled condition.

Method

Research design and ethical approval

This study involved a one-group pretest–posttest survey research design. The study was approved by the Institutional Review Board of the University of Alabama at Birmingham, protocol number of X160216003.

Participants

Participants were adult visitors to one of the three urban parks in Mountain Brook, Birmingham, Alabama, United States. Data were collected from 98 adult park visitors; 4 visitors reported that they participated in this study twice. Data from the second participation were excluded, resulting in 94 unique participants participating in this study.

Study parks

The city of Mountain Brook is located in Jefferson County, Alabama, a suburb of Birmingham. The city spans 33.2 km^2 (or 12.8 mi^2). Based on demographic data available from the United States Census Bureau Survey (United States Census Bureau 2013), it is estimated that the population of Mountain Brook in 2016 was 20,532 (*https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml*); 96.5% were White. The city of Mountain Brook manages seven public parks. Residents from two vicinity suburbs, Vestavia Hills (population = 34,243 with 91.1% White) and Homewood (population = 25,652 with 80.6% were White), also have easy access to these three parks.

The three urban parks included in this study were Overton Park, Jemison Park, and Cahaba River Walk. Overton Park is comprised of a large lawn area for picnics, a pavilion available to rent for events, and tennis and basketball courts. It has a large children's playground and a 0.3-km (or 0.2-mi) brick walking path. Jemison Park is a 0.2-km^2 area designed as a green way with a 1.6-km (or 1-mi) trail throughout the park. Cahaba River Walk (0.02 km^2) consists of a nature path and lookout points along the Cahaba River, with easy access to the river for fishing, swimming, and rafting. There is also a pavilion for social gatherings, some exercise equipment, and open space for free play.

These parks were selected for the study because they were the three main public parks in Mountain Brook and had a relatively high volume of visitors daily.

Procedures

Research assistants received 2 h of orientation and training as a group in the administration of the study protocol prior to participant recruitment in the parks. They were stationed in pairs at the entrance or the parking lot of the three study parks and were responsible for participant recruitment. There were recruitment signs approved by the Mountain Brook City Council posted at the entrances and the parking lots of the three parks to inform visitors about the study. Park visitors were approached by the research assistants to provide information regarding study objectives and to seek consent to participate, regardless of race, gender, or age. The inclusion criterion were adults with a self-reported age of 18 years or above, planning to stay in the park for no more than 2–3 h, and willingness to participate in this study. If those criteria were met, participants were then asked to complete a short questionnaire and to wear an ActiGraph accelerometer while in the park.

The questionnaire had two parts; the first part included questions related to background information of the participant (age, gender, race, and residency), and questions asking how often the participant visited this park, reasons for visiting the park today, and how many times they had participated in this study. The second part was a set of 15 items that measured participants' SWB, which included two standardized measures: the Satisfaction with Life Scale (SWLS; Diener et al. 1985) and the Positive Affect and Negative Affect Schedule (PANAS; Watson et al. 1988). The accelerometer was used to record participants' level of physical activity during their park visit.

Research assistants waited at the entrance or the parking lot until the participant completed the park visit to collect the accelerometer and asked them to complete the second part of the same questionnaire that they did before their park visit. Participants did not have access to their pre-park visit responses when completing the post-park visit questionnaire. The research assistants recorded the date and time on the questionnaire as the participant donned the accelerometer and headed to the park. After they completed the park visit, they were asked to complete the questionnaire again and to turn in the accelerometers.

The study started in late May and ended in early December 2016, with the majority of visitors enrolled in the month of June (36%), followed by October (23%) and July (15%). Research assistants collected data on both weekdays (95%) and weekends (5%), with the majority of visitors enrolled on Wednesday (31%), followed by Monday (22%) and Tuesday (22%). Research assistants were stationed in the parks on different times of day from 7 am to 6 pm, with the majority of visitors enrolled in the study between 4 pm and 6 pm (36%), followed by 8 am–9 am (13%) and 2 pm–3 pm (13%).

Outcome measure

The outcome measure of this study was the SWB, an indicator of mental health and commonly associated with happiness, which has been used to assess the impact of urban parks on mental health (Saw et al. 2015). The SWB was a composite of the constructs of life satisfaction and affect balance (Liang 1985; Diener 1994). The SWB score was calculated using the following formula: SWLS score + (positive affect score − negative affect score).

Life satisfaction was assessed using the SWLS (Diener et al. 1985), which is used to evaluate the global self-assessment of one's quality of life. The SWLS consists of five statements where participants indicated how much they agreed or disagreed with each statement about their life satisfaction using a 7-point Likert scale, ranging from 1 = strongly disagree to 7 = strongly agree.

Affect balance is the balance between positive and negative affect (i.e. pleasant and unpleasant emotion) and was assessed using the PANAS (Watson et al. 1988). The instrument consists of 10 affective adjective words with five positive affect (alert, inspired, determined, attentive, and

active) and five negative affect (upset, hostile, ashamed, nervous, and afraid). Participants were asked to indicate how they feel right now (i.e. immediately before and right after their park visit) as described in each of the 10 affective adjective words on a 5-point Likert scale, ranging from 1 = never to 5 = always. The affect balance score was computed by subtracting the negative affect score from the positive affect score. The Cronbach's alpha coefficient of the SWB (15 items) for this study was .63, which is considered to be acceptable (Loewenthal 2001). Whereas the Cronbach's alpha coefficient of the SWLS (5 items), and the PANAS (10 items) for this study was .82, and .52, respectively.

Data analysis

Significant difference in the response to the SWB questionnaire before and after park visit was evaluated using a paired-samples *t*-test. The objective of this study is to identify factors that contributed to the change in SWB, affect, and life satisfaction right after a short-term visit to the urban park. As expected, the change scores of the SWB, PANAS, and SWLS (response variables) were not normally distributed; therefore, data were recoded, and multivariable logistic regression analysis was performed. The mean and median of the change (improvement) in participants' SWB from before to after park visit was 1.4 unit and 1 unit, respectively. There were 59.6% of participants (n = 56) whose SWB scores improved after the park visit. Of which, 13.8% (n = 13) showed 1 unit of improvement, and 45.7% (n = 43) showed more than 1 unit of improvement. There were 40.4% of participants (n = 38) whose SWB scores did not improve after the park visit, with 12.7% (n = 12) showing no change and 27.7% (n = 26) deteriorated.

Placing the cutoff value at the median is a commonly used method to separate the ability of a group of participants into two, with one scoring above the median (i.e. improvement), and the other scoring at or below the median (no improvement; Mills and Melican 1988). The SWB change score was recoded as 1 if participants' scores between before and after park visit were greater than one point, which meant participants experienced an improvement in well-being immediately after the park visit (45.7%). The SWB change score was coded as 0 if participants' scores between before and after park visit were negative, the same (i.e. no change) or improved only one point, which meant participants perceived either no detectable change, or deterioration in well-being immediately after the park visit (54.3%).

Distribution of participants' change scores of the PANAS and SWLS after the park visit was as follows: The median of the change (improvement) in participants' PANAS scores from before to after park visit was 1 unit. There were 53.2% of participants (n = 50) whose PANAS scores improved after the park visit. Of which, 22.3% (n = 21) showed 1 unit of improvement, and 30.9% (n = 29) showed more than 1 unit of improvement. There were 46.8% of participants (n = 44) whose PANAS scores did not improve after the park visit, with 25.5% (n = 24) showing no change and 21.3% (n = 20) deteriorated. The PANAS change score was recoded as 1 if participants' scores between before and after park visit were greater than one point (30.9%, n = 29), and the PANAS change score was coded as 0 if participants' scores between before and after park visit were negative, the same, or improved only one point (69.1%, n = 65).

The median of the change (improvement) in participants' SWLS scores from before to after park visit was 0. There were 46.8% of participants (n = 44) whose SWLS scores improved after the park visit. There were 53.2% of participants (n = 50) whose SWLS scores did not improved after the park visit, with 36.2% (n = 34) showing no change and 17.0% (n = 16) deteriorated. The SWLS change score was recoded as 1 if participants' scores improved after the park visit (46.8%, n = 44), and the SWLS change score was coded as 0 if participants' scores between before and after park visit were negative or the same (53.2%, n = 50).

Potential explanatory variables included in the multivariable logistic regression model were number of steps as registered in the accelerometer, time spent in the park, mean activity intensity, which was estimated by dividing the number of steps recorded in the accelerometer by the amount of

time spent in the park (i.e. steps per minute); age; gender (female = 2 vs. male = 1); race (White = 2 vs. non-White = 1); residency: A = local (i.e. residents of the three suburbs, Mountain Brook, Vestavia Hills, and Homewood, next to the parks), B = vicinity suburb or city, other than the three suburbs, to the parks, C = another county, out of state, or oversees; park: Overton, Jemison, and Cahaba River Walk; and frequency of visit to the park (≥5 days/week = 4, 3–4 days/week = 3, 1–2 days/week = 2, and <1 day/week = 1). The prevalence of non-White in this study sample was extremely low (3%). Since extremely low-prevalence binary explanatory variables have been shown to affect model fitting (Ogundimu et al. 2016), race was not included in the model.

For the preliminary analysis related to the multivariable logistic regression modeling, explanatory variables were initially screened for consideration in the model using bivariate association between each explanatory variable and the response variable. For the adjusted analysis, a multivariable logistic regression model was fit with improvement in SWB scores as the response variable. Explanatory variables were considered as candidates for inclusion in the multivariable logistic regression analysis if they were significantly associated with the response variable (p-value < .10) in the bivariate analyses (Harrell 2001). A backward stepwise procedure was used for model building to obtain the most parsimonious sets of explanatory variables for participants' improvement in SWB scores after the park visit. Since SWB scores comprised two scales (PANAS and SWLS), analyses were also conducted to evaluate factors associated with participants' improvement in PANAS and SWLS scores after the park visit.

Explanatory variables whose regression coefficients had p-values less than .05 were retained in the multivariable logistic regression models. All data analyses were conducted using the Statistics Package for Social Sciences (SPSS) for Windows, version 23 (www.spss.com).

Receiver operating characteristic (ROC) curve analysis was performed for the explanatory variables such as park visit duration to assess the area under the curve (AUC) and identify an optimal cutoff value that indicated a high probability for participants exhibiting improvement in SWB after the park visit.

Results

The mean and standard deviation change (improvement) in participants' SWB from before to after park visit was 1.43 unit and 3.56 units, respectively, and the mean duration of park visit was 32 min (ranged from few minutes to ~1.5 h), with 45% of the participants staying more than half-an-hour in the park. There was a significant improvement in the SWB scores from before (M = 37.83, SD = 6.69) to after (M = 39.26, SD = 6.71) park visit; $t(93) = 3.88$, $p < .001$, with an effect size (Cohen's d) of .4. Significant improvement in the scores of the two SWB components (affect balance and life satisfaction) was also observed. The PANAS scores increased from before (M = 8.74, SD = 3.92) to after (M = 9.55, SD = 3.81) the park visit, $p = .004$, $d = .3$, and the SWLS scores increased from before (M = 29.09, SD = 4.32) to after (M = 29.70, SD = 4.13) the park visit, $p = .005$, $d = .3$.

Thirty percent of participants engaged in physical activity of more than 100 steps/min while they were in the park, which is equivalent to three or more metabolic equivalent of tasks (METs; Marshall et al. 2009). Three METs and above indicate that participants engaged in at least moderate intensity physical activities (Marshall et al. 2009). There was a strong association between amount of time spent in the park and number of steps recorded ($r = .8$, $p < .001$). No significant differences were found between gender and frequency of park visit, amount of time spent in the park, number of steps recorded, or mean intensity of physical activity during the park visit. There were no significant association between time in the park and deterioration in SWB ($p = .13$, $n = 26$), SWLS ($p = .45$, $n = 16$), or PANAS ($p = .28$, $n = 20$). Table 1 shows the demographic information of participants and their activity pattern for the park visit.

Table 1. Sociodemographics of participants and their activity pattern for the park visit (N = 94).

	Number (%)/mean ± SD (range)		
Variable	All participants (N = 94)	Participants whose SWB scores improved after the park visit (n = 56)	Participants whose SWB scores showed no change or deteriorated after the park visit (n = 38)
Age (years)	42.2 ± 17.5 (range: 18–86)	43.1 ± 15.7 (range: 19–75)	41.6 ± 18.8 (range: 18–86)
Female	55 (58.5%)	38 (67.9%)	17 (44.7%)
White[a]	91 (96.8%)	53 (94.6%)	38 (100%)
Residency			
Local	69 (73.4%)	41 (73.2%)	28 (73.7%)
Vicinity suburb	7 (7.5%)	4 (7.1%)	3 (7.9%)
Out of state, county, or oversees	18 (19.1%)	11 (19.6%)	7 (18.4%)
Park			
Overton	28 (29.8%)	19 (33.9%)	9 (23.7%)
Jemison	44 (46.8%)	21 (37.5%)	17 (44.7%)
Cahaba River Walk	22 (23.4%)	7 (12.5%)	12 (31.6%)
Frequency of park visit			
≥5 days/week	31 (33.0%)	18 (32.1%)	13 (34.2%)
3–4 days/week	35 (37.2%)	21 (37.5%)	14 (36.8%)
1–2 days/week	13 (13.8%)	7 (12.5%)	6 (15.8%)
<1 days/week	15 (16.0%)	10 (17.9%)	5 (13.2%)
Number of steps recorded in the accelerometer	2548.2 ± 1988.9 (range: 162–7580)	2641.1 ± 2034.3 (range: 175–7580)	2411.2 ± 1938.7 (range: 162–6048)
Time spent in the park (min)	31.9 ± 17.8 (range: 4–86)	34.7 ± 18.1 (range: 4–86)	27.9 ± 16.8 (range: 4–63)
Mean activity intensity (steps/min)	77.6 ± 35.3 (range: 8–156.3)	72.6 ± 34.6 (range: 8.0–151.8)	85.1 ± 35.5 (range: 8.6–156.3)

[a]One of each of the following non-White race/ethnicity: Asia, Black, and Hispanic.
SWB: subjective well-being.

Factors associated with participants' improvement in SWB scores after the park visit

From the results of the bivariate analyses, variables with a p-value of less than .10 included in the multivariable logistic regression model were time spent in the park (p = .036), Cahaba River Walk (p = .005), age (p = .072), and gender (p = .044). After adjusting for the explanatory variables, only Cahaba River Walk (p = .004) and gender (p = .033) were included in the final multivariable logistic regression model for participants' improvement in SWB scores after the park visit.

Factors associated with participants' improvement in PANAS scores after the park visit

From the results of the bivariate analyses, variables with a p-value of less than .10 included in the multivariable logistic regression model were Cahaba River Walk (p = .056), age (p = .022), and gender (p = .071). After adjusting for the explanatory variables, only age (p = .043) was included in the final multivariable logistic regression model for participants' improvement in PANAS scores after the park visit.

Factors associated with participants' improvement in SWLS scores after the park visit

From the results of the bivariate analyses, variables with a p-value of less than .10 included in the multivariable logistic regression model were time spent in the park (p = .064), Cahaba River Walk (p = .013), Overton Park (p = .081), and age (p = .035). After adjusting for the explanatory variables, only time spent in the park, Overton Park, and age were included in the final multivariable logistic regression model for participants' improvement in SWLS scores after the park visit. For participants who stayed one more minute in the park, a 3% improvement in the odds of the SWLS scores would be perceived right after the park visit (adjusted odds ratio (OR) = 1.03, 95% confidence interval (CI) = 1.00–1.06, p = .026). Multicollinearity was assessed using tolerance and the variance inflation factor; no multicollinearity was found among the explanatory variables. The OR of each explanatory variable with significant effect on the participants' improvement in SWLS scores after the park visit is shown in Table 2.

Figure 1 shows the ROC curve for park visit duration as an explanatory variable of improvement in SWLS after the park visit. The AUC of park visit duration for predicting improvement in SWLS after the park visit was 0.64 (95% CI: 0.52–0.75), p = .023, demonstrating that park visit duration was considered as a fair explanatory variable of improvement in SWLS after the park visit. The ROC curve and its corresponding AUC, an index of discrimination, showed that a park visit duration of 20.5 min has the predictive ability to discriminate park visitors who exhibited improvement in SWB from those who did not after the park visit. Results for the ROC curve analysis for the park visit duration for predicting improvement in SWB were in agreement with the analysis of the park visit duration for predicting improvement in SWLS, showing that a park visit duration of 19.5 min has the predictive ability to discriminate park visitors who exhibited improvement in SWB from those who did not after the park visit.

Table 2. Bivariate and multivariable logistic regression analyses examining factors associated with improvement in scores of Satisfaction with Life Scale after the park visit.

	Bivariate analysis			Multivariable analysis		
Predictor	OR	95% CI	p-value	Adj OR	95% CI	p-value
Time spent in the park (min)	1.02	1.00–1.05	.064	1.03	1.00–1.06	.026
Age (years)	0.97	0.95–1.00	.035	0.97	0.95–1.00	.032
Overton Park	2.23	0.91–5.51	.081	3.57	1.29–9.88	.014
Cahaba River Walk	0.25	0.08–0.75	.013			

Adj OR: adjusted odds ratio; CI: confidence interval.

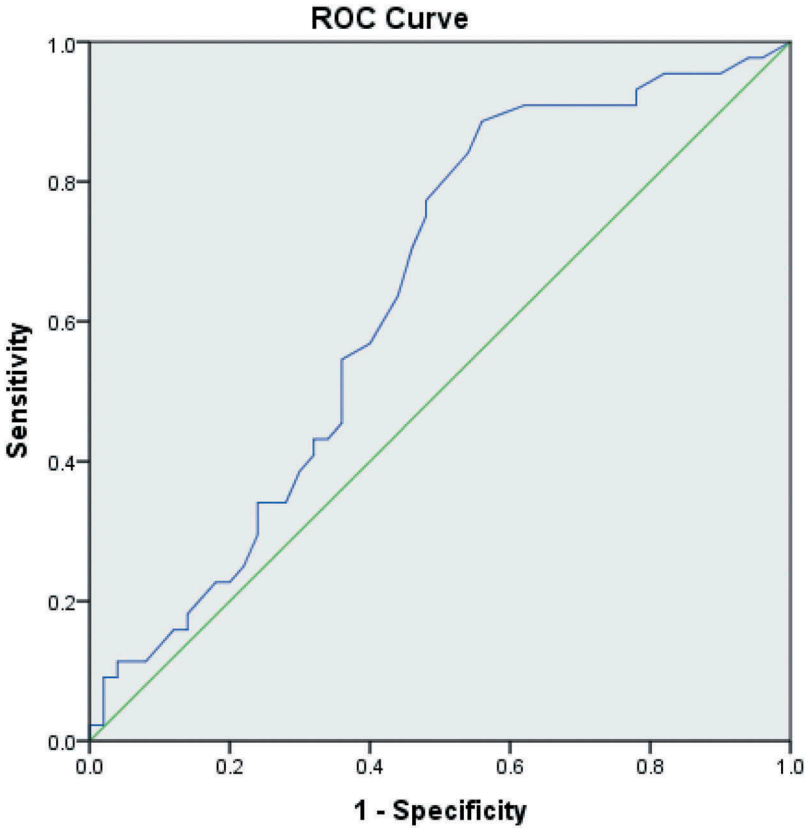

Figure 1. Area under the receiver operating characteristic (ROC) curve for the park visit duration to predict detectable improvement in scores of Satisfaction with Life Scale after park visit. Area under the curve (AUC) = 0.64, 95% confidence interval (CI) = 0.52–0.75, p = .023.

Taking the maximum Youden's index J (sensitivity + specificity − 1) as the criterion for the optimal cutoff value (Youden 1950), a score greater than or equal to the optimal cutoff value on park visit duration provided the highest overall accuracy in predicting improvement in SWLS after the park visit. Table 3 shows sensitivity and specificity over a range of cutoff values for the park visit duration. Sensitivity is the proportion of SWLS improvement that park visit duration correctly identified park visitors who actually had an improvement in SWLS. Specificity was the proportion of no SWLS improvement that park visit duration correctly identified park visitors who did not show an improvement in SWLS (Streiner and Cairney 2007; Carter et al. 2016). A cutoff park visit duration of 20.5 min could predict improvement in life satisfaction with a sensitivity of 89% and a specificity of 44%.

Discussion and conclusions

Results of this study indicated a significant improvement in SWB (including PANAS and SWLS) scores of park visitor participants from before to after their visit, and the amount of time the participants spent in the park (i.e. visit duration) was associated with the improvement in SWB and SWLS scores after the park visit. The SWB scores were bivariately associated with improvement in SWB scores after the park visit, whereas the SWLS scores were independently associated with improvement in SWLS scores after the park visit, controlling for the park and age. Findings from this study were consistent with those in the literature (Barton and Pretty, 2010; Hansmann et al. 2007;

Table 3. Using the Youden's index (*J*) to select the optimal cutoff value for the park visit duration in predicting improvement in scores of Satisfaction with Life Scale after park visit.

Id	Park visit duration (min), cutoff value	Sensitivity	Specificity	Youden's index (*J*)
1	3.000	1.000	.000	.000
2	4.500	.977	.040	.017
3	6.500	.977	.060	.037
4	8.500	.955	.100	.055
5	9.500	.955	.120	.075
6	11.000	.955	.140	.095
7	13.500	.955	.180	.135
8	16.000	.932	.220	.152
9	17.500	.909	.220	.129
10	18.500	.909	.320	.229
11	19.500	.909	.380	.289
12	**20.500**	.886	.440	**.326**
13	21.500	.841	.460	.301
14	22.500	.795	.500	.295
15	23.500	.773	.520	.293
16	24.500	.750	.520	.270
17	25.500	.705	.540	.245
18	26.500	.636	.560	.196
19	28.500	.568	.600	.168
20	30.500	.545	.640	.185
21	31.500	.500	.640	.140
22	32.500	.455	.640	.095
23	33.500	.432	.660	.092
24	34.500	.432	.680	.112
25	36.000	.409	.680	.089
26	37.500	.386	.700	.086
27	38.500	.341	.720	.061
28	39.500	.341	.740	.081
29	40.500	.341	.760	.101
30	41.500	.295	.760	.055
31	43.000	.250	.780	.030
32	44.500	.227	.800	.027
33	47.000	.227	.820	.047
34	49.500	.205	.840	.045
35	50.500	.182	.860	.042
36	51.500	.159	.860	.019
37	52.500	.159	.880	.039
38	53.500	.136	.900	.036
39	54.500	.114	.920	.034
40	57.000	.114	.940	.054
41	59.500	.114	.960	.074
42	61.500	.091	.960	.051
43	63.500	.091	.980	.071
44	66.500	.068	.980	.048
45	73.500	.045	.980	.025
46	81.500	.023	.980	.003
47	85.500	.023	1.000	.023
48	87.000	.000	1.000	.000

Note. The maximum *J* value is in bold.

White et al. 2013; Carrus et al. 2015) that length of visit to an urban park is an important factor related to psychological restorative benefits. This study supported Barton and Pretty's argument that urban green space contributed to enhancement of SWB beyond being physically active in the natural environment as visit duration has also shown beneficial effects on the visitors' mental health (Barton and Pretty, 2010). The ROC analysis showed that park visit duration was somewhat better than chance in correctly discriminating between participants' improvement in SWB or life satisfaction and those who did not improve after the park visit. Evaluation of the area under the ROC curves demonstrated that, among park visitors, a park visit duration of 20 min provided modest overall accuracy for improvement in SWB or life satisfaction.

Changes in SWB of the park visitors observed in this study could be explained by the Stress Recovery Theory (Ulrich et al. 1991). It is suggested that natural green space can facilitate stress recovery through autonomic nervous system changes that enhance positive affect and diminish negative affect (Bowler et al. 2010; Lovell et al. 2014; McMahan and Estes 2015). Therefore, improvements in participants' SWB could be mediated through perceived psychological restoration and stress recovery (Carrus et al. 2015) and increased connectedness to nature (Mayer et al. 2009).

This study validated that a short-term direct exposure to the urban parks promote positive changes in SWB (i.e. affect and life satisfaction), and these changes were associated with participants' visit duration. Whether such a short-term effect on the change in SWB or life satisfaction resulted in longer term health benefits if park visitors exposure to urban park was on a regular basis was unclear. Even though the present study did not investigate the longer term sustained effect of enhancement in SWB or life satisfaction after urban park visit, existing literature (Barton et al. 2012; Korpela et al. 2016) has provided some evidence on the culminated and sustained effect of individual park visit session on improving mental well-being.

Limitations

Data on reasons to the park visit were collected before participants' entered the park instead of after the visit, and the response was open-ended. As a result, it was unclear exactly what activities the participants were engaged during the park visit, and categorization of these data to provide quantitative analysis was limited. About three quarters of participants indicated that they came to the park to walk their dog, or to walk, run, or exercise, and several participants indicated that they walked or played with friends or their children, but the exact number of participants for each category cannot be verified as some wrote they performed multiple categories of activities. The study time frame was limited to only 6 months with summer and fall seasons, excluding the winter and spring months. Also, the research assistants did not stay in the three parks continuously from 7 am to 6 pm everyday (weekdays and weekends) throughout the entire 6 months. The duration of the participants' stay in the park was slightly less than 1.5 h, which limited the interpretation of the findings beyond this duration. Comparison of visit duration and improvement in SWB or life satisfaction across the three parks was not conducted as the sample size of park visitors of each park was relatively small. Finally, it would have strengthened the validity of the findings, had there been a control group included to adjust for the changes in mood changes over time.

Implications for practice and advancement of research

The results of this study showed that improvement in SWB and SWLS scores was associated with the duration of time spent in urban parks. This dose–response indicated that by increasing the minutes of participants to stay in the park would increase the odds or chances for their improvement in SWB or life satisfaction after the park visit. Therefore, it is imperative that urban planners and landscape architects factor in duration of time visitors spent in the park as an outcome of the success of the park design. This study suggests that designing space to ensure that visitors are motivated to spend more time per park visit will enhance the well-being benefits. To achieve this objective, urban planners and landscape architects need to ensure that parks are not overdesigned but focus on trees, grass, walkways, and rest areas so that they satisfy the needs of a broad range of visitors. Increased biodiversity and quality of green areas may help attract visitors stay longer in the park (Pazhouhanfar 2018), and exposure to biodiversity has also been shown to improve well-being (Lovell et al. 2014). Parks should retain or enhance the natural contours of land and allow the visitors to both see and walk through it. Features within the park should capture the attention and imagination of visitors, allowing time

for discovery and restoration through the inclusion of walkways for intentional walking and features and elements that promote satisfaction and engagement. The goal of designers should be to motivate visitors to remain in the space beyond a fleeting visit, and this will be achieved by creating space that interest people and that people value parks as part of their neighborhood.

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