Research Reports

The Relationship between the Use of Green Spaces and Public Gardens in the Work Place on Mental Well-being, Quality of Life, and Job Satisfaction for Employees and Volunteers

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SUMMARY. Research investigating the relationship between physical environments and various aspects of quality of life have found that people who live or work near natural areas have improved health and increased levels of satisfaction at home, work, and with life in general. Research has also shown that workers who performed their job function in offices with windows or interior plants had higher job satisfaction. The purpose of the current study was to investigate the relationship between the use of green spaces and public gardens in the work place on mental well-being, overall quality of life, and job satisfaction. The sample for this study was drawn from participants who were on the contact list of public garden employees and volunteers for a winter in-service training hosted by the Smithsonian Gardens (Washington, DC). Participants were e-mailed asking for their participation in the survey. An incentive of winning a greenhouse tour was used to improve the response rate. A total of 105 usable surveys were received out of 423 invitations that were sent for a response rate of 24.8%. Participants were asked to respond to questions regarding their work environment, mental well-being, overall quality of life, and job satisfaction. Differences were identified based on whether the participant was a paid employee or unpaid worker. Based on time spent outdoors during the workday, the only difference within the overall group existed with regard to how frequently the participant ate outdoors and their reported mental well-being. On the quality of life questions, differences for the overall sample, the paid group, and the unpaid group were found for having window views of plants or nature. On the job satisfaction question, differences were identified in the overall sample and the paid group for having a window in their immediate office or workplace. Several variables did not identify any statistically significant difference, which might result from this sample being already largely connected to nature due to their employment or volunteer work within a public garden.

Research investigating the relationship between physical environments and various

aspects of quality of life have found that, “people with access to nearby natural settings have been found to be healthier overall than other individuals” including increased levels of satisfaction at home, work, and with life in general (Kaplan and Kaplan, 1989). This concept of nearby nature can be extended to scenes of nature

as well. For example, Ulrich (1981) found that when viewing slides of nature as opposed to slides of views of urban areas, participants increased attentiveness and positive mood, especially when such natural scenes included water. Another study found similar psychological effects on individuals with views of distant mountains (Heerwagen, 1990; White and Heerwagen, 1998). Even incarcerated criminals with window views of natural areas have reported less incidence of illness when compared with those without window views of natural areas (Moore, 1981).

Furthermore, numerous researchers have found that mood improves and pleasure increases when viewing scenes with vegetation. For example, Hull and Harvey (1989) found that participants’ reported pleasure increased with increased tree density when viewing slides of a suburban park. In addition, when Thayer and Atwood (1978) asked participants to rate five landscape types, suburban residential, industrial, urban commercial, city park, and strip highway (in each of these groupings, two slides were used, one with plants, and one without) on scales rating the pleasantness of the scene, they found that participants who viewed slides with plants rated the scenes as more pleasing when compared with those who viewed slides without plants in all of the five landscape types. Similarly, Sheets and Manzer (1991) asked participants to rate scenes that varied only in the amount and size of plant materials shown. Groups who viewed the vegetation scenes rated the surrounding inhabitants of the viewed area as having higher quality of life and expressed higher affective pleasure when compared with groups who rated the non-vegetation scenes. In a similar study, Galindo and Rodriguez (2000) found that participants who rated scenes as aesthetically pleasing also rated their mood more positively than those who rated their scenes with low aesthetic scores. Furthermore, 25% of participants who rated their scene as aesthetically pleasing gave reasons pertaining to the naturalness of the scene and 24% of individuals who rated their scene as aesthetically poor gave reasons pertaining to lack of naturalness. Wolf (1996) also explained that research has revealed that urban forests also provide a more satisfying quality of life for

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urban residents. With findings such as these that indicated a relationship between the physical environment and mood, researchers have concluded that human responses to vegetation are aesthetic, affective, and cognitive (Sheets and Manzer, 1991). These findings indicate that nature, even in modest quantities, can have a positive influence on residents who live nearby.

The relationship between physical environment and human response is physiological as well. Ulrich (1984) also found that surgery patients recovered faster when they had windows with views of nature in their rooms than those patients without such views. Individuals driving with vegetation along the roadsides have lower stress levels and quicker recovery from stress when compared with those driving in areas with no vegetation along the highway (Parsons et al., 1998). These findings indicated that human response to the physical environment transcended psychological well-being, and also included physiological well-being.

Several studies have found physiological differences in individuals who worked in areas with plants or natural views when compared with those working in areas without them. Employees report fewer incidences of headaches and other illness when having a view of nature at work. In addition, Lohr et al. (1996) found that plants in an office-type environment both increased productivity and decreased stress. Finally, Chang and Chen (2005) conducted a study measuring psychophysiological responses to window views and indoor plants in the workplace. Their findings indicated that participants were less nervous and experienced less anxiety when in a room with interior plants or a view of outside nature.

Studies have also shown workers who performed their job function in offices with windows or interior plants had higher job satisfaction. Randall and Shoemaker (1992) found a positive relationship between job satisfaction and the presence of interior plants in the workspace in an office in northern Virginia. Similarly, Dravigne et al. (2008) found that live interior plants and window views of green spaces appeared to positively influence employees' perceptions of

Table 1. Pearson product-moment correlations for statement responses from Smithsonian Gardens (Washington, DC) employees and volunteers indicating time spent in each activity outdoors in a nicely landscaped area, natural area, or other green space or garden area during the typical work shift, excluding periods of inclement weather and the Warwick-Edinburgh mental well-being scale score (WEMWBS) in the study of the relationship between the use of green spaces and public gardens in the work place on mental well-being, quality of life, and job satisfaction for employees and volunteers.

Statement		WEMWBS score
Overall sample	Overall	
	Pearson correlation	0.050
	<i>P</i>	0.613
Walking through	<i>n</i>	105
	Pearson correlation	0.131
	<i>P</i>	0.184
Eat	<i>n</i>	105
	Pearson correlation	0.251*
	<i>P</i>	0.010
Taking a break	<i>n</i>	105
	Pearson correlation	0.117
	<i>P</i>	0.234
Socializing	<i>n</i>	105
	Pearson correlation	0.124
	<i>P</i>	0.207
Job duties	<i>n</i>	105
	Pearson correlation	0.063
	<i>P</i>	0.525
Paid employees only	<i>n</i>	105
	Pearson correlation	0.084
	<i>P</i>	0.569
Walking through	<i>n</i>	48
	Pearson correlation	0.044
	<i>P</i>	0.768
Eat	<i>n</i>	48
	Pearson correlation	0.328*
	<i>P</i>	0.023
Taking a break	<i>n</i>	47
	Pearson correlation	0.092
	<i>P</i>	0.536
Socializing	<i>n</i>	48
	Pearson correlation	0.082
	<i>P</i>	0.581
Job duties	<i>n</i>	48
	Pearson correlation	-0.008
	<i>P</i>	0.955
Unpaid workers only	<i>n</i>	48
	Pearson correlation	0.061
	<i>P</i>	0.655
Walking through	<i>n</i>	57
	Pearson correlation	0.248
	<i>P</i>	0.062
Eat	<i>n</i>	57
	Pearson correlation	0.206
	<i>P</i>	0.124
Taking a break	<i>n</i>	57
	Pearson correlation	0.168
	<i>P</i>	0.213
	<i>n</i>	57

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Table 1. (Continued) Pearson product-moment correlations for statement responses from Smithsonian Gardens (Washington, DC) employees and volunteers indicating time spent in each activity outdoors in a nicely landscaped area, natural area, or other green space or garden area during the typical work shift, excluding periods of inclement weather and the Warwick-Edinburgh mental well-being scale score (WEMWBS) in the study of the relationship between the use of green spaces and public gardens in the work place on mental well-being, quality of life, and job satisfaction for employees and volunteers.

Statement		WEMWBS score
Socializing	Pearson correlation	0.164
	<i>P</i>	0.223
	<i>n</i>	57
Job duties	Pearson correlation	0.123
	<i>P</i>	0.360
	<i>n</i>	57

*Statistically significant at the 0.05 level.

overall job satisfaction (particularly for males), employees' perceptions of their overall life quality, and employees' perceptions of their physical work environment. Although past research has focused on live plants or window views in the workplace, few studies look at the impact of walking through natural areas outdoors during the workday.

It is also important to consider volunteers in nonprofit organizations, as both types of workers often do similar types of work for an organization. Volunteers and employees tend to have similar characteristics (Light, 2002); however, the nature of the nonobligatory work of volunteers means there are inherent differences in their satisfaction (Boezeman and Ellemers, 2009). Since the context of their work is different, organizations looking to improve the health and longevity of their work and volunteer force should consider both types of workers, but with consideration of their status as employees or volunteers (Johns, 2006).

The purpose of the current study was to investigate the relationship between the use of green spaces and public gardens in the work place on mental well-being, overall quality of life, and job satisfaction with consideration of both employees and volunteers. The hypothesis of this study is that people who spend more time in natural or landscape areas during the workday, or who have window views of natural areas or live plants in their office will have higher scores on the mental well-being, quality of life, and job satisfaction questions.

Materials and methods

SAMPLE. The sample for this study was drawn from participants who were on the contact list of public garden employees and volunteers for a winter in-service training hosted by the Smithsonian Gardens (Washington, DC). This training program is held yearly and is offered to all public garden employee and volunteers in the mid-Atlantic United States. An e-mail was sent to all of the people who were enrolled on this mailing list inviting their participation. The research project was also announced at each of the in-service training dates. This sample was a convenience sample and it is likely that some, or many, of this group would fit within the group of people who used green spaces regularly through the course of their work whether paid or unpaid. Since the researcher had access to both employees and volunteers, data were collected for both samples. Thus, data were analyzed with the entire sample as well as subsamples of paid employees and unpaid workers.

INSTRUMENT. The survey for this project was composed of questions that asked the participant to indicate whether they had a window within their immediate office or within the overall office area, and if so, to indicate whether they had views of live plants or trees. Participants were also asked whether there were live trees or plants within the interior of the office space or building, and if there was a common outdoor area with plants or trees in which employees could take breaks. These work environment questions were modeled after

previous studies investigating employee job satisfaction related to the presence of interior live plants or window views of plants or trees (Dravigne et al., 2008).

Additional work environment questions were added to the survey asking participants to quantify the amount of time they spent in various outdoor activities through the course of a typical work-shift. This section of the survey was modeled after a previous study that investigated students' use of campus green-spaces but was adapted to apply only questions that related to a workplace setting (McFarland et al., 2008, 2010). Specifically, participants responded to a statement asking them, "Please indicate an average of how often you spend time in each of the following activities outdoors in a nicely landscaped area, natural area, or other green space or garden area during the typical work shift, excluding periods of inclement weather." Participants responded to five specific activity statements, including "walking through," "eating," "taking a break," "socializing," and "performing job duties," and one overall statement on a 5-point Likert-type (Likert, 1967) scale with answer choices ranging from "never" to "multiple times every day or for most of the day." A value of 1 was assigned to the response "never," 2 to the response "once per month or less," 3 to the response "at least once weekly, but not every day," 4 to the response "about once every day, for only part of the day," and 5 to the response "multiple times every day or for most of the day."

The second section of the survey included questions asking participants to rate various aspects of their quality of life or mental well-being. The first part of this section asked participants to respond to the Warwick-Edinburgh mental well-being scale [WEMWBS (Tennant et al., 2007)]. The WEMWBS was developed and validated for use in the United Kingdom, but has also been used within the United States (Sandvik et al., 2009). The WEMWBS is a revised and shortened version of the Affectometer 2, which has previously been identified as a superior instrument in measuring subjective well-being or quality of life (Sandvik et al., 2009; Tennant et al., 2007).

Table 2. *T* test comparisons identifying differences in mean scores on the Warwick-Edinburgh mental well-being scale based on responses from Smithsonian Gardens (Washington, DC) employees and volunteers to questions regarding windows, window views, and the presence of live plants in the office in the study of the relationship between the use of green spaces and public gardens in the work place on mental well-being, quality of life, and job satisfaction for employees and volunteers.

Question		n	Mean	SD	<i>t</i>	df	<i>P</i>
Overall sample							
Do you have a window in your immediate office or workspace?	Yes	59	56.40	7.94	−1.935	90	0.056
	No	33	53.15	7.36			
Does the window in your immediate office or workspace have a view of plants and/or trees?	Yes	55	56.63	7.41	−1.158	62	0.251
	No	9	53.44	9.19			
Are there other windows in your office area that are outside of your immediate office or workspace?	Yes	70	55.74	7.89	−0.842	86	0.402
	No	18	54.00	7.57			
Do any of the windows have views of plants and/or trees?	Yes	68	56.21	7.80	−1.846	72	0.069
	No	6	50.17	5.95			
Do you have live plants inside your immediate office or workspace?	Yes	71	56.24	7.04	−2.041	95	0.044*
	No	26	52.73	8.67			
If you work in a building, are there other live plants in your building such as an indoor atrium, common spaces or lobby entranceway?	Yes	52	56.48	8.64	−1.159	76	0.250
	No	26	54.27	6.29			
Paid employees only							
Do you have a window in your immediate office or workspace?	Yes	35	55.26	6.61	−2.288	46	0.027*
	No	13	50.08	7.90			
Does the window in your immediate office or workspace have a view of plants and/or trees?	Yes	31	55.00	6.35	0.478	36	0.635
	No	7	56.29	6.80			
Are there other windows in your office area that are outside of your immediate office or workspace?	Yes	40	54.50	6.89	−1.037	45	0.305
	No	7	51.43	9.13			
Do any of the windows have views of plants and/or trees?	Yes	37	54.95	7.03	−1.738	40	0.90
	No	5	49.20	6.10			
Do you have live plants inside your immediate office or workspace?	Yes	30	55.43	5.75	−1.749	44	0.087
	No	16	51.53	9.28			
If you work in a building, are there other live plants in your building such as an indoor atrium, common spaces or lobby entranceway?	Yes	25	54.76	7.69	−0.665	39	0.510
	No	16	53.19	6.87			
Unpaid workers only							
Do you have a window in your immediate office or workspace?	Yes	24	58.08	9.46	−1.178	42	0.245
	No	20	55.15	6.41			
Does the window in your immediate office or workspace have a view of plants and/or trees?	Yes	24	58.75	8.25	−2.454	24	0.022*
	No	2	43.50	12.02			
Are there other windows in your office area that are outside of your immediate office or workspace?	Yes	30	57.40	8.90	−0.602	39	0.551
	No	11	55.64	6.31			
Do any of the windows have views of plants and/or trees?	Yes	31	57.71	8.49	−0.314	30	0.756
	No	1	55.00				
Do you have live plants inside your immediate office or workspace?	Yes	41	56.83	7.86	−0.808	49	0.423
	No	10	54.60	7.66			
If you work in a building, are there other live plants in your building such as an indoor atrium, common spaces or lobby entranceway?	Yes	27	58.07	9.30	−0.666	35	0.510
	No	10	56.00	5.08			

*Statistically significant at the 0.05 level.

The WEMWBS has been shown to have high validity and reliability [$\alpha = 0.91$ (Gall et al., 2006; Tennant et al., 2007)]. The scale was funded by the Scottish Executive National Program for improving mental health and well-being, commissioned by NHS Health Scotland, developed by the University of Warwick and the University of Edinburgh, and is jointly owned by NHS Health Scotland, the University of Warwick, and the University of Edinburgh. Permission to use this scale was requested and obtained

(F. Taggart, personal communication). Published instructions for use and scoring were followed (Stewart-Brown and Janmohamed, 2008). Some examples of questions on the scale include, "I've been feeling optimistic about the future," and "I've been feeling confident." The possible range of scores on this scale was 14 to 70, which is calculated by summing the responses of statements on a Likert-type scale (Likert, 1967) per the WEMWBS instructions, with higher scores indicating

more positive mental well-being and lower scores indicating less positive mental well-being.

Two additional questions regarding overall quality of life were asked and were modeled after previous studies on quality of life (Dravigne et al., 2008; McFarland et al., 2008, 2010; Waliczek et al., 1996), which showed these questions to be valid and reliable. These questions were "overall, how would you rank the quality of your life?" and "when all things in your life are

Table 3. Pearson product-moment correlations for statement responses from Smithsonian Gardens (Washington, DC) employees and volunteers indicating time spent in each activity outdoors in a nicely landscaped area, natural area, or other green space or garden area during the typical work shift, excluding periods of inclement weather and quality of life statement responses in the study of the relationship between the use of green spaces and public gardens in the work place on mental well-being, quality of life, and job satisfaction for employees and volunteers.

Statement		When all things in your life are considered, how do you feel today?	Overall, how would you rate the quality of your life?
Overall sample			
Overall	Pearson correlation	0.065	0.058
	<i>P</i>	0.513	0.556
	<i>n</i>	104	104
Walking through	Pearson correlation	0.145	0.106
	<i>P</i>	0.141	0.283
	<i>n</i>	104	104
Eat	Pearson correlation	0.132	0.157
	<i>P</i>	0.181	0.112
	<i>n</i>	104	104
Taking a break	Pearson correlation	0.041	0.129
	<i>P</i>	0.679	0.193
	<i>n</i>	104	104
Socializing	Pearson correlation	0.105	0.119
	<i>P</i>	0.290	0.229
	<i>n</i>	104	104
Job duties	Pearson correlation	0.148	0.144
	<i>P</i>	0.133	0.145
	<i>n</i>	104	104
Paid employees only			
Overall	Pearson correlation	0.202	0.019
	<i>P</i>	0.168	0.900
	<i>n</i>	48	48
Walking through	Pearson correlation	0.241	0.023
	<i>P</i>	0.099	0.879
	<i>n</i>	48	48
Eat	Pearson correlation	0.240	0.129
	<i>P</i>	0.100	0.384
	<i>n</i>	48	48
Taking a break	Pearson correlation	0.095	0.077
	<i>P</i>	0.519	0.603
	<i>n</i>	48	48
Socializing	Pearson correlation	0.184	0.100
	<i>P</i>	0.211	0.500
	<i>n</i>	48	48
Job duties	Pearson correlation	0.204	0.065
	<i>P</i>	0.165	0.662
	<i>n</i>	48	48
Unpaid workers only			
Overall	Pearson correlation	-0.015	0.184
	<i>P</i>	0.911	0.174
	<i>n</i>	56	56
Walking through	Pearson correlation	0.123	0.309*
	<i>P</i>	0.365	0.020
	<i>n</i>	56	56
Eat	Pearson correlation	0.049	0.207
	<i>P</i>	0.719	0.126
	<i>n</i>	56	56
Taking a break	Pearson correlation	0.025	0.260
	<i>P</i>	0.853	0.053
	<i>n</i>	56	56

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Table 3. (Continued) Pearson product-moment correlations for statement responses from Smithsonian Gardens (Washington, DC) employees and volunteers indicating time spent in each activity outdoors in a nicely landscaped area, natural area, or other green space or garden area during the typical work shift, excluding periods of inclement weather and quality of life statement responses in the study of the relationship between the use of green spaces and public gardens in the work place on mental well-being, quality of life, and job satisfaction for employees and volunteers.

Statement		When all things in your life are considered, how do you feel today?	Overall, how would you rate the quality of your life?
Socializing	Pearson correlation	0.041	0.163
	<i>P</i>	0.762	0.229
	<i>n</i>	56	56
Job duties	Pearson correlation	0.104	0.259
	<i>P</i>	0.445	0.054
	<i>n</i>	56	56

*Statistically significant at the 0.05 level.

Table 4. *T* test comparisons identifying differences in mean responses to two quality of life questions based on responses from Smithsonian Gardens (Washington, DC) employees and volunteers to questions regarding windows, window views, and the presence of live plants in the office in the study of the relationship between the use of green spaces and public gardens in the work place on mental well-being, quality of life, and job satisfaction for employees and volunteers.

Question		n	Mean	SD	<i>t</i>	df	<i>P</i>
Overall sample							
When all things in your life are considered, how do you feel today?							
Do you have a window in your immediate office or workspace?	Yes	59	4.37	0.79	-1.609	90	0.111
	No	33	4.09	0.84			
Does the window in your immediate office or workspace have a view of plants and/or trees?	Yes	55	4.44	0.74	-1.987	62	0.051
	No	9	3.89	0.93			
Are there other windows in your office area that are outside of your immediate office or workspace?	Yes	70	4.33	0.76	-1.046	86	0.298
	No	18	4.11	0.90			
Do any of the windows have views of plants and/or trees?	Yes	68	4.40	0.76	-2.204	72	0.031*
	No	6	3.67	1.03			
Do you have live plants inside your immediate office or workspace?	Yes	70	4.40	0.73	-1.812	94	0.073
	No	26	4.08	0.89			
If you work in a building, are there other live plants in your building such as an indoor atrium, common spaces or lobby entranceway?	Yes	52	4.27	0.82	0.198	76	0.844
	No	26	4.31	0.78			
Overall, how would you rate the quality of your life?							
Do you have a window in your immediate office or workspace?	Yes	59	4.47	0.79	-1.152	48.999	0.255
	No	33	4.21	1.16			
Does the window in your immediate office or workspace have a view of plants and/or trees?	Yes	55	4.56	0.63	-1.458	8.569	0.180
	No	9	3.89	1.36			
Are there other windows in your office area that are outside of your immediate office or workspace?	Yes	70	4.43	0.86	-0.840	86	0.298
	No	18	4.22	1.17			
Do any of the windows have views of plants and/or trees?	Yes	68	4.43	0.97	-1.026	72	0.308
	No	6	4.00	1.10			
Do you have live plants inside your immediate office or workspace?	Yes	70	4.61	0.73	-2.704	32.762	0.011*
	No	26	3.96	1.14			
If you work in a building, are there other live plants in your building such as an indoor atrium, common spaces or lobby entranceway?	Yes	52	4.42	0.89	-1.167	76	0.247
	No	26	4.15	1.08			
Paid employees only							
When all things in your life are considered, how do you feel today?							
Do you have a window in your immediate office or workspace?	Yes	35	4.29	0.75	-1.987	46	0.053
	No	13	3.77	0.93			
Does the window in your immediate office or workspace have a view of plants and/or trees?	Yes	31	4.29	0.78	-0.459	36	0.649
	No	7	4.14	0.39			
Are there other windows in your office area that are outside of your immediate office or workspace?	Yes	40	4.28	1.11	-1.822	45	0.075
	No	7	3.71	0.68			
Do any of the windows have views of plants and/or trees?	Yes	37	4.32	0.71	-2.658	40	0.011*
	No	5	3.40	0.89			

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Table 4. (Continued) T test comparisons identifying differences in mean responses to two quality of life questions based on responses from Smithsonian Gardens (Washington, DC) employees and volunteers to questions regarding windows, window views, and the presence of live plants in the office in the study of the relationship between the use of green spaces and public gardens in the work place on mental well-being, quality of life, and job satisfaction for employees and volunteers.

Question		n	Mean	SD	t	df	P
Do you have live plants inside your immediate office or workspace?	Yes	30	4.33	0.66	-1.676	44	0.101
	No	16	3.94	0.93			
If you work in a building, are there other live plants in your building such as an indoor atrium, common spaces or lobby entranceway?	Yes	25	4.12	0.78	-0.020	9	0.984
	No	16	4.13	0.81			
Overall, how would you rate the quality of your life?							
Do you have a window in your immediate office or workspace?	Yes	35	4.40	0.74	-2.125	14.566	0.051
	No	13	3.54	1.39			
Does the window in your immediate office or workspace have a view of plants and/or trees?	Yes	31	4.42	0.72	-0.878	36	0.386
	No	7	4.14	0.90			
Are there other windows in your office area that are outside of your immediate office or workspace?	Yes	40	4.35	0.80	1.574	6.603	0.162
	No	7	3.43	1.51			
Do any of the windows have views of plants and/or trees?	Yes	37	4.30	1.00	-1.037	40	0.306
	No	5	3.80	1.10			
Do you have live plants inside your immediate office or workspace?	Yes	30	4.53	0.57	-2.919	18.339	0.009*
	No	16	3.56	1.26			
If you work in a building, are there other live plants in your building such as an indoor atrium, common spaces or lobby entranceway?	Yes	25	4.28	0.94	-1.057	39	0.297
	No	16	3.94	1.12			
Unpaid workers only							
When all things in your life are considered, how do you feel today?							
Do you have a window in your immediate office or workspace?	Yes	24	4.50	0.83	-0.836	42	0.408
	No	20	4.30	0.73			
Does the window in your immediate office or workspace have a view of plants and/or trees?	Yes	24	4.63	0.65	-3.172	24	0.004*
	No	2	3.00	1.41			
Are there other windows in your office area that are outside of your immediate office or workspace?	Yes	30	4.40	0.86	-0.127	39	0.900
	No	11	4.36	0.67			
Do any of the windows have views of plants and/or trees?	Yes	31	4.48	0.81	0.626	30	0.536
	No	1	5.00				
Do you have live plants inside your immediate office or workspace?	Yes	40	4.45	0.78	-0.537	48	0.594
	No	10	4.30	0.82			
If you work in a building, are there other live plants in your building such as an indoor atrium, common spaces or lobby entranceway?	Yes	27	4.41	0.84	0.643	35	0.524
	No	10	4.60	0.70			
Overall, how would you rate the quality of your life?							
Do you have a window in your immediate office or workspace?	Yes	24	4.58	0.88	0.268	42	0.790
	No	20	4.65	0.75			
Does the window in your immediate office or workspace have a view of plants and/or trees?	Yes	24	4.75	0.44	-0.874	1.004	0.542
	No	2	3.00	2.83			
Are there other windows in your office area that are outside of your immediate office or workspace?	Yes	30	4.53	0.94	0.653	39	0.517
	No	11	4.73	0.47			
Do any of the windows have views of plants and/or trees?	Yes	31	4.58	0.92	0.447	30	0.658
	No	1	5.00				
Do you have live plants inside your immediate office or workspace?	Yes	41	4.68	0.83	-0.272	48	0.787
	No	10	4.60	0.52			
If you work in a building, are there other live plants in your building such as an indoor atrium, common spaces or lobby entranceway?	Yes	27	4.56	0.85	-0.170	35	0.866
	No	10	4.50	0.97			

*Statistically significant at the 0.05 level.

considered, how do you feel today?" Participants rated these statements on a 5-point Likert-type scale (Likert, 1967). The statements were scored such that the least positive response scored only 1 point and the most positive response scored 5 points.

A single question asking about job satisfaction was asked. Single statements have been verified to be appropriate for research on job satisfaction, and in fact some researchers believe them to be superior to multi-item scales for this purpose as it

allows a respondent to consider every aspect they consider to be important, rather than only those factors the researcher considers important (Nagy, 2002; Wanous et al., 1997). The question "overall, how satisfied are you with your job?" was asked

on a 5-point Likert-type (Likert, 1967) as suggested by previous researchers on job satisfaction (Nagy, 2002; Scarpello and Campbell, 1983). The rating was scored by assigning 5 points to the answer of “very satisfied” and 1 point to the answer “very dissatisfied.”

In the third and final section of this survey, standard demographic questions were asked and were modeled after previous studies (Dravigne et al., 2008). Specifically, questions pertaining to age, gender, ethnicity, marital status, hours worked per week, and average commute time to work were asked. The initial question on the survey asked people to consider only one place of work or volunteerism, and to indicate whether they were answering the survey as an employee or as a volunteer. Each of these demographic categories were used to ensure the control and treatment samples were similar.

DATA COLLECTION. Participants were e-mailed asking for their participation in the survey. An incentive of winning a Smithsonian Gardens greenhouse tour (normally only accessible by specific Smithsonian Gardens employees) was used to improve the response rate. A total of 105 usable surveys were received out of 423 invitations that were sent for a response rate of 24.8%. Nonresponse was not controlled; however, multiple invitations and reminders were distributed. Data were collected continuously from February to March.

DATA ANALYSIS. Data were collected using Constant Contact (Waltham, MA) and then downloaded into an Excel spreadsheet (version 12.0; Microsoft, Redmond, WA). Data in the Excel file were organized and coded and then imported into SPSS (version 17.0™; IBM Corp., Armonk, NY).

Pearson's product-moment correlations were calculated between the WEMWBS, the two quality of life statements, and the job satisfaction statement and each measure of spending time outdoors during the workday for paid and unpaid workers individually and for the overall sample. In addition, *t* tests were calculated for each responder category on each window, window view, and live plants within the office question comparing the mean scores on the WEMWBS scale, the two quality of

Table 5. Pearson product-moment correlations for statement responses from Smithsonian Gardens (Washington, DC) employees and volunteers indicating time spent in each activity outdoors in a nicely landscaped area, natural area, or other green space or garden area during the typical work shift, excluding periods of inclement weather and the job satisfaction question in the study of the relationship between the use of green spaces and public gardens in the work place on mental well-being, quality of life, and job satisfaction for employees and volunteers.

Statement		Overall, how satisfied are you with your job?
Overall sample		
Overall	Pearson correlation	0.063
	<i>P</i>	0.522
	<i>n</i>	104
Walking through	Pearson correlation	-0.010
	<i>P</i>	0.921
	<i>n</i>	104
Eat	Pearson correlation	0.074
	<i>P</i>	0.452
	<i>n</i>	104
Taking a break	Pearson correlation	-0.030
	<i>P</i>	0.766
	<i>n</i>	104
Socializing	Pearson correlation	0.096
	<i>P</i>	0.334
	<i>n</i>	104
Job duties	Pearson correlation	0.149
	<i>P</i>	0.131
	<i>n</i>	104
Paid employees only		
Overall	Pearson correlation	0.193
	<i>P</i>	0.190
	<i>n</i>	48
Walking through	Pearson correlation	0.125
	<i>P</i>	0.398
	<i>n</i>	48
Eat	Pearson correlation	0.237
	<i>P</i>	0.104
	<i>n</i>	48
Taking a break	Pearson correlation	0.081
	<i>P</i>	0.584
	<i>n</i>	48
Socializing	Pearson correlation	0.152
	<i>P</i>	0.302
	<i>n</i>	48
Job duties	Pearson correlation	0.173
	<i>P</i>	0.240
	<i>n</i>	48
Unpaid workers only		
Overall	Pearson correlation	-0.015
	<i>P</i>	0.912
	<i>n</i>	56
Walking through	Pearson correlation	-0.077
	<i>P</i>	0.571
	<i>n</i>	56
Eat	Pearson correlation	-0.135
	<i>P</i>	0.323
	<i>n</i>	56
Taking a break	Pearson correlation	-0.126
	<i>P</i>	0.356
	<i>n</i>	56

(Continued on next page)

Table 5. (Continued) Pearson product-moment correlations for statement responses from Smithsonian Gardens (Washington, DC) employees and volunteers indicating time spent in each activity outdoors in a nicely landscaped area, natural area, or other green space or garden area during the typical work shift, excluding periods of inclement weather and the job satisfaction question in the study of the relationship between the use of green spaces and public gardens in the work place on mental well-being, quality of life, and job satisfaction for employees and volunteers.

Statement		Overall, how satisfied are you with your job?
Socializing	Pearson correlation	0.044
	<i>P</i>	0.745
	<i>n</i>	56
Job duties	Pearson correlation	0.157
	<i>P</i>	0.247
	<i>n</i>	56

*Statistically significant at the 0.05 level.

life questions, and the job satisfaction question.

Results

MENTAL WELL-BEING. Pearson's product-moment correlations were calculated comparing scores on the WEMWBS scale and each category of time spent outdoors during typical workdays. For the overall sample, a statistically significant relationship was identified with regard to the category of eating outdoors and the WEMWBS scale score ($r = 0.251$, $P = 0.010$). This indicated that as an individual within the overall group reported spending more time eating outdoors during the workday, they also scored higher on the WEMWBS scale, a measure of the respondents' mental well-being. No other category statement resulted in a significant relationship with the WEMWBS scale for the overall sample (Table 1).

The same Pearson's product-moment correlation calculation was analyzed for the groups of respondents who indicated that they were paid or unpaid workers. Within the category of paid workers, a statistically significant relationship was also identified with the category of eating outdoors ($r = 0.328$, $P = 0.023$). This indicated that as an individual within the paid workers' group reported spending more time eating outdoors during the workday, they also scored higher on the WEMWBS scale, a measure of the respondents' mental well-being. Within the unpaid workers' group, no statistically significant correlations were identified between the

categories of time spent outdoors and the WEMWBS scale score.

T test analyses were conducted to investigate the difference in mean scores on the WEMWBS scale based on how the respondent answered questions regarding windows, window views, and the presence of live plants. Statistically significant differences between mean scores on the WEMWBS scale were identified within the overall sample of those who have live plants in their immediate office or workspace and those who reported not having live plants. Descriptive statistics indicated that those who responded "yes" had a higher mean WEMWBS score when compared with people who responded "no." No statistically significant differences in mean scores were found on the WEMWBS based on response to any other question regarding windows, window views, and the presence of live plants (Table 2).

Within the paid employees' sample, a statistically significant difference in mean scores on the WEMWBS scale was found based on responses to "Do you have a window in your immediate office or workspace?" ($P = 0.027$). Paid employees who responded "yes" to this question had a higher mean score when compared with people who responded "no." Within the unpaid workers' sample, a statistically significant difference in mean scores was found for the question "Does the window in your immediate office or workspace have a view of plants and/or trees?" ($P = 0.022$). Descriptive statistics indicated that those who responded "yes" to this question had a higher

mean WEMWBS score when compared with people who responded "no" (Table 2).

QUALITY OF LIFE. Pearson's product-moment correlations were calculated comparing responses on the two quality of life questions and each category of time spent outdoors during typical workdays. For the each of the overall samples, paid employees, and the unpaid workers' samples, neither quality of life question was related to any of the measures of outdoor time [all $P > 0.05$ (Table 3)].

T test analyses were conducted to investigate the difference in mean responses to each quality of life question based on how the respondent answered questions regarding windows, window views, and the presence of live plants. Statistically significant differences between mean responses on the question, "When all things in your life are considered, how do you feel today?" were identified based on the question, "Do any of the windows in your office area have views of plants and/or trees?" ($P = 0.031$). Descriptive statistics indicated that those who responded "yes" had a higher mean score when compared with people who responded "no" (Table 4). With regard to the question, "Overall, how would you rate the quality of your life?" statistically significant differences in responses were identified for the question, "Do you have live plants inside your immediate office or workspace?" ($P = 0.011$). Descriptive statistics indicated that those who responded "yes" had a higher mean response to the quality of life question when compared with people who responded "no."

Within the group of paid employees, a statistically significant difference on the quality of life statement, "When all things in your life are considered, how do you feel today?" was found based on responses to, "Do any of the windows in your office area have views of plants and/or trees?" ($P = 0.011$). Descriptive statistics indicated that those who responded "yes" to this question had a higher mean response to the quality of life question when compared with those who responded "no." A difference was also found with regard to the question, "Overall how would you rate the quality of your life?" based on responses to the statement, "Do you have live plants inside your immediate office or workspace?"

Table 6. *T* test comparisons identifying differences in mean responses from Smithsonian Gardens (Washington, DC) employees and volunteers on the job satisfaction question based on responses to questions regarding windows, window views, and the presence of live plants in the office in the study of the relationship between the use of green spaces and public gardens in the work place on mental well-being, quality of life, and job satisfaction for employees and volunteers.

Question		n	Mean	SD	<i>t</i>	df	<i>P</i>
Overall sample							
Do you have a window in your immediate office or workspace?	Yes	59	4.29	1.03	-1.166	90	0.247
	No	33	4.03	0.98			
Does the window in your immediate office or workspace have a view of plants and/or trees?	Yes	55	4.41	0.85	-2.498	9.007	0.034*
	No	9	3.22	1.39			
Are there other windows in your office area that are outside of your immediate office or workspace?	Yes	70	4.21	0.99	-0.174	86	0.862
	No	18	4.17	1.20			
Do any of the windows have views of plants and/or trees?	Yes	68	4.22	1.03	-0.849	72	0.399
	No	6	3.83	1.47			
Do you have live plants inside your immediate office or workspace?	Yes	70	4.37	0.94	-1.971	94	0.052
	No	26	3.92	1.13			
If you work in a building, are there other live plants in your building such as an indoor atrium, common spaces or lobby entranceway?	Yes	52	4.17	1.09	-0.226	76	0.822
	No	26	4.12	1.10			
Paid employees only							
Do you have a window in your immediate office or workspace?	Yes	35	4.11	1.23	-1.895	46	0.064
	No	13	3.38	1.04			
Does the window in your immediate office or workspace have a view of plants and/or trees?	Yes	31	4.32	1.01	-3.256	36	0.002*
	No	7	2.86	1.35			
Are there other windows in your office area that are outside of your immediate office or workspace?	Yes	40	4.03	1.17	-1.196	45	0.238
	No	7	3.43	1.51			
Do any of the windows have views of plants and/or trees?	Yes	37	4.00	1.25	-0.658	40	0.515
	No	5	3.60	1.52			
Do you have live plants inside your immediate office or workspace?	Yes	30	4.07	1.20	-0.990	44	0.327
	No	16	3.69	1.30			
If you work in a building, are there other live plants in your building such as an indoor atrium, common spaces or lobby entranceway?	Yes	25	3.80	1.38	0.635	39	0.529
	No	16	4.06	1.12			
Unpaid workers only							
Do you have a window in your immediate office or workspace?	Yes	24	4.54	0.59	-0.477	42	0.636
	No	20	4.45	0.69			
Does the window in your immediate office or workspace have a view of plants and/or trees?	Yes	24	4.54	0.58	-0.095	24	0.925
	No	2	4.50	0.71			
Are there other windows in your office area that are outside of your immediate office or workspace?	Yes	30	4.47	0.63	0.751	39	0.457
	No	11	4.64	0.67			
Do any of the windows have views of plants and/or trees?	Yes	31	4.48	0.63	0.812	30	0.423
	No	1	5.00				
Do you have live plants inside your immediate office or workspace?	Yes	40	4.60	0.59	-1.397	48	0.169
	No	10	4.30	0.67			
If you work in a building, are there other live plants in your building such as an indoor atrium, common spaces or lobby entranceway?	Yes	27	4.52	0.58	-1.344	35	0.188
	No	10	4.20	0.79			

*Statistically significant at the 0.05 level.

($P = 0.009$). Descriptive statistics indicated that those responded “yes” had a higher mean response to the quality of life question compared with those who responded “no” (Table 4).

Within the unpaid workers’ sample, a statistically significant difference on the question, “When all things in your life are considered, how do you feel today?” was identified between people who responded differently to the question, “Does the window in your immediate office or workspace have a view of plants and/or trees?” People who responded “yes” had a higher mean response to the quality

of life question when compared with those who responded “no” (Table 4).

JOB SATISFACTION. Pearson’s product-moment correlations were calculated comparing responses on the job satisfaction question and each category of time spent outdoors during typical workdays. For the each of the overall sample, the paid employees’ sample, and the unpaid workers’ samples, the job question was not related to any of the measures of outdoor time [all $P > 0.05$ (Table 5)].

T test analyses were conducted to investigate the difference in mean responses to the job satisfaction

question based on how the respondent answered questions regarding windows, window views, and the presence of live plants. Within the overall sample, a statistically significant difference was identified based on how respondents answered the question, “Does the window in your immediate office or workspace have a view of plants and/or trees?” ($P = 0.034$). Respondents who answered “yes” to this question responded with a higher mean response on the job satisfaction question when compared with those who answered “no” (Table 6).

Within the sample of paid employees only, statistically significant differences on job satisfaction were found based on how people responded to the question, “Does the window in your immediate office or workspace have a view of plants and/or trees?” ($P = 0.002$). Descriptive statistics indicated that people who responded “yes” to this question had a higher mean response on the job satisfaction question when compared with people who responded “no” to this question. Within the sample of unpaid workers only, no statistically significant differences on the job satisfaction question were identified (Table 6).

Discussion

The results of this study support past research findings indicating benefits to spending time, even small quantities of it, in nature (Kaplan and Kaplan, 1989; Waliczek et al., 1996). Within the categories of time respondents spent in outdoor, landscaped areas in different activities, very few differences were identified. The only significant difference was found with regard to people who indicated that they ate outdoors during the workday more frequently scoring higher on the mental well-being scale when compared with those who ate outdoors less frequently. People who have time to eat outdoors are likely to be less stressed through their workday as indicated by the degree of autonomy exhibited in their choice to eat outdoors (Trougakos et al., 2014). People who work or run errands during lunch exhibit less autonomy and are likely to be more stressed. Volunteers have less need for such autonomy since the very nature of volunteerism is nonobligatory, and hence may explain differences seen between volunteers and employees (Boezeman and Ellemers, 2009). However, management encouraging employees to eat outdoors in the garden areas may help reduce workplace stress and allow employees to actually take the time to relax during their lunch and other breaks.

Most other statistically significant differences were found with regard to those variables related to having a window in the immediate office area, the general office area, or the views provided by one of those windows. This indicated that for this

population of people, having a window or a window view was highly related to other variables including mental well-being, quality of life, and job satisfaction. This supports research by Dravigne et al. (2008) who found that individuals who work in offices with windows or live plants felt better about their work, job, and overall quality of life.

While differences existed between significant results for paid and unpaid workers, both groups had statistically significant results for the mental well-being scale and overall quality of life scale. This indicated that the work and volunteer environment can have a relationship to other areas of life outside the office, suggesting that employers have a duty to provide both paid and unpaid workers with positive work environments that include window views of nature or plants. In urban areas, having green window views may often be difficult, but the presence of public gardens in between buildings and plantings on roadsides can help mediate the stress of working in such environments. In addition, indoor atriums could potentially be a substitute for outdoor views and should be studied for more information.

Several of the t tests and correlational analysis did not result in statistically significant results, which may limit the findings of this study. One reason for this limitation is because this sample was drawn from people who already have a positive relationship with nature and are likely to have high contact with nature, even outside the work place. Since the sample is public garden employees, volunteers, and other unpaid workers, inclusion of another sample from another source may yield additional results.

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