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Proximity to Urban Parks and Mental Health

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Abstract

Background—Urban parks have received attention in recent years as a possible environmental factor that could encourage physical activity, prevent obesity, and reduce the incidence of chronic conditions. Despite long hypothesized benefits of parks for mental health, few park studies incorporate mental health measures.

Aims of the Study—To test the association between proximity to urban parks and psychological distress.

Methods—Cross-sectional analysis of individual health survey responses. Data were collected for a study of capital improvements of neighborhood parks in Los Angeles. A survey was fielded on a sample of residential addresses, stratified by distance from the park (within 400m, 800m, 1.6 km, and 3.2km; N=1070). We used multiple regression to estimate the relationship between the psychological distress as measured by the MHI-5 (outcome variable) and distance to parks (main explanatory variable), controlling for observed individual characteristics.

Results—Mental health is significantly related to residential distance from parks, with the highest MHI-5 scores among residents within short walking distance from the park (400m) and decreasing significantly over the next distances. The number of visits and physical activity minutes are significantly and independently related to distance, although controlling for them does not reduce the association between distance and mental health.

Discussion and Limitations—This paper provides a new data point for an arguably very old question, but for which empirical data are sparse for the US. A nearby urban park is associated with the same mental health benefits as decreasing local unemployment rates by 2 percentage points, suggesting at least the potential of environmental interventions to improve mental health. The analysis is cross-sectional, making it impossible to control for important confounders, including residential selection.

Implications for Health Policy—Mental health policy has traditionally focused on individual-centered interventions. Just as health policy for preventable chronic illnesses has shifted attention to modifiable environmental determinants, population mental health may benefit substantially from environmental interventions.

Implications for Future Research—Policy evaluations should incorporate mental health measures when assessing neighborhood improvement programs and physical environments. Many recent and ongoing studies have excluded mental health measure in the belief that they are too

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burdensome for respondents or irrelevant. If a causal relationship is confirmed, then ameliorating neighborhood conditions and physical environments could represent a scalable way to improve mental health issues for large populations.

Introduction

The choices of community designs can influence the physical and mental health of residents. Crowded, noisy, and dangerous places have adverse effects on psychological wellbeing, while exposure to or just views of green space are believed to relieve stress, strengthen social interactions, and improve mental health.(1,2,3,4,5) As environments affect many people, even individually small impacts can add up to large effects at the population level, making the built environment a relevant topic for mental health policy.

This study investigates one specific question within the large area of environmental determinants of population health: Is proximity to urban parks/green space related to mental health? Empirical evidence is much more limited than one would expect for such a straightforward question. While many projects analyzing improvements of parks or related environmental interventions, mental health measures are commonly excluded because evaluators perceive them being irrelevant or too burdensome for respondents. The data set analyzed here is unusual because the survey conducted as part of a parks improvement project in Los Angeles included a 5-item mental health measure.

There are several mechanisms through which urban parks could be associated with mental health. One is through increased exercise or physical activity, which is the dominant health outcome in park studies.(6,7,8,9) Even small amounts of physical activity, as little as 20 min/week, may have mental health benefits, with greater risk reduction for higher volume/intensity.(10,11) Natural environments may enhance the health benefits of exercise compared to synthetic environments (e.g. gyms), but reliability of previous findings and their significance for public health is unclear.(12) Among depressed patients, exercise interventions appear efficacious for short-term outcomes.(13) A review concludes that methodologically stronger studies tend to show smaller beneficial effects of exercise in the treatment of depression than studies with weaker designs.(14)

Exposure to nature, a second mechanism of action, may potentially affect mental health directly. Contact with urban nature has been linked to greater ability to cope with life stressors, improved work productivity and reduced job-related frustration, increased self-esteem, enhanced capacity to pay attention, and greater life satisfaction.(2,15) Studies analyzing that pathway include a variety of settings, including laboratories, workplaces, homes, schools, hospitals, or community gardens.

A third hypothesized pathway of how public parks could affect population mental health is through increased social interaction.(16,4) Green spaces act provide informal gathering place, strengthening neighborhood social ties.

Economists will point out that associations between green space and health are likely to also reflect residential selection, a causal relationship in the opposite direction. People in poorer health have lower incomes and as a consequence of more limited resources will live in less

desirable neighborhoods. This reverse causality would be strongest in epidemiologic studies that cover large geographic areas with pronounced sociodemographic variations.

Regardless of hypothesized pathways, a first step is to determine whether or not there even is a meaningful association that would warrant further examination. The association between mental health and urban parks is a research question at the intersection between two different areas of investigation, one on neighborhood characteristics and mental health, the other on green space and health.

Research on neighborhood characteristics and mental health, summarized in multiple review articles,(17,18,19) has predominantly studied social characteristics (e.g. neighborhood sociodemographics) and processes (e.g. crime). None of the 45 studies included in Mair et al.(18) analyzed parks or greenspace. In fact, only one study addresses a related issue, namely the association between an objective measure of walkability and depressive symptoms among 740 older adults in King County.(20) Walkability, however, is mainly about street connectivity or proximity to grocery stores and other amenities, not about parks or green space (although that is included as well). At a larger geographic scale, urban sprawl is associated with more chronic conditions, but not worse mental health.(21)

The other field, research on parks and larger urban green space as they relate to health, is dominated by physical activity or obesity as the health outcome, with a smaller number of ecological studies analyzing mortality rates.(22) Regarding mental health, the latest review concludes that “much of the literature on the psychological benefits of green space tended to be qualitative or from grey literature sources, the quality of which varied. There is generally a lack of robust evidence for the link between mental health, well-being and green space but this may be due to the inherent difficulties in quantifying non-physical health benefits.”(22) There is indeed a surprising gap between the limited empirical research on mental health outcomes and the hypothesized benefits of parks.

Our literature search found five newer studies that investigated a research question similar to ours. Each study was conducted in a different country: Denmark,(23) the Netherlands,(24) New Zealand,(25) Sweden,(26) and the UK.(27) All five studies have been published since the systematic review by Mair et al.;(18) we found no US study. Three studies indicated a positive association between green space or parks and better mental health (25,27,23), two were primarily null findings.(24,26) Only one study tried to address selection issues,(27) using longitudinal survey data and fixed-effects models. It is the only analysis that considers selection issues, but the advantage of fixed-effects model was limited because the environmental measure was only available at one point and did not change over time (the environmental measure is collinear with the fixed effect for people not moving across areas).

All studies measured mental health outcomes using either the GHQ-12 (27,24,26) or the 5-item mental health inventory (MHI-5) that is part of the SF-36.(25,23) Our data include the latter.

There were large differences in how access and distance to green-space were operationalized. One study used survey respondents self-report to indicate availability with a range of distances, the smallest being 300 m.(23) The other 4 studies used objective

measurement, but two used means within administrative units averaging 4-5 $km^{2,}$ (27,25) one calculated means for 1 and 3 mile buffers around individual residences,(24) and one calculated availability within 300m.(26)

In Europe, 300m has been proposed as a limit for people to exploit green spaces for recreational purposes and that distance is also believed to represent a person's recreational neighborhood.(26,28,29) For U.S. transit planning, the typical standard for walkability is ¼ mile or 400 m and walking distance (as compared to motorized travel) is a qualitative boundary to determine access. We use objective distance and classify the distances between respondent's homes and study parks as being within 400m, 800m, 1.5 km, and further.

Methods

This study is a secondary data analysis of data collected for an evaluation of park improvements conducted between January 2004 and March 2008 in the city of Los Angeles, California. The original study compared five parks that were designated by the city to receive capital improvements and five matching parks similar in size, facilities, and neighborhood characteristics that did not receive improvements. All 10 parks were public, urban, neighborhood parks with playgrounds, field areas, and a recreation center building. All park census tracts had a high percentage of ethnic minorities, had few non-Hispanic White (8 of them 5% or less), and had high household poverty (range 10–55%) compared with the national percentage (Table 1). The original project is described in Cohen et al.(30) At the park level, data were collected at similar times of the year before and after construction. Data collection included systematic observations of park use and activities, surveys of park users, qualitative interviews with stakeholders, and a household survey of residents in the neighborhood. The main finding was that capital improvements did not change the utilization of parks, which appears to be much more dependent on organized programs.(31)

We reanalyzed the household survey in this paper. Residences around the parks were classified into four strata (within 400m, 400-800m, 800m-1.6 km, and more than 1.6 km from each park) and equal numbers of households from each stratum were sampled. Field staff, bilingual promotoras from a community-based organization, administered the interviews in either English or Spanish with the adult at home whose birthday most closely matched the visit date. Interviewers were asked to return to a sampled household up to 5 times to locate residents before selecting an alternate address. Respondents were questioned about their use of the park and their physical activity patterns. The surveys also included the 5-item mental health inventory (MHI-5) from the Medical Outcomes Study.(32) The scale is scored 0-100, with 0 the worst and 100 the best mental health status. The same addresses were visited at baseline and follow-up, but unique identifying personal information was not collected from respondents. It was not a longitudinal study and respondents typically differed across waves. All methods were approved by the RAND Human Subjects Protection Committee.

The primary explanatory variable is residential distance from park. Other independent variables included age, gender, body mass index, overall health status, and an indicator of

whether the survey was administered at baseline or follow-up. No data on income, employment status, education, etc. were collected in the survey. We tested for seasonal effects and regional unemployment rates and models including physical activity, which may be a mediating pathway accounting for a correlation between distance and mental health.

Sample stratification and clustering were taken into account using hierarchical linear models, fitting random intercept models using STATA/SE Version 12.0 (College Station, USA). No sampling or post-stratification weights were available.

Results

Table 2 shows descriptive statistics for respondents according to distance from study parks. There are only three variables which are related to distance with high statistical significance: Mental health, frequency of park use, and probability of weekly exercise. A test rejects the null hypothesis of no association at $p<0.001$ for all three variables. The means of all three variables decline with distance from study parks, although for mental health the decline is only for the first 3 distance buffers.

There is only one other statistically significant difference by distance, namely the number of weekly visits to other parks ($p=.04$). Individuals living more than 1.6 miles away from their closest study park have about as many visits to the study park as to other parks, whereas for residents living closer, the ratio is 4-5 times as many visits to a study park. While exercise minutes decline with distance, the variation across individuals is very large and the relationship with distance is not statistically different from no association. There is no evidence that distance is associated with body mass index or overall health status.

Table 3 shows regression results with MHI-5 as the dependent variable. Mental health declines significantly, by about 2 points, for residents living more than 400m (1/4 mile) from a park, but still within easy walking distance (800m). Mental health declines by 4.5 points for resident living more than 800 m, but less than 1.6 km from a park, compared to residents within 400 m. There is no statistically significant difference for residents more than 1.6 km from a study park. At these larger distances, proximity to a study park may become less relevant as people may live closer to other parks.

Age and being female is associated with worse mental health status, as is a higher body mass index. Minorities in these neighborhoods (primarily white and Asians) have better mental health than Latinos (the reference group). There is no statistically significant difference in mental health between Blacks and Latinos.

Mental health improved significantly in the population overall during the follow-up period. This could be related to improved economic conditions during the follow-up period as the regional unemployment rate dropped by 1.6 percentage points between baseline and follow-up period. In bivariate comparisons, a 1 percentage point drop in the regional unemployment rate was associated with improvements in mental health status by 2 points on the MHI-5 scale (results not shown). However, the 0-1 variable indicating baseline or follow-up status was a better predictor of mental health than unemployment rates (which becomes insignificant when both are included); the final model does not include the regional

unemployment rate. We tested for seasonal effects, but found no significant variations and excluded time of year (this result may be specific to Southern California). The sample is clustered around specific parks, which accounts for 6 percent of the unexplained variation. We tested whether this unexplained variation could be captured with other neighborhood indicators from Table 1 (poverty rate, age structure), but it did not.

The last two columns of Table 3 test whether the association between proximity and mental health is mediated by physical activity or park visits, two other variables that in bivariate comparisons are significantly associated with distance to parks. However, these two variables themselves are not significant in a multivariate model and do not change the estimated associations between distance and mental health.

Discussion

This paper provides a new data point for an arguably very old question, but for which empirical data are sparse: Is there a relationship between urban parks and mental health? There are five analyses from New Zealand and northern European countries, but this may be the first US data set on the relationship between objective distance to urban parks and mental health.

Mental health is significantly related to residential distance from parks, with the highest MHI-5 scores among residents within short walking distance from the park (400m) and decreasing significantly over the next distances. A nearby urban park is associated with the same mental health benefits as decreasing local unemployment rates by 2 percentage points, suggesting at least the potential of environmental interventions to improve mental health. The number of visit and physical activity minutes are significantly related to distance. However, controlling for the amount of physical activity does not reduce the association between distance and mental health. Thus, physical activity may not be a primary pathway relating green space and mental health, mirroring the results reported by Richardson et al. (25) for New Zealand.

Our data are cross-sectional and we cannot account for other causal pathways, most importantly residential selection. Thus, estimates are likely to be an upper bound of the potential of environmental interventions. Selection biases are likely to be most prominent in studies that compare sociodemographically very heterogenous areas. So far, only one study has explicitly tried to address selection using a fixed-effects model (although the absence of longitudinal data on the environment limited their approach).(27) Selection biases would be attenuated (but not resolved) in our data, which selected only high minority and lower income neighborhoods, but there is nothing we can do statistically to control for important confounders, including residential selection.

Regarding policy relevance and future research, our results suggest that it would be desirable to incorporate mental health as a measure for evaluating neighborhood improvement programs. This would bring together two disparate strains of research: One is the large field of physical environments and health, including work on urban parks, walkability, and transportation; the other is research on mental health and neighborhoods.

The former objectively assesses the environment, but rarely considers mental health. Research on mental health and neighborhoods tends to study social factors or self-reported perceptions, but does not assess environments independently. As a consequence, empirical data to study the mental health benefits of urban green space are more limited than one would expect given that such benefits have long been hypothesized. This could be addressed if the next wave of studies on urban parks includes mental health measures and the next wave of studies on mental health and neighborhoods includes objective measures of green space.

Health policy in many other areas of preventable chronic illnesses has shifted attention to modifiable environmental determinants of health. Population mental health may benefit substantially from environmental interventions and progress may be limited if only individual-level interventions are implemented, although stronger evidence on the role of environment factors is needed.

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Table 1

Park and Neighborhood Characteristics

	Acres	# of facilities	% White	% Latino	% Black	% Asian	% Households in poverty (1999)	% < 18	% > 60
Algin Sutton Park	16.0	17	2	65	31	2	44.3	42.2	6.3
Green Meadows	9.0	17	0	65	34	0	36.1	38.1	10.7
Costello	3.4	8	1	95	0	4	54.9	38.0	8.0
Pecan	4.2	7	5	80	2	12	35.6	25.8	15.8
St. Andrews	8.5	12	0	11	88	0	16.6	26.3	21.8
Van Ness	8.1	16	1	21	75	1	16.3	28.8	16.6
Evergreen	6.4	11	2	94	0	3	31.9	31.7	14.0
Wilmington	6.9	11	5	86	5	2	41.2	41.9	6.8
Bellevue	9.0	10	26	52	3	17	23.9	21.3	10.9
Fernangeles	10.0	9	27	55	1	11	9.8	29.7	14.6

Table 2

Descriptive Statistics: Residents by Distance from Study Parks

	<400m	400-800m	800m-1.6km	>1.6km	p-value for test of equality
Number of respondents with MHI-5 scores	244	222	271	208	
MHI5	89.9 (10.3)	88.5 (15.0)	84.0 (13.3)	90.3 (12.4)	<0.001
Female	66.1 (47.4)	65.6 (47.6)	67.2 (47.0)	63.9 (48.1)	0.90
Age	39.3 (12.9)	37.6 (13.5)	40.0 (12.9)	37.2 (13.6)	0.06
Number of weekly park visits	5.2 (4.3)	3.7 (4.3)	4.0 (4.2)	1.3 (2.9)	<0.001
Number of weekly visits to other parks	0.9 (1.7)	1.1 (2.1)	1.2 (2.0)	1.5 (2.6)	0.04
Poor Health	7.5 (26.4)	10.9 (31.3)	12.0 (32.6)	12.1 (32.7)	0.32
Any exercise	59.4 (49.2)	44.6 (49.8)	58.6 (49.4)	42.1 (49.5)	<0.001
Exercise minutes	115 (137)	93.8 (147)	90 (109)	86 (146)	0.14
Body mass index	26.6 (3.6)	26.3 (4.8)	26.8 (4.2)	26.3 (4.9)	0.37

Table 3

Regression of Mental Health Status

	MHI-5 Score	MHI-5 with exercise minutes	MHI-5 with park frequency
< 800 m	-2.24* (1.14)	-2.21 (1.19)	-2.24* (1.14)
< 1.6km	-4.64** (1.08)	-4.48** (1.14)	-4.64** (1.08)
> 1.6 km	-0.33 (1.17)	-0.15 (1.21)	-0.33 (1.17)
Female	-1.94* (0.85)	-3.03** (0.85)	-1.94* (0.85)
Age	-0.17** (0.03)	-0.20** (0.03)	-0.17** (0.03)
BMI	-0.35** (0.09)	-0.28** (0.10)	-0.35** (0.09)
Black	1.28 (1.30)	0.47 (1.39)	1.28 (1.30)
Other race/ethnicity	4.74* (1.87)	4.53* (1.85)	4.74* (1.87)
Wave 2	4.89** (1.74)	4.43* (1.92)	4.89** (1.74)
Weekly Exercise minutes		0.0002 (0.003)	
Park Visit Frequency			-0.05 (0.11)
R^2	0.14	0.15	0.14
N	881	730	874
Percentage of variance due to clustering/random effect	0.06	0.08	0.06

Notes: Dependent variable is MHI-5, range from 0-100, with higher indicating better mental health. Reference group for distance is residents within 400m of study park. Reference group for race/Hispanic is Latino/Hispanic. “Other” (<10% of sample) includes White and Asian.

* significant at 5%;

** significant at 1%