Active Design and NYC Health

EXPLORING HOW ACTIVE DESIGN FEATURES IN NYC NEIGHBORHOODS RELATE TO OVERALL COMMUNITY HEALTH

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RESEARCH QUESTION

How do active design features in NYC neighborhoods such as walking distance to a park, vegetative coverage, bicycle network coverage, and unhealthy food access correlate to overall community health?

INTRODUCTION

New York City has been using elements of urban design to respond to issues concerning the health of its citizens since the mid-19th century. In those days, infectious disease was the most predominant cause of death. Central Park, the Department of Street-Sweeping, the Tenement House Act, and the 1916 Zoning Ordinance were just some of the successful actions taken by the city to promote the health of New Yorkers and improve the cleanliness of the city.[1] From the 20th century to present, chronic diseases (obesity, diabetes, cancer, etc.) have become the leading causes of death in NYC. One of the city's modern approaches to combating chronic disease is known as "active design." Research has shown that a prevalence of certain characteristic features of a city like its "walkability" and access to parks can support higher reported levels of physical activity of its citizens.[2] "Active design" is NYC's attempt to incorporate this research into a philosophy of urban design in the 21st century in the form of architectural and planning guidelines that encourage active lifestyles in order to improve the health of New Yorkers.

The **Active Design Guidelines** were officially launched by the NYC DDC (Department of Design and Construction) in 2010.[3] Since then, a large amount of data has been collected to track the growth of active design elements across the different neighborhoods of NYC. These elements vary considerably by neighborhood, with disparate access to parks, green spaces, tree coverage and walkability.[4] Our research focus has been to analyze this data along with recent available health data for NYC to determine whether neighborhoods with more active design features exhibit better overall community health, including higher levels of physical activity, and lower levels of diabetes, obesity, and premature death. Some studies indicate that mitigating negative aspects may have a larger impact than adding new positive features to an area, while others indicate a noticeable link between walkability and lower disease rates.[5,6] Our hypothesis is that there is a positive association between the presence of active design features and community health in NYC.

METHODS - DATA

Data was taken from publicly available datasets from the NYC Department of Health (DOH), collected between 2010 and 2021. Our variables were sorted into two categories: Active Design and Community Health.

The Active Design dataset contained data on park proximity, transit coverage for subway and biking, and green coverage on a range of scales, including on the borough, community district, and neighborhood tabulation area levels. It was aggregated from a variety of open sources, including census data, LiDAR, and official counts from different NYC agencies. These variables served as measurable indicators of the overall built environment from neighborhood to neighborhood.

The Community Health dataset contained data about population demographics, social & economic conditions, housing & neighborhood conditions, and different health conditions and outcomes for each of the 59 community districts in New York City. It was aggregated by the DOH using sources such as census data, randomized telephone surveys, hospital statistics, and reports from various New York City and State agencies.

These datasets were chosen because they both used the Community District (CD) geographic scale which allowed for direct comparison and alignment of our variables.

METHODS - ANALYSIS

The Active Design variables chosen for our analysis were:

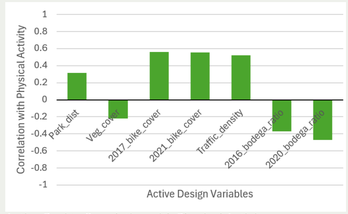
Walking Distance to a Park: The percentage of the population who live within walking distance to a park.
Vegetative Cover: The percentage of each CD that is covered in vegetation.
2017 Bike Coverage and **2021 Bike Coverage:** Percentage of streets with bicycle lanes.
Traffic Density: Annual vehicle miles traveled per area, in million miles traveled per square mile.
2016 Bodega Ratio and **2020 Bodega Ratio:** The number of bodegas per supermarket within a CD.

The Community Health variables chosen were:

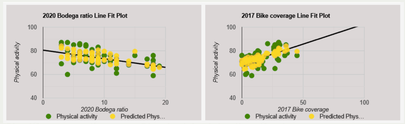
Self Reported Health: Percentage of adults who report their overall health is “excellent,” "very good" or “good”.
Physical Activity: Percentage of adults who report participating in any physical activity in the last 30 days.
Obesity: Percentage of adults who have obesity (Body Mass Index of 30 or greater).
Diabetes: Percentage of adults who report being told by a healthcare professional that they have diabetes.
Hypertension: Percentage of adults who report being told by a healthcare professional that they have hypertension.
Psychiatric Hospitalization: Rate of psychiatric hospitalizations per 100,000 adults.
Premature Mortality Rate: Rate of premature deaths (before the age of 65) per 100,000 people.
Life Expectancy: Life expectancy at birth.
Pedestrian Hospitalization: Rate of pedestrian injury hospitalizations per 100,000 people

Using the Active Design variables as our predictors, we ran a multiple linear regression on each Community Health variable at a time, noting down correlations as well as R square and p-values.

RESULTS

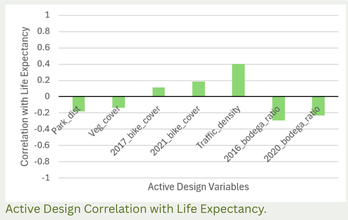


Active Design Correlation with Physical Activity.



Significant predictor vs. Physical Activity line-fit plots.

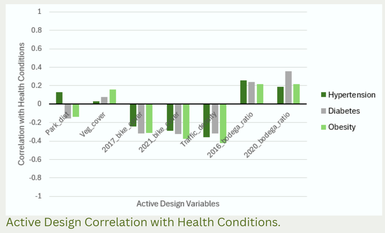
Physical Activity multiple linear regression values:
R square = 0.470754.
Adjusted R square = 0.451852.
Overall regression: right-tailed, F(2,56) = 24.905405, p-value = 1.82988e-8.



Active Design Correlation with Life Expectancy.

Significant predictor vs. Life Expectancy line-fit plots.

Life Expectancy multiple linear regression values:
R square = 0.427358. Adjusted R square = 0.38494.
Overall regression: right-tailed, F(4,54) = 10.074954, p-value = 0.00000363991.



Active Design Correlation with Health Conditions.

Hypertension multiple linear regression values:
R square = 0.340855.
Adjusted R square = 0.304901.
Overall regression: right-tailed, F(3,55) = 9.480464, p-value = 0.0000380452.

Diabetes multiple linear regression values:
R square = 0.201457.
Adjusted R square = 0.172938.
Overall regression: right-tailed, F(2,56) = 7.063877, p-value = 0.001838.

Obesity multiple linear regression values:
R square = 0.17647.
Adjusted R square = 0.162022.
Overall regression: right-tailed, F(1,57) = 12.214223, p-value = 0.00092507.

RESULTS (CONTINUED)

	Self_Rep_Health	Physical_Activity	Obesity	Diabetes	Hypertension	Psych_Hosp	Premature_Mort	Life_Expectancy	Pedestrian_Hosp
Park_dist	**-0.0268566**	0.312918	-0.136438	-0.156922	**0.130467**	**0.315282**	**0.291481**	**-0.182812**	0.100384
Veg_cover	-0.0226281	-0.217713	0.15792	0.0799143	0.0328725	-0.126725	-0.0518663	**-0.134631**	-0.000680266
2017_bike_cover	**0.242389**	**0.558533**	-0.312246	**-0.31925**	-0.243935	0.190504	-0.0180642	0.114396	-0.0704507
2021_bike_cover	0.229628	0.554609	-0.377144	-0.322196	**-0.289371**	0.124611	-0.0780417	0.184282	-0.112364
Traffic_density	0.24257	0.523276	**-0.420083**	-0.315817	**-0.358322**	-0.0121168	**-0.289472**	**0.402888**	**-0.28104**
2016_bodega_ratio	-0.300984	-0.372279	0.21546	0.240618	0.257194	0.194575	**0.355709**	**-0.292605**	**0.380821**
2020_bodega_ratio	**-0.320784**	**-0.473095**	0.218936	**0.357266**	0.185899	0.105106	0.251398	-0.230165	0.364213
R squared:	0.20216	0.470754	0.17647	0.201457	0.340855	0.099403	0.388718	0.427358	0.206558
Adjusted R squared:	0.158642	0.451852	0.162022	0.172938	0.304901	0.083603	0.355376	0.38494	0.178221
p-value:	0.00576736	1.83E-08	0.00092511	0.001838	3.80452E-05	0.0150032	5.0811E-06	3.63991E-06	0.00153613

Full Correlation Matrix for Community Health vs. Active Design Variables.
Bolded values represent most significant active design variables for each regression.

CONCLUSIONS

We hypothesized that active design features would be positively correlated with the health of NYC communities. However, we also understood that on its own, active design is not the sole predictor of health outcomes in the city. Our expectation was that this may limit the significance of our analytic results, or possibly invalidate our hypothesis altogether. But while none of our R^2-values exceeded 0.5, we still discovered significant correlations between our datasets. There were particularly visible linear trends linking active design with physical activity (R^2= 0.470754) and life expectancy (R^2= 0.427358).

Most correlations were in the direction that we predicted. For example, bike coverage had the highest positive correlation with self-reported levels of physical activity. Bodega ratios, on the other hand, were negatively correlated with the same outcome. This was logical, since bodega ratios are a socioeconomic indicator of poor access to healthy foods. Chronic health conditions (hypertension, diabetes, and obesity) also exhibited linear correlations with our hypothesized predictors: bike coverage was negatively correlated while bodega ratios were positively correlated.

Traffic density trends were a surprise, however, since we assumed that more cars in a neighborhood would have a negative impact on health (noise, pollution, accidents, parking stress). However, our analysis showed a positive correlation between traffic density and community health, similar to trends we observed for bike coverage. We can interpret both variables as signals of increased connection. Well-connected neighborhoods increase the mobility of their citizens, making local and regional infrastructures more readily available which may improve overall access to healthcare, jobs, and education. These factors may explain the positive correlation with the health markers in our study.

Park walking distance curiously had correlations in both directions. We found a positive correlation with physical activity, which was expected, but a negative correlation with life expectancy. Similar ambiguities and inconsistencies were found with vegetative cover.

Active design is not the full picture; factors like socioeconomic status and access to healthcare often play a more direct role in overall community health. However, as our analysis reveals, there are clear positive correlations between certain active design features and beneficial health outcomes, particularly bike lanes and food access. Further analysis of similar predictors with more health outcome variables might shed further light onto active design’s recent impact on the health of new Yorkers, but we can already clearly see that the way we feel is directly connected to the environments we live in. It is our responsibility to help shape our city into one that improves the lives of its citizens, and active design is one way to do that.

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