Examining the relationship between walkability and community resilience in Washington D.C.

by

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Abstract

To investigate the connection between walkability and community resilience in Washington D.C., data points across 180 census tracts were plotted and analyzed using a bivariate model. To understand why a positive relationship between walkability and community resilience did not exist in the data, as the literature indicated that it would, the researcher attempted to include qualitative data from key informants. However, it was not possible to acquire key informant data; thus, the researcher analyzed the data in terms of the literature to determine plausible explanations for the discrepancies, using explanation-building as a method. The initial but tentative hypothesis was challenged by the data, which ultimately showed no trend across the census tracts. Because of the lack of uniformity among definitions, existing research on the relationship between walkability and community resilience may not apply to the city of Washington D.C., which coincides with the lack of connection in the statistical data.

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Introduction

Resilience became an official strategy for Washington D.C. city planners in 2016 when the city was selected as one of 100 cities to become part of the 100 Resilient Cities network, receiving technical and financial support from large scale foundations such as the Rockefeller Foundation. Community resilience can be defined as the ability to prepare, adapt, and recover quickly from disaster or disruption (United States Census, 2022). In response, Washington D.C.'s Executive Office of Mayor Muriel Bowser along with the Office of the City Administrator created the city's first ever urban resilience plan, Resilient DC. The plan focuses on two main areas: Resilient Rivers and Equity in Governance and hopes to make explicit efforts to eliminate racial disparities and deliver equitable outcomes. Within the two focus areas there are four goals with 16 objectives, eventually resulting in 68 new initiatives specific to adapting and leveraging equitable change. In this plan, improving walkability is specified as an objective for making transportation more people-centered and adding to the overall goal of inclusive growth that, in turn, promotes community resilience (Resilient DC, 2019, pg.75).

Walkability as a method for increasing community resilience is well researched, with scholars across multiple disciplines arguing that higher levels of walkability can result in higher levels of community resilience as communities look for a way to adapt to climate change (Robertson, 2017). Walkable neighborhoods were able to withstand impacts of market collapse and retain home value when compared to their less walkable counterparts (Xu et al., 2018). Walkability was also found as a useful variable when addressing food deserts through public space improvements (Pohmajevic, 2021), and creating efficient and cost reductive evacuation routes (Porebska et al., 2019).

Background and Review of Literature

Since the1950s, pedestrian access has declined to promote faster industrial modes of transportation. As development shifts, superhighways and bus stations take precedence over spacious sidewalks (Forsyth et al., 2008). While the concept of walkability was once considered a question of accessibility, it has, over time, become a broader concept that examines the relationship between pedestrians, the built environment, and a set of social practices (Blecic et al., 2015).

Some studies examine the relationship between walkability and physical health, showing an association between less walkable neighborhoods and a higher risk for cardiovascular disease (Howell et al., 2019). From a social ecological perspective, public health officials often emphasize the complexity and relationship of physical and social environments as determinants of behavior (Adkins et al., 2019). Though there exists thorough research on how walking behavior affects a community, there has not been one agreed-upon definition of walkability. The term was coined in response to Jeff Speck's *Walkable Cities: How Downtown Can Save America, One Step at a Time* (2012), where Speck detailed his *General Theory of Walkability* to urge community planners to adopt walkability as an answer for issues related to health and environmentalism. Speck's theory outlines four conditions– walking should be useful, safe, comfortable, and interesting (Speck, 2012).

The United States Department of Health & Human Services says a community is considered resilient when it is socially connected and has accessible systems that are designed to endure adversity and foster community recovery from disaster (NPRSB, 2014). Research shows that increasing the resilience of a community is an important part of planning and development because resilience is connected to capacity building by empowering community members, building networks, and managing complex community systems (Cavaye & Ross, 2019).

Furthermore, walkability has been linked to community development through its association with the concept of social capital, defined by the networks of relationships in a community, by promoting community cohesion. Rogers et al. (2013) found a positive correlation between walkability and social capital, especially when linked to social-environmental aspects of sustainability such as contributing to community projects, volunteering, and attending public meetings.

Research articulates two aspects of community resilience. The first aspect focuses on information related to technological units, for example, critical infrastructure or the built environment (Serre & Heinzlef, 2018). The other aspect focuses on the way that human, environmental, built, and social systems connect. This aspect proves beneficial because literature suggests that "resilience depends first on the actions of people operating at the individual and neighborhood scale" (Rentschler, 2013).

Research Question

With literature supporting a connection between walkability and community resilience where high walkability often leads to high community resilience, this research aims to discover if the same relationship is true for the city of Washington D.C. The goal of this research is to understand if the data supports these findings and to further prove if a connection between walkability and community resilience exists, or if the data conflicts with the original theoretical hypothesis. Table 1 below summarizes the findings of the literature that was analyzed and its support for the relationship between walkability and community resilience.

Table 1: Literature Review Findings

Author	Title	Takeaway
Jan Gehl	Cities for People	Planners should plan at the human sense and visualize city plans at the speed of walking
Pohmajevic	Addressing Bogota's Food Deserts through Public Space Improvements	Foodscape study showing the largest barrier to food access was inaccessibility of walking paths
Porebska, Rizzi, Otuski, Shirotusuki	Walkability and Resilience: A qualitative approach to design for risk reduction	Dual use, walkable evacuation routes were cheaper to make, more efficient ways to prepare for disaster and offered subjective benefits to evacuees
Xu, Yu, Lee, Frank	Single-family housing value resilience of walkable versus unwalkable neighborhoods during a market downturn: causal evidence and policy implications	Walkable neighborhoods retained more value than their non-walkable counterparts during a housing market crash

Methodology

Design

To better understand the relationship between walkability and resiliency in Washington D.C., a case study method was used, specifically a single explanatory case study (Yin, 2018). Based on the literature, the initial hypothesis was that high levels of walkability in a given area would lead to high levels of community resilience. This initial but tentative theoretical statement was tested by conducting a bivariate analysis and comparing real data from two government agency-funded indices: the National Walkability Index and Community Resilience Estimates. As walkability scores were compared to resilience estimates across census tracts, it became clear that the data did not support the relationship outlined in the literature. For example, there were cases where high walkability in an area was associated with low resiliency, or where high resiliency was associated with low walkability, etc. To examine these findings in more detail, a case study method was used to try to explain the discrepancies and to build a theoretical foundation for the case of Washington D.C., bound by the variables walkability and community resilience (Yin, 2018). Data from the two indices was compared and plotted to determine if the trend that is documented in the literature (high walkability is related to high resiliency) existed. After analyzing the data, a trend was not evident and the reasons for this were explored.

The data from the two indices provided an up-close and in-depth look at walkability and resiliency. The indices were chosen because data was available at the level of census tract which allowed the variables to be compared on a micro-level. Washington D.C., unlike many other U.S. cities, is both a city and a district and cannot be broken into counties.

Resilience Index: The United States Census 2019 Community Resilience Estimates (CRE) bases its data on the 2019 American Community Survey and defines community resilience as "the capacity of individuals and households to absorb, endure, and recover from the health, social, and economic impacts of a disaster (US Census Bureau, 2019)." This interactive tool is based on the premise that some groups have fewer resources or capacity to recover from the effects of a disaster. The CRE uses data from the 2019 American Community Survey and the Census Bureau's Population Estimates Program to design population estimates based on individual and household level risk factors. The risk factors are binary components that add up to ten possible risks. The defined measures are listed in Table 1 below.

Table 2. Risk Factors Identified in the United States Census 2019 Community Resilience Estimates (from CRE)

Risk Factor	Description
RF 1	Income-to-Poverty Ratio
RF 2	Single or zero caregiver household – only one or no individuals living in the household who are 18-64
RF 3	Unit-level crowding defined as > 0.75 persons per room
RF 4	Communication barrier defined as either limited English-speaking households or no one in the household over the age of 16 with a high-school diploma
RF 5	No one in the household is employed full-time year-round. The flag is not applied if all residents are aged 65 years or older
RF 6	Disability posing constraints to significant life activity
RF 7	No health insurance coverage
RF 8	Being aged 65 years or older
RF 9	Households without a vehicle
RF 10	Households without broadband internet access

The result is an index that produces aggregate-level estimates categorized into three different groups: 0 risks, 1-2 risks, and 3+ risks. For this research, the data pulled was based on Washington D.C. Census Tracts and the percentage of their populations that had three plus risk factors.

Walkability Index: The United States Environmental Protection Agency (EPA) conducted a meta-analysis of research connecting urban land use and transportation outcomes and responded by creating three data products that consistently measure the built environment and transit accessibility of neighborhoods across metropolitan regions. The third of the data products, the **National Walkability Index**, provided walkability scores by ranking block groups using the following indicators. Indicators used in scoring are listed below in Table 2.:

Table 3. Data Indicators used in the National Walkability Index (US EPA, 2022)

Dataset Field Name	Description
D2A_EPHHM	The mix of employment types and occupied housing. A block group with a diverse set of employment types (such as office, retail, and service) plus a large quantity of occupied housing units will have a relatively high value. Higher values correlate with more walk trips.
D2B_E8MIXA	The mix of employment types in a block group (such as retail, office, or industrial). Higher values correlate with more walk trips.
D3b	Street intersection density (pedestrian-oriented intersections). Higher intersection density is correlated with more walk trips.
D4a	Predicted commute mode split - proportion of workers in the block group who carpool.
D2A_Ranked	Resulting rank of block group for D2A_EPHHM within all block groups. Range from 1-20, higher ranks indicate more walk trip likelihood.
D2B_Ranked	Resulting rank of block group for D2B_E8MIXA within all block groups. Range from 1-20, higher ranks indicate more walk trip likelihood.
D3B_Ranked	Resulting rank of block group for D3B within all block groups. Range from 1-20, higher ranks indicate more walk trip likelihood.
D4A_Ranked	Resulting rank of block group for D4A within all block groups. Range from 1-20, higher ranks indicate more walk trip likelihood.

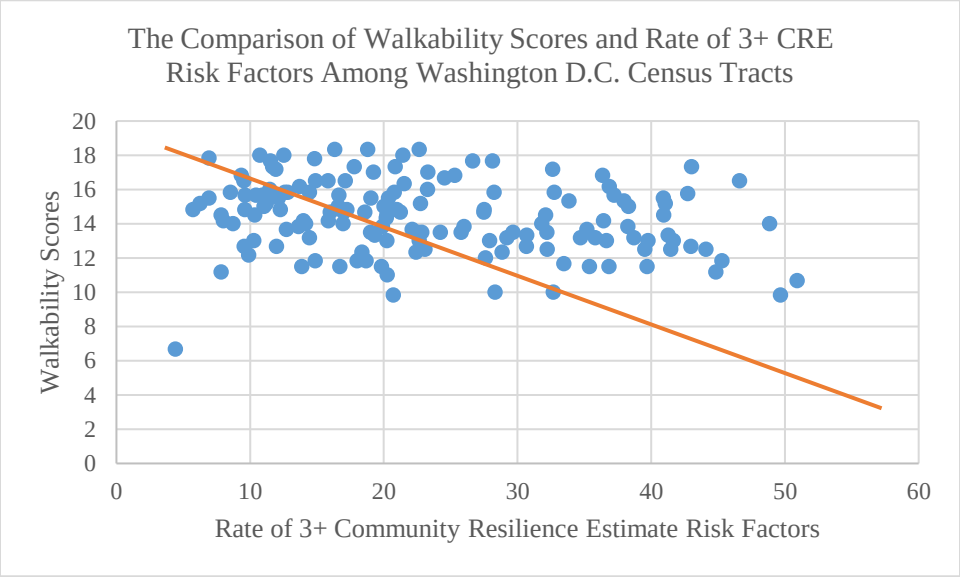
Data Collected

For Washington D.C., across each of the 180 census tracts, the average percentage of households who held 3+ risk factors is 23.69. The average Walkability score for Washington D.C. is 14.37. Tables 4-7 in the appendix show the data categorized in four quadrants which show data that falls under the expected hypothesis based on research and data that does not conform to the expected hypothesis. Tables 4 and 5 show walkability scores and CRE percentages that conform to the expected hypothesis based on literature. Tables 6 and 7 present opposite findings, displaying walkability scores and CRE percentages that contradict the hypothesis. It is important to note that the resilience data, because of its dependence on presence of risk, is inverse to the amount of resiliency in the community. Therefore, the higher the number, the less resilient the community, and the lower the number, the more resilient the community.

Results

To determine if the information reported in the literature on resilience and walkability was consistent, data points from 179 census tracts across Washington D.C. were plotted, resulting in the scatterplot below. The researcher assumed that plotting the scores would result in a trend that supported the literature; however, no trend developed. The theoretical statement or hypothesis that came from the reviewed literature would have shown an inverse relationship between high percentage of resilience risk factors and walkability scores, seen by the expected trend line (orange) in Figure 1. Instead, the data had no visible trend and contained many outliers which did not conform to the hypothesis.

Figure 1. The Comparison of Walkability Scores and Rate of 3+ CRE Risk Factors Among Washington DC Census Tracts



The bivariate analysis contradicts what was found in the literature. There is no clear relationship between walkability and community resilience estimates from a statistical standpoint. A scatterplot that would have conformed to the hypothesis would have shown a clear trend line where a census tract with a high walkability score would have a low rate of 3+ risk factors. Following research conducted by Porebska et al. (2019), and to understand why the data did not indicate a trend, a decision was made to gather nuanced expertise from key informants who could provide valuable insight on whether data was truly representative of the District of Columbia neighborhoods. Porebska et al. (2019) used qualitative interviews to emphasize the complexity of the relationship between walkability and risk reduction in Susaki City, Japan.

Complications with Intended Methods

The researcher intended to obtain qualitative data to contextualize the statistical data and provide a relativist perspective through key informant interviews with local leaders who represent Washington D.C. neighborhoods and advocate for their neighborhood on a variety of community issues (i.e., zoning, street quality, recreation, education, social services, etc.). These representatives are known as Advisory Neighborhood Commissioners (ANCs) and are non-partisan elected officials that serve two-year terms without pay. The ANCs operate under the District of Columbia Mayor's Office. Their position allows them to be a voice in advising District and Federal government (Office of Advisory Neighborhood Commissions, 2022).

Four census tracts that represented the four different possible relationships between walkability and resilience or quadrants of data were selected, and the ANCs were contacted for interviews. After numerous failed attempts to contact the ANCs, the decision was made to continue without the addition of the key informant interviews.

Limitations

This research was only conducted in one city and was meant to be an in-depth study into the case of Washington D.C. and is therefore not generalizable to other parts of the country. The study was focused on two data sets that only fell within the physical boundaries of Washington D.C., however, as planners across the country consider walkability, they should think about the term walkability and understand that it has no singular agreed-upon definition. It may have different interpretations and should therefore be supported by contextual information.

Discussion

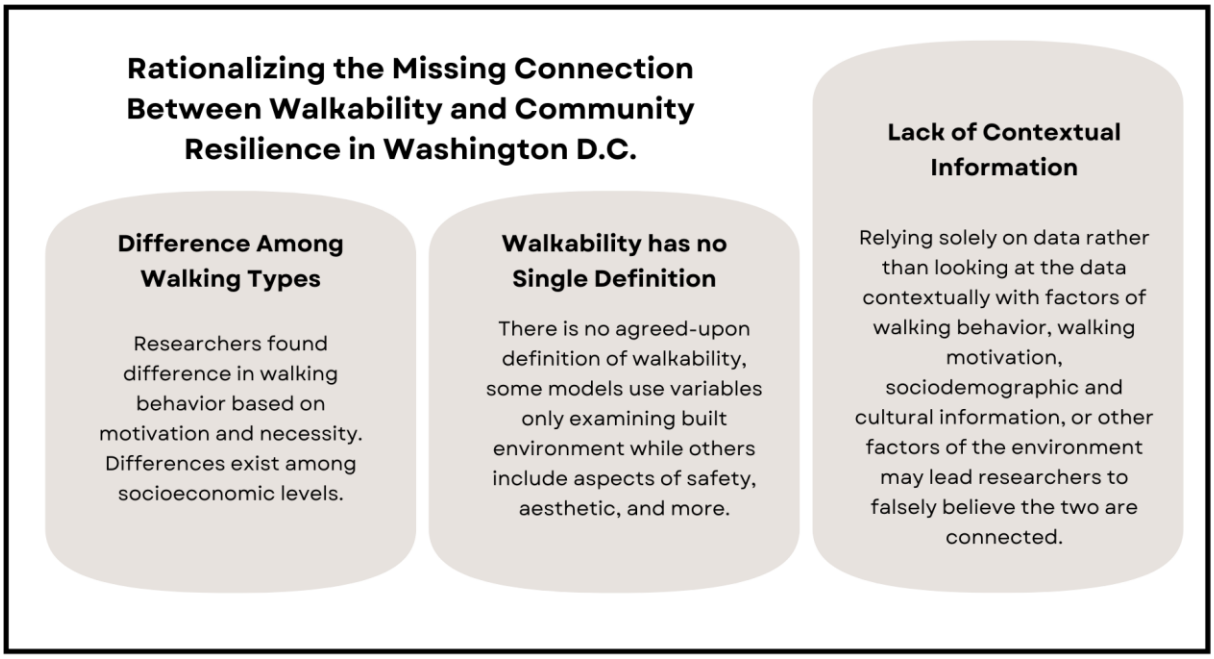
The value of personal factors that contribute to walkability of an urban area that goes beyond the built environment of the city is an important consideration. Kang et al. (2017) present walking as multi-dimensional, where there are two main categories for walking behavior: utilitarian and recreational walking. Utilitarian walking is guided more by the destination, is more rigid in frequency, and is based more on proximity of home and work. Recreational walking shows difference in speed, duration, and related built environment (Kang et al., 2017). Adkins et al. (2017) expand on the question of walkability to determine the relationships between built environments and socioeconomically disadvantaged populations. Here, walkability is defined not only by road and sidewalk structures but also includes social characteristics. Adkins et al. (2017) demonstrate that disadvantaged populations walk more frequently in unsupportive built environments (environments with higher crime levels, less access to services, and less pedestrian safety infrastructure).

Hunter et al. (2020) shows inequalities in walking behavior in the aftermath of the height of the COVID-19 pandemic and its shelter-in-place regulations. Low socioeconomic areas with more unsupportive built environments have higher utilitarian walking rates. Because working in person was halted for many employment industries during COVID, these groups had the largest interruption in walking behavior. For higher socioeconomic areas with more access to supportive walking environments like parks and other green spaces, walking rates increased during COVID-19 (Hunter et al., 2020). This means that pre-existing inequalities related to walking behavior were reinforced, because low socioeconomic neighborhoods were most at risk from COVID-19 (Hawkins et al., 2020). These findings demonstrate that inequality in walking conditions is an important gauge of disparities in the population. Mirzaei et al. (2018) support a similar conclusion where research findings indicate inequalities among attitudinal and socio-demographic variables in the models of walking.

Walkability is often linked to one single outcome, demonstrating the interconnectedness of physical and social neighborhood features, and walking behavior. However, relying on data points rather than looking at the data contextually may have led researchers to false conclusions (Hajna et al., 2017). Some researchers use more contextualized measures of walkability to create

a more well-rounded picture of walking environments for communities: mixed land use, accessibility/convenience, presence of pedestrian facilities, aesthetics, presence of well-maintained sidewalks, and/or absence of heavy and high-speed traffic (Forsyth, 2015). It is therefore important for planners and researchers to include contextual information when using walkability as a variable for measuring or strengthening other community concepts to avoid false conclusions or unwanted outcomes. Figure 2 below summarizes three plausible explanations present in literature for the discrepancy in the relationship between walkability and community resilience in Washington D.C.

Figure 2: Rationalizing the Missing Connection Between Walkability and Community Resilience in Washington D.C.



Conclusion

To investigate the connection between walkability and community resilience in Washington D.C., data points across 180 census tracts were plotted and analyzed through a bivariate model. To understand why a positive relationship between walkability and community resilience did not exist in the data, as the literature indicated that it would, the researcher attempted to include qualitative data from key informants. However, it was not possible to acquire key informant data; thus, the researcher analyzed the data in terms of the literature to determine plausible explanations for the discrepancies, using explanation-building as a method. The initial but tentative hypothesis was challenged by the data, which ultimately showed no trend across the census tracts. Because of the lack of uniformity among definitions, existing research on the relationship between walkability and community resilience may not apply to the city of Washington D.C., which coincides with the discrepancies in the statistical data.

Planners must recognize that built environments and walking behavior may vary by socioeconomic levels and evaluate interventions across different socioeconomic environments. While this research is not generalizable because of its physical limitations consisting of only Washington D.C. census tracts, it is possible that other cities may have used a similar approach to resilience planning and come to a conclusion that may, incorrectly, consider walkability and resilience independent of social factors. If the Resilient DC plan is to include a specific section on inclusive growth and try to eliminate growing inequality through planning using the general term of walkability, which fails to acknowledge socioeconomic or cultural factors, it may do more harm than good.

Recommendations

Figure 3: Recommendations for Future Planning Regarding Walkability

More research is needed to discover if there is a relationship between walkability and community resilience by including additional context or incorporating a relativist perspective from those who serve or exist in the described community. As described in Figure 3 above, if policymakers are going to continue to use walkability as a measure for community resilience planning, they should be aware of the specific measures of walkability they are describing, recognize the context of the usage, and lastly, acknowledge the socioeconomic and cultural factors that may influence walking behavior. Otherwise, researchers may be using an inaccurate variable that could wrongly influence their research or planning.

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Appendix

Table 4. Higher than Average Rate of 3+ CRE Risk Factors (Less Resilient) + Lower-than-Average Walkability Scores / Conforms to the Research Hypothesis

Census Tract	Rate of 3+ CRE Risk Factors	Walkability Score
78.09	24.22	13.5
105.00	25.79	13.5
99.05	26	13.83
99.03	27.59	12.00
95.07	27.91	13.00
18.03	28.31	10.00
99.07	28.85	12.33
111.00	29.21	13.17
78.06	29.65	13.50
98.01	30.67	12.67
76.04	30.69	13.33
18.04	31.80	14.00
74.03	32.21	12.5
74.07	32.68	10.00
99.01	33.47	11.67
74.09	34.71	13.17
89.03	35.19	13.67
88.02	35.38	11.50
50.02	35.81	13.17
78.07	36.42	14.17
96.01	36.65	13.00
71.00	36.84	11.50
99.04	38.24	13.83
2.01	38.71	13.17
95.08	39.51	12.50
75.04	39.69	11.50
77.07	69.76	13.00
96.03	41.27	13.33
74.08	41.45	12.50
74.01	41.65	13.00

95.01	42.97	12.67
98.02	44.08	12.50
26.00	44.82	11.17
68.04	45.29	11.83
92.04	48.85	14.00
109.00	49.67	9.83
23.02	50.91	10.67

Table 5. Lower than Average Rate of 3+ Risk Factors (More Resilient) and Higher than Average Walkability Scores / <u>Conforms to the Research Hypothesis</u>

Census Tract	Rate of 3+ CRE Risk Factors	Walkability Score
83.01	5.73	14.83
67.00	6.26	15.17
72.00	6.92	17.83
44.00	6.93	15.5
39.00	7.84	14.5
80.01	8.52	15.83
14.01	9.35	16.83
38.00	9.54	16.5
68.02	9.61	14.83
53.01	9.62	15.67
42.01	10.35	14.5
69.00	10.44	15.67
48.01	10.72	18.00
82.00	10.92	15.67
11.00	11.52	17.67
40.01	11.68	17.33
40.02	11.93	17.17
5.02	12.12	15.50
20.02	12.25	14.83
66.00	12.53	18.00
101.00	12.59	15.83
55.00	12.82	15.83
50.01	13.70	16.17

102.00	14.44	15.83
106.00	14.82	17.80
47.02	14.89	16.50
84.10	15.82	16.50
22.02	15.98	14.67
5.01	16.32	18.33
19.01	16.59	15.00
24.00	16.63	15.67
79.03	17.00	14.67
59.00	17.12	16.50
4.00	17.24	14.83
103.00	17.79	17.33
25.02	18.58	14.67
1.00	18.78	18.33
21.02	19.04	15.50
31.00	19.23	17.00
93.02	20.01	15.00
22.01	20.22	14.5
87.02	20.35	15.50
35.00	20.79	15.83
17.02	20.86	17.33
93.01	20.98	14.83
62.02	21.43	18.00
12.00	21.53	16.33
49.02	22.65	18.33
91.01	22.74	15.17
94.00	23.26	16.00
95.05	23.28	17.00

Table 6. Higher than Average Rate of 3+ Risk Factors (Less Resilient) + Higher than Average Walkability Score / Does Not Conform to Hypothesis

Census Tract	Rate of 3+ CRE Risk Factors	Walkability Score
47.01	24.54	16.67
108.00	25.31	16.83
49.01	26.63	17.67

107.00	27.49	14.67
21.01	27.50	14.83
34.00	28.13	16.67
89.04	28.24	15.83
69.04	32.1	14.5
88.03	32.62	17.17
90.00	32.75	15.83
78.08	33.84	15.33
75.03	36.35	16.83
56.00	36.85	16.17
76.05	37.22	15.67
76.01	37.97	15.33
73.04	38.29	15
78.04	40.91	15.5
79.01	40.93	14.50
96.02	41.05	15.17
77.09	42.73	15.76
88.04	43.00	17.33
104.00	46.59	16.5

Table 7. Lower than Average Rate of 3+ CRE Risk Factors (More Resilient) and Lower than Average Walkability Score / Does Not Conform to the Research Hypothesis

Census Tract	Rate of 3+ CRE Risk Factors	Walkability Score
73.01	4.42	6.67
10.02	7.82	11.17
70.00	8.00	14.17
81.00	8.72	14.00
15.00	9.56	12.67
3.00	9.90	12.17
27.02	10.28	13.00
8.02	11.96	16.67
92.03	12.71	13.67
36.00	13.63	13.83
8.01	13.86	11.50
29.00	13.98	14.17

19.02	14.16	14.00
13.02	14.43	13.17
10.01	14.86	11.83
41.00	15.86	14.17
7.02	16.71	11.50
2.02	16.96	14.00
6.00	18.00	11.83
111.00	18.36	12.33
98.03	18.67	11.83
25.01	19.01	16.50
30.00	19.32	13.33
27.01	19.82	11.50
95.04	19.89	13.83
7.01	20.19	14.33
9.01	20.22	13.00
16.00	20.24	11.00
13.01	20.70	9.83
68.01	22.13	13.67
99.02	22.41	12.33
76.03	22.54	13.50
98.04	22.65	13.00
74.04	22.84	13.50
95.03	23.08	12.50
68.07	32.2	13.5

References

Adkins, A., Makarewicz, C., Scanze, M., Ingram, M., & Luhr, G. (2017). Contextualizing walkability: Do relationships between built environments and walking vary by socioeconomic context? *Journal of the American Planning Association*, *83*(3), 296–314. https://doi.org/10.1080/01944363.2017.1322527

Blečić, I., Cecchini, A., Congiu, T., Fancello, G., & Trunfio, G. A. (2015). Evaluating walkability: A capability-wise planning and Design Support System. *International Journal of Geographical Information Science*, *29*(8), 1350–1374. https://doi.org/10.1080/13658816.2015.1026824

Cavaye, J. & Ross, H. (2019) Community resilience and community development: What mutual opportunities arise from interactions between the two concepts?, Community Development, 50:2, 181-200, DOI: 10.1080/15575330.2019.1572634

Desouza, K. C., & Flanery, T. H. (2013). Designing, planning, and managing resilient cities: A conceptual framework. *Cities*, *35*, 89–99. https://doi.org/10.1016/j.cities.2013.06.003

EPA. (2022). *Smart Location Mapping*. EPA. Retrieved November 21, 2022, from https://www.epa.gov/smartgrowth/smart-location-mapping#walkability

Forsyth, A., Hearst, M., Oakes, J. M., & Schmitz, K. H. (2008). Design and destinations: Factors influencing walking and total physical activity. *Urban Studies*, *45*(9), 1973–1996. https://doi.org/10.1177/0042098008093386

Gehl, J. (2010). *Cities for people*. Island Press.

Hawkins, R. B., Charles, E. J., & Mehaffey, J. H. (2020). Socio-economic status and covid-19–related cases and fatalities. *Public Health*, *189*, 129–134. https://doi.org/10.1016/j.puhe.2020.09.016

Hajna, S., Ross, N.A., Griffin, S.J. *et al.* Lexical neutrality in environmental health research: Reflections on the term walkability. *BMC Public Health* **17**, 940 (2017). https://doi.org/10.1186/s12889-017-4943-y

Hunter, R. F., Garcia, L., de Sa, T. H., Zapata-Diomedi, B., Millett, C., Woodcock, J., Pentland, A. 'S., & Moro, E. (2021). Effect of COVID-19 response policies on walking behavior in US cities. *Nature Communications*, *12*(1). https://doi.org/10.1038/s41467-021-23937-9

Kang, B., Moudon, A. V., Hurvitz, P. M., & Saelens, B. E. (2017). Differences in behavior, time, location, and built environment between objectively measured utilitarian and recreational walking. *Transportation Research Part D: Transport and Environment*, *57*, 185–194. https://doi.org/10.1016/j.trd.2017.09.026

Mirzaei, E., Kheyroddin, R., Behzadfar, M. *et al.* Utilitarian and hedonic walking: examining the impact of the built environment on walking behavior. *Eur. Transp. Res. Rev.* **10**, 20 (2018). https://doi.org/10.1186/s12544-018-0292-x

National Preparedness and Response Science Board (NPRSB) 2014. *Community Health Resilience Recommendations*

Office of Advisory Neighborhood Commissions. (2022). About ANCs. Retrieved November 21, 2022, from https://anc.dc.gov/page/about-ancs

Pohmajevic, C. M. (2021, August 30). Addressing Bogotas Food Deserts Through Public Space Improvements [web log]. Retrieved from https://gehlpeople.com/blog/addressing-bogotas-food-deserts-through-public-space-improvements/.

Porębska, A., Rizzi, P., Otsuki, S., & Shirotsuki, M. (2019). Walkability and resilience: A qualitative approach to design for risk reduction. *Sustainability*, *11*(10), 2878. https://doi.org/10.3390/su11102878

Rentschler, J. E. (2013). Why resilience matters — the poverty impacts of disasters. *Policy Research Working Papers*. https://doi.org/10.1596/1813-9450-6699

Robertson, N., & Hachem-Vermette, C. (2017). Walkability as an indicator of Neighbourhood Resilience (breakout presentation). *Journal of Transport & Health*, *7*. https://doi.org/10.1016/j.jth.2017.11.137

Rogers, S., Gardner, K., & Carlson, C. (2013). Social Capital and walkability as social aspects of sustainability. *Sustainability*, *5*(8), 3473–3483. https://doi.org/10.3390/su5083473

Serre, D., & Heinzlef, C. (2018). Assessing and mapping urban resilience to floods with respect to cascading effects through Critical Infrastructure Networks. *International Journal of Disaster Risk Reduction*, *30*, 235–243. https://doi.org/10.1016/j.ijdrr.2018.02.018

Speck, J. (2013). *Walkable City: How downtown can save america, one step at a time*. North Point Press, a division of Farrar, Straus and Giroux.

United States Environmental Protection Agency. (2021, June). *National Walkability Index: Use Guide and Methodology*. EPA. Retrieved from https://www.epa.gov/sites/default/files/2021-06/documents/national_walkability_index_methodology_and_user_guide_june2021.pdf

Xu, M., Yu, C.-Y., Lee, C., & Frank, L. D. (2018). Single-Family Housing Value Resilience of walkable versus unwalkable neighborhoods during a market downturn: Causal evidence and policy implications. *American Journal of Health Promotion*, *32*(8), 1714–1722. https://doi.org/10.1177/0890117118768765

Yin, R. K. (2018). *Case study research and applications: Design and methods*. SAGE.