Exploring the Walkability in a Hospital-Anchored Neighborhood: A Case Study of Emory University Hospital Midtown Campus

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ABSTRACT: The field of healthcare design is embracing the concept of healthy communities as a model for planning and designing a hospital that are anchored to a neighborhood. A hospital-anchored neighborhood is defined as a neighborhood that physically surrounds a hospital campus with blurred boundaries between the two. The primary mechanism for connecting a hospital campus to its adjacent neighborhood is the street. The urban design qualities of streets contribute to walkability by accommodating a comfortable and safe walking environment, supporting active street life with diverse programs, and providing a pleasant outdoor experience. Walkability is a concept in urban planning for creating healthy, vibrant, and livable communities, yet rarely applied to healthcare facilities.

Therefore, the purpose of this study is to explore the relationship between street design qualities of a hospital-anchored neighborhood and walkability through a newly proposed Street-Level Walkability Framework (Walkability Framework). The Walkability Framework includes seven street-level dimensions including compactness, mixed-use, imageability, human scale, enclosure, transparency, and complexity. A qualitative case study approach is used to explore the walkability patterns of the Emory University Hospital and the surrounding neighborhood in Midtown, Atlanta. The study employs ethnographic observations to generate behavioral maps that pinpoint pedestrians' locations and street use behaviors from photographs of streets during the morning, noon, and evening hours. Street design characteristics, collected from GIS archival data, Google views, and field photos and compared for the two most busy street segments and the two least busy street segments. The pedestrians' walking experience is collected from 40 semi-structured interviews with people familiar with the neighborhood.

The Walkability Framework informed the ranking of the 34 street segments of the Emory University Hospital and surrounding neighborhood based on street use behavior levels. The analysis revealed a segment of Peachtree Street Northeast had the highest number of pedestrian present, while a segment of Ted Turner Drive Southwest and a segment of Spring Street Northwest next to the highway had the least number of pedestrians present. Five hot spots on the streets were identified from an analysis of street activities, and thematic patterns are discussed from the pedestrians' experience gleamed from interviews. Findings from this pilot offered some revisions to the Walkability Framework.

KEYWORDS: hospital-anchored neighborhood, walkability, street design, street behavior, pedestrian experience

INTRODUCTION

Hospitals have been anchor intuitions to adjacent neighborhoods as they contribute to both economic growth for the communities and population health (Franz et al. 2019). As civic institutions, hospitals have longstanding ties to their communities dedicated to caring for the sick and promoting the welfare of people. The disciplinary and spatial dichotomy of hospitals changed following World War II when hospitals became more fortress-like and separated from their surrounding context by roadways. Once spatially connected and integrated with neighborhoods, post World War II medical institutions were fortress-like complexes housing technologies and professional clinicians to treat ill patients. The importance of the spatial design of hospital campuses in improving the health of the neighborhood has been underestimated due to contemporary urban planning practices after World War II. Hospital-anchored neighborhood is a contemporary term to imply that the hospital and neighborhood are more intricately woven to promoting community health, wellness and foster healing environments. Walkability is a concept that can help restore this connection and cohesion across different functions that are defined by place.

Following this broader perspective, healthcare systems are embracing the concept of healthy communities to create hospital-anchored neighborhoods and pedestrian-friendly environments that incorporate a mix of medical and wellness programs. Hospital-anchored neighborhoods have difficulties in providing walkable environments due to contemporary auto-centric developments. Healthcare campuses are isolated from surrounding communities, and their streets often do not connect to the urban fabric and pedestrian patterns of neighborhoods. Post-World War II Hospitals often lack the essential urban design principles such as a fine-grid street network, mixed-uses, stacked parking, attractive public spaces, and landscape elements. In part, large-scale medical campuses do not prioritize sidewalks, green spaces, active first-floor uses, pedestrian-friendly streets with pleasant views, people, and the presence of vibrant life on the street. These are all ingredients for thriving Hospital-Anchored Neighborhoods with active pedestrian streets.

Walkability is one spatial measure that can contribute to both the physical and mental health of patients, staff and local residents. Walkability is a key indicator of vibrant, healthy, and livable streets and public spaces across various types of development. It is a concept used to understand if the design of a street is pedestrian-friendly, accommodates pedestrian comfort and safety, provides a positive experience or place for respite, and allows people to exercise. Public spaces on streets are influenced by many physical environmental features such as buildings, landscape elements, sidewalks, paving materials, trees, streetlights, bike lanes and curbs. Another factor that contributes to walkability is the uses that take place in public spaces on streets such as walking on sidewalks, outdoor cafes, seating areas, vending, street festivals, and more (Funk 2014). Studies have shown that public spaces that score high in walkability contribute to higher levels of social interaction, an increase in physical behavior, stimulate economic development, and promote a sense of community (Braun and Read 2015). This study explores the walkability of streets in one urban hospital-anchored neighborhood: Emory University Hospital at Midtown.

1.0 FRAMEWORK

1.1. Neighborhood-level Walkability

The National Walkability Index (US EPA 2014) is one of the current methods that uses GIS data to score the walkability of neighborhoods. However, a limitation of the Walkability Index is that it addresses the neighborhood scale only and does not include street-level visual differences.To assess walkability, this study identifies a 10-minute walking radius around Emory University Hospital Midtown. It documents four neighborhood-level design characteristics and walkability using the existing Neighborhood-level Design Walkability Framework proposed by the EPA (US EPA 2014).

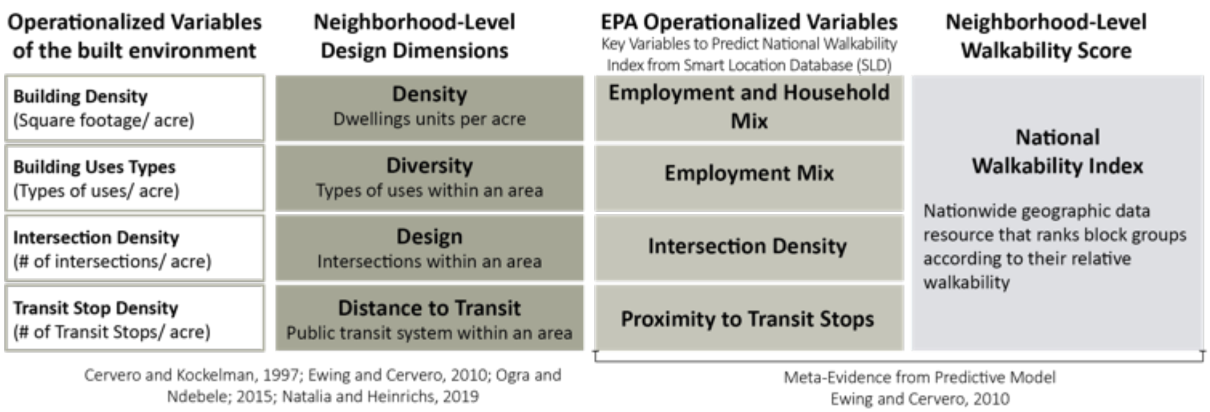

Figure 1: Neighborhood-level Design Walkability Framework by EPA.

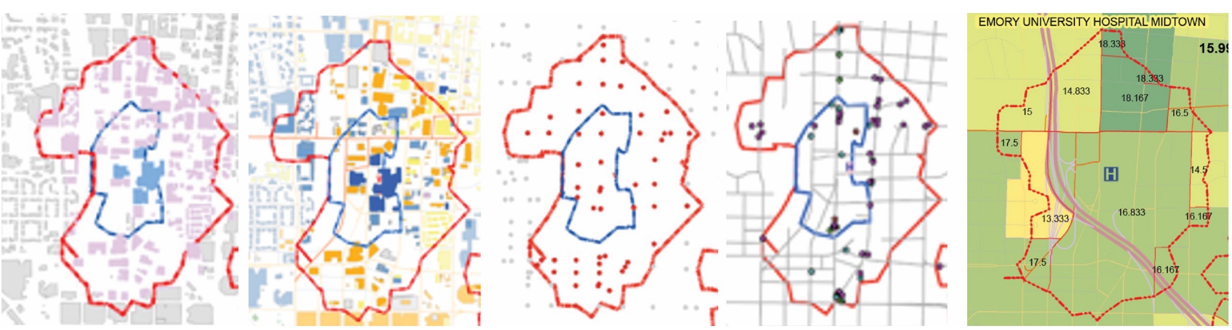

Figure 2: Design Characteristics and Walkability Score.

Table 1: Design Characteristics and Walkability Score by EPA.

Case	Density (Building)	Building Density	0.25	# Bldg.sqft/ Area sqft
	Diversity (Building-use)	Mix Entropy	1.33	Entropy level
	Design	Transit Stops Density	0.24	#/ Area (acre)
	Distance to Transit	Transit Stops Density	0.22	#/ Area (acre)
	National Walkability Index by EPA	Weighted based on area	15.99	Walkability Score

The building density is derived from the square footage of building areas (lilac color in Figure 2) divided by the square footage of the area. Diversity (Land-use of Buildings) is calculated by types of land-use within an area. The land-use categories measured are residential, commercial, and mixed-use (mixed-use for land-use type, not mixed-use building), open space, residential, and transportation utilities. The diversity uses the mix entropy to represent mixed levels of building uses in an area. Building uses are determined by the use of land-use parcels. Design (Intersection Density) uses the number of intersection points from the previous network analysis divided by the area acreage. Distance to Transit (Transit Stops Density) uses the number of transit stops within the study regions divided by the area acreage. The walkability score is calculated by the sum-up of the weighted National Walkability Index of each census block in the studied region (US EPA 2014). The classification range of walkability is from 1 (least walkable) – 20 (most walkable). The score generated from the analysis is 15.99, which indicates this medical district is walkable.

Consequently, there are significant variations in the walkability of streets in a neighborhood. To assess a more comprehensive and detailed street-level walkability assessment, studies have incorporated various methods including audits, instruments, survey questionnaires, checklists, scales, etc. (Clifton, Livi Smith, and Rodriguez 2007; Maghelal and Capp 2010). Most studies investigate several street characteristics individually rather than a comprehensive list of street features framed by urban design features. Among the studies that investigated design features, only a few have been empirically analyzed for their association with walking, and none focus on urban hospital-anchored neighborhoods.

1.2. Street-level Walkability

This paper builds upon existing studies and aims to address gaps in the literature by connecting planning, landscape design, architecture, and public health to create and pre-test a Street-level Design Walkability Framework for urban hospitals within neighborhoods. This new Framework intends to complement the EPA's Neighborhood-level Walkability Index. The Street-Level Walkability Framework expands on Ewing and Clemente's (2013) “five intangible dimensions” of urban design that contribute to walkability and livable streets. Two more intangible dimensions related to walkability, informed from the literature, are added to the five to create a total of seven street design dimensions (Harvey 2014; Mahdzar 2008). The seven street design dimensions are Compactness, Mixed-use, Imageability, Enclosure, Human Scale, Transparency, and Complexity (Figure 3). In this study, street-level walkability will be studied by assessing pedestrians’ walking experience through interviews and street use behaviors through observations.

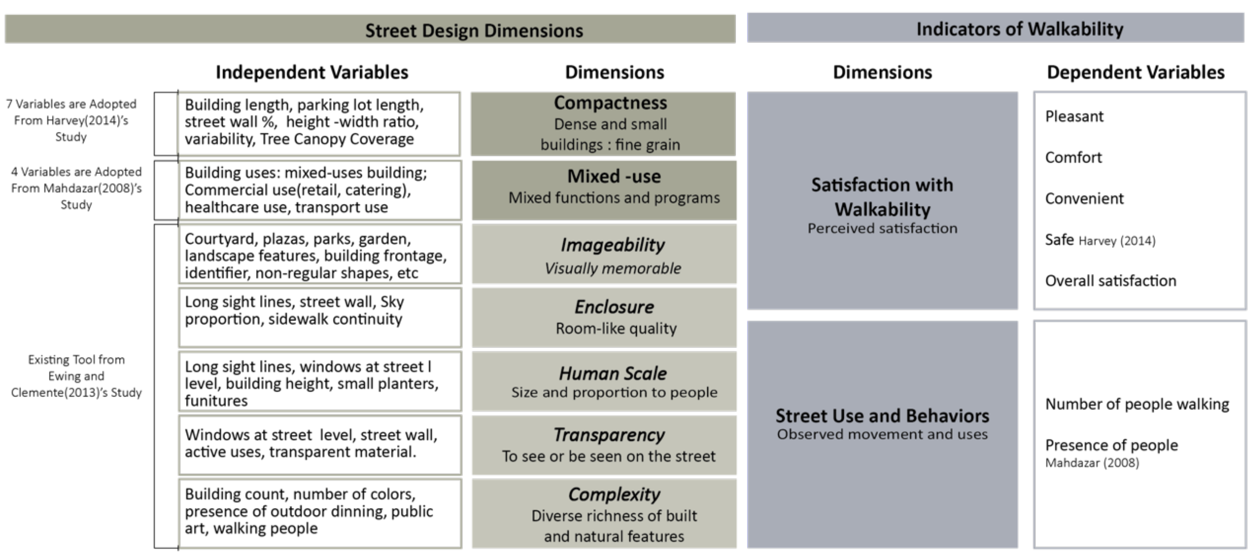

Figure 3: Proposed Complimentary Street and Neighborhood-level Design Walkability Framework.

2.0 METHODOLOGY

2.1. Research Questions and Objectives

This study serves as a pilot study for a doctoral dissertation study to test the framework, methods, data collection and analysis tools. The research objectives of this study are three-fold: (1) To develop and operationalize a Street-level Walkability Framework to systematically document street design features related to walkability in urban hospitals within neighborhoods (Ewing & Clemente, 2013). (2) To explore walkability patterns in a hospital-anchored neighborhood through studying the types of behaviors that occur on streets, how pedestrians use the streets, and how they experience walking in the neighborhood. (3) To present some modest design recommendations for creating walkable streets in urban hospital-anchored neighborhoods based on lessons learned.

2.2. Case Study Research Approach

A qualitative case study approach is used to explore walkability patterns in one urban hospital-anchored neighborhood: Emory University Hospital at Midtown. It is a short-term acute care hospital with over 500 beds and over 700 physicians.

With the high number of staff, visitors and patients, the hospital has an opportunity to connect to the neighborhood environment. Emory University Hospital Midtown campus aims to be an active urban hub connecting to the surrounding neighborhood by providing pedestrian-friendly sidewalks, active transportations, assessable retails, and programs for experiential engagement (Keenan 2019). This pilot study uses a 5-minute walking radius (walking shed) as the study region, including 34 segments with labeled ID and street names (Figure 4).

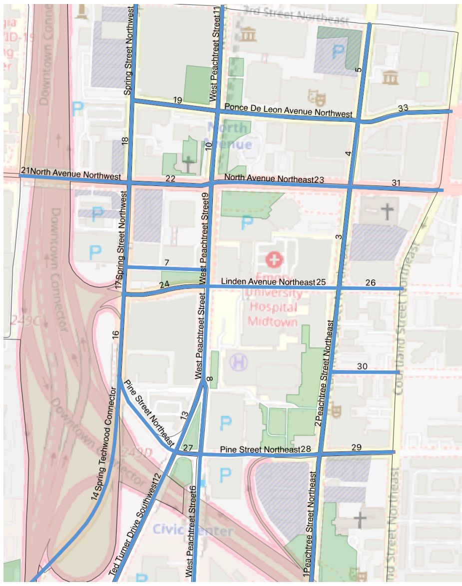

Figure 4: Case Study Scope: 34 segments of Emory University Hospital-anchored neighborhood.

2.3. Data Collection and Data Analysis

Using the Street-level Walkability Framework developed for this study, three types of data were collected and analyzed for the case:

1) Ethnographic observations were used to track the uses on the streets. The pedestrians' locations and behaviors were recorded three times for each of the 34 street segments while walking and taking photographs. The walk-throughs occurred in the morning from 8:00-9:00, noon from 12:00-13:00, and evening from 17:00-18:00 during one sunny weekday of October. QGIS Mapping (Space Syntax) techniques to generate the behavioral maps of pedestrians' locations and use of the street. Descriptive statistics are used to count the number of street behaviors and pedestrian on the streets. A spatial analysis was used to generate heatmaps to detect hot spots or most active areas on the streets.

2) The two most busy streets and the two least busy streets were selected to collect the street design features. Street design characteristics were collected from GIS archival data, Google views, and field photos. The design features for each street were mapped and operationalized using the Walkability Framework as a guiding structure.

3) A total pf 40 semi-structured interviews were conducted with pedestrians familiar with the area. Pedestrians near the hotspots of were conveniently selected to gain insight of the pedestrian walking experiences. The semi-structured interviews were analyzed using thematic analysis to describe themes from the pedestrians' experience of walking in the neighborhood.

3.0 FINDINGS AND RESULT

3.1. Street Use Behavior Patterns from Observations

A total of 421 street use behaviors were observed from the multiple snapshots of walking on each street segment, including 328 moving behaviors and 93 pausing behaviors. There were several types of behaviors observed. Nine types of moving behaviors were sorted into the following categories: walking, jogging, shopping, walking with food, dog-walking, biking, scooter riding, using a golf cart, and using handicapped devices. Eight types of paused behaviors were sorted into the following categories: using ATM, taking photos, sitting, standing, or waiting, lying, talking, smoking, working (security or construction).

Table 2: The Street Use Pattern in a Day

Moving	walking	jogging	shopping	walking w/ food	dog-walking	biking	scooter	golfcart	handicapped	TOTAL
Morning	71	2	0	0	1	1	0	1	0	76

Noon	105	1	2	5	2	5	0	1	2	123
Evening	119	0	0	1	0	3	5	0	1	129
	295	3	2	6	3	9	5	2	3	328
Pausing	using ATM	photo	sitting	standing /waiting	lying	talking	smoking	working		
Morning	1	0	6	6	0	2	1	8		24
Noon	0	0	7	5	0	1	2	13		28
Evening	0	3	19	15	2	0	0	2		41
	1	3	32	26	2	3	3	23		93

The data collected were analyzed for hot spots using heatmaps in QGIS. The heatmap in figure 5 shows five hot spots based on the total pedestrian behaviors counted in the morning, noon and evening. The patterns vary three times a day. The movement flows happen on Peachtree Street Northeast (4. All Day- IV, V), West Peachtree Street (4. All Day- I, II, III), and North Avenue Northeast (4. All Day- I, V). The morning and evening have similar locations for hotspots, while the heatmap of noon indicates more behavior on Peachtree Street (1. Morning- III, IV, V) and less behavior on West Peachtree Street (1. Morning- III and 3. Evening- III). Most behaviors occur in the north-eastern part of the studied area. Fewer behaviors happen along highways besides Spot III.

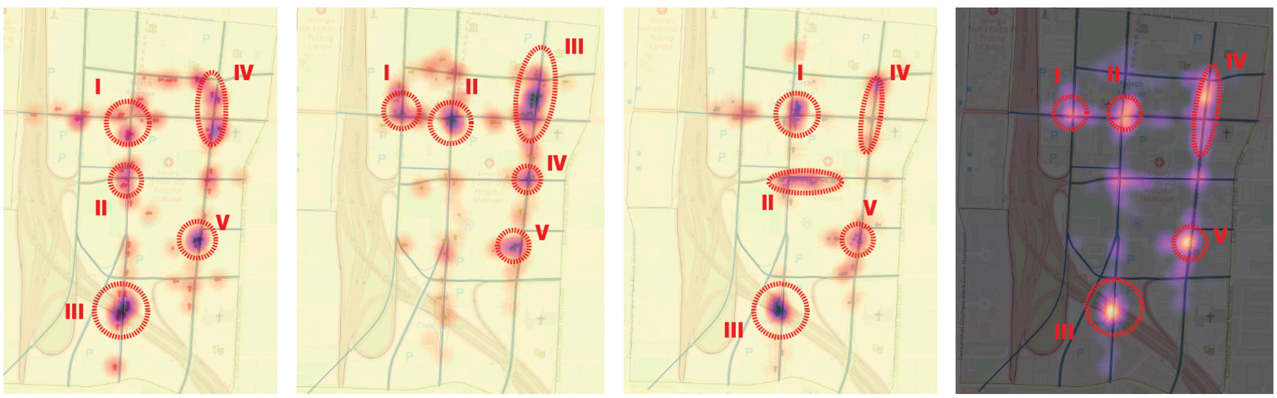

Figure 5: Heatmap and Identified Hot Spots: 1. Morning; 2. Noon; 3. Evening; 4. All Day.

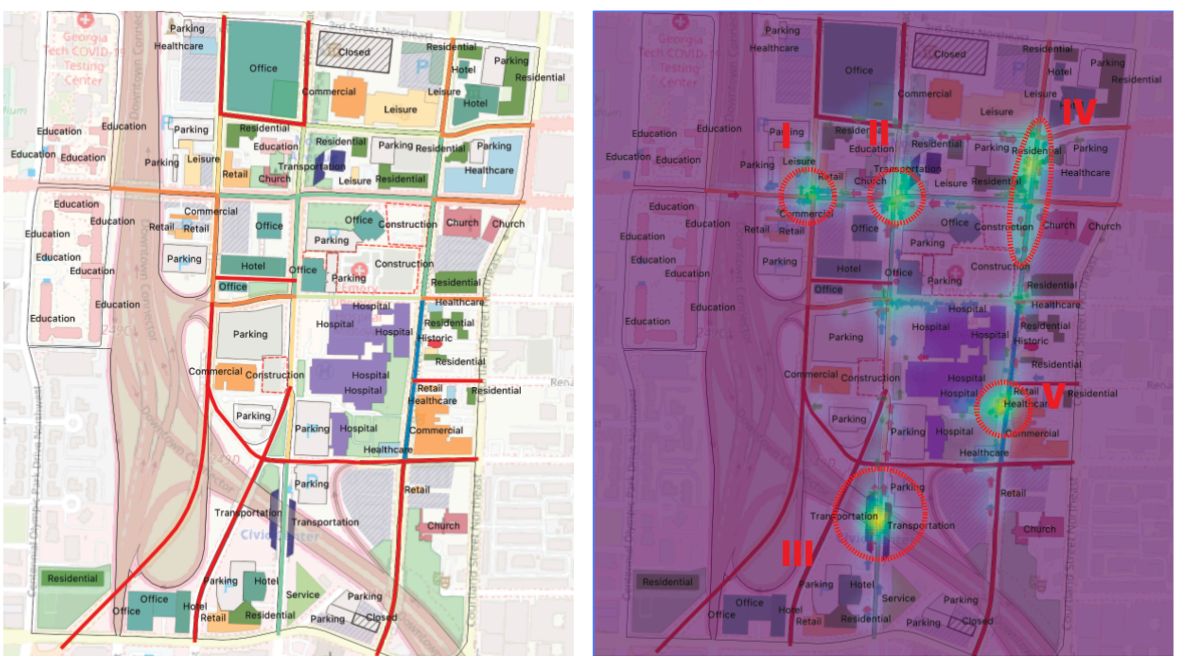

Figure 6: Hot spots in relation to Street Design Characteristics

The heatmaps are explored in the context of streets and building uses. Figure 6 indicates spot I and spot IV are for commercial and retail uses; Spots II and III are Marta stations, and Spot V is the main entrance of the Emory University Hospital.

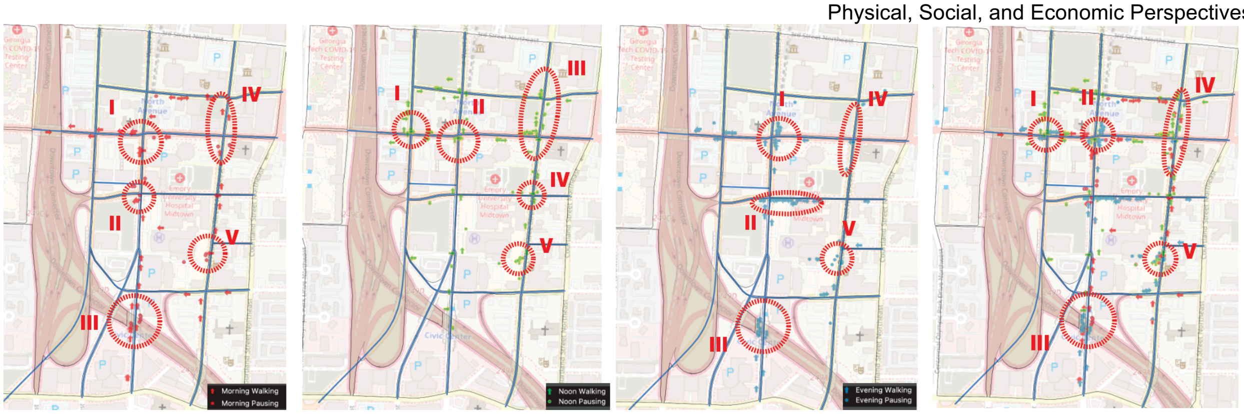

Figure 7: Movement Flows: 1. Morning; 2. Noon; 3. Evening; 4. All Day.

Figure 7 maps out how people move, which direction they are moving, and where they pause in the morning, noon, and evening. In the morning, people move away from two separate Marta train stations (1-I and III) to move toward Georgia Tech University, Emory University Hospital, and other workplaces. Hospital staff move from the parking deck to the side entrance of the hospital. In the evening, the pattern is reversed as people move from work to transportation. During noontime, people move along Peachtree Street to get to the Fox Theatre commercial circle toward restaurants, cafes, and retails or even further north to the Midtown commercial circle for food, banking, and other leisure places. The main entrance of Emory University Hospital (4-V) is always a busy spot with people in and out, relaxing, waiting for buses, dropping off patients, etc.

3.2. Street-Level Design Characteristics of High and Low Numbers of Street Behaviors

The first map in Figure 8 indicates the rankings of 34 street segments based on the number of behaviors in each street segment. The second map in Figure 8 indicates the number of behaviors each street segment has per 300 feet since the length of the street segment varies. The results suggest that #2_Peachtree Street Northeast has the highest behavior level (54 people), and #4_Peachtree Street Northeast has the highest behavior level per 300 feet. #16_Ted Turner Drive Southwest and #12_Spring Street Northwest next to the highway have the least behavior levels.

Figure 8: 1. The Number of Street Use Behaviors in total. 2. The Number of Street Use Behaviors per 300 feet. 3. Top Two Most and Least Walkable Streets.

Based on the preliminary analysis, two street segments (#2 and #4) were selected due to their high levels of street behaviors and two street segments (#16 and #12) were selected due to their low levels of street behaviors. The street design features were documented for each segment based on the criteria in the Walkability Framework and tested for the four street segments. The results show design features of streets that exhibit a high number of street behaviors have a higher value compared to the design features of streets with a low number of street behaviors.

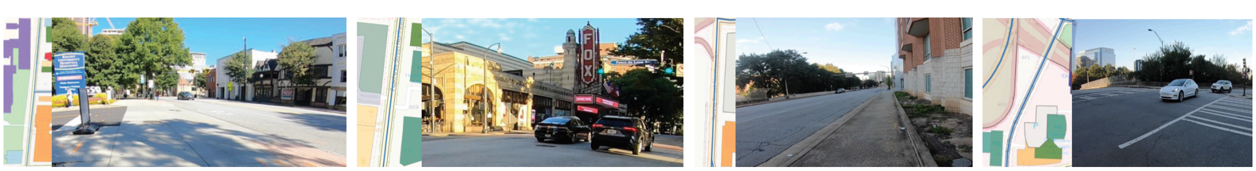

Figure 9: 1. High No.1- ID#2_Peachtree Street Northeast; 2. High No.2 – ID#4_Peachtree Street Northeast; 3. Low No.1- ID#16_Spring Street Northwest Low No.2– ID#12_Ted Turner Drive Southwest

Table 3: Street Design Characteristics informed by Street-Level Walkability Framework.

	High Number of Street Behaviors		**Low Number of Street Behaviors**	
Design Features in Dimension	Street Segment #2 881 feet	Street Segment #4 347 feet	Street Segment #16 437 feet	Street Segment #12 1052 feet
A. Compactness				
A-1. buildings	10	4	2	0
A-2. street wall /300 feet	322	497	253	167
A-3. height (weighted)/ width ratio	78.96	330.0	252.01	0
A-4. tree canopy	40%	70%	40%	20%
A-5. ground parking	90 feet	154 feet	0	0
B. Mixed-use				
B-1. use types	3	4	2	2
B-1. active uses/ inactive	11	10	0	2
B-2. active entrance	13	15	0	1
C. Imageability				
C-1. garden, plazas, or parks	1 (462 feet)	2 (360 feet)	0	0
C-2. major landscape feature	0	0	0	1 (city skyline)
C-3. historic building	1 (33 feet)	2 (412 feet)	0	0
C-4. Identifiers/ signage	8 (2 signage)	10 (3 signage)	0	0
C-5. non-rectangular shape	3	5	1	0
C-6. outdoor dining	1	3	0	0
D. Enclosure				
D-1. vertical height/ sidewalk width	1.45	2.08	0	1.25
D-2. sidewalk continuity	100%	100%	100%	100%
E. Human scale				
E-1. average building height	44 feet	110 feet	102 feet	0
E-2. windows	60%	60%	50%	5%
E-3. planters or street furniture	42	26	4	6
F. Transparency				
F-1. transparent window	20%	60%	0	0
F-2. transparent fence	462 feet	210 feet	0	1500 feet
G. Complexity				
G-1. buildings colors	16	9	3	2
G-2. building materials	9	10	2	2
G-3. public art	1 (mural)	0	0	0

The results suggest some revisions for the Street-level Walkability Framework. Some street design features included in the Street-level Walkability Framework do not apply in the real context of this case (marked grey in Table 3), including C-2. major landscape feature, D-2. sidewalk continuity, E-1. average building height, and G-3. public art. These design features may not lead to differences in the behavior level of streets. B-2. active entrance (marked green in Table 3) is the design feature that was not mentioned in the Street-level Walkability Framework but was observed making a difference in the pilot study. Even though A-5. ground parking (marked yellow in Table 3) was considered a design feature that negatively influenced compactness, the street with the higher number of behaviors has a longer ground parking length. This contrast needs further explanation after studying more street segments.

3.3. Identified Themes from Semi-structured Interviews

Forty semi-structured interviews were administered at five hotspots. Thirty-four interviewees claimed they are familiar with the neighborhood and finished the whole interview. One interviewee was not familiar with the neighborhood, and five interviewees were too busy to finish. Patterns were identified from the 34 interviewsand are summarized in Table 4.

Table 4: Street features relate to walking experience from interview

	Good Walking Experience	Bad Walking Experience
Convenient/ Accessible (Connectivity)	crossing; sidewalk; signs; shops; foods; car-parking; people; information board; signage; shops	no point of interest; long block (street network); closed store; handicapped unfriendly
Comfortable	Seat/bench; shade; sidewalk condition, good weather; lighting; open business; “Fox theatre like”	heavy traffic; construction; scooter; litter; noise; non-stopping cars; bad smells

Safe	security guard; patrolling car; police officer; surveillance camera; lighting from stores; open business	traffic; harassment; crimes; robbery; poor lighting bridge
Pleasant/ Visually attractive	greenery; open business (shops); trees; clear sight; architecture façade; something to look at (art, flower, building); cleanliness; façade of buildings; artworks, graffiti	litter; not well maintained; bridge; blocked window
Other	friendly people, smoking places, fresh air	homeless people; stray dogs

Ten interviewees were hospital staff. The biggest issue expressed by these interviewees was the lack of points of interest, such as food, café, entertainment, recreation, green space, etc. Interviewees claimed there was "nowhere to go," "there is nothing to do," or "nowhere to walk to." Another issue is parking, with staff suggesting that there is not enough space to park. Some of them park their car at the hospital rented parking lots in the neighborhoods and needed to take shuttles or walk to the hospital. Eight of the interviewees were members of patient families. They expressed being stressed and in need of places to rest, smoke, and wait for visiting hours. Most of them describe the neighborhood as unfriendly and unsafe. The six other interviewees are visitors to the neighborhood, four residents who live in the area, and six people who work in the area. The visitors' biggest concern is safety. Many places in the neighborhood do not feel dangerous to walk. Residents prefer to have more interesting places in the area, like more food options, shopping places, recreation, and greenspaces. People who work in the area feel they are not connected to the neighborhood. They said they come in the morning and leave in the evening. Interviewees consider Peachtree Street and Ponce De Leon Avenue to be the most walkable streets. Piedmont Avenue Northeast and several places around the highway are dangerous or uncomfortable to walk (marked as red stars in figure 10). Unfortunately, Piedmont Avenue Northeast is not in the scope of the pilot study. Pedestrians noted preferred and interesting places (marked as yellow stars in figure 10), including Nail Dynasty, Bobby Dodd Stadium, Mellow Mushroom, Jimmy John's, Fox Theater, Wells Fargo, Rufus Rose House, and the Shakespeare Tavern Playhouse. Most of these places are for food or entertainment.

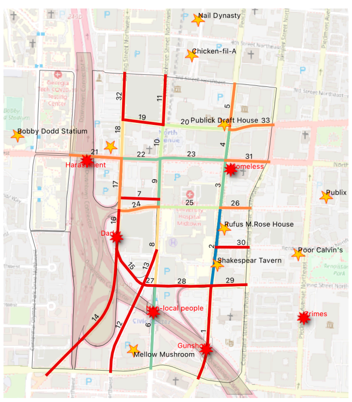

Figure 10: Preferred Places and Unsafe Places from Interviews.

CONCLUSION

The findings provide insights into the walkability patterns of a hospital-anchored neighborhood. The hospital is located in an urban area, at the edge of a neighborhood with convenient car access to roadways. The highway has been known to cause division in urban form patterns whereby negatively affecting the walkability of neighborhoods (Knorr 2016). The expectation was that the large-scale hospital would be the reason that their was poor walkability in the neighborhood. The results show, however, that the hospital itself has the potential to increase street use behaviors and walking experiences for pedetrians.

There are several recommendations for designing and planning a hospital campus. At first, there is a need for public space that is shared with hospitals and neighborhoods to use. Urban plazas could be a planning option for designing high-level behavior public spaces. Second, hospitals could provide parking garages with active first-floor functions for high transparency. It would improve parking issues with hospitals staff, and the active first-floor uses would improve activity levels on the streets. The third suggestion is to provide diverse food options, entertainment places, and recreation or greenspaces since there is nowhere to go other than the hospital for patients and staff. Fourth, security guards and surveillance cameras are necessary to address for safety concerns of pedestrians. At last, there is a need for food distribution and shelters in the area since some of them were closed due to the COVID-19 pandemic.

This pilot study revealed some refinements to the Street-Level Walkability Framework. Some street features do not seem to relate to street behaviors but are highly mentioned in pedestrians' experiences, like tree canopy and public art. An updated framework will separate design features by behaviors and experiences. Another major lesson learned is that that the 5-minute walking radius is too small for studying hospital-anchored neighborhoods. Thus, the dissertation study will expand the scope of study to 10-minute walking radius.

The methodology will be used to study three cases in Atlanta in next study. Increasing the number of observations and the number of interviews will also strengthen the results. Furthermore, increasing the number of streets segments will enable a statistical analysis to compare street features of walkable streets and unwalkable streets.

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