REDEFINING WALKING DISTANCE OF OPERATIONAL PLANNED WALKABLE NEIGHBORHOOD IN MALAYSIAN CITIES

THE CASE OF PUTRAJAYA CITY

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Abstract:

Urban planners, transport engineers and policy makers are emphasizing on creating environments to encourage people to walk. The concept of walkable neighborhoods is gaining prominence because evidence suggests that neighborhood socio-physical structure may affect physical activity for health and transportation purposes. It is evident that majority of our daily walk is comprised of activities such as walking for transport, work and domestic activity instead of active leisure pursuits. Understanding how people's local neighborhood environments affect their walking behavior is essential to create walkable environment. Existing literature regarding measures of perceptions of the environment related with walkability commonly depends on providing a definition of neighborhood with walking distance of 1 mile or 1.6 km around the home. Whereas traditional neighborhoods have some specific sizes which are based on walking distances which are equivalent to a quarter-mile radius or five minutes walking distance. The aim of this study is to examine the congruence between definitions used in literature review and residents own definition of walkable neighborhood. This aim will be achieved with the help of printed maps showing the neighborhood with road names and indicating places such as (Shop, Parks, Restaurant, Services, and Mosque) and the respondents were asked to draw their neighborhood walking area on the map and they have been provided three copies of the same map. For the three days, they were asked to mark areas visited on the map and later these annotated maps were scanned back into GIS software 9.3 versions for their analysis. The advent of GIS in physical activity research helps in objective measurement of the environment, linking geographical data with socio-demographic, behavioral and environmental data. When participants from residential precincts of Putrajaya were asked to draw their neighborhood boundary, the resulting areas were smaller than those calculated using GIS based on standard neighborhood definitions (1 mile or 1.6 km) Euclidean buffer area around the home. This shows a considerable variation in relative size of measured versus standard 1 mile walkable neighborhood definition. Thus it is concluded that adult's interpretation of their neighborhood area does not appear accurately to the definitions typically used 1 mile around the home into environment perception and walking related study and relate closer to estimated '5-minute walking' distances. It is also concluded that it would appear that operational definitions of neighborhood need to be smaller than those typically used.

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1. Introduction:

Studies on the relationship between characteristics of an adolescent's neighbourhood and physical activity are numerous (Colabianchi et al., 2007). Although, some studies have found a positive relationship (Davison and Lawson, 2006; Ferreira et al., 2007), there is still no consensus across various studies in the operational definition of one's neighbourhood. This paper examines the various theories defining neighbourhood and offers a practical approach on how to measure thresholds of walkable neighbourhoods.

(Mujahid, 2006) noted that previous studies adopted census tract as the basis upon which neighbourhoods are described. More recently researchers From United States (Frank et al., 2006) and from Australia (Mc Cormack et al., 2007; Leslie et al. 2008) have begun to explore the importance of the neighbourhood scale down to (400 m buffer around respondent's homes). However, of recent, buffers surrounding peoples home are used as a proxy for a neighbourhood (Porter et al., 2004) In literature, commonly used distances that are adopted when creating buffers in the adolescent physical activity are 0.5-0.6 miles (800-1000 meters) (Braza et al., 2004;Timperio et al 2006) or 1 mile (1500-1600mts) buffer around homes. Buffers as very small as 0.25 miles (400meters) have been used (Jago et al., 2006) and as big as 5 miles (8.05 kilometres) . The need for more research in to selection of these distances have been stressed as empirical data for their selection is lacking (Timperio, 2006) noted that one of the ways for choosing these locations is that they match an easy walking distance though there is no existing empirical standard for defining an easy walking distance(Colabianchi et al., 2007). The average walking speed of a human is at approximately 3 miles per hour, which translates to ¼ of a mile in five minutes. The ¼ mile radius circle shows the distance as the crow flies. One rationale for selecting these geographies is that they correspond to an easy walking distance though little empirical evidence exists for defining an easy walking distance. (Smith G. et al., 2010)

Studies that have been carried out on to explore the perceptions of neighbourhood boundaries with adults are few (Coulton CJ 2001). Adolescent's perception of neighbourhood boundaries is likely to be different. Again, literatures on studies that examine variation in neighbourhood boundaries across other features, such as whether the person lives in rural or an urban area are lacking.

This paper comprises of two objectives. First, it provides a general summary of theoretical frameworks defining and measuring neighborhoods. Second this study examine the congruence between definations used in literature review and residents's own definition of their neighbourhood. The case study used in this study is conducted in

Putrajaya City Malaysia. Putrajaya is a planned garden city. Fig 1 shows the location of Putrajaya.

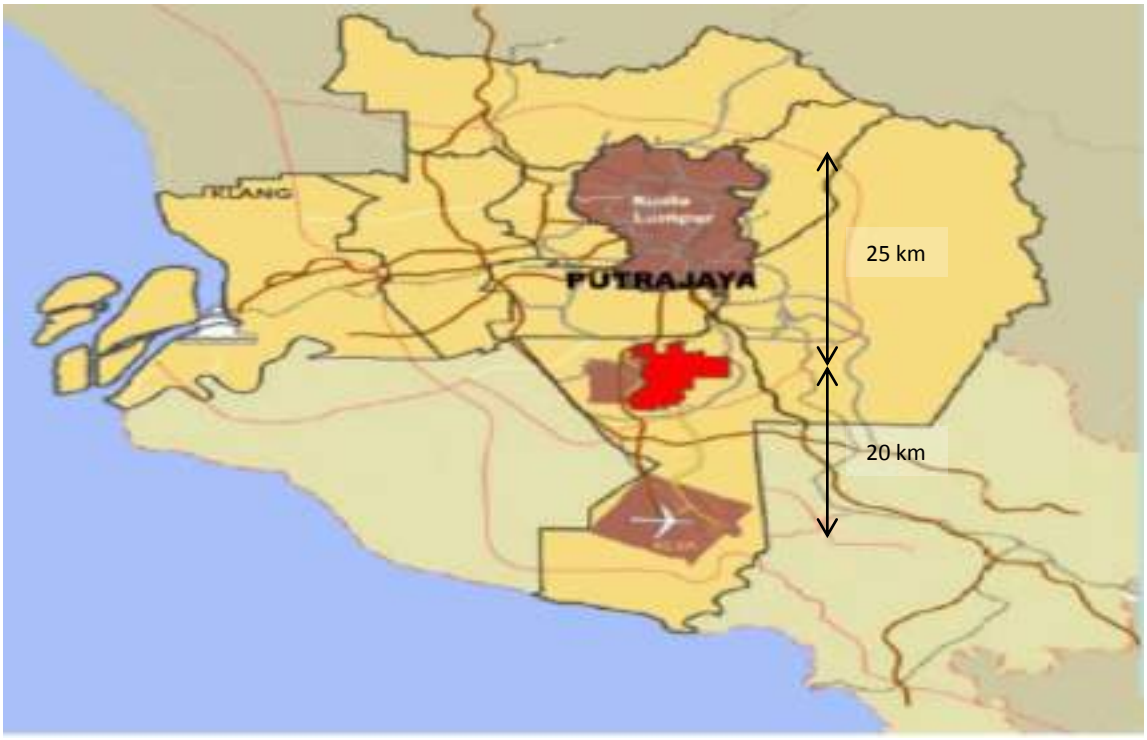

FIG.1: Location of Putrajaya (Source Draft Structure Plan Sustainable Putrajaya 2025 October 2011)

2. Theoretical Framework:

2.1Towards a Walkable Neighborhood theory:

The beginning of modern urban planning has been traced to Howard (1898) with his proposed garden cities. Howard was concerned about the over –crowded, unplanned and hostile British cities of his day, and recognized their relevance as sources of jobs and social infrastructures. Taking a cue from physics, Howard propounded the establishment of not only urban magnets that would attract workers to it but equally rural magnets that act as attraction force. He noted that doing this would involve the establishment of those human activities that can generate employment, self –containing, surrounded by all around by sphere of agricultural activities which serve as a green area to protect the establishment from external incursion.

Howard's great feat led to the launching of what became known as the new town movement. His idea was to transform urban planning from a public health exercise, to

one in which detailed spatial organizations of urban activities, housing unit, neighbourhood or as he called it the ward and town with respect to other places. Hence, neighbourhood for the first time became an essential part of urban planning activity. (Choguill, 2008).

From Ebenezer Howard Garden City theory, which modeled "new" (turn of the 19th and 20th centuries) British cities on small agglomerations of 6,000 to 30,000 people living within walkable distance to services and linked by rail transit. Today, conspicuous supporters of the New Urbanism have continued to advocate walkable neighborhoods, characterized alternatively as Traditional Neighborhood Design (TND), Transit Oriented Development (TOD), Pedestrian Pockets, Transit Villages, Urban Villages, and other sustainable models.

Following Howard garden city theory, the dawn of the 19th century saw the emergence of British cities on small agglomerations of about 6000 to 30,000 people residing within a walkable distance to services connected by rail transit. Today, many proponents of new urbanism have continued to canvass for walkable neighbourhoods characterized alternatively as Traditional Neighborhood Design (TND), Transit Oriented Development (TOD), Pedestrian Pockets, Transit Villages, Urban Villages, and other sustainable models.

In defining the walkable neighbourhood, it should go beyond pedestrian concerns as ability to move or walk freely in a neighbourhood shows not only a type of mobility and means of movement but also the kind of rapport that exist among neighbours which together affect their mental, physical , spiritual and health condition (Moudon AV et al. 2006)

Howard's concept was taken and developed by Perry (1929). (Choguill C.L. 2008) Perry propounded the concept of "neighbourhood unit" which allows children and families to move and walk safely from their dwellings to schools and recreational centres within the community. The educational and recreational facilities must be located within walking distance for all residents residing in the neighbourhood. Perry's theory is derived from social reforms that aim at growing urban population, and from Ebenezer Howard's (Moudon AV et al. 2006)

Perry was not only concern about the physical arrangements but also the involvement of the citizens in decision making about the neighbourhood. He viewed school as the right neighbourhood meeting point. Coupled with its educational function, it also serves as a community centre. He noted that school is preferable to clubhouses or churches because all members within the neighbourhood would see it as neutral.

The effect Perry's argument has on the present day urban planning is evident. Though he emphasized on the physical terms, his major concern was the building of social cohesion among residents in a well-defined neighbourhood. Most of Perry's concept was

integrated in to British public housing estates though sometimes not well incorporated, into British interwar (i.e., 1918-1939).

2.2 The Neighborhood Unit

The neighbourhood unit is defined as a physically defined unit with school, recreational areas and churches as its centre. The unit was sized to the catchment area of the typical elementary school (Kevin lynch, 1985). It is designed in such a way that residents walk not more than a quarter mile to get to these facilities and other nearby commercial areas without having to pass a major arterial street. Those streets that allow thorough traffic are not encouraged while arterial streets are located to the boundary, thereby allowing pedestrians to walk freely within the neighbourhood without any vehicular interference. Also, interior curvilinear streets characterize the neighbourhood unit's break with the traditional urban grid system. Perry proposed that that a 160 acre neighbourhood should be developed at 10 units per acre which can support between 5000-9000 residents. For more than Fifty years, it has been virtually the sole basis for formally organizing residential space (Banerjee and Baer, 1984). He even went further to suggest that 10 percent of the neighbourhood land area should be left for open spaces and parks for leisure and relaxation of residents. He equally advocated the building of schools with major play areas and community centre with various institutional uses. All these he noted, make up the physical nature concept. (Lawhon. 2009).

2.3 Principles of the Neighborhood Unit.

Perry organized the neighbourhood based on numerous physically oriented ideals. He noted that schools should be located centrally in the neighbourhood so that a child has to walk to a school only about one-quarter of a mile and no more than one-half mile without crossing any major arterial street as shown in Fig 2. Size the neighborhood to sufficiently support a school, between 5,000 to 9,000 residents, approximately 160 acres at a density of ten units per acre. Implement a wider use of the school facilities for neighborhood meetings and activities, constructing a large play area around the building for use by the entire community.

Place arterial streets along the perimeter so that they define and distinguish the "place" of the neighborhood. Bordered by arterial roads, neighbourhood units were to allow residents to do day to day activities on foot with little interference from vehicular traffic. The concept comprised pathways and internal street systems organized so as to discourage the through traffic (Pierre and Karen 2003).

FIG.2: CLARENCE PERRY'S "NEIGHBORHOOD UNIT" OF 1929

2.4 Neighborhood Concept in Putrajaya:

All residential areas within Putrajaya are developed on the 'neighborhood' concept. At the heart of this concept is that each distinct neighborhood within a larger residential precinct will be well-serviced, would have good access and vehicular and pedestrian movement routes, have ample facilities, or be well connected to such facilities, have adequate landscaped open spaces, be safe and secure, be well- maintained and equally important, have a critical mass of residents to make it livable, regardless of housing density. Each neighborhood would be defined by road ways, parks and open space or housing blocks. At the minimum, each neighborhood would have at least one neighborhood park and would be in close proximity to a larger park beyond its boundary (Review Master plan 1997). In figure (3) some of the concepts of Putrajaya master plan are depicted.

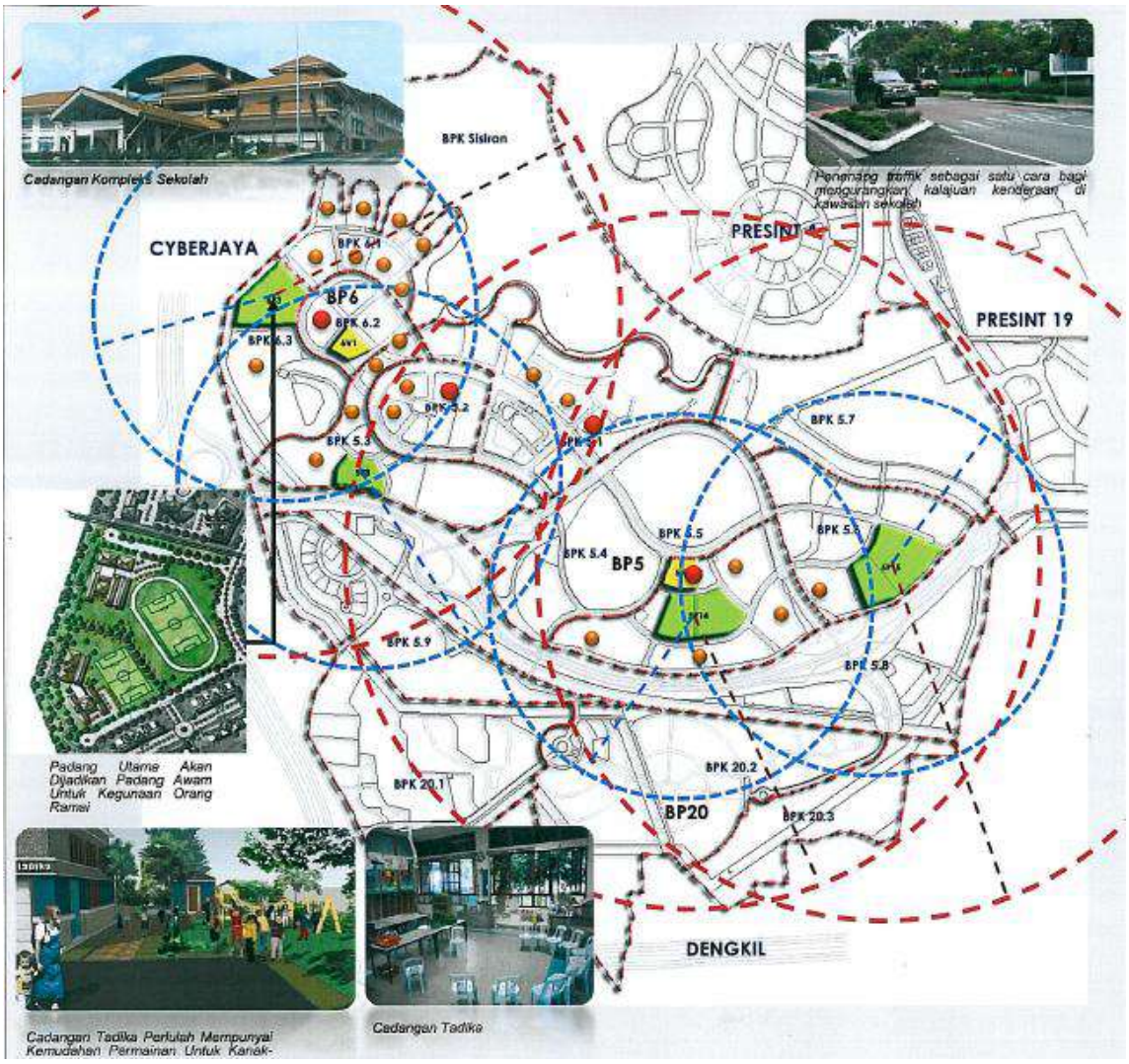

Fig. 3 School catchment area (source: local plan Putrajaya report in Malay)

800 meter buffer covering a Primary school

1600 meter buffer covering a secondary school

School complex (Primary and Secondary School)

Religious School

Kindergarten near office premises

Proposed kindergarten locations

2.5 Measurements of Neighborhood:

The urban planners measure neighborhood by considering the street pattern and land use pattern, pedestrian accessibility, connectivity and environment. Their chief methodological instruments are field observations and spatial pattern analysis using maps and are occasionally complemented with survey of residents. Street pattern includes number of cul-de-sac or grid pattern and whether they have small block or big boxes. The number of intersections within the different neighborhoods corresponds to variations in the length of the street networks. Grid network provide better connectivity between the land uses of a neighborhood than curvilinear streets, crescents, and culs-de-sacs. Planners usually assess the pedestrian accessibility potential of each neighborhood by computing the number of residential units within 500 m of three categories of facilities which are supermarkets, convenience stores, and primary schools via the road network and pathways. Psychologists use mental mapping to measure individual neighborhoods. Sociologists identify common attributes of social, economic, cultural, and physical aspects of neighborhood bringing forth indicators of cohesiveness. Homogeneity and heterogeneity. However, they recognize that relevant sociologic measure vary by behavior, domain, and outcome of interest.

3. Methods:

Face to Face interview were conducted with residents (aged 10-63) of Putrajaya lasting 15-20 minutes. GIS maps were created using the scale 1:12,500. Maps displayed an area of 1 mile around the boundary of each residents (approximately centered on participants' residents) and included road names and places of local interest such as green space, shops, services, schools and physical activity facilities.

Each participant was shown the printed GIS map for their local area. The interviewer helped to orientate them by pointing out the location of their residence, main roads and local landmarks. Using maps for reference or simply from recall, participants were asked to:

(i) Recall last day walking destinations from their home. In the event those participants belonging to the pre-teen age group were unable to identify any walking destinations from the map with the help of interview using a mind mapping techniques they were ask to recall any places they had walked from their home without using the map their destinations using major landmarks like local shopping areas, family friends, eating and drinking.

(ii) Draw their neighbourhood area on the map. Participants were also advised that their neighbourhood area could be any size or any shape.

Annotated maps from all participants were scanned back into a GIS for analysis. All recalled destinations points and neighbourhood area boundaries were digitized and the annotation from the maps recorded as feature attributes. GIS analysis was used to create a number of Euclidean buffer and network distance buffers around the address location of each participant. A Euclidean buffer is a straight line circular radius around the participant address location. Whereas the networks buffer were calculated by measuring a define distance along the pedestrian network which is like roads and pathways used by pedestrians in all possible directions away from the participant resident The end point of these routes were joined together to form an enclosed area representing the total area within a defined walking distance of the address.

For each participant we produced 5(five) different neighbourhood areas as shown in (Figure 4): 1 mile (or 1.6km) around the individual's home, Euclidean and network buffers; 1 km around the individual's home, Euclidean and network buffers; and participant perceived neighbourhood area. The areas of the perceived neighbourhoods were calculated as a proportion of the different network and Euclidean buffer to explore discrepancies in area size [i.e., area within perceived neighbourhood boundary (m^2)/area within network or Euclidean neighbourhood boundary (m^2) x 100]

Reported walking destinations were placed into eight categories retail (e.g. Shops, Supermarkets, Grocers) local services (e.g. banks, libraries); eating and drinking (e.g., cafes, restaurants); Family and friends; work/school; bus stops; green space (e.g., parks and common areas and lakes); and physical activities facilities (e.g., leisure centres, Gyms, swimming pools). These were examined for the sample as a proportion of total walking destinations.

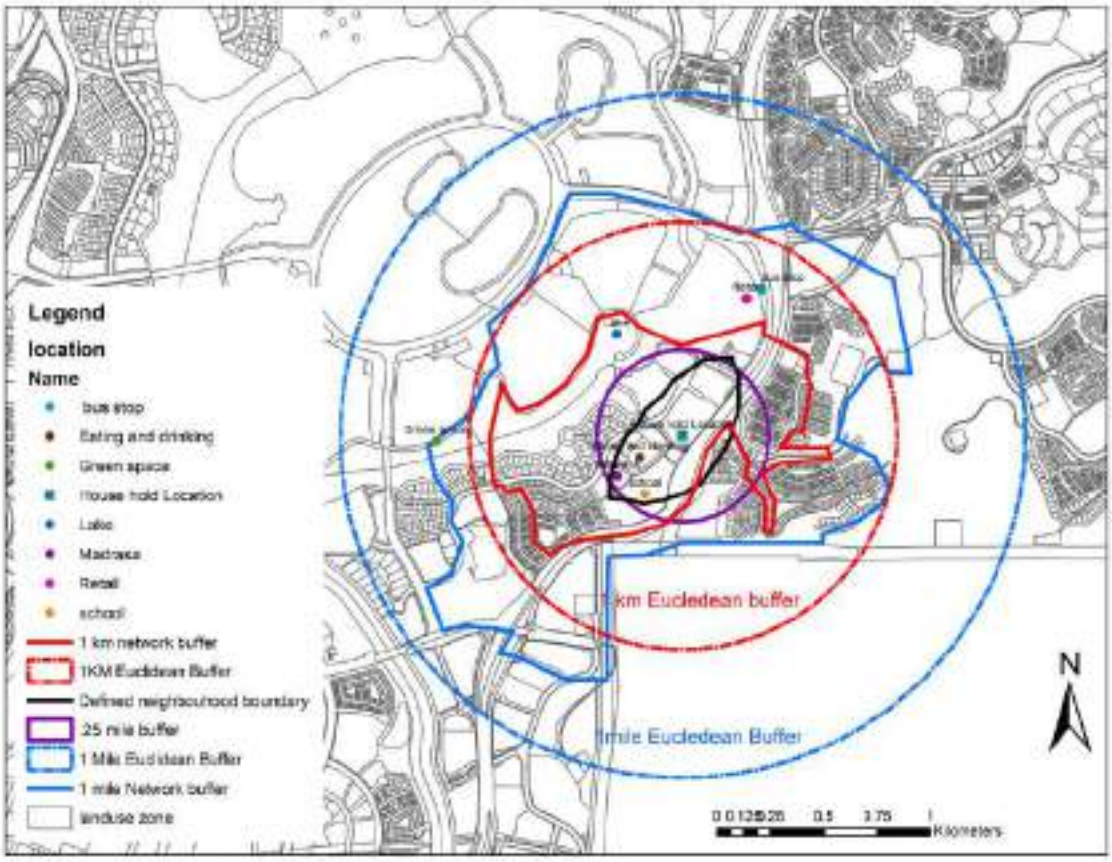

Figure 4: Illustrative figure of neighbor's perceived neighbourhood boundaries and GIS-defined boundaries and their walking destinations

4. RESULTS:

This study highlights important discrepancies among definition used in literature review and participants own definition of neighbourhood. The participants were generally conceptualizing a smaller neighbourhood area than those used in literature review.

When participants were asked to draw their 'neighbourhood' boundary, the resulting areas were smaller than those calculated using GIS based on standard neighbourhood definitions (1 mile or 1 km around the home). Perceived neighbourhood areas, on average, represented only 20 ± 25% of the commonly used 1 mile (1.6 km) Euclidean buffer area. Compared with a 1 mile network buffer area, the perceived neighbourhood area accounted for just 15±20%. This indicated a large discrepancy and considerable variation in relative size of perceived versus standard 1 mile neighbourhood definition. Analysis repeated using 1 km buffer areas revealed that, on average, the perceived neighbourhood still represented less than the 40±50% of the Euclidean buffer and 20±25

of the network buffer. This indicated a large discrepancy and considerable variation in relative size of perceived versus standard 1 mile neighbourhood definition.

Table 1 summarizes counts and proportions of the sample reporting different walking destinations. Most residents reported walking to retail destinations like supermarket, grocery approximately half walked to eating/drinking establishments and over one-third to family/friends and to local green spaces and lakes. This pattern was similar when looking at the contribution of each destination type as a proportion of the total number reported. Only 20% participants reported walking to physical activity facilities, whereas informal recreational activity through visiting green space was more frequently reported.

Table 2 indicates the discrepancies and variation between the percentages of walking destinations that fell within the variously defined neighbourhood areas. Whereas the network buffers captures relatively less. The most commonly used Euclidean buffer 1 mile area captures around 93% of destinations. The neighbourhood area calculated using definitions of 1 km around the home captures 84% of destinations.

Table 1: Percentage of participants who walked to different destinations types (n=50)

DESTINATION TYPES	n	%
Retail	42	84
Eating and drinking	30	60
Family / Friends	17	34
Green Spaces/lakes	17	34
Work /school	17	34
Bus stop	15	30
Local services	15	30
Physical Activity	10	20
Total	50	

Table2: Percentage of participants who walked to destinations types within perceived and objectively defined neighbourhood (1km and 1 mile) (n=50)

Neighbourhood definition	% of total destination	Mean Walk Time (mins)

1km buffer: *Euclidean* *Network*	 84 80	 12:50
1mile buffer: *Euclidean* *Network*	 93 90	 20.19 min
Perceived Neighbourhood	50	5.4 min

Conclusions:

It is concluded here that resident's interpretation of their neighbourhood area does not appear to relate accurately to the definitions used in research and into environmental perceptions and walking. But relate closer to Perry's definition of 5 minutes walking distance. It is also concluded that the average walkable neighbourhood area in our sample would be smaller than 0.75 miles and closer to estimated 5 minutes walking distances used elsewhere e.g., 0.25miles (Hoehner C.M. et al. 2005) 400m (Boehmer T.K. et al. 2006) this proves that operational definitions of neighbourhood needs to define smaller than those typically used particularly in hot tropical regions. This study explores that different age group interpretation of their neighbourhood area does not appear to relate accurately to the definition typically used in research into environmental perceptions and walking. The study suggests that bye laws used by Government agencies should use small buffers for walkability catchment areas and should do the Pedshed analysis for hot tropical climate of Malaysia.

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