

Inequalities in Neighbourhood Walkability for Older Adults

Dr Razieh Zandieh

Lecturer in Urban Design and Planning



razieh.zandieh@manchester.ac.uk



[@RaziehZandieh](https://twitter.com/RaziehZandieh)

MANCHESTER
1824

The University of Manchester

**HEALTHY
CITY DESIGN
INTERNATIONAL**

RESEARCH • POLICY • PRACTICE

14-15 OCTOBER 2019

ROYAL COLLEGE OF PHYSICIANS, LONDON



Encouraging physical activity = one of the objectives of HUP

Physical activity for older adults (≥ 65 years) is important.

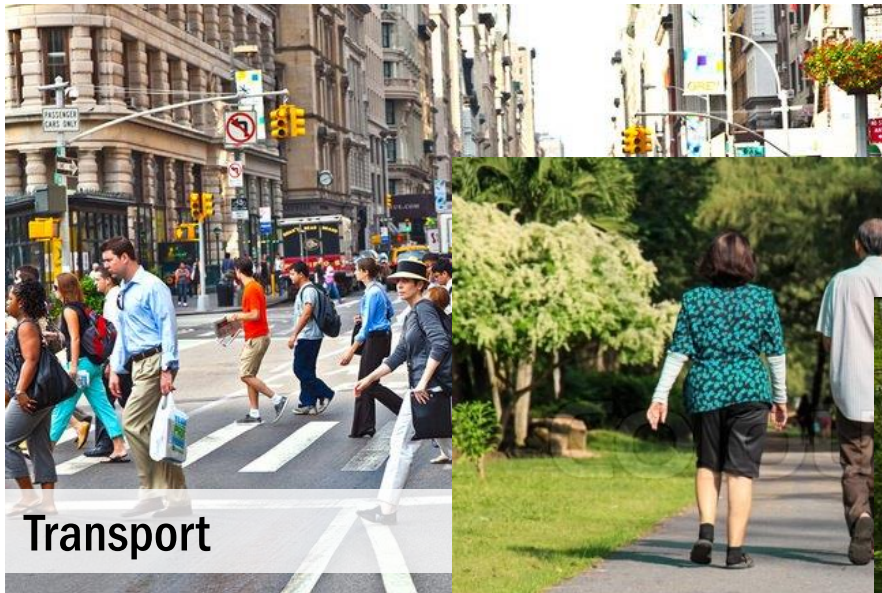
- Increasing longevity
- Declining health with aging
- Prevalence of inactivity



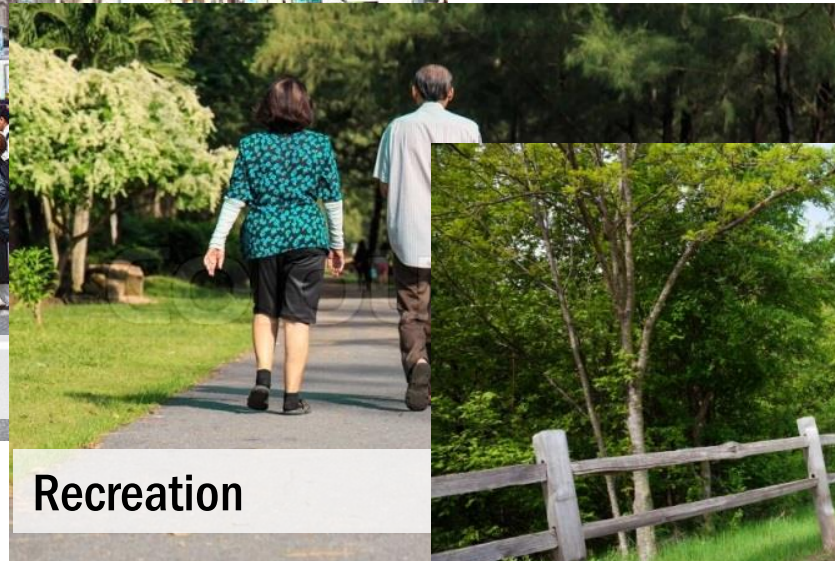
Inactivity: especially among older residents of high-deprivation areas



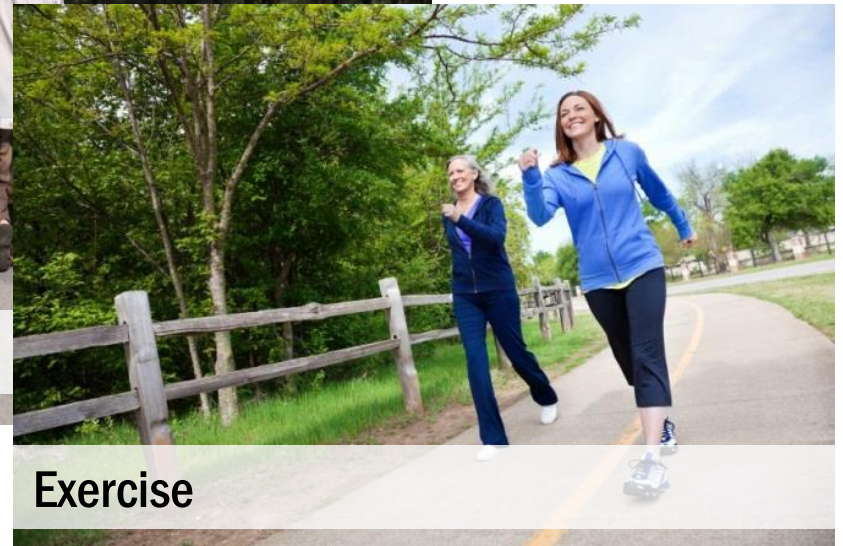
OUTDOOR WALKING: The excellent form of PA for older adults



Transport



Recreation



Exercise

To encourage older adults to take outdoor walks.



Factors that may influence outdoor walking

Personal characteristics

- **Socio-demographic status:**
 - Age
 - Ethnicity
 - marital status
 - etc.

- **Health status**

Socio-economic deprivation

- **Individual deprivation:**
Individual disadvantage in terms of material welfare and the ability to participate in social life.
 - Educational attainment
 - Income
 - Occupational status

- **Area deprivation**
Relative disadvantage of urban areas in which people live.



Factors that may influence outdoor walking

Built Environment

Neighbourhood

Predominant context of walking for older adults

Retirement
Smaller social network
Age-related changes

Neighbourhood Walkability

■ Macro built env. attributes:

- Residential density
- Land-use mix and intensity
- Street connectivity
- Retail density

■ Micro built env. attributes:

- Safety
- Pedestrian infrastructure
- Aesthetics



Macro built environment attributes:

Residential Density

Number of dwellings in relation to the total amount of land devoted to residential use

Land-use mix

Level of integration of divers types of land uses in neighbourhood

Land-use intensity

Amount of land devoted to each type of use relative to the total land of the neighbourhood

Street Connectivity

Junction density in a neighbourhood

Retail density

Amount of retail floor area in relation to the total amount of land devoted to retails



Micro built environment attributes:

Safety

Absence of threat from crime

Pedestrian infrastructure

- Traffic condition
- Pavement condition
- Presence of amenities (bench, public toilet, shelter)
- Quietness
- Air quality

Aesthetics

Sense of beauty and visual appearance

Unanswered:

- 1) Do older residents of high-deprivation areas have a less supportive neighbourhood for outdoor walking than those of low-deprivation areas?
- 2) How do neighbourhood built environment attributes influence outdoor walking among older adults living in low- and high-deprivation areas?

Spatial inequality:

Uneven provision of urban opportunities and resources among urban areas with different levels of socioeconomic deprivation (UN-Habitat 2008)

The associations between area deprivation and older adults' objectively measured outdoor walking levels (frequency and duration).

The Associations Between Area Deprivation and Objectively Measured Older Adults' Outdoor Walking Levels

Razieh Zandieh¹, Javier Martínez¹, Johannes Flacke¹, and Martin van Maarseveen¹

Abstract

Outdoor walking has positive impacts on older adults' health. It is crucial to identify less active older adults and to encourage them to take outdoor walks. Previous studies have shown that physical activity levels vary according to socioeconomic deprivation. However, knowledge on objectively measured older adults' outdoor walking levels is limited. This study investigated associations between area (socioeconomic) deprivation and older adults' objectively (geographic positioning system [GPS]) measured outdoor walking levels (i.e., walking durations and frequencies) in Birmingham, United Kingdom. It used a multilevel approach. The final sample included 173 participants (65 years and above). A questionnaire was used to collect data on personal characteristics (e.g., educational attainment as a proxy of individual deprivation, age, and marital status). The results show that independent of personal characteristics, area deprivation associates with outdoor walking durations. Participants from high-deprivation areas spend less time for outdoor walking than those from low-deprivation areas. Associations between area deprivation and outdoor walking frequencies were nonsignificant. Future research needs to investigate how attributes (e.g., environmental attributes) of low- and high-deprivation areas drive disparities in outdoor walking durations among older residents of low- and high-deprivation areas.

Keywords

physical activity, walking durations and frequencies, socioeconomic, multilevel, GPS

Physical activity has positive impacts on health (Department of Health, 2011). It is especially important for older adults, who are at risks of chronic disease (Department of Health, 2011) and isolation (Age, 2010). For older adults, walking is an excellent type of physical activity (Centers for Disease Control and Prevention, 1999; Cunningham & Michael, 2004). As Broderick, McCullagh, White, Savage, and Timmons (2015) have reported, walking and being able to spend time outdoors is very important for older adults. Outdoor walking (total walking for transport, recreation, and exercise in outdoor space) reduces risks of chronic disease (e.g., diabetes II and stroke) and improves social interactions (Lee & Buchner, 2008; Sugiyama & Thompson, 2007). Thus, development of interventions aiming at encouraging older adults to take outdoor walks has been recommended (Department of Health, 2011). Addressing outdoor walking is especially important for urban planning discipline, because outdoor walking takes place in outdoor spaces such as urban streets and urban open spaces. One of the aims of a healthy urban planning is encouraging outdoor walking among all people (Barton & Tsourou, 2000; World Health Organization [WHO], 2011). Great health benefits could be obtained by encouraging older adults who are less active—and, therefore,

are more at risks of health problems—than others (Hillsdon, Lawlor, Ebrahim, & Morris, 2008). Reducing inactivity and eliminating disparities in physical activity are important public policy priorities (Healthy People, 2006; Public Health England, 2014; Ruseski, 2014). Therefore, it is necessary to examine disparities in older adults' outdoor walking levels and to identify less active groups of older adults.

Evidence indicates a socioeconomic deprivation gradient in older adults' health (Grundy & Sloggett, 2003; Lima-Costa, De, Oliveira, Macinko, & Marmot, 2012) and health behavior (e.g., healthy eating; Bianchetti, Rozzini, Carabellese, Zanetti, & Trabucchi, 1990; Conklin et al., 2014; Conklin, Forouhi, Surtees, Wareham, & Monsivais, 2015). Socioeconomic deprivation is defined as relative disadvantage in terms of social and material resources (Crampton, Salmond, Woodward, & Reid, 2000). It has been

¹University of Twente, Enschede, The Netherlands

Corresponding Author:

Razieh Zandieh, Faculty of Geo-Information Science and Earth Observation (ITC), University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands.
Email: rzh.zandieh@gmail.com



Inequalities in macro built environment attributes in high-versus low-deprivation areas and their possible influences on disparities in older adults' outdoor walking levels.



Article

Do Inequalities in Neighborhood Walkability Drive Disparities in Older Adults' Outdoor Walking?

Razieh Zandieh ^{1,*} , Johannes Flacke ¹ , Javier Martinez ¹ , Phil Jones ² 
and Martin van Maarseveen ¹

¹ Faculty of Geo-Information Science and Earth Observation (ITC), University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands; j.flacke@utwente.nl (J.F.); j.martinez@utwente.nl (J.M.); m.f.a.m.vanmaarseveen@utwente.nl (M.v.M.)

² School of Geography, Earth and Environmental Sciences, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK; p.i.jones@bham.ac.uk

* Correspondence: r.zandieh@utwente.nl; Tel.: +31-53-4874532

Received: 31 May 2017; Accepted: 3 July 2017; Published: 7 July 2017

Abstract: Older residents of high-deprivation areas walk less than those of low-deprivation areas. Previous research has shown that neighborhood built environment may support and encourage outdoor walking. The extent to which the built environment supports and encourages walking is called “walkability”. This study examines inequalities in neighborhood walkability in high- versus low-deprivation areas and their possible influences on disparities in older adults' outdoor walking levels. For this purpose, it focuses on specific neighborhood built environment attributes (residential density, land-use mix and intensity, street connectivity, and retail density) relevant to neighborhood walkability. It applied a mixed-method approach, included 173 participants (≥ 65 years), and used a Geographic Information System (GIS) and walking interviews (with a sub-sample) to objectively and subjectively measure neighborhood built environment attributes. Outdoor walking levels were measured by using the Geographic Positioning System (GPS) technology. Data on personal characteristics was collected by completing a questionnaire. The results show that inequalities in certain land-use intensity (i.e., green spaces, recreation centers, schools and industries) in high- versus low-deprivation areas may influence disparities in older adults' outdoor walking levels. Modifying neighborhood land use intensity may help to encourage outdoor walking in high-deprivation areas.

Keywords: physical activity; GIS; GPS; facilities; qualitative; quantitative; perception; walking interview; multilevel/hierarchical analyses; healthy urban planning

1. Introduction

Outdoor walking refers to total walking for different purposes—including transport, recreation and exercise—in outdoor space. It is a type of physical activity and has certain benefits for healthy aging [1,2]. Therefore, physical activity guidelines recommend older adults to take outdoor walks [3,4]. Despite this widespread knowledge, there is prevalence of physical inactivity among majority of older adults [3,5], particularly among older residents of high-deprivation areas (areas with high levels of social and economic disadvantages) of cities [6,7]. It has been shown that older residents of high-deprivation areas walk less than those of low-deprivation areas [6,8]. These findings highlight the importance of promoting outdoor walking levels among older adults, particularly among older residents of high-deprivation areas.

To promote outdoor walking levels, a growing body of literature has addressed the link between the built environment and walking [9–12]. Although the influences of the built environment on walking are not yet well understood [13,14], transportation and urban planning research has identified

Inequalities in perceived micro built environment attributes in high- versus low-deprivation areas and their possible influences on disparities in older adults' outdoor walking levels.



Article

Older Adults' Outdoor Walking: Inequalities in Neighbourhood Safety, Pedestrian Infrastructure and Aesthetics

Razieh Zandieh ^{1,*}, Javier Martinez ¹, Johannes Flacke ¹, Phil Jones ² and Martin van Maarseveen ¹

¹ Faculty of Geo-Information Science and Earth Observation (ITC), University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands; j.martinez@utwente.nl (J.M.); j.flacke@utwente.nl (J.F.); m.f.a.m.vanmaarseveen@utwente.nl (M.v.M.)

² School of Geography, Earth and Environmental Sciences, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK; p.i.jones@bham.ac.uk

* Correspondence: r.zandieh@utwente.nl; Tel.: +31-53-4874532

Academic Editor: Marcia G. Ory

Received: 27 July 2016; Accepted: 21 November 2016; Published: 25 November 2016

Abstract: Older adults living in high-deprivation areas walk less than those living in low-deprivation areas. Previous research has shown that older adults' outdoor walking levels are related to the neighbourhood built environment. This study examines inequalities in perceived built environment attributes (i.e., safety, pedestrian infrastructure and aesthetics) and their possible influences on disparities in older adults' outdoor walking levels in low- and high-deprivation areas of Birmingham, United Kingdom. It applied a mixed-method approach, included 173 participants (65 years and over), used GPS technology to measure outdoor walking levels, used questionnaires (for all participants) and conducted walking interviews (with a sub-sample) to collect data on perceived neighbourhood built environment attributes. The results show inequalities in perceived neighbourhood safety, pedestrian infrastructure and aesthetics in high- versus low-deprivation areas and demonstrate that they may influence disparities in participants' outdoor walking levels. Improvements of perceived neighbourhood safety, pedestrian infrastructure and aesthetic in high-deprivation areas are encouraged.

Keywords: physical activity; walking; deprivation; built environment; older adults; perception; inequalities; GPS

1. Introduction

Outdoor walking, as a type of physical activity, takes place in outdoor spaces. It has well-known benefits for health in later life [1,2] and older adults are recommended to take outdoor walks [3]. However, evidence shows that most older adults, especially those living in high-deprivation areas of cities (areas with high levels of social and economic disadvantages) [4,5], are physically inactive [6,7]. Fox, et al. [8] found that older residents of high-deprivation areas walk less than those of low-deprivation areas. This finding indicates the necessity of encouraging outdoor walking among older adults, especially those living within high-deprivation areas.

Although some previous studies have found insignificant relationships between the built environment and older adults' walking [9,10], there is growing evidence showing that older adults' walking level is related to the built environment of residential neighbourhoods [11–13]. Neighbourhood built environment may encourage older adults to take outdoor walks [1,3]. Built environment attributes fall into two categories [14]: (1) macro built environment attributes, including neighbourhood residential density, land use-mix and route connectivity, which shape the overall design and structure of



To examine inequalities in built environment attributes in high-versus low-deprivation areas and their possible influences on disparities in older adults' outdoor walking levels.

Research questions

- How (un)equal are neighbourhood built environment attributes in high-versus low-deprivation areas?
- What are the relationships between neighbourhood built environment attributes and older adults' outdoor walking levels?



METHOD

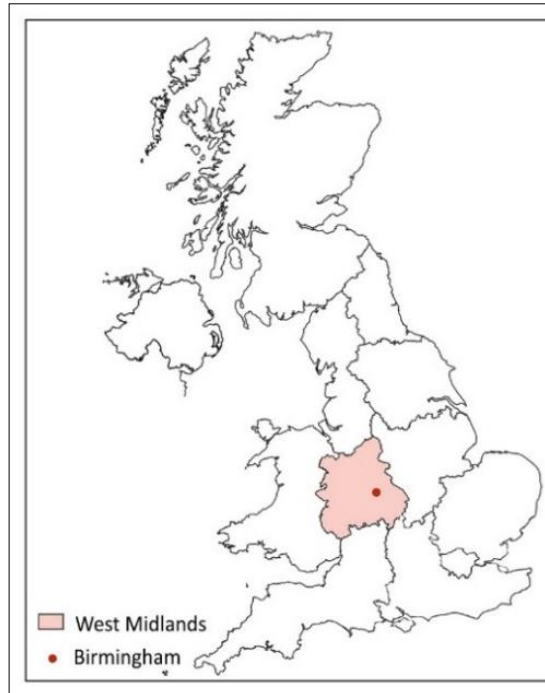


Research design

- A multilevel approach;
- A mixed- method (combining quantitative and qualitative methods) approach;

Birmingham, West Midlands, UK

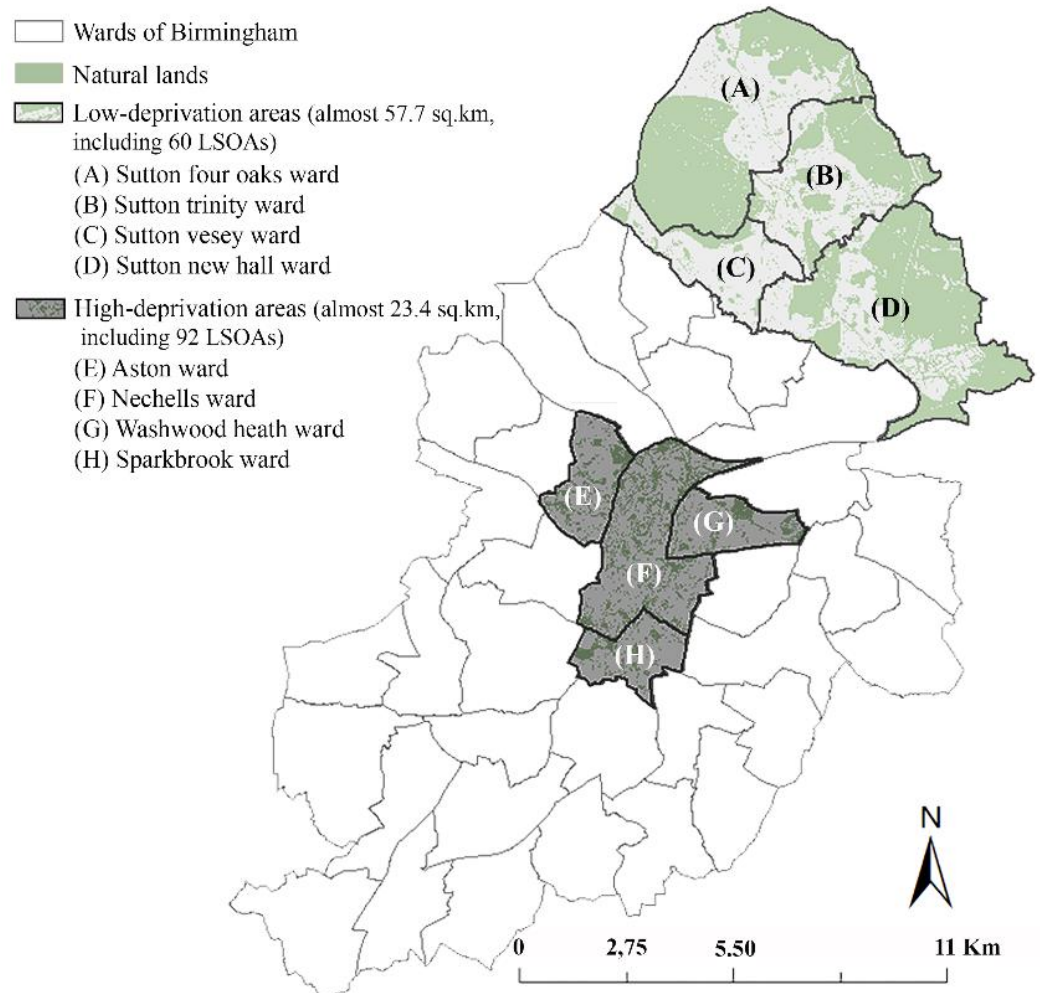
- Over 1 million population
- Second largest city in the UK
- A superdiverse city





Area deprivation

Index of multiple deprivation (IMD): low- and high-deprivation areas of Birmingham.





Pilot study

- To explore older adults' behaviour;
- To test appropriateness of different methods
- Initial observation of disparities in the built environment.





Data Collection:

(7th July – 31st October 2012)

- Convenience sampling
- Quota sampling

Final Sample

173 participants:

80 from high-dep. areas

93 from low-dep. areas



Sub-sample

19 participants:

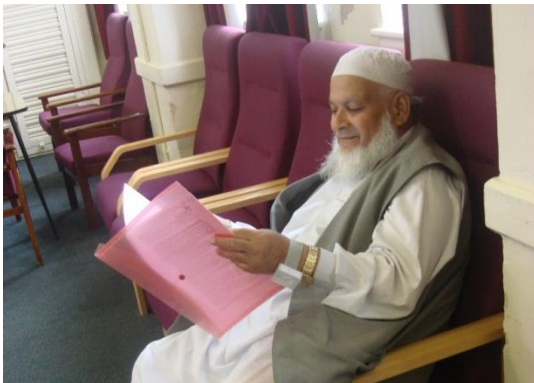
10 from high-dep. areas

9 from low-dep. areas



GPS

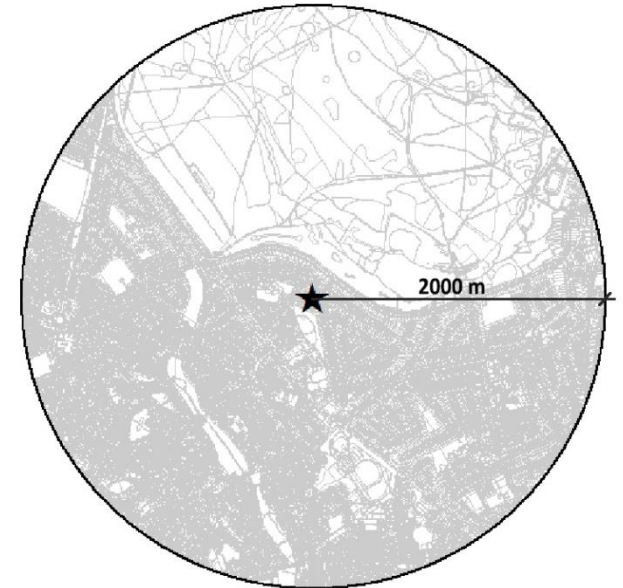
To measure outdoor walking levels





GPS

- Walking in home-based neighbourhood:
 - Started from home and ended in a destination;
 - Followed a trip by car/public transport.



★ The participant's home

Average walking level (minute/day)

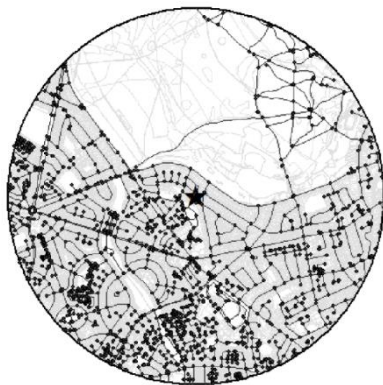
A participant's home-based neighbourhood



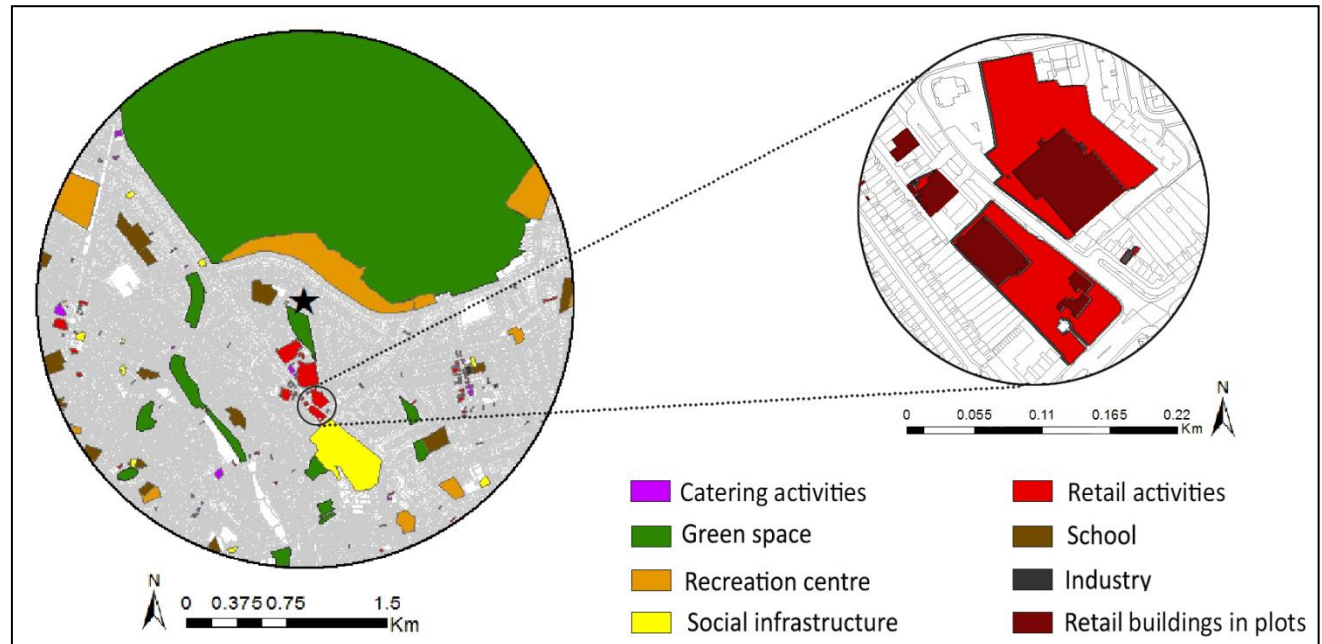
GIS: Macro built environment attributes



Residential use



Street connectivity



Land use mix / Land use-intensity / Retail density



Questionnaire:

- Micro built environment attributes

- Personal characteristics:
 - Age
 - Gender
 - Marital status
 - Ethnicity
 - Perceived health status

- Individual deprivation:
 - Educational attainment





Walking interview (with a subsample):





Data Analysis

- **SPSS: statistical (e.g., descriptive statistics, t-test, hierarchical linear regression analyses – controlled for individual characteristics and deprivation);**
- **Arc GIS: analysis of spatial distributions;**
- **Atlas.ti: Content analysis.**



RESULTS



Participants characteristics

	Area deprivation		Total sample (low- and high-deprivation areas)
	Low-deprivation areas	High-deprivation areas	
Number of participants (number)	93	80	173
Age of participants (<i>M</i> (<i>SD</i>))	74.8 (5.82)	73.5 (5.95)	74.2 (5.90)
Educational attainment (%)			
GCSE and higher	80	24	54
Sub-GCSE	10	64	35
Age (%)			
More than 75 years old	53	43	48
65-74 years old	47	57	52
Gender (%)			
Men	30	59	43
Women	70	41	57
Marital status (%)			
In relationship	53	53	53
Single	47	47	47
Ethnicity (%)			
White British	97	41	71
BME groups	3	59	29
Health status (%)			
Good	93	92	92
Poor	6	8	7

Note. GCSE = General Certificates of Secondary Education; BME = Black and minority ethnic.



Outdoor Walking Levels

High-deprivation areas < Low-deprivation areas



Residential Density

QUAN. Results

High-deprivation areas > Low-deprivation areas

No relationship with walking.

QUAL. Results

High-deprivation areas: Many people and houses and more social disorder, less beautiful scenery and fewer local green spaces for outdoor walking

Low-deprivation areas: Residential area is suitable for recreational walking



Land-use Mix & Intensity

QUAN. Results

High-deprivation areas > Low-deprivation areas

No relationship with walking in high-dep areas.

Positive relationship with walking in low-dep areas.



QUAL. Results

Different destinations for walking

Close distances to different destinations



Land-use Intensity

QUAN. Results

Recreational & green space :

High-deprivation areas < Low-deprivation areas

Positive relationship with walking.

School & Industries:

High-deprivation areas > Low-deprivation areas

Negative relationship with walking.



QUAL. Results

Schools: generate traffic and traffic hazards

Industries: provide unattractive scenery

Green space, eating/drinking, social infrastructure, retail: Low quality, not affordable in high-deprivation areas.



Street Connectivity & Retail Density

QUAN. Results

Street connectivity

High-deprivation areas > Low-deprivation areas

Negative relationship with walking.

Retail density:

High-deprivation areas > Low-deprivation areas

No relationship with walking.

QUAL. Results

Street Connectivity: Satisfied with moving through different shortcuts.

Retail Density: Using car for heavy shopping, not to carry heavy bags;



Safety

QUAN. Results

High-deprivation areas < Low-deprivation areas
Positive relationship with walking.

QUAL. Results

High-deprivation areas:

Lack of safety: Presence of gangs and groups of hooligans, anti-social behaviour, high crime rate, drug use and lack of street lights, lack of surveillance

Low-deprivation areas:

Perceived safety: nothing to frighten anyone, no real crime, no vandals, good visibility and safety



Traffic & pavement conditions

QUAN. Results

High-deprivation areas < Low-deprivation areas
No relationship with walking.



QUAL. Results

Choosing routes with less problem/ walking in quiet traffic time or in quiet roads, crossing roads without using crossing.



Amenities & Quietness

QUAN. Results

Amenities

High-deprivation areas < Low-deprivation areas
No relationship with walking.

Quietness:

High-deprivation areas < Low-deprivation areas
Positive relationship with walking.



QUAL. Results

Using benches and public toilets in shops and shopping malls



Air quality & Aesthetics

QUAN. Results

Air quality

High-deprivation areas > Low-deprivation areas

No relationship with walking.

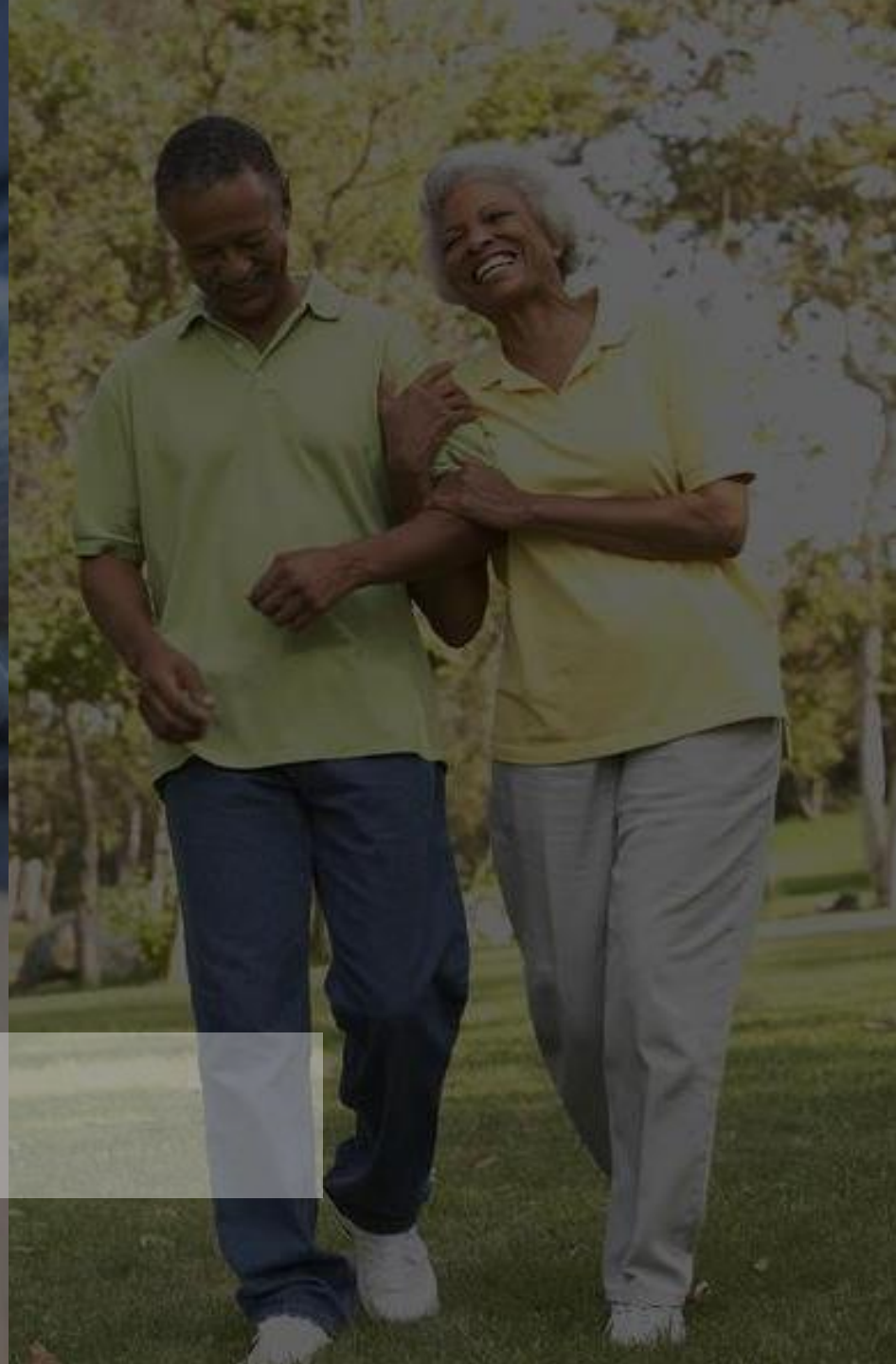
Aesthetics:

High-deprivation areas < Low-deprivation areas

Positive relationship with walking.

QUAL. Results

Air quality is poor in winter.



CONCLUSION



One of the first: combining spatial inequality, GIS and GPS technology and participants' perceptions.

**Outdoor walking levels in neighbourhood:
High-dep. Areas < Low-dep. areas**

Quantitative + Qualitative Results

Neighborhood Built Environment Attribute	Quantitative Results		Qualitative Results
	Spatial Inequalities	Related to Walking ^a Levels	Perceived Influences of Neighborhood Built Environment Attributes on Outdoor Walking Levels
Residential density	High > Low	No	High: encouraged walking by providing close destination. Discouraged walking due to generating social disorder, less beautiful scenery and fewer open spaces. Low: encouraged walking by providing close destinations and offering a suitable area for recreational walks.
Land-use mix	High > Low	No ^b	High and Low: close distance to diverse destinations/place was important and encouraged walking.
Land-use intensity Eating/drinking	High > Low	No	High: were perceived as unattractive destinations by some participants and did not support walking among them. Low: were perceived as attractive destinations and encouraged walking.
Green space	High < Low	Yes +	High: lack of green spaces as attractive destinations/places for walking discouraged walking. Low: presence of green spaces as attractive destinations/places for walking encouraged walking.
Recreation centers	High < Low	Yes +	High: lack of recreation centers in neighborhood did not support walking. Low: presence of recreation centers in neighborhood encouraged walking.
Social infrastructure	High > Low	No	High: lack of these destinations (i.e., community centers with social activities for older adults) did not support walking. Low: lack of these destinations (i.e., libraries and community centers with social activities for older adults) did not support walking.
Retail	High > Low	No	High: were perceived as unattractive destinations by some participants and did not support walking among them. Low: lack of these destinations (i.e., shops) in some areas discouraged walking.
Schools	High > Low	Yes -	High: presence of many schools discouraged walking due to generating traffic dangers. Low: presence of schools discouraged walking due to generating traffic dangers.
Industries	High > Low	Yes -	High: presence of many industries discouraged walking by offering unattractive scenery in the neighborhood. Low: presence of industries was not discussed by participants.
Street connectivity	High > Low	Yes -	High and Low: perceived short and alternative routes encouraged walking.
Retail density	High > Low	No	High and Low: presence of spaces devoted to cars (e.g., parking) was not perceived as a challenge for walking.



Quantitative + Qualitative Results

Neighbourhood Built Environment Attribute	Quantitative Results		Qualitative Results
	Spatial Inequalities	Related to Walking Levels	Perceived Influences of Neighbourhood Built Environment Attributes on Outdoor Walking Level
Safety	High < Low	Yes	High: perceived intimidating neighbourhoods were unsupportive and discouraging for outdoor walking. Low: perceived safe neighbourhoods supported and encouraged participants to take outdoor walks.
Traffic condition	High < Low	No	High: perceived poor traffic conditions made outdoor walking uncomfortable. Participants took outdoor walk in quiet traffic time or in quiet roads and they carefully crossed the roads without using crossings. Low: perceived some poor traffic conditions made walking uncomfortable.
Pavement condition	High < Low	No	High and Low: perceived poor pavement conditions made walking uncomfortable. Participants chose even pavements for walking.
Presence of amenities	High < Low	No	High and Low: lack of benches and public toilets were perceived. Participants used benches and public toilets of shops, malls and supermarkets.
Quietness	High < Low	Yes	High: perceived noise, especially from traffic, in neighbourhood dissuaded participants to walk outside. Low: perceived quietness of neighbourhood definitely encouraged outdoor walking.
Air quality	High < Low	No	High: air quality was perceived poorer in winter. A clean air was preferred for outdoor walking. Low: perceived clean air encouraged outdoor walking.
Aesthetics	High < Low	Yes	High: perceived boring, uninteresting and unenjoyable neighbourhoods discouraged outdoor walking. Low: perceived beautiful and enjoyable neighbourhoods encouraged outdoor walking.



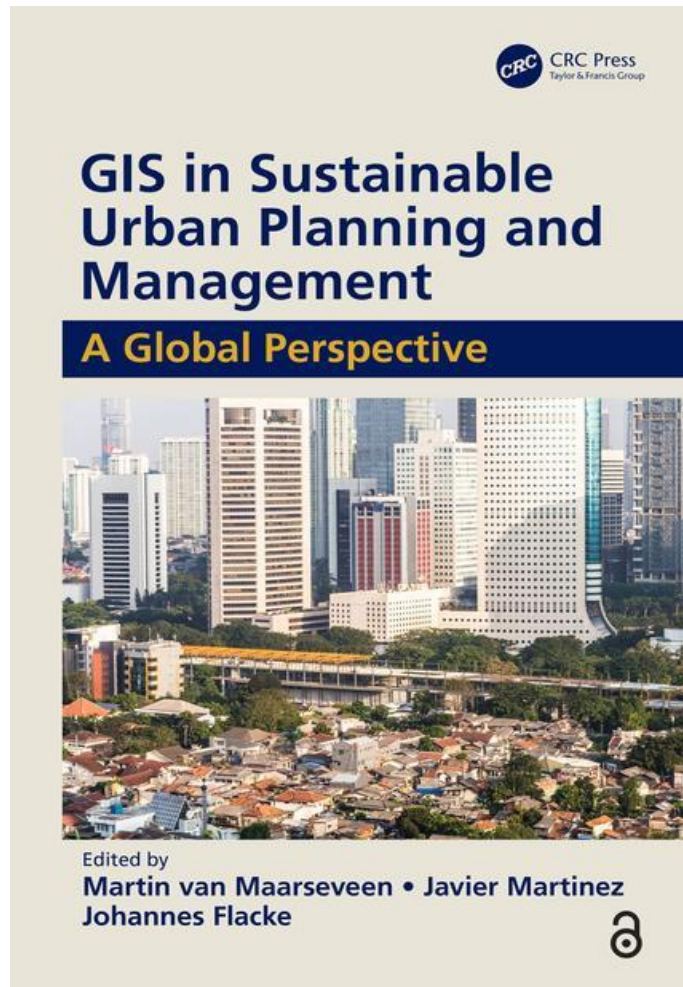
Strategies aiming at

- **Modifying intensities of certain land-uses in neighbourhoods.**
- **Improving living environment conditions leading to positive perception of neighbourhood safety, quietness and aesthetics in high-deprivation areas is encouraged.**

may help in supporting and encouraging outdoor walking in high-deprivation areas



Correlation between macro and micro built environment attributes



5 Relationships between Outdoor Walking Levels and Neighbourhood Built-Environment Attributes *The Case of Older Adults in Birmingham, UK*

Razieh Zandieh, Johannes Flacke, Javier Martinez, and Martin van Maarseveen

CONTENTS

5.1	Introduction	63
5.2	Case Study Area: Birmingham (UK)	65
5.3	Methods	66
5.3.1	Data on Neighbourhood Built-Environment Attributes	67
5.3.2	Data Analysis	68
5.3.2.1	GIS Measures of Macro Built-Environment Attributes	68
5.3.2.2	Statistical Correlations	70
5.4	Results	72
5.4.1	Capacity of GIS for Measuring Macro Built-Environment Attributes	72
5.4.2	Correlations among and between Neighbourhood Built-Environment Attributes	72
5.4.3	Correlations among GIS-Measured Macro Built-Environment Attributes	74
5.4.4	Correlations among Perceived Micro Built-Environment Attributes	74
5.4.5	Correlations between GIS-Measured Macro and Perceived Micro Built-Environment Attributes	75
5.5	Discussion	76
5.6	Limitations of Our Study	78
5.7	Conclusion	79
	References	79

5.1 INTRODUCTION

Outdoor walking is one of the forms of physical activity that takes place in urban areas. Outdoor walking may be undertaken for different purposes, such as walking as a means of transport and walking for recreation (Zandieh et al., 2017b). Walking has well-known positive impacts on people's health (Lee and Buchner, 2008; Sugiyama and Thompson, 2007), and for this reason people (especially those who are at risk for health problems, such as older adults) are advised to take outdoor walks (Age UK, 2016; Department of Health, 2011).

Thank you

Dr Razieh Zandieh

Lecturer in Urban Design and Planning

 razieh.zandieh@manchester.ac.uk

 @RaziehZandieh

MANCHESTER
1824

The University of Manchester