EXPLORING THE RELATIONSHIP BETWEEN HEALTH AND WALKABILITY

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Abstract

This study aimed to broaden Theory of Planned Behaviour (TPB) by including healthy urban performance attributes of the residential neighbourhoods as an additional predictor for walking behaviour. First, the study reviewed the literature on TPB and walkability in residential environments, and then constructed a TPB model based on walkability to set the hypotheses. The study explored the correlations among walkability attributes and walkability behaviour through a survey conducted with residents in Ankara, Turkey (n= 220). To analyse the data, first confirmatory factor analysis and later, structural equation modelling were used. The findings of the study highlighted two aspects of planning for a walkable neighbourhood: (i) a walkability model based on the three constructs of TPB should not neglect the measured and experienced urban performance; (ii) utilizing pedestrian environment for walking as fully as possible requires a collaborative and an experiential approach as well as a multi-parameter decision-making process.

Keywords: *Theory of Planned Behaviour (TPB), Healthy Urban Performance, Walkability, Residential Environments.*

INTRODUCTION

Over the last decade, the design research community has become increasingly interested in promoting more sustainable behaviours through the design of new urban environments, buildings, products and services. The quality of life in residential neighbourhoods and walkability in residential communities are necessary to enhance an effective urban performance and positive behavioural intentions for liveable communities. Walkability is a new term to describe how friendly a city and healthy an urban space is (ZUNIGA-TERAN et al., 2017a). Walkable urban spaces increase secure social interaction, physical fitness and wellness, while promoting an accessible and sustainable urban experience. However, walkability is now fractured. Currently, redevelopment efforts in urban environments target toward automobile-dependent and more stable residential neighbourhoods with a limited mobility (MARQUET and MIRALLES-GUASCH, 2015). A walkable experience and walkability require behavioural change in urban life.

Although there is an extensive literature about the development of walkability audits, models, parameters and frameworks (LEE and TALEN, 2014), most of these studies evaluate the walkability features of a case urban setting. There are only few studies that examine the influences of the urban environment on walking motivation, but none of the studies analysed walkability behaviour through the correlations among attitudes, subjective norms, perceived behavioural controls, healthy urban performance, and intentions.

This paper contributes to this stream of research by broadening the role of the Theory of Planned Behaviour (TPB) (AJZEN, 1991) to understand the associations between the healthy attributes of the residential neighbourhoods and the promotion of walkability intention to perform walkability behaviour. According to the theory, the stronger the intention to engage in behaviour, the more likely is its performance. In TPB, attitudinal factors, normative factors and perceived behavioural control could predict behaviour. This study aims to broaden TPB by including healthy attributes of the residential neighbourhoods as an additional predictor for walking intention (Figure 1). The research question that is analysed throughout the paper is how a healthy urban performance in residential neighbourhoods shapes our walking behaviour? In the study, a healthy urban performance is identified as the degree of the availability of the following walkability categories within an urban environment; connectivity, density, land use, traffic safety, surveillance, experience and green space (ZUNIGA-TERAN et al., 2017a).

THEORY OF PLANNED BEHAVIOUR (TPB)

Explaining human behaviour is both complex and difficult. Various theories and predictive models are proposed to explain physiological and psychological processes (AJZEN, 1991). During the last decade, TPB has been well supported in a wide range of fields, such as recycling (NIGBUR et al., 2010), transportation use (BAMBERG and SCHMIDT, 2003), water conservation (CLARK and FINLEY, 2007), workplace

intentions (GREAVES et al., 2013), ecological awareness (MANCHA and YODER, 2015), green consumer behaviour (TAUFIQUE and VAITHIANATHAN, 2018) etc. TPB is an extension of the theory of reasoned action (AJZEN and FISHBEIN, 1980), but differs in its addition of perceived behavioural control. Theory of reasoned action predicts behavioural intention and discusses the factors that limit the intention of the behaviour (AJZEN and FISHBEIN, 1980).

In TPB, intention is still a central factor of a behaviour, but shaped by the following three core constructs; attitudes, subjective norms and perceived behaviour control. Attitude is defined as the degree, to which a person has favourable or unfavourable appraisal of the behaviour and its outcome. Subjective norm refers, how a social pressure is received to perform or not to perform the behaviour (AJZEN, 1991). Perceived behavioural control is the reflection of past experience in terms of ease or difficulty of the behaviour. These factors influence behaviours through their impact on intentions (KNUSSEN et al., 2004). According to TPB, perceived control plays an important role and could have a direct impact to predict behavioural achievement, particularly when behaviour is perceived as difficult.

Recently, TPB has been criticised for its focus on only three above-defined predictors (HAGGER, 2010). Thus, researchers have incorporated additional predictors. Chan and Bishop (2013) found that intention-behaviour relationship was challenged by moral norm with respect to recycling behaviour. Mancha and Yoder (2015) developed an environmental model of TPB to predict environmentally–friendly intentions of both American and Indian students and added the role of self-identity. Gao et al. (2017) used an extended TPB to understand individual's energy saving behaviour in workplaces. Bird et al. (2018) extended TPB by including a measure of habit and visibility to predict walking and cycling behaviour.

Although the predictive ability of TPB in respect of walking behaviour has been often analysed, there is a lack of consensus on their results. Some studies found perceived behaviour control as the strongest predictor (LEE and SHEPLEY, 2012), some reported attitude as the strongest predictor (RHODES et al., 2007). Since walking behaviour is closely related to the changes made in design elements of urban environments, there is a need of further extended TPB studies to elaborate the walking behaviour deeply and its relationship with healthy urban performance.

WALKABILITY FOR HEALHTY URBAN PERFORMANCE

Walking is the simplest form of human transportation and a low-cost physical activity. Walkability is the measure of how walking-friendly an environment is (SPECK, 2012). Studies indicated the strong influence of urban neighbourhoods on human transportation and physical activities (LEE and DEAN, 2018). Each individual should obtain at least 30 minutes of physical activity with a moderate-intensity on five or more days a week (United States Department of Health and Human Services, 2008). Furthermore, active transportation (walking and cycling) has a positive impact on the urban environment in terms of sustainability as well. Walking leads to less carbon emissions and less air pollution with reduction of motorised transportation. According to Frank et al. (2010), there are significant positive associations among energy expanded from walking, transit accessibility, residential density, and street connectivity.

However, lack of walking is considered as a global public health problem that should be solved through the change in human behaviours, urban patterns and sustainable walkability models (SAELENS and HANDY, 2008). The streets are less walkable and primarily served as roads for automobiles so that people are discouraged from walking behaviour (LEE and DEAN, 2018). There are strong correlations among healthy urban performance of neighbourhoods, such as street connectivity, overall access to services and the likelihood of an individual participating in walking (CERIN et al. 2017). Thus, it is necessary to investigate how to get people walking and how intention and availability of walkability features of a neighbourhood mediates the relationship between the walking habit and behaviour.

In the last decade, there are a large number of studies on the relationship between physical and social environmental qualities of urban spaces and walkability. Most studied environmental qualities are greenery (LU et al., 2018), aesthetic pleasantness (RHODES et al., 2007), safety and social control with the neighbourhood (COMSTOCK et al., 2010). Patterson and Chapman (2004) found positive associations among walking behaviour, close retail destinations and safe walking paths. Alfonzo (2005) developed a hierarchical walkability model, which defined pleasurability, comfort, safety, accessibility and feasibility as the variables that affect people's decision to walk. Rhodes et al. (2007) highlighted the effects of neighbourhood aesthetics on walking behaviour. According to Cubukcu (2013), there are seven aspects of an urban environment that makes it walking-friendly; land use safety, traffic, crime rate, ease in walking and cycling, accessibility and environmental aesthetics.

Ferreira et al. (2016) enlarged TPB by adding emotional impact on walking intention and behaviour. Zuniga-Teran et al. (2016) developed the Walkability Framework identifying nine walkability categories: connectivity, land-use, density, traffic safety, surveillance, parking, experience, greenspace and community. These nine categories address not only the perspective of sustainable architecture and urban design,

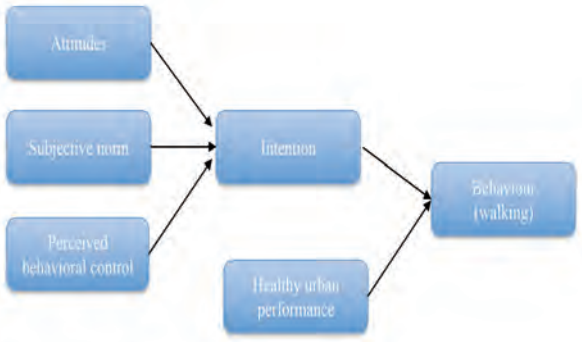


Figure 1. The hypothesised structural equation model. (Source: Authors, 2018).

but also physical activity, land planning, transportation and health. More recently, this walkability framework was also applied in four neighbourhood designs, which were traditional development, suburban development, enclosed community and cluster housing (ZUNIGA-TERAN et al., 2017a). The model proved useful in identifying walkability categories and provided an empirical evidence of the significance of greenspace to encourage walking behaviour. A follow-up study by Zuniga-Teran et al. (2017b) identified greenspace, traffic safety, density and land use as the most influential aspects of walkability.

In this study, a walkability model with reference to the study of Zuniga-Teran et al. (2017a) was applied as the variables of healthy urban performance. Thus, the nine categories of this model were taken as the variables of healthy urban performance, and different from previous studies they were integrated as additional predictors to TPB, directly to behaviour, in the context of Turkish walkability. Thus, this study is an initial step to gain a deeper understanding of correlations between this extended TPB and walking behaviour of Turkish people.

METHOD OF THE STUDY

The method of the study was developed to test the following three hypotheses: (H1) Both intention and healthy urban performance variables strongly mediate the relationship between the core TPB constructs and walking behaviour; (H2) The direct effects of the three core constructs of TPB on walking intention are statistically significant; (H3) Healthy urban performance variables have larger direct effect on walking behaviour than their indirect effect, mediated by intention. (Figure 1) illustrates the hypothesised structural equation model of the broadened TPB.

Participants and the setting

A total of 220 Turkish people (113 female, 103 male) participated to the study voluntarily, with the mean age of 46.48 (Table 1). The average length of living of the participants in the selected neighbourhood was over 10 years to ensure that they represented a broad range of views. The participants were asked to sign the

Characteristics		n	% Percentage
Gender			
	Female	113	51.4
	Male	107	48.6
Age			
	18-29	35	15.9
	30-39	48	21.8
	40-49	51	23.2
	50-59	33	15
	60-69	34	15.5
	70-79	10	4.5
	80+	9	4.1
Education			
	Less than middle school	3	1.4
	High school	78	35.5
	College graduate	139	63.1
Marital Status			
	Married	123	55.9
	Unmarried	97	44.1
Car Ownership			
	Owner	90	40.91
	Non-owner	130	59.09

Table 1. Demographics of the participants. (Source: Authors, 2018, performed using the IBM SPSS Statistics 22.0 software package).

informed consent, stating the purposes of the study, their involvement, risks and emergency procedures. After they signed, they were enrolled to the study. They were also informed about the confidentiality of the study and their right to terminate their participation in the study at any time.

The case setting was chosen from the most popular residential neighbourhood area in Ankara, Turkey, which was Ayranci neighbourhood of Cankaya District (Figure 2). The planning history of Ayranci neighbourhood went back to the early 1950s, when radical urban transformations occurred in Ankara based on Jansen master plan with the founding of Republic in 1923 (ASLANOGLU, 2001). In the late 19th century, Ankara was a small size city. Ayranci neighbourhood had a character far from an urban context, where the land was covered with vineyards. There were one-story houses with two bedrooms (ASLANOGLU, 2001). After the founding of the Republic of Turkey in 1923, Ankara became urbanised, and its population increased rapidly. Sumnu (2014) stated that in 1950s, the built environment in Ayranci evolved from a few number of detached houses to mass-produced apartment houses.

According to Turkish Statistical Institution's data, Ankara has the highest rates of the number of registered automobiles per inhabitant in Turkey (32, 8% according to data obtained in January 2017). This

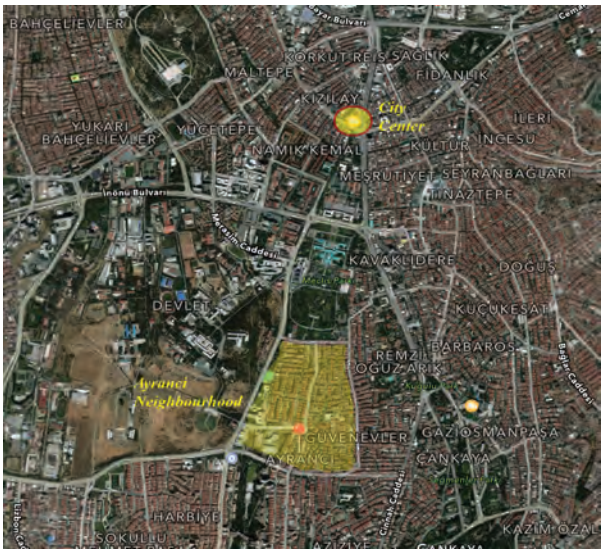


Figure 2. Aerial view of Ayranci neighbourhood area. (Source: www.maps.google.com).

situation also affects the walkability of Ayranci neighbourhood, and some of the housing backyards have been transformed into car parking lots. Currently, the environment consists of five/six storey apartments, which have similar design characteristics in terms of locations of windows and doors, garden walls, materials and colour (Figure 3). There are mostly shops, cafes and banks in the ground floor of these apartments (Figure 4). The greenery is mostly achieved with backyards connected to sidewalk, street and land use system (KARAIBRAHIMOGLU, 2015). There is also a heavy traffic load within the neighbourhood because of car ownership ratio, its walking distance to the city centre and dense urban facilities, such as schools and mosques. The District Municipality does not have an extensive initiative focused on improving active travel (walking and biking) in the neighbourhood. In terms of social dimension, the residents have close interaction with other residents of the neighbourhood through social activity and social support from neighbours. Education level of the residents is high (Table 1). The neighbourhood is safe and secure, even at night. This neighbourhood was selected as the survey area because of these physical and social dimensions.

Instruments

A validated TPB questionnaire (AJZEN, 1991; FISHBEIN and AJZEN, 2010) was translated to Turkish, and a formative research was conducted to make the questionnaire suitable for the walking behaviour. The first part of the questionnaire included demographic questions. The second part had 42 items. Four items measured intention (e.g. "I intend to walk in my neighbourhood for at least 30 minutes, 5 times per week (school, shopping, leisure, work"); five related to attitudes (e.g. "I find it desirable to walk in my neighbourhood"); four related to subjective norm (.e.g. "People

Figure 3. Exemplary windows, garden walls, materials and colour of residential buildings in Ayranci neighbourhood. (Source: Authors, 2018).

Figure 4. An exemplary café located on the pedestrian walking in Ayranci neighbourhood. (Source: Authors, 2018),

I care about encourage me to walk in my neighbourhood for at least 30 minutes, 5 times per week"); five related to perceived behavioural control (e.g. "If I wanted to, I could easily walk in my neighbourhood for at least 30 minutes, 5 times per week); twenty-one items related to healthy urban performance (e.g. "There are sidewalks on most of the streets in my neighbourhood") and three items to behaviour (e.g. "I walk in my neighbourhood totally automatically without thinking"). Twenty-one items of healthy urban performance were adapted from nine walkability categories defined by Zuniga-Teran et al. (2017b). (Table 2) illustrates healthy urban performance questionnaire items and their related variables and walkability categories. Participants were asked to rate each item listed under on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The data were collected during face-to-face surveys with people in a public seating area. To avoid any biases, participants were not allowed to listen to others being surveyed.

Walkability Category	Variable	Questions
Connectivity	Barriers	There are major barriers to walking in my neighbourhood.
	Small blocks	The distance between intersections is usually short (90m)
	Multiple routes	There are many alternative routes for getting from place to place.
Land use	Proximity of services	There are services that are located within a 10-min walk from my home: Bus stop, gym, post office, bank, supermarket, hair salon, barber, school, police station, food store with produce, laundry / dry cleaner, theatre / cinema, restaurant / cafe / diner, medical clinic, pharmacy, convenient store, clothing store, government office, farmers' market, child-care facility, social services centre, hardware, museum.
Traffic safety	Pedestrian infrastructure	There are sidewalks on most of the streets. A grass/dirt strip separates the streets from the sidewalk. There are crosswalks and pedestrian signals to help walkers crossing busy streets.
Surveillance	Ability of people to be seen in the streets	There is enough shade to walk comfortably. My neighbourhood streets are well lit at night. The buildings are located close to the street.
Experience	Aesthetics	There is trash/litter.
	Slope	There are many attractive natural sights to look at while walking.
	Wayfinding	There are attractive buildings and homes. Possible interactions with wildlife make it attractive to go on walks. Most streets are hilly, making it difficult to walk or bike. It is easy to get lost while walking. Clear signage or landmarks are present that help me find my way. There is enough shade to walk comfortably.
		There are trees along the streets.
Greenspace	Proximity to greenspace	Green space is located within a 10-min walk from home. It is easy to walk to green space from my home.
Community	Availability of spaces for community interaction	There is a mosque close to home.

Table 2. Healthy urban performance questionnaire items, variables and categories considering participants' neighbourhood. (Source: adapted from Zuniga-Teran et al., 2017b).

Procedure

First, Ayranci neighbourhood was observed, photographed, and analysed by the authors. Then, the authors conducted the questionnaire. Later, data were screened for normality and missing values, and the normality for all items was moderate (skewness<2 and kurtosis<7) with reference to Flora and Curran (2004). Finally, statistical analyses were performed using the IBM SPSS Statistics 22.0 software package for the confirmatory factor analysis to test that each item was adequately explained by the latent variable, and the IBM AMOS 24.0 software package for Structural Equation Modelling (SEM) to explore direct and indirect effects of TPB constructs and healthy urban performance variables on walking behaviour. Six indices were used to measure whether the results of the SEM model fit well; chi-square , goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), root-mean-square error of approximation (RMSEA) and Cronbach- α. This study considered that the model fit well when <3, CFI>0.90 and RMSEA<0.08.

FINDINGS and DISCUSSION

Descriptive Statistics and Confirmatory Factor Analysis

Overall, the participants had a positive attitude toward the walking behaviour (M=3.84, SD= 1.242). Means of subjective norm (M=3.67, SD= 1.242) indicated that they had a moderate level of social support to perform the walking behaviour. Regarding perceived behavioural control, the perceived ease of performing walking was moderately high (M=4.064, SD=1.195), and the participants had moderately high intention to walking (M=4.052, SD=1.174). However, healthy urban performance items had lower mean values. Means of 2.58 (SD=1.480), 2.71 (M=1.516), 2.79 (M=1.569), 2.94 (M= 1.447) and 2.75 (M=1.586) for experience and traffic safety, respectively, indicated that participants had a lower level of satisfaction with the healthy urban performance of their neighbourhood. Moreover, mean of 4.08 for walking in the neighbourhood naturally without thinking indicated that participants had moderately high agreement for the walking behaviour. Moreover, a confirmatory factor analysis (CFA) was conducted for the model. The model was tested as reliable, and all the loadings on latent variables were significant (Table 3). The fit indices for the model were all above the recommended levels.

	χ^2/df	GFI	AGFI	CFI	RMSEA	Cronbach-α
AT	2.945	0.995	0.918	0.998	0.057	0.916
SN	1.045	0.998	0.976	0.999	0.014	0.859
PBC	1.475	0.997	0.959	0.999	0.047	0.939
HUP	2.645	0.911	0.874	0.930	0.067	0.936
INT	2.639	0.988	0.938	0.995	0.059	0.915
B	1.641	0.995	0.970	0.999	0.054	0.929

Table 3. The results of CFA for the scales of attitude (AT), subjective norm (SN), perceived behaviour control (PBC), healthy urban performance (HUP), intention (INT) and behaviour (B). (Source: Authors, 2018, performed using the IBM AMOS 24.0 software package).

Structural Equation Modelling

In order to test the hypotheses and the model, Structural Equation Modeling (SEM) was conducted. The structural model presented satisfactory fit indices (, GFI= 0.917; AGFI= 0.889; CFI= 0.940; RMSEA= 0.054). (Figure 5) illustrates the standardised path coefficients for the structural model. According to the model, all the variables presented significant positive relationships with the intention and behaviour. Both intention ($\beta = 0.52$, $p < 0.01$) and healthy urban performance ($\beta = 0.48$, $p < 0.01$) had significant direct effects on walking behaviour. So, the first hypothesis (H1), 'both intention and healthy urban performance variables strongly mediate the relationship between the core TPB constructs and walking behaviour', was supported. In addition, the direct effects of the three constructs, attitude, subjective norm and perceived behavioural control, on walking intention were found statically significant, as well as the direct effects of walking intention and healthy urban performance on walking behaviour (Table 4). So, the second hypothesis (H2) was supported. Moreover, the mediating effect

Paths			Std. Coef. Estimate	S.E.	t-value	p*
Attitudes	→	Intention	0.426	0.062	6.097	0.000
Subjective Norm	→	Intention	0.282	0.076	4.017	0.000
Perceived Behavioral Control	→	Intention	0.289	0.058	4.380	0.000
Healthy Urban Performance	→	Behaviour	0.482	0.100	6.471	0.000
Intention	→	Behaviour	0.520	0.083	7.875	0.000

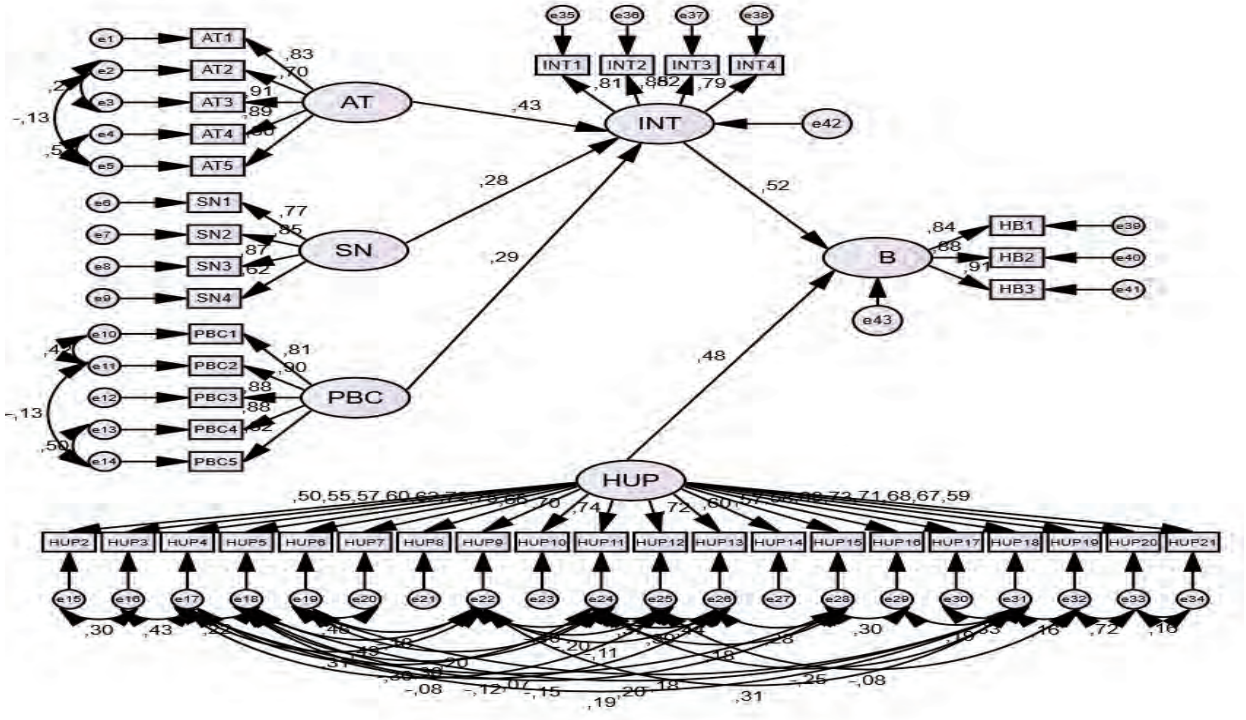
* All coefficient estimates are significant at p < 0.05.

Table 4. Hypothesis testing of the relationship of AT, SN, PBC, HUP, INT and B. (Source: Authors, 2018, performed using the IBM AMOS 24.0 software package).

of healthy urban performance variables through intention on walking behaviour was also tested, and a lower indirect effect was found ($\beta = 0.11$, $p < 0.01$) compared to its direct effect on walking behaviour. Thus, hypothesis three (H3) was also supported.

The study provided a deep understanding in predicting the effects of connectivity, density, land use, traffic safety, surveillance, experience and greenspace as healthy urban performance variables on Turkish people's walking behaviour. Previous studies identified perceived behaviour control as a significant determinant of healthy behaviour (RHODES et al., 2007; SHIBATA et al., 2009). However, the present study proved that the inclusion of walkable aspects of neighbourhood design was more strongly correlated with walking behaviour than with walking intention. Hence, it is possible to discuss the findings from two points of view. First is the intention-behaviour gap. Although people could develop an intention to change their behaviour in general, they might not take any action (SNIEHOTTA et al., 2005). Even the neighbourhood residents' knowledge of sustainable living or their awareness of active transportation might not be correlated with actual walking behaviour. Ajzen et al. (2011) focused on the relationship between energy-saving behaviour and environmental knowledge. Environmental knowledge was introduced as a new predictor for the TPB, and environmental intentions and behaviours had almost no correlations; because environmental knowledge had no influence on the main predictors of the TPB.

Results showed that healthy urban performance variables were associated with lower levels of walking behaviour, if their relationship was mediated through intention. It means that the spatial and social practices of urban environment influences walking behaviour. However, the key question returns policy makers and discipline experts to the way they define urban activities and land planning to bridge the gap between walking intention and behaviour. Land use planners, architects, even interior architects could employ sustainable decisions and mechanisms. As Barton (2015) suggested, in Turkey sustainable land use policies such as countryside and parkland protection, conservation areas, housing and employment zoning, mixed-use centres, density and affordable housing guidelines, site selection, local and natural



* All coefficient estimates are significant at p < 0.05

Figure 5. The standardised path coefficients for the structural model. (Source: Authors, 2018, performed using the IBM AMOS 24.0 software package).

land investments could be also developed. Designers, investors and developers need to get people walking rather than driving their cars, both intentionally and behaviourally. Thus, urban planning should not neglect the measured and experienced urban performance. In that respect, second point of view is that planning for a walkable neighbourhood needs both a collaborative and experiential approach (Barton, 2015).

Today, most of the studies and diverse urban activities (CERIN et al. 2017; SAELENS and HANDY, 2008) focus on promoting either healthy intentions or behaviours for a walking-friendly neighbourhood, but rarely both at the same time. Utilizing pedestrian environment for walking as fully as possible requires a multi-parameter decision-making process. Likewise, the predictors of walking behaviour could also differ independently from walking intention. Hence, the broadened TPB with these healthy urban variables in the present study could help designers and others involved in the decision-making process of walking to develop healthy residential neighbourhoods that reflect why, where and how people choose to walk, intent to walk and just walk automatically without thinking.

CONCLUSION

The study investigated walking behaviour in a selected residential neighbourhood by broadening TPB with the above-mentioned nine healthy urban performance variables. Similar to the studies in the walkability literature, this study also considers that a walkable neighbourhood leads healthy lives for people, which is the most meaningful indicator for healthy urban performance of a neighbourhood design. According to the statistical results, both intention and healthy urban performance had significant direct effects on walking behaviour. Moreover, the mediating effect of healthy urban performance variables through intention on walking behaviour had a lower indirect effect compared to its direct effect on walking behaviour. Considering practical implications of this study, there are still several gaps in elaborating the relationships between the complexity of walking behaviour and measured physical and social walkability characteristics of urban environments. Getting people physically active on daily basis is not easy. It requires comprehensive walkability framework developments, which explore strategies for optimal behaviour-intention-environment fits. The optimal fit among the three core constructs of TPB and urban environment is design, planning, public health and governance issue.

There are several limitations of the study. First limitation is the sample size. Larger representative samples could present different findings. Second limitation is that the influence of neighbourhood design and street layout are not analysed. This can lead to different results if the study will be conducted in a sub-urban development, gated community or cluster-housing neighbourhood.

Future studies could focus on other social interactions with neighbourhoods, such as beliefs, motivation, familiarity, place attachment, sense of community, along behaviour and intention. Future research could include diverse respondent groups and differences among them, such as elderly, disabled people and youth populations. Moreover, cross-cultural and longitudinal studies could also help to gain a better understanding of the relationship between perceived environmental qualities of urban environments (spatial-physical and social) and predictions of walking practices.

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