sciendo
RIGA TECHNICAL UNIVERSITY
Architecture and Urban Planning
2024, Vol. 20, Issue 1, pp. 202–212
https://doi.org/10.2478/aup-2024-0017
https://content.sciendo.com
Online ISSN 2255-8764

Neighbourhood Physical Factors and Residents' Physical Activity

Tohid Hatami Khanghahi*, Sahar Rahimi Gendeshmin, Akbar Abravesh, Anita Asadilour

University of Mohaghegh Ardabili, Ardabil, Iran

Received 2023-11-24; accepted 2024-10-08

Keywords

Neighbourhood physical factors, physical activity, physical characteristics of the neighbourhood.

Abstract

The purpose of this study is to extract and evaluate the components affecting the level of physical activity of residents of five different neighbourhoods in Urmia city in Iran and compare the impact pattern of these components in these five neighbourhoods with each other. Through literature studies and field surveys, 18 indicators were identified as architectural (physical) factors affecting the number of days that neighbourhood residents engage in physical activity during a month in a case study. Then, a researcher-made questionnaire was prepared and the data were analyzed in SPSS 26 software by the Poisson regression method. The results showed that, in different parts of a city, different factors affect the physical activity of residents. This is a challenge that warns urban planners that the same approach cannot be used for different neighbourhoods.

Introduction

The quality of the living environment plays an important role in increasing physical activity [1]. A healthy lifestyle is influenced by urban planning decisions that lead to the formation of the physical environment of cities [2]. A large part of the world's population has an inactive lifestyle. About half of the population of Iran lives a sedentary life [3]. The fourth most important factor in increasing mortality in the world is insufficient physical activity [4]. Lack of physical activity increases mortality and a variety of diseases, such as obesity [5], cardiovascular disease, and some cancers [6]. In addition to the negative impact on health, lack of adequate mobility also causes economic problems [7].

Using cars instead of walking, using elevators instead of stairs, as well as playing video and computer games and watching TV instead of dynamic activities have eliminated daily physical activity from people's lives. The process of designing neighbourhoods has become such that it is difficult to engage in physical activity [7]. Failure to pay attention to methods such as the design of residential areas to improve the level of physical activity of neighbourhood residents can lead to the use of costly alternative methods and loss of good potential [8]. There is a direct relationship between the level of physical activity and the form of the city [9]. Public health professionals can work with urban planners and designers instead of encouraging people to attend the stadium [9]. By doing so, they can change design trends that limit physical activity [9]. Increasing physical activity is possible by creating opportunities for exercise in daily life [10].

If it is assumed that the physical environment has an indirect effect on human behaviour, modern psychology should examine urban environments. Modern psychology is of special importance to environmental designers so that they can respond to the needs of those who use the designed spaces [11]. Designers and planners of residential neighbourhoods in Urmia City, Iran, pay little attention to physical factors affecting the level of physical activity in these areas. The lack of studies in Iran, especially in Urmia city, has made it difficult to identify the factors that can promote physical activity promotion patterns using proper design methods and support an active lifestyle.

The form of influence of environmental factors on the behaviour of individuals and, consequently, the

* Corresponding author. E-mail address: t_hatami@uma.ac.ir

amount of their physical activity is influenced by cultural conditions, religious beliefs [12], and the social and economic status of individuals. The characteristics such as ethnicity and economic and social status affect a person's lifestyle choices [13]. Daily health-related behaviours are influenced by social and economic factors [14]. According to a social-ecological view of health, cultural, environmental, biological, and social factors influence the behaviour related to physical activity in society [12]. People's behaviour, expectations, and attitudes toward physical activity are influenced by cultural factors [12]. Economic, social, and cultural constraints can also hinder the improvement of individual behaviours [12]. For example, the lower presence of women in public spaces for physical activity can be rooted in the cultural and social criteria of an area [15]. In addition, geography is effective in maintaining, developing, and changing health-related behaviours [16]. The environment is considered a determining factor in behaviour and can create conditions that make the behaviour easier or more limited [17]. Therefore, it is necessary to examine the impact of the physical environment on physical activity in different societies with different cultural, social, and economic conditions. The authors are aware of the effect of different environmental factors on the level of physical activity of residents in different areas with different conditions, but the purpose of this study is to more accurately assess the impact of different factors and examine the differences and similarities of environmental factors on physical activity. Which factors are significant in which neighbourhoods? Are there common influential factors between neighbourhoods in a city like Urmia? What is the impact and prioritisation of each of the effective factors in different areas? The authors also suggest that common factors affecting physical activity can be achieved across different neighbourhoods on a city scale.

Therefore, this study aims to extract and evaluate the components affecting the physical activity of residents of five neighbourhoods of Urmia in Iran and compare the pattern of the effectiveness of these components in these five neighbourhoods.

I. Theoretical Foundations

A. Physical Activity

One must distinguish between physical activity and exercise because these two concepts are separate, and exercise is part of physical activity. Activities such as walking, gardening, and yoga [12] are among the physical activities. Physical activity is divided into two categories: 1) moderate physical activity such as housework and walking, and 2) intense physical activity. According to research on physical activity and health, moderate physical activity has more benefits than strenuous physical activity [18]. By physical activity in this study, we mean moderate physical activity. The most important type of moderate physical activity is walking [19]. A 'targeted walk' to buy groceries or go to school is one of the best types of physical activity. Neighbourhood design can affect this type of activity [20].

B. Physical Characteristics of the Neighbourhood

Neighbourhood design can be effective in physical activity by creating appropriate infrastructure [10]. Measures such as smaller street blocks [21], high residential density, and access to sidewalks [22] can increase pedestrian traffic.

Different neighbourhoods, in terms of resources and facilities, quality of social services, voluntary activities, and outdoor facilities, are different [23]. Residents of underdeveloped neighbourhoods feel that their neighbourhood is less safe than the middle and upper neighbourhoods in socioeconomic terms, and this reduces their physical activity in the open space of the neighbourhood [17]. Another difference between neighbourhoods is the degree of social cohesion. People in neighbourhoods with higher social cohesion are better able to cope with stress, and in these neighbourhoods, better access to recreational facilities creates more opportunities for physical activity [24]. Evidence also suggests that lower-income neighbourhoods have fewer recreational facilities and parks, although deprived neighbourhoods may have higher levels of walkable urban form [25]. However, there are disagreements between studies in this regard. Some studies indicate that in neighbourhoods with higher socioeconomic status, the ability to walk and physical activity is higher, while some studies have achieved the opposite results [26]. The characteristics of the neighbourhoods can also be examined in terms of being old or new. Older neighbourhoods are known for their 'higher residential density', 'mixed land use', and 'network of congested roads', and studies show that residents of such neighbourhoods are more likely to walk and cycle than residents of scattered neighbourhoods [27]. Geographical location is another factor in the difference between neighbourhoods. Sometimes the geographical location and unfavourable weather conditions make the sports facilities unusable [13].

C. Background

According to Mehdinejad and Sadeghi Habibabad [10], the urban form of the neighbourhood environment is effective in promoting physical health and architectural and urban design strategies can increase regular physical activity.

According to Molina-García et al. [28], in neighbourhoods with higher socioeconomic status

and ability to walk, the rate of physical activity of adolescents was higher, and in neighbourhoods with low socioeconomic status, obesity and overweight were higher. Soltani and Hoseini's [15] research showed that there is a difference between the pattern of activity in Iran and developed countries and this is due to the difference in environmental design, social attitude, and lifestyle.

Monsur et al. [29] showed that there is a positive relationship between the type of street near the house, the width of the street, the availability of open space or playground near the house, and the child's time spent outside the house. Peykani and Bavar [30] offer architectural ideas for designing children's spaces that help promote their creativity and health. Creating a dynamic space and variability in its components, the use of nature, the interference of open and closed spaces, diversity, etc., are among these ideas.

D. Case Study

A case study of this research is five different neighbourhoods in Urmia city. We tried to randomly select one neighbourhood from each of the five districts of Urmia Municipality. In this case, these neighbourhoods have physical, economic, cultural, and social differences and similarities. These differences and similarities help us to examine how physical factors affect the physical activity of neighbourhood residents in different situations.

These five neighbourhoods are almost similar in terms of area and number of inhabitants, but in terms of access to public uses and outdoor facilities, the shape and width of the passages, and cultural and social characteristics are different (Table I).

II. Method

First, literature studies have been made to select the most appropriate indicators, followed by field surveys and interviews with local residents and managers of Urmia municipality.

Here are some of the key physical indicators that influence physical activity, as identified in the research literature: cycling infrastructure, the walkability of a neighbourhood, mixed user features, parks, playgrounds and being open [10], [29], residential density [32], street width and its branching, street connection, safety [33], [34], access to recreational programs, traffic, and street layout [35]. Improvement of aesthetic and social environment qualities is also linked to physical activity levels [36].

Then, the physical factors were extracted as indicators affecting the number of days that the residents of the neighbourhoods engage in physical activity per month (Table II). In factor extraction, we tried to select physical methods that can be used in the design process. In the review phase, duplicate or ambiguous items were removed and the written literature of the research questions was edited.

TABLE I

Case Studies [developed by the authors]

Name	Kooye Mohandesin	Hakim Nezami	Hashte Shahrivar	Sardaran	Bargh
Area (hectares)	42.4	44.4	43	43.2	41.7
Population (people)	4881	4761	5201	4951	4702
Year of construction	1991	1966	1956	1960	1981
Fabric	semi-dense	dense	dense	dense	semi-dense
Infrastructures	public restrooms, bus stops, proper lighting at night	–	bus stops, proper lighting at night	bus stops, amenities	public restrooms, bus stops, proper lighting at night
The average number of floors of buildings	8	4	5	6	9
Dominant occupation	self-employmen, employee	worker, low-income class	employee	self-employmen, worker	self-employmen, employee
Important uses	commercial, green space with multiple accesses, office	residential, highway, green space with multiple accesses, sports club	commercial and residential, sports complex, many green spaces on the side of the street	commercial, office, residential	commercial, office, residential, and sports complex
The average building area of houses (m2)	120–500	50–120	80–250	100–300	100–500
Distinctive features	proximity to the river	–	–	adjacency to Urmia historical fridge	–

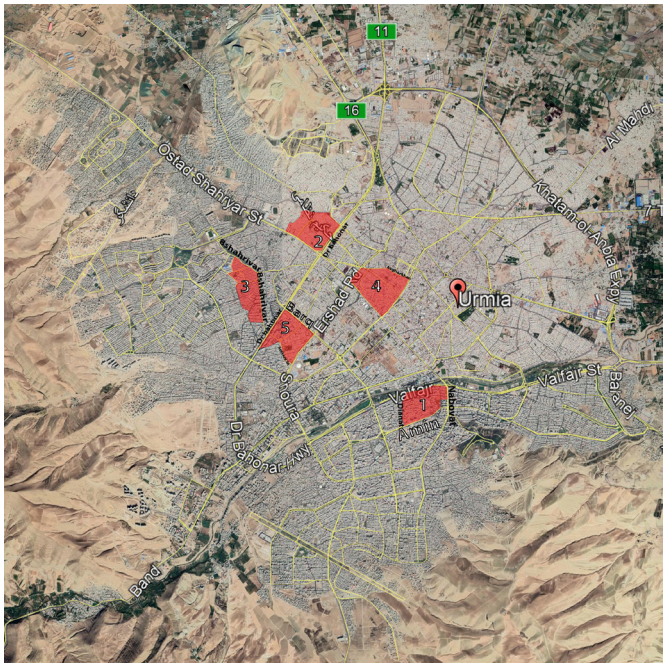

Fig. 1. Location of case studies [31].

Then, a researcher-made questionnaire was prepared based on 18 indicators in the form of five-choice Likert-scale questions. Content validity was used to determine the validity of the questionnaire. For this purpose, the questionnaire was reviewed and approved by the professors of the architecture and urban planning group of Urmia University and Mohaghegh Ardabili. Cronbach's alpha coefficient of this questionnaire for 50 people of the statistical population was equal to 0.871 and greater than 7.0, which indicates its high reliability. Then, according to Cochran's formula, out of 24 496 total residents of five neighbourhoods, 1000 questionnaires (200 questionnaires for each neighbourhood) were prepared and distributed among families by random sampling method.

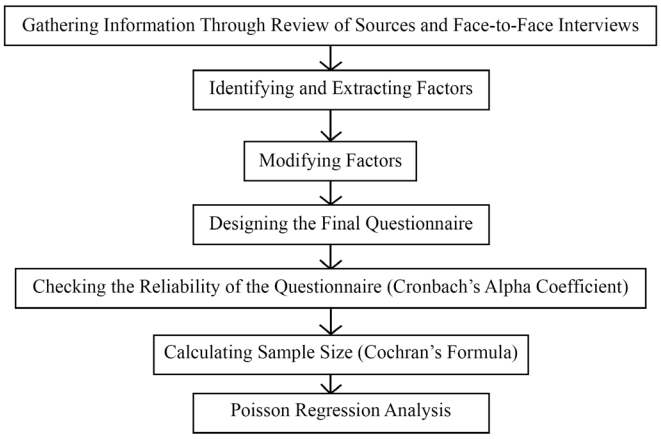

Fig. 2. Diagram of the method [developed by the authors]

TABLE II

Physical Indicators [developed by the authors]

Symbol	Independent variable
C	**Fixed coefficient**
X_1	Visually attractive elements (sculptures and stands, fountains, facades of buildings, existence of trees)
X_2	Material and colour of urban furniture
X_3	Pavement materials
X_4	Cleanliness of the neighbourhood
X_5	The presence of bike stations and bike paths
X_6	Neighbourhood sports equipment
X_7	Clarity and legibility of alleys and public environments
X_8	Access to recreational facilities and services (e.g., public parks, bus stations, etc.)
X_9	The improper slope of roads and poor quality of surface water disposal
X_{10}	Open space between residential lands (undeveloped, degraded open space, or unbuilt residential lands)
X_{11}	Public spaces in the neighbourhood (pedestrian nodes, gathering places, communal spaces, etc.)
X_{12}	Urban furniture (trash bins, bench, canopy, etc.)
X_{13}	Number of floors of buildings
X_{14}	Existence of city guide signs
X_{15}	The lighting of passages
X_{16}	The existence of a suitable environment for pets to rest and have fun
X_{17}	Width of passages and sidewalks
X_{18}	The existence of dead-end and silent alleys

III. Results

The data of the questionnaires were examined using Poisson regression analysis. In this model, the dependent variable is equal to 'the number of days that neighbourhood residents engage in physical activity per month', and the independent variables are 18 physical indicators affecting residents' physical activity, which were provided in the questionnaire.

If $X \in \mathrm{R}n$ is a vector of the dependent variable and Y is the independent variable, the Poisson regression model is as follows:

$$\log(E(Y|x)) = a'x + b, \quad (1)$$

where $b \in \mathrm{R}$ & $a \in \mathrm{R}^n$.

Once the parameter θ and the input vector are known, a prediction for the dependent variable can be obtained as follows (which we will explain below):

$$E(Y|x) = e^{\theta' x} \quad (2)$$

The omnibus test was rejected for the data of all neighbourhoods ($P < 0.001$; $x^2 = 113.899$). Therefore, it is appropriate to use the Poisson regression model for data analysis. The results of the Omnibus test are summarized in Table III.

TABLE III

Omnibus Test Results for the Five Neighbourhoods [developed by the authors]

Neighbourhood	Ratio chi-square maximum likelihood	Degrees of freedom	Significance
Kooye Mohandesin	151.089	19	<0.001
Hakim Nezami	77.692	19	<0.001
Hashte Shahrivar	139.787	19	<0.001
Sardaran	33.132	19	0.023
Bargh	38.115	19	0.006
All	113.899	19	<0.001

E. Neighbourhood Evaluation by Individuals

The authors are aware that variables such as gender can influence the model. For this purpose, the gender variable of individuals was entered into the regression model as an auxiliary variable. According to the results obtained from the implementation of the regression model by different neighbourhoods, the gender variable had a significant effect on the results of neighbourhoods, except in Kooye Mohandesin. Therefore, the presented model and the coefficients obtained from it were adjusted considering this auxiliary variable (gender). The results of the regression model, including the regression coefficients, are reported in the attached file.

In Kooye Mohandesin: Based on Poisson regression and according to the residents of the neighbourhood, variables X1, X3, X9, X10, X16, and X17 have a significant impact on their physical activity because the significance of these variables is less than 0.05, and the rest of the variables do not have a significant impact. According to the opinion of the residents, the variables X10, X17, X9, X1, X3, and X16 have an impact on their physical activity, respectively. According to the Wald chi-square, among these six variables, X10 (open space between residential lands) has the most impact, and X16 (existence of a suitable environment for pets to rest and have fun) has the least impact. Variables affecting the physical activity of residents in the case study have different impact coefficients. An impact coefficient lower than 1 indicates the negative impact of the variable, and an impact coefficient larger than 1 indicates the positive impact of the independent variable. For example, X10 has an impact coefficient of 0.740, indicating that a unit increase in X10 decreases the dependent variable by 0.740 times. Among these six variables, X1 (visually attractive elements), X3 (pavement materials), X16 (existence of a suitable environment for pets to rest and have fun), and X17 (width of passages and sidewalks) have a positive impact and X9 (improper slope of roads and poor quality of surface water disposal) and X10 (open space between residential lands) have a negative impact. In explaining variable X10, it should be said that from the perspective of the residents of the neighbourhood, the presence of open spaces between residential lands causes the gathering of strangers and unknown people, and this causes inconvenience to the residents. Therefore, the residents of the neighbourhood considered this factor as a factor that has a negative impact on their physical activity.

In Hakim Nezami: Based on Poisson regression and according to the residents of the neighbourhood, six variables have a significant impact on their physical activity because the significance of these variables is less than 0.05, and the rest of the variables do not have a significant impact. According to the Wald chi-square, among these six variables, X6 (neighbourhood sports equipment) has the most impact, and X3 (pavement materials) has the least impact. In general, according to the opinion of the residents of this neighbourhood, X6 (neighbourhood sports equipment), X14 (existence of city guide signs), X18 (existence of dead-end and silent alleys), X8 (access to recreational facilities and services), X16 (existence of a suitable environment for pets to rest and have fun), and X3 (pavement materials) have the impact on their physical activity, respectively. Among these six variables, only X18 (existence of dead-end and silent alleys) has a negative impact, and others have a positive impact.

In Hashte Shahrivar: Eight variables have a significant effect on the physical activity of the residents of this neighbourhood. According to the Wald chi-square, among these eight variables, X2 (material and colour of urban furniture) has the most impact, and X11(public spaces of the neighbourhood) has the least significant effect. In general, according to the opinion of the residents of the Hashte Shahrivar neighbourhood, X2, X1, X18, X17, X7, X16, X12, and X11 have an impact on their physical activity, respectively. Among these eight variables, X1(visually attractive elements), X7 (clarity and legibility of alleys and public environments), X16 (existence of a suitable environment for pets to rest and have fun), and X17 (width of passages and sidewalks) have a positive effect and X2 (material and colour of urban furniture), X11 (public spaces of the neighbourhood), X12 (urban furniture), and X18 (existence of dead-end and silent alleys) have a negative effect. The residents of this neighbourhood have been dissatisfied with the materials and colours of urban furniture in the neighbourhood. According to them, the neighbourhood of Hashte Shahrivar did not have proper urban facilities. Therefore, according to the residents of this neighbourhood, X2 and X12 have a negative effect on their physical activity. The presence of public spaces in the neighbourhood has a different nature in different neighbourhoods, and secondary factors such as neighbours, the general

culture of the neighbourhood people, etc., have a positive or negative impact on this factor. For example, Hashte Shahrivar is one of the old neighbourhoods of Urmia, and the residents are not interested in gathering in the public spaces of the neighbourhood due to their specific culture. Therefore, according to the opinion of the residents of this neighbourhood, X11 has a negative effect on their physical activity.

In Sardaran: Variables X5 (the presence of bike stations and bike paths) and X13 (the number of floors of buildings) have a significant effect on the physical activity of the residents of this neighbourhood because the significance of these two variables is less than 0.05, and the rest of the variables do not have a significant effect. According to the Wald chi-square, X13 and X5 have an impact on physical activity, respectively, and X13 (the number of floors of buildings) has a positive effect, and X5 (the presence of bike stations and bike paths) has a negative effect. The neighbourhood of Sardaran is weak in terms of cycling routes, and according to the residents of the neighbourhood, the lack of a cycling route has had a negative effect on the physical activity of the residents.

In Bargh: Four variables have a significant effect on the physical activity of the residents of this neighbourhood. According to the Wald chi-square, among these four variables, X11 (public spaces of the neighbourhood) has the most impact and X2 (material and colour of urban furniture) has the least significant effect. According to the opinion of the residents of this neighbourhood, X11, X7, X15, and X2 have an impact on their physical activity, respectively. Among these four variables, X7 (clarity and legibility of alleys and public environments) and X11 (public spaces of the neighbourhood) have a positive effect, and X2 (material and colour of urban furniture) and X15 (lighting of passages) have a negative effect. According to the current situation of the Bargh neighbourhood, this neighbourhood does not have proper passage lighting, and the residents are not satisfied with the materials and colours of urban furniture; so in their opinion, these two factors have a negative effect on the physical activity of the residents of the neighbourhood.

The results of the analysis showed that in none of these neighbourhoods, variable X4 (cleanliness of the neighbourhood) does not affect the number of days that residents engage in physical activity. Since all neighbourhoods of Urmia city are under the supervision of the municipality and generally all five neighbourhoods are clean, the residents do not have any problems in this matter. For this reason, according to the residents of these five neighbourhoods, X4 was not important in the physical activity of the residents of any of these neighbourhoods. Also, no variable jointly affected the total number of days residents engaged in physical activity in the five neighbourhoods. The pattern of impact was different in each neighbourhood.

F. Predicting the Number of Days Residents of Each Neighbourhood Engage in Physical Activity

According to Formula (2) and the description from the previous section, the Poisson regression model output for each neighbourhood is included in Table IV as generated by the SPSS software.

In the Formula, Y is the number of days that the residents of the neighbourhood engage in physical activity per month, and x is equal to the average score that the relevant experts will allocate to the effective indicators in each specific neighbourhood and at a specific time. This numerical score will be between 0 and 5.

Therefore, using the proposed models, in each of the studied neighbourhoods, the number of days that the residents of the neighbourhood engage in physical activity monthly can be predicted based on significant independent variables of each neighbourhood.

G. Findings in Total Without Separating Neighborhoods

The results of the hypothesis test for the sum of data of all neighbourhoods without neighbourhood breakdown are reported in the attached file. Variables X1, X2, X6, X10, X11, X13, X16, and X18 have a significant impact on the physical activity of the residents of these neighbourhoods

TABLE IV

The Formula for Predicting the Number of Days of Physical Activity [developed by the authors]

Neighbourhood	Poisson reegression model
Kooye Mohandesin	$E(Y\|x) = -0.847 + 1.204^{X_1} + 1.242^{X_3} + 0.788^{X_9} + 0.740^{X_{10}} + 1.130^{X_{16}} + 1.399^{X_{17}}$
Hakim Nezami	$E(Y\|x) = 1.347^{I(\text{Gender=Female})} + 1.173^{X_3} + 1.209^{X_6} + 1.160^{X_8} + 1.196^{X_{14}} + 1.129^{X_{16}} + 0.862^{X_{18}}$
Hashte Sharhrivar	$E(Y\|x) = 0.735^{I(\text{Gender=Female})} + 1.335^{X_1} + 0.677^{X_2} + 1.267^{X_7} + 0.874^{X_{11}} + 0.871^{X_{12}} + 1.232^{X_{16}} + 1.300^{X_{17}} + 0.746^{X_{18}}$
Sardaran	$E(Y\|x) = 0.804^{I(\text{Gender=Female})} + 0.885^{X_5} + 1.121^{X_{13}}$
Bargh	$E(Y\|x) = 1.244^{I(\text{Gender=Female})} + 0.871^{X_2} + 1.186^{X_7} + 1.200^{X_{11}} + 0.877^{X_{15}}$
* $I(\text{Gender=Female}) = \begin{cases} 1 \text{ Gender = Female} \\ 0 \text{ Gender = Male} \end{cases}$ is an indicator function.	

because the significance of these variables is less than 0.05. Of these eight variables, X18 (existence of dead-end and silent alleys) has the most impact, and X11 (public spaces of the neighbourhood – pedestrian nodes, gathering places, communal spaces, etc.) has the least significant impact. This is influenced by the societal norms and culture of the studied society, as well as the quality of its public spaces. In general, according to the opinion of the residents of whole neighbourhoods, X18, X16, X2, X10, X1, X13, X6, and X11 have an impact on their physical activity, respectively. Among these variables, X1 (visually attractive elements), X6 (neighbourhood sports equipment), X11 (public spaces of the neighbourhood), X13 (number of floors of buildings), and X16 (existence of a suitable environment for pets to rest and have fun) have a positive effect and X2 (material and colour of urban furniture), X10 (open space between residential lands), and X18 (existence of dead-end and silent alleys) have a negative effect. The presence of dead-end and dark alleys is considered a negative feature in the neighbourhood, and for this reason, it has been chosen as a negative factor affecting physical activity. Examining the views of residents of 5 neighbourhoods showed that these neighbourhoods are weak in facilities such as urban furniture, and for this reason, X2 had a negative effect on the physical activity of residents in these neighbourhoods. Variable X10 also has a negative effect on the physical activity of the residents of all neighbourhoods. The interview with the residents of the neighbourhood showed that the presence of open space between the residential lands (undeveloped, degraded open space, or unbuilt residential lands) causes the gathering of strangers who are not residents of the neighbourhood and causes dissatisfaction among the residents of the neighbourhood.

Dependent variable (Y): The number of days that neighbourhood residents engage in physical activity per month.

According to the previous explanations and Formula (2) and the attached file, the Poisson regression model for the outcome of the five neighbourhoods is as follows:

Using the Poisson regression model presented in the above relation, we can predict the number of days that residents of a total of five neighbourhoods engage in physical activity in a month based on nine values of independent variables that had a significant effect on it.

IV. Discussion

According to Mehdinejad and Sadeghi Habibabad [10], to increase the mobility of residents, we can use physical factors that can be intervened through architectural design strategies. These studies share in the effectiveness of physical factors on the amount of physical activity, although our goal was to examine the impact of these factors on physical activity in different neighbourhoods and how effective they are. According to Peykani and Bavar [30], the use of nature in the design of spaces helps to promote health. In the present study, the use of natural elements such as trees, flowers, etc., in spaces in a variable subset of visually attractive elements was investigated and the results showed that this variable is effective in improving the level of physical activity in Kooye Mohandesin and Hashte Shahrivar. The analysis of the data from five neighbourhoods together also showed that this factor is effective in the amount of physical activity of the residents of all neighbourhoods. The research by Monsur et al. [29] showed that the type and width of the street near the house and the ability to access the open space near the house are effective in children's activity outside the home. In this study, the variable 'width of passages and sidewalks' in two neighbourhoods had a positive effect on the number of days that residents engaged in physical activity. However, this variable was not identified as an effective factor in a total of five neighbourhoods (without separating the neighbourhoods). This indicates that one result is not generalized to all neighbourhoods. The variable 'public spaces of the neighbourhood' had a negative effect on the physical activity of the residents of Hashte Shahrivar, but from the perspective of the residents of the Bargh neighbourhood, it had a positive effect on the physical activity of the residents. According to the residents of all five neighbourhoods (without separating the neighbourhoods), the variable 'public spaces of the neighbourhood' had a positive effect on the physical activity of the residents of the neighbourhoods. In explaining these results, it should be noted that 'public spaces of the neighbourhood' are areas where people can engage in social interaction. Pedestrian nodes, gathering places, communal spaces, and other similar spaces all qualify as public spaces within the neighbourhoods studied. The variable 'public spaces of the neighbourhood' has a different nature in different neighbourhoods, and secondary factors such as adjacency, the culture of the neighbourhood people, etc. are effective in the form of influence of this variable. The use of public spaces in a neighbourhood can be influenced by the cultural conditions that prevail in the area. In some societies, customs and cultural norms hinder social interaction in public spaces, while in others, these norms promote and encourage people to engage in social communication in the neighbourhood's public areas.

Soltani and Hosseini [15] showed that there is a difference between the pattern of activity in Iran and other countries, and this is due to differences in lifestyle and social attitudes. Molina-García et al. [28] showed that there is a relationship between the socioeconomic status of a neighbourhood and the level of physical activity. The present study also showed that residents of different neighbourhoods with different economic, social, cultural, and geographical characteristics choose different physical factors as effective factors in the amount of physical

activity. This indicates the effect of other characteristics of the neighbourhood on the extent to which the body is affected by physical activity.

Conclusions

The evaluation of the research topic was done in two ways. First, the factors affecting physical activity in each neighbourhood were evaluated separately. Second, all the residents of five neighbourhoods and the factors affecting physical activity were investigated collectively.

In the case where we statistically analyzed all the responses in all five neighbourhoods, the effective factors had differences from the analysis that examined the neighbourhoods separately. We think that it is not possible to achieve a common factor for public use in all neighbourhoods, and the characteristics of the local community affect these factors People's concerns, living standards, economic status, cultural situation, and social and geographical conditions are factors that affect citizens' expectations of urban spaces and the extent to which their behaviours are influenced by physical factors in the neighbourhood.

When we divide a part of a city into several neighbourhoods, the research results in each neighbourhood have differences from the total results (total number of people from all the target neighbourhoods). Therefore, dividing an urban statistical population into smaller parts, such as neighbourhoods, leads to changes in the results of the research. A smaller population gives more accurate and specific results that guarantee the success of the proposed plans (possibility of more precise interventions). Based on the research findings and the priorities of residents in each neighbourhood, the following suggestions are presented to promote physical activity among neighbourhood residents:

- The passages and sidewalks in the Kooye Mohandesin neighbourhood should be designed with appropriate width, and the open space between residential lands (undeveloped, degraded open space, or unbuilt residential lands) should be designated.
- Hakim Nezami's neighbourhood should be equipped with suitable sports equipment.
- The material and colour of urban furniture in the Hashte Sharhrivar neighbourhood should be improved.
- Also, based on the findings of the current research, it is suggested to design buildings with a high number of floors in the Sardaran neighbourhood. Increasing the number of floors and implementing a more compact design can optimize the land use for creating walking, cycling, etc., routes to increase the physical activity of the residents.
- In the Bargh neighbourhood, it is better to focus on designing appropriate public spaces.

The strategies that are generally used by municipalities to improve the quality of neighbourhoods may have different effects in different neighbourhoods. Different cultural conditions, varied resident expectations, and existing land uses in each neighbourhood can impact the effectiveness of proposed solutions. We concluded that there is no single, common solution for neighbourhoods with different characteristics. However, some solutions can be effective in residents' physical activity levels in most neighbourhoods, except for some special cases. Based on the results of this study, we can consider the physical factors that have influenced the level of physical activity in a greater number of the neighbourhoods studied, as well as in total (without separating the neighbourhoods). Hence, creating a suitable environment for pets to rest and enjoy, incorporating visually attractive elements, making decisions about adding or removing public spaces in the neighbourhood (while considering cultural and other specific conditions), avoiding designing dead-end and silent alleys, and creating urban furniture with appropriate colours and materials are all effective solutions for most neighbourhoods. However, it is important to emphasize that the impact of these solutions may vary greatly from one neighbourhood to another. As described in the discussion section, a physical factor may have a positive effect on physical activity in one neighbourhood while having a negative effect on physical activity levels in another neighbourhood.

Designers' attention to these effects provides the basis for purposeful intervention. We think that just as physicians determine the stages of diagnosis and treatment for each patient according to the condition of the patient and the individual, architects should also analyze each neighbourhood separately to increase the physical activity of the residents of each neighbourhood and offer solutions for it. We think that generalizations of similar research results are not reliable.

Acknowledgement

This article is partly taken from a research project entitled 'Assessing the relationship between physical activity of residents and environmental factors in the neighbourhoods of Urmia'. The authors are aware that to measure the level of physical activity, we can use variables such as duration of exercise or the length of a sidewalk or cycling and other similar cases. But following the advice of a statistician, physical activity, such as light daily activities, was considered in this study. Therefore, only the intention and action to perform the activity was considered as a unit of activity. We wanted to know if the research audience engaged in physical activity on a few days of the month, regardless of the duration of each action or the length of the route on which they walk or ride a bike.

REFERENCES

1. **Haskell, W. L., Lee, I. M., Pate, R. R., Powell, K. E., Blair, S. N., Franklin, B. A., Macera, C. A., Heath, G. W., Thompson, P. D., Bauman, A.** Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med Sci Sports Exerc*, 2007, vol. 116, no. 9, pp. 1081–1093. https://doi.org/10.1161/CIRCULATIONAHA.107.185649
2. **Barton, H., Tsourou, C.** *Healthy urban planning*. Published on Behalf of the World Health Organization, Regional Office for Europe, Spon Press, 2000.
3. World Health Organization (WHO). *Global health risks mortality and burden of disease attributable to selected major risks.* Geneva: WHO, 2009. 62 p.
4. World Health Organization (WHO). *Global Health Observatory (GHO), prevalence of insufficient physical activity,* 2008.
5. **Kesaniemi, Y. A., Danforth, E. Jr., Jensen, M. D., Kopelman, P. G., Lefèbvre, P., Reeder, B. A.** Dose-response issues concerning physical activity and health: an evidence-based symposium. *Med Sci Sports Exerc*, vol. 33, no. 6, 2001, pp. S351–S358. https://doi.org/10.1097/00005768-200106001-00003
6. **Cerin, E., Cain, K. L., Conway, T. L., Dyck, D. V., Hinckson, E., Schipperjin, J., Bourdeaudhuij, I. D., Owen, N., Davey, R. C., Hino, A. A. F., Mitáš, J., Orzanco-Garralda, R., Salvo, D., Sarmiento, O. L., Christiansen, L. B., Macfarlane, D. J., Schofield, G., Sallis, J. F.** Neighborhood environments and objectively measured physical activity in 11 countries. *Med Sci Sports Exerc,* vol. 46, no. 12, 2014, pp. 2253–2264. https://doi.org/10.1249/MSS.0000000000000367
7. **Narayan, K. M. V., Boyle, J. P., Thompson, Th. J., Sorensen, S. W., Williamson, D. F.** Lifetime risk for diabetes mellitus in the United States. *Journal of the American Medical Association,* vol. 290, no.14, 2003, pp. 1884–90. https://doi.org/10.1001/jama.290.14.1884
8. **Carlos, S., Irala, J. D., Hanley, M., P., Martínez-González, M. Á.** The use of expensive technologies instead of simple, sound and effective lifestyle interventions: a perpetual delusion. *J Epidemiol Community Health*, vol. 68, no. 9, 2014, pp. 897–904. https://doi.org/10.1136/jech-2014-203884
9. **Özbil, A., Peponis, J.** The effects of urban form on walking to transit. In: *Proceedings of Eighth International Space Syntax Symposium, Santiago, de Chile: PUC*, 2012. 15 p.
10. **Mehdinejad, J., Sadeghi Habibabad, A.** Environmental psychology and health in architectural design: past and present guidance and analysis on a series of dynamic design topics (promoting physical activity and health in architectural design). *Journal of Elite Sciences and Engineering*, vol. 3, no. 2, 2018, pp. 32–42.
11. **Motalebi, Gh.** Environmental psychology: the new knowledge-based discipline at architecture and urban design's service. *Honar-ha-ye-ziba*, vol. 10, 2002, pp. 52–67.
12. **Joseph, N. M., Ramaswamy, P., Wang, J.** Cultural factors associated with physical activity among U.S. adults: an integrative review. *Applied Nursing Research*, vol. 42, 2018, pp. 98–110. https://doi.org/10.1016/j.apnr.2018.06.006
13. **Seefeldt, V., Malina, R., Clark, M. A.** Factors affecting levels of physical activity in adults. *Sports Med*, vol. 32, no. 3, 2002, pp. 143–168. https://doi.org/10.2165/00007256-200232030-00001
14. **Hanson, M., Chen, E.** Socioeconomic status and health behaviors in adolescence: a review of the literature. *Journal of Behavioral Medicine*, vol. 30, 2007, 263–285. https://doi.org/10.1007/s10865-007-9098-3
15. **Soltani, A., Hoseini, S. H.** An analysis of the connection between built environment, physical activity and health: comparing three urban neighborhoods from Shiraz, Iran. *International Journal of Urban Sciences*, vol. 18, no. 1, 2014, pp. 19–30. http://doi.org/10.1080/12265934.2013.874546
16. **Glanz, K., Bishop, D.** The Role of behavioral science theory in development and implementation of public health interventions. *Annual Review of Public Health*, vol. 31, no. 1, 2010, pp. 399–418. https://doi.org/10.1146/annurev.publhealth.012809.103604
17. **Aliyas, Z.** Does social environment mediate the association between perceived safety and physical activity among adults living in low socioeconomic neighborhoods? *Journal of Transport & Health*, vol. 14, 2019, 100578. https://doi.org/10.1016/j.jth.2019.100578
18. **Pikora, T., Giles-Corti, B.** Developing a framework for assessment of the environmental determinants of walking and cycling. *Social Science & Medicine*, vol. 56, no. 8, 2003, pp. 1693–1703. http://doi.org/10.1016/S0277-9536(02)00163-6
19. **Alimardani, M., Mohammadi, M., Zibaee Farimani, N.** The effect of place attachment- walking- on health issue at neighborhood level, case study: Motahary neighborhood in Mashhad city. *Arman Shahr Journal*, vol. 21, no. 10, 2018, pp. 193–204.
20. **Ewing, R., Cervero, R.** Travel and the built environment: a synthesis. *Journal of the Transportation Research Board*, vol. 1780, no. 1, 2001, pp. 87–114. https://doi.org/10.3141/1780-10
21. **Moudon, A. V., Lee, Ch., Cheadle, A. D., Garvin, Ch., Johnson, D., Schmid, Th. L., Weathers, R. D., Lin, L.** Operational definitions of walkable neighborhood: theoretical and empirical insights. *Journal of Physical Activity and Health*, vol. 3, no. S1, 2006, pp. S99–S117. https://doi.org/10.1123/jpah.3.s1.s99
22. **Hoehner, Ch. M., Ramirez, L. K. B., Elliott, M. B., Handy, S. L., Brownson, R. C.** . Perceived and objective environmental measures and physical activity among urban adults. *Am J Prev Med*, vol. 28, no. 2S2, 2005, pp. 105–116. https://doi.org/10.1016/j.amepre.2004.10.023
23. **Havdal, H. H., Fosse, E., Gebremariam, M. K., Lakerveld, J., Arah, O. A., Stronks, K., Lien, N.** Perceptions of the social and physical environment of adolescents' dietary behavior in neighbourhoods of different socioeconomic position. *Appetite*, vol. 159, 2021, 105070. https://doi.org/10.1016/j.appet.2020.105070
24. **Yang, Y., Xiang, X.** Examine the associations between perceived neighborhood conditions, physical activity, and mental health during the COVID-19 pandemic. *Health & Place*, vol. 67, 2021, 102505. https://doi.org/10.1016/j.healthplace.2021.102505

25. **King, K. E., Clarke, Ph. J.** A disadvantaged advantage in walkability: finding from socioeconomic and geographical analysis of national built environment data in the United States. *American Journal of Epidemiology*, vol. 181, no. 1, 2015, pp. 17–25. https://doi.org/10.1093/aje/kwu310
26. **Rydenstam, T., Fell, T., Benti, B. G., King, A. C., Balter, K.** Using citizen science to understand the prerequisites for physical activity among adolescents in low socioeconomic status neighborhoods – the NESLA study. *Health and Place*, vol. 65, 2020, 102387. https://doi.org/10.1016/j.healthplace.2020.102387
27. **Saelens, B. E., Sallis, J. F., Black, J. B., Chen, D.** Neighborhood-based differences in physical activity: an environment scale evaluation. *American Journal of Public Health*, vol. 93, no. 9, 2003, pp. 1552–1558. https://doi.org/10.2105/ajph.93.9.1552
28. **Molina-García, J., Queralt, A., Adams, M. A., Conway, T. L., Sallis, J. F.**. Neighborhood built environment and socio-economic status in relation to multiple health outcomes in adolescent. *Preventive Medicine*, vol. 105, 2017, pp. 88–94. https://doi.org/10.1016/j.ypmed.2017.08.026
29. **Monsur, M., Mansur, M., Islam, M. Z.** Are children living on dead-end streets more active? Near-home street patterns and school-going children's time spent outdoors in Dhaka, Bangladesh. *Preventive Medicine*, vol. 103, 2017, pp. S73–S80. https://doi.org/10.1016/j.ypmed.2016.11.016
30. **Peykani, O., Bavar, S.** Designing standards of residential complexes with an approach of improving of children health in urban area. *Architectural Recognition*, vol. 1, no. 6, 2019.
31. Google Earth [online, cited 1.12.2023]. https://earth.google.com/web/
32. **Wang, L., Chen, W.** The relationship between the neighborhood built environment and active transportation among adults: A systematic literature review. *Urban Science*, vol. 1, no. 3, 2017, pp. 29–35. https://doi.org/10.3390/urbansci1030029
33. **Brian, E., Sallis, J. F., Black, J. B., Chen, D.** Neighborhood-based differences in physical activity: an environment scale evaluation. *American Journal of Public Health*, vol. 93, no. 9, 2003, pp. 1552–1558. https://doi.org/10.2105/ajph.93.9.1552
34. **Centers for Disease Control and Prevention (CDC).** Neighborhood safety and the prevalence of physical inactivity-selected states, 1996. *MMWR. Morbidity and mortality weekly report*, vol. 48, no. 7, 1999, pp. 143–146.
35. **Beth, E., Gortmaker, S. L., Bull, F. C., Buka, S. L.** Unsafe to play? Neighborhood disorder and lack of safety predict reduced physical activity among urban children and adolescents. *American Journal of Health Promotion*, vol. 18, no. 5, 2004, pp. 378–386. https://doi.org/10.4278/0890-1171-18.5.378
36. **Handy, S. L., Cao, X., Mokhtarian, P. L.** The Causal Influence of Neighborhood Design on Physical Activity Within the Neighborhood: Evidence from Northern California. *American Journal of Health Promotion*, vol. 22, no. 5, 2008, pp. 350–358. https://doi.org/10.4278/ajhp.22.5.350

Tohid Hatami Khanghahi in 2001 received his master's degree in Architecture from Imam Khomeini International University, Qazvin, Iran. He received his PhD in 2015 from Shahid Beheshti University, Tehran, Iran.
He is an Associate Professor in the Department of Architecture at the University of Mohaghegh Ardabili, Ardabil, Iran. His research interests are urban and rural texture design.

Sahar Rahimi Gendeshmin graduated with a master's degree in Architecture from the University of Mohaghegh Ardabili, Ardabil, Iran, in 2022. In 2017, she received her bachelor's degree in architecture from the University of Mohaghegh Ardabili.
She works as a guest instructor at Mohaghegh Ardabili University. She is interested in research in the field of urban design and creative urban places.

Akbar Abravesh is a graduate with a PhD in Statistics. He received his master's degree in Mathematical Statistics in 2012 from Shahid Beheshti University, Tehran, Iran. He received his PhD in 2018 from the University of Mohaghegh Ardabili, Ardabil, Iran.
He is an Assistant Professor in the Department of Statistics and Computer Science at the University of Mohaghegh Ardabili, Ardabil, Iran. His goal is to provide statistical consulting and help with statistical analysis. He has written several papers on statistics and done many data analysis projects for different fields of science. He is interested in helping non-statistician scientists in different fields of research.

Anita Asadilour graduated with a master's degree in architecture from the University of Mohaghegh Ardabili, Ardabil, Iran, in 2020. She received her Bachelor of Architecture in 2015 from Urmia University, Urmia, Iran. Her main research experience is the study of the physical factors of urban neighbourhoods.

Contact Data

Tohid Hatami Khanghahi, Associate Professor
University of Mohaghegh Ardabili, Ardabil, Iran
Address: University of Mohaghegh Ardabili, Department of Architecture, Ardabil, Iran, Postal Code: 5619913131
E-mail: *t_hatami@uma.ac.ir*
ORCID iD: https://orcid.org/0000-0003-4696-7199
Phone Nr.: 00984531505771

Sahar Rahimi Gendeshmin, Master of Architecture
University of Mohaghegh Ardabili, Ardabil, Iran
Address: University of Mohaghegh Ardabili, Department of Architecture, Ardabil, Iran, Postal Code: 5619913131
E-mail: *sahar.rahimi.739@gmail.com*
ORCID iD: https://orcid.org/0000-0001-7402-7730

Akbar Abravesh, Assistant Professor
University of Mohaghegh Ardabili, Ardabil, Iran
Address: University of Mohaghegh Ardabili, Department of Statistics and Computer Science, Ardabil, Iran, Postal Code: 5619913131
E-mail: *akbar.abravesh@uma.ac.ir*
ORCID iD: https://orcid.org/0000-0001-5846-7306

Anita Asadilour, Master of Architecture
University of Mohaghegh Ardabili, Ardabil, Iran
Address: University of Mohaghegh Ardabili, Department of Architecture, Ardabil, Iran, Postal Code: 5619913131
E-mail: *anitaasadi663@yahoo.com*
ORCID iD: https://orcid.org/0000-0003-4157-736X