

ORIGINAL RESEARCH PAPER

Analyzing the impact of equitable urban service distribution on citizen mobility: a spatial justice perspective

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ABSTRACT

BACKGROUND AND OBJECTIVES: Achieving spatial-place justice in the distribution of urban services is a significant goal for urban planners. It involves ensuring fair and equitable access to resources and services in a physical space so that all individuals can benefit equally from the facilities and opportunities provided in that space. The unfair distribution of urban services has curtailed the presence of pedestrians and limited the daily mobility of citizens, making cities low-mobility environments. To address this issue, urban managers can identify local community issues, create equal opportunities, and promote public participation. By doing so, they can achieve spatial equity in local communities and provide opportunities for equality and justice. This research aims to investigate the relationship between the fair spatial-place distribution of urban services and the mobility of citizens in the Navid and Ab o Bargh areas of Mashhad.

METHODS: This study utilizes a descriptive-analytical approach to investigate spatial justice. Data was collected using the spatial justice questionnaire based on the Likert scale and the International Physical Activity Questionnaire. Researchers assessed the questionnaire's reliability using Cronbach's alpha test and its validity using the content validity coefficient of the item formula. The researchers employed several statistical methods to explore the relationship and correlation between the components of spatial justice and mobility, prioritized the indicators of spatial justice by neighborhoods, and compared the prioritization of the components of spatial justice affecting mobility.

FINDINGS: The results revealed a significant relationship between access to urban services and the mobility of citizens in the studied areas. As such, the positive correlation in the Ab o Bargh area was confirmed for all indicators (functional index (0.466), environmental indicator, (0.384) index aesthetic indicator (0.145). The results suggested a direct relationship between the balanced spatial distribution of urban services and enhanced mobility of citizens in the study area.

CONCLUSION: Research results show a direct relationship between spatial justice and citizen mobility in the city. Spatial justice means the fair distribution of facilities and services between different urban areas and equal access to them by citizens. As a result, citizen mobility in the city is influenced by spatial justice. In other words, Inappropriate distribution of services in the city can cause social differences among citizens. The difference between privileged and underprivileged neighborhoods is in the amount of benefit from urban services. By improving the quality of research indicators in the form of policies and urban planning interventions in all neighborhoods, spatial justice can be realized.

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INTRODUCTION

The growing urban population, improper planning, and inefficient management have aggravated inequality in the distribution of urban facilities and services. This trend is manifested by urban poverty, inefficient local management, informal settlements, and environmental pollution in the form of social-spatial imbalances (Zarabi and Mousavi, 2010). The non-optimal distribution of services in different urban areas and neighborhoods gives rise to problems brought on by social and economic injustices and inequalities (Esmailpoor and Shakibamanesh, 2019). Spatial justice and mobility are closely related concepts that intersect in various ways. Spatial justice refers to the fair distribution of resources and opportunities in space, taking into account the socio-economic conditions of different groups of people (Setianto and Gamal, 2021). Mobility, on the other hand, is the ability to move freely and easily within a space, which is essential for accessing resources and opportunities (Rocco, 2014). While the proper and fair distribution of urban services in temporal and spatial dimensions would contribute to the fulfillment of spatial justice of services in cities. Spatial justice, with its democratic approach to space, seeks to ensure equality of all residents to access resources, services, opportunities, and infrastructure, regardless of ethnic, racial, gender, biological, and religious differences. It is achieved by the participation of residents of urban settlements in decision-making (hafeznia et al., 2015). By exploring inequalities in the distribution of urban facilities and services and recognizing the spatial pattern of injustice, it is possible to contribute to the fair and balanced distribution of social and public services, alleviate spatial injustices, and ensure improved quality of urban life and sustainable development (Ahmadi and Shamsipour, 2020). The concentration of urban services and facilities in certain areas and therefore their deficiency in other areas can undermine spatial justice in the distribution of urban services, thereby thwarting the realization of social justice as one of the fundamental pillars of sustainable development. Moreover, the concentration of service centers in specific areas causes a rift in cities, leading to the influx of the consumer population to the areas that have access to more services, which in turn gives rise to issues such as environmental pressure, traffic, noise pollution, air pollution, etc. (Kalantari et al., 2013). In their research,

urban planners point out the link between the form and appearance of built environments and the unbalanced distribution of urban services (Tonkiss, 2020). This study aims to investigate the relationship between the spatial distribution of urban services and the mobility of citizens in the Navid and Ab o Bargh areas of Mashhad. The dependent variable is mobility, and the independent variable is the qualities of the neighborhood's perceived environment, both of which are linked to the establishment of spatial justice and mobility. To attain the goal, the interrelationship and significance of selected variables and mobility, as one of the main steps of this study, are studied. Nowadays, spatial justice and mobility are challenging issues in the world and have been one of the most important concerns of researchers and experts. Over time, various research has been conducted on the subject of spatial justice, each of which seeks to address issues and problems from a different perspective. The importance of the subject, articles, and studies available on the Scopus scientific database, one of the most comprehensive and reputable scientific databases, were reviewed, and the keywords of spatial justice and physical mobility were searched (Fig. 1). The search results indicate that more than 1000 valid articles have been published on this topic so far. These studies have had an upward trend since 2000. Urban design can lead to justice in communities through small actions. According to the results of the research conducted on the amount of research in the Scopus scientific database, the subject of urban design and spatial justice and its relationship with physical mobility has had an upward trend. However, the examination of the frequency of research conducted indicates that research conducted by researchers around the world has been limited. Given the limited research background, the role of urban design as a prominent factor in creating justice-oriented communities is more felt than ever. Therefore, this study can play a role in defining the position of urban design and its capacities to create justice-oriented urban communities by expressing the dimensions of a resilient society and promoting physical mobility. This study was conducted in the Ab o Bargh and Navid Neighborhoods of Mashhad in Iran in 2023.

Background of research

Pourahmad et al., (2023) conducted a study

(2022) in an article entitled “Sustainability analysis of urban neighborhoods with emphasis on spatial social justice in Maragheh, measured social capital and spatial equity of citizens. According to their results, urban infrastructure and facilities can increase citizens’ satisfaction and contribute to the proper distribution of services and thus play an important role in increasing social capital. [Jian et al., \(2020\)](#) in their research titled “Spatial Justice in Public Open Space Planning” argued that open spaces, as the most valuable assets of the city and local community, are closely linked to the improved physical and mental health of citizens. This research also explored issues related to spatial justice in three dimensions: physical justice, social justice, and right to the city, presenting a framework for examining spatial justice. [Ahmadi and Shamsipour \(2020\)](#) article entitled “Analysis of the Spatial Distribution of Public Services in Terms of Spatial Justice Approach (Case study: Bojnourd)” studied the access of citizens to public services in urban areas. According to their findings, Bojnourd struggles with the severe shortage of public service centers. Also, this deficiency is unfairly distributed in urban neighborhoods, which has brought to the fore inequality and injustice in neighborhoods. [Saedi Monfared et al., \(2020\)](#) In their paper titled “Exploring the Physical and Functional Components Affecting Spatial Justice in Marginal Settlements”, study physical and functional factors affecting spatial justice in the core of urban poverty in Mashhad. Their results showed that physical diversity is a key determinant factor in ensuring spatial justice in marginal settlements. [Lorraine et al., \(2019\)](#) in a study titled “Who Has Access to Urban Green Spaces?” Access to urban green space has been studied from the perspective of spatial equity in 10 U.S. metropolitan areas. Their findings showed that there was a positive correlation between access to urban green spaces and income, as well as a negative correlation between green space and the status of racial minorities. [WHO \(2017\)](#) published a report entitled “Towards more physical activity in cities” highlighting the importance of boosting mobility to prevent deaths from non-communicable diseases. This report stressed that individual, social, built, and natural environmental factors have a significant bearing on people’s physical health. [Mohammadi et al., \(2012\)](#) in their study, titled “Spatial Analysis of Distribution and Access to Urban Services in Urban Areas of Ardabil with Spatial

Justice Approach,” examined the level of citizens’ access to commercial uses in Ardabil neighborhoods. The results showed that there is general inequality in access to commercial land use in urban areas of Ardabil and consequently low sustainability. According to the theoretical literature and background of the research, there is no consensus on spatial justice indicators, despite numerous studies in the field. Previous studies have examined spatial justice in various applications such as sports, green space, or single-use. However, in this research, we have attempted to present a comprehensive model encompassing all aspects of functional, aesthetic, and environmental experimentation. This study uniquely explores the relationship between spatial equity in privileged and underprivileged neighborhoods and its impact on physical mobility in urban spaces and the physical health of city residents. The study’s findings can be utilized by urban planners, designers, and policymakers to improve spatial justice in low-income neighborhoods, promoting the well-being and physical health of citizens.

MATERIALS AND METHODS

Survey design and data collection

The questionnaire used in this study consisted of three main parts. The first part includes the definition of spatial justice, physical mobility, and socio-demographic information such as education level, occupation, age, and gender. The second part included questions that indicate spatial justice indicators affecting physical mobility in three functional, aesthetic, and environmental components on a five-point Likert scale to obtain information on the influencing variables, namely access to public transportation stations, access to open space and entertainment, and so on. The Likert scale ranged from one to five, which refers to a range from “very little” to “very much”. The third part included the International R which has validity and reliability. Before asking the respondents to answer all the questions in the three above-described main parts, the trained interviewers informed respondents about the purposes of the study and explained clearly all the specific terms used in the content of the questionnaire, to make sure the respondents understood. The questionnaire was pretested and had minor changes before conducting the actual survey. Then a survey of residents was conducted and analyzed.

Analytical framework

This is an applied study that adopts a descriptive-analytical research method. The data was gathered from 588 questionnaires on spatial justice and physical activity. Data analysis was conducted using a two-sample independent t-test, Pearson correlation, regression, Friedman test, and t-test in SPSS software. The sample size was determined by Cochran's formula (based on the population size). To strike a balance between the samples based on the population of each neighborhood, 338 and 250 questionnaires were distributed in the Ab o Bargh and Navid neighborhoods, respectively. The questionnaires explored indicators of spatial justice in the distribution of urban services and their effect on mobility. To evaluate the validity of the research, the content validity coefficient of the item method was utilized. A questionnaire was then designed and distributed to 20 experts in urban planning to discuss all research indicators. The validity of the questionnaire was also rated as desirable (CVCI = 80). Cronbach's alpha test was utilized to investigate the reliability of the questionnaire ($\alpha = 0.94$). To test the normal distribution of the variables, the Kolmogorov-Smirnov test was used, with the results confirming the normal distribution of variables in the three functional, environmental, and aesthetic indicators. Confirming the normal distribution of data using the Kolmogorov-Smirnov test is crucial. If the data doesn't follow a normal distribution, our statistical analysis results may be incorrect and lead to inaccurate decisions. Therefore, performing the Kolmogorov-Smirnov test can help us ensure the accuracy and reliability of our statistical results.

RESULTS AND DISCUSSION

Spatial justice

The concept of spatial justice has been the subject of scholarly attention since the early 1820s, and in 1970, informed by Rawls's studies, it made its way to geography and urban planning (Godillon, 2011). Zhian *et al.*, (2020) cite Lefebvre as saying that city dwellers have a specific spatial right that includes fair participation in the process of creating urban space, the right to access facilities and privileges, the right to prevent spatial segregation, and the right to access public services. Spatial justice is a theory that underlines respect for the equal rights of individuals, protecting human and social values (Annabestani and

Hosseini, 2018).

Spatial justice in the city

Spatial justice is a type of social justice that ensures equal access and use of services for all people. From the perspective of social justice, spatial justice requires the formulation of laws that allocate urban services equally to all citizens. Social justice hampers or mitigates deprivation and economic inequalities (Uwayezu and De Vries, 2018). It can be contended that spatial justice in the city is the most important factor in the distribution of urban services (Chianeh *et al.*, 2015). Space is the intersection of all urban events and issues, and spatial justice can be seen as the gravity center of all types of justice in urban planning, which is independent of other forms of justice (economic, social, and environmental) and seen as the heart of justice movements in the city. Therefore, spatial justice is inalienable from social justice (Cardoso and Breda-Vázquez, 2007). Fig. 2 shows the concept of justice and its types in the city from different perspectives.

Solution for improving citizens' mobility in the city using spatial justice

Improving the mobility of citizens in a city using spatial justice involves ensuring that all social groups have fair and equitable access to transportation services and opportunities. Here are some ways to achieve this:

Promote public transportation

Encouraging the use of public transportation can help reduce traffic congestion and air pollution while providing affordable and accessible transportation options for all citizens (Tzanni *et al.*, 2022).

Encourage walking and cycling

Promoting walking and cycling can help reduce reliance on cars and provide healthy and sustainable transportation options for citizens. This can be achieved by creating safe and accessible pedestrian and cycling infrastructure, such as sidewalks, bike lanes, and bike-sharing programs (Tzanni *et al.*, 2022).

Ensure equitable distribution of transportation services

Ensuring that transportation services are distributed fairly and equitably across different

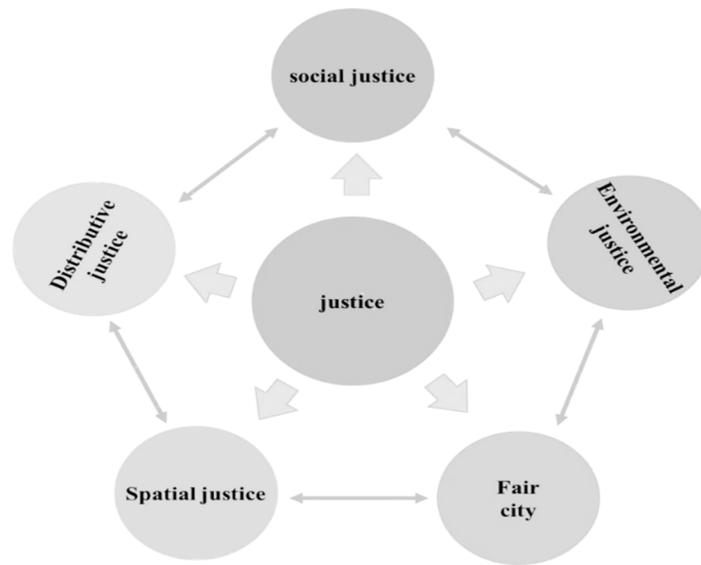


Fig. 2: Interrelationships of the concept of justice from various perspectives

neighborhoods and social groups can help reduce spatial injustice in mobility. This can be achieved by analyzing the social-spatial unevenness of benefits and dis-benefits for different social groups and taking steps to address any disparities. Consider the needs of diverse urban actors: Recognizing and examining the mobility needs, experiences, values, and practices of diverse urban actors can help ensure that transportation policies and interventions are inclusive and equitable. This can involve engaging with citizens and community groups to understand their transportation needs and preferences (Verlinghieri et al., 2020). Overall, improving the mobility of citizens in a city using spatial justice involves promoting equitable access to transportation services and opportunities for all citizens, regardless of their social group or neighborhood.

Types of spatial justice

Spatial justice is the common thread that connects social justice in the city and urban planning. Social inequalities prompt a sense of marginalization and fear in residents. Urban justice means that all profits and losses are equally distributed among the residents Fig. 3 shows the types of justice and their meaning in the city.

Criteria to ensure spatial justice

Spatial justice means the distribution of urban services proportional to the needs and merits of citizens. In the distribution of municipal services, priority is given to disadvantaged and vulnerable people.

In connection to urban spatial justice, the following criteria can be mentioned.

Equality of opportunities

It means equal opportunities in accessing and using urban uses, services, and information, as well as valuable social interests in space, legal interests of plans, and urban projects (Ghaderi Hajat et al., 2022). Also, equal access to urban services should be informed by the ability and merit of the residents (Pourkhaksar, 2020).

Transparency

To raise the local community and citizens' awareness of the benefits and harms of implementing urban development programs, it is essential to sufficiently inform them (Rafeian et al., 2019).

Difference

Focus on spatial-temporal identity, function, and

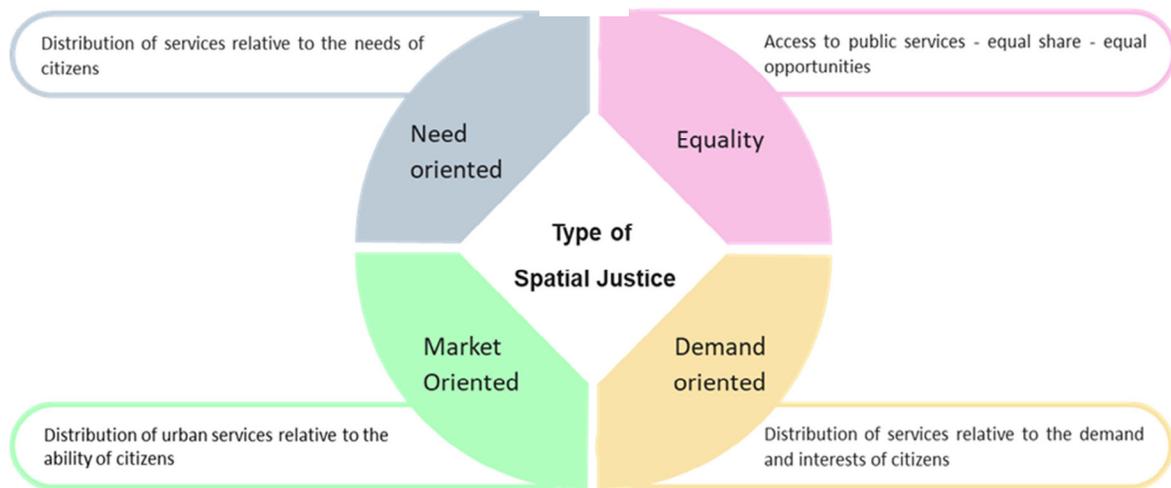


Fig. 3: Types of spatial justice in the city (Cho, 2003), (Rostami, 2011)

different economic, social, and cultural conditions of districts and urban areas at the time of making plans to provide urban services (Pourkhaksar, 2020).

Negation of marginalization

It indicates the assertion of the oppressed groups, which can deter the marginalization of the indigent and low-income groups (Afsharnia et al., 2019).

Freedom

Participation of citizens in decision-making and the citizens' right to equal choices for daily activities (Dadashpoor et al., 2015).

Stability and durability:

The growth of inequalities over time and their consolidation in many areas calls for continuous and sustainable measures (Pourkhaksar, 2020).

Participation

Determining the fate of citizens and the city and active participation of citizens in the re-creation of space (Mirgholami et al., 2018).

Diversity

The term diversity means different things to urban planners and urban designers. For urban designers, it implies different types of construction, and for urban planners, it suggests mixed land use, diverse social and cultural groups, and diverse ethnic,

gender, age, and income groups (Alvandipour, 2016). For those who consider diversity as a key criterion, the greatness of the city lies in encouraging people to move towards public open spaces and interaction (Young and Allen, 1990).

The concept of distributive justice

Edward Soja (2009) believes that distributive inequalities are the clearest expression of spatial justice. Spatial justice is the chain link between social justice and space. Distributive justice focuses on the fair distribution of resources among diverse members of a society, the fair allocation of distributed resources, the distribution process, and the pattern of distribution in society. The main focus of distributive justice is firstly on relative poverty and income distribution among people and then on economic and social transactions (Dadashpoor and Rostami, 2010). Distributive justice is entwined with principles and issues such as justice, need, welfare, and merit (Bozorg, 2010). Distributive justice is also used to describe environmental benefits and the effects of environmentally destructive places and locations on humans and societies (Francesca et al., 2022).

Structural justice

Structural justice imparts different meanings and denotes diverse but sometimes identical criteria in different schools of thought. In Marxism, people like Lefebvre accentuate the generality of the

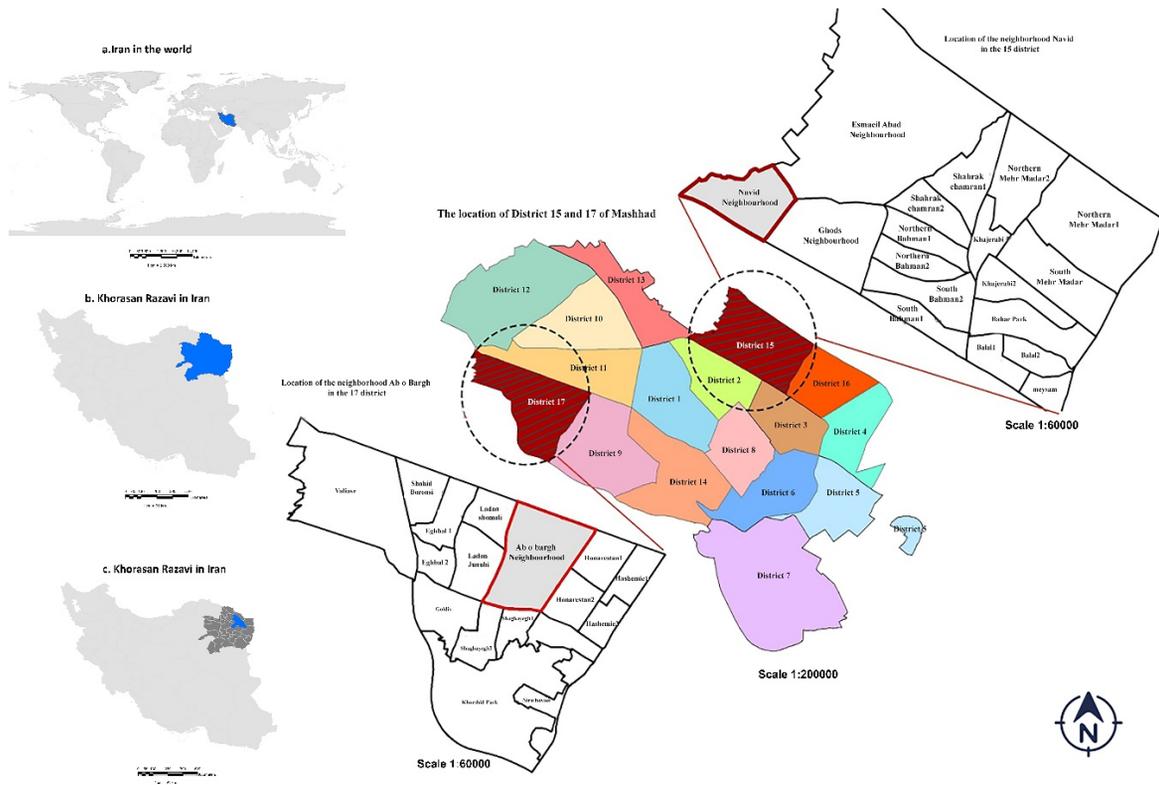


Fig. 4: Location of the research area in the world, country, and metropolis of Mashhad

space, participation, and creation of the new space (Lefebvre, 1996). Neo-Marxists such as David Harvey see structural justice as the right to participation, need, and public interest (Harvey, 1997). However, Edward Soja searches for structural justice in freedom, equality, and democracy (Soja, 2009). In Liberalism, structural justice is concerned with difference, equality, and freedom, and John Rawls is one of the main advocates of this school (Rawls, 1971). Nonetheless, neoliberalism proponents like Susan Feinstein sum up structural justice in equality, democracy, and diversity (Harvey and Potter, 2009).

The scope of the research

The study area covered two known areas of the Mashhad metropolis, the Ab o Bargh, and Navid neighborhoods. These two areas are distinct in terms of urban form, building density, type of access, and socioeconomic status. Located in district 17 of Mashhad municipality, Ab o Bargh is home

to a population of about 31021 people. Regarding the planning areas of Mashhad, it is situated in the southwest. Navid neighborhood, located in District 15 of Mashhad Municipality, is also situated in the northeast planning areas of Mashhad city. This area has a population of about 3431 people (peiravi et al., 2021a, 2021b). Fig. 4 shows the geographical location and scope of the research in the Mashhad metropolis.

Environmental qualities and their components

Environmental quality is the outcome of three indicators of functional, empirical - aesthetic, and environmental quality of cities. Functional quality, which involves ensuring proper mobility and access to sidewalks, entertainment, gatherings in the urban space, etc. in the city, guarantees the vitality and richness of the spatial experience of the city. The empirical-aesthetic quality deals with the perceptual, cognitive, and environmental preferences of people about urban spaces. Environmental quality

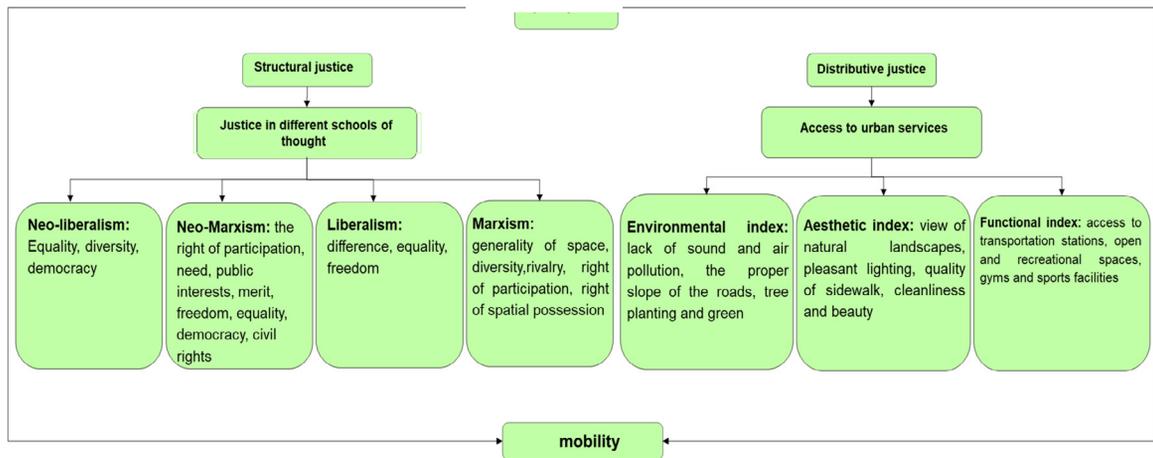


Fig. 5: The effect of spatial, distributive, and structural justice on mobility

Table 1: Results of the principal component analysis with varimax rotation

Variable/index	Variable	Mean	SD	T	Df	Sig
Functional	Ab o Barg	17.27	2.45	56.189	588	0.001
	Navid	7.34	1.54			
Environmental	Ab o Barg	16.97	2.48	48.038	588	0.001
	Navid	8.34	1.60			
Aesthetic	Ab o Barg	18.05	2.07	33.062	588	0.001
	Navid	12.76	1.67			

is associated with urban ecology and how natural resources such as land, water, etc. are exploited in urban plans (Golkar, 2001). Each of these indicators can influence the mobility of citizens from the perspective of spatial justice in the urban space. Using the theory of justice (distributive and structural), Fig. 5 presents the relationship between mobility and functional quality, and cognitive and environmental beauty.

1- Function and mobility index: It includes activities that are conducted to do daily activities or achieve a specific goal. In the planning and design of urban areas, it is of utmost importance to stress the principle of pedestrian circulation to boost mobility. Considering factors such as radius of access, urban services, optimal time interval, permeability, flexibility, compatibility of urban form with uses, harmony of adjacent uses, safety, etc., can encourage residents to walk and thus increase their mobility and physical activity.

2- Aesthetic index and mobility: The incorporation

of aesthetic principles spaces such as sidewalk quality, cleanliness and beauty, lighting, visual proportions, human scale, and readability in the design of urban can increase citizens' willingness to walk and attend urban spaces.

3- Environmental index and mobility: Urban design qualities geared toward characteristics of the natural environment, like climate comfort, clean air, and the proper slope of roads encourage mobility and walking among citizens.

Two-sample independent T-test

To compare the status of residents of Navid and Ab o Bargh neighborhoods in terms of spatial justice, the two-sample independent t-test was used. The findings are outlined in Table 1, based on Fig. 5. As suggested by the results, the residents of Navid and Ab o Bargh neighborhoods differ in spatial justice, and on average, the three study indicators are higher in Ab o Bargh than in Navid neighborhood.

Regarding the performance index, the construction

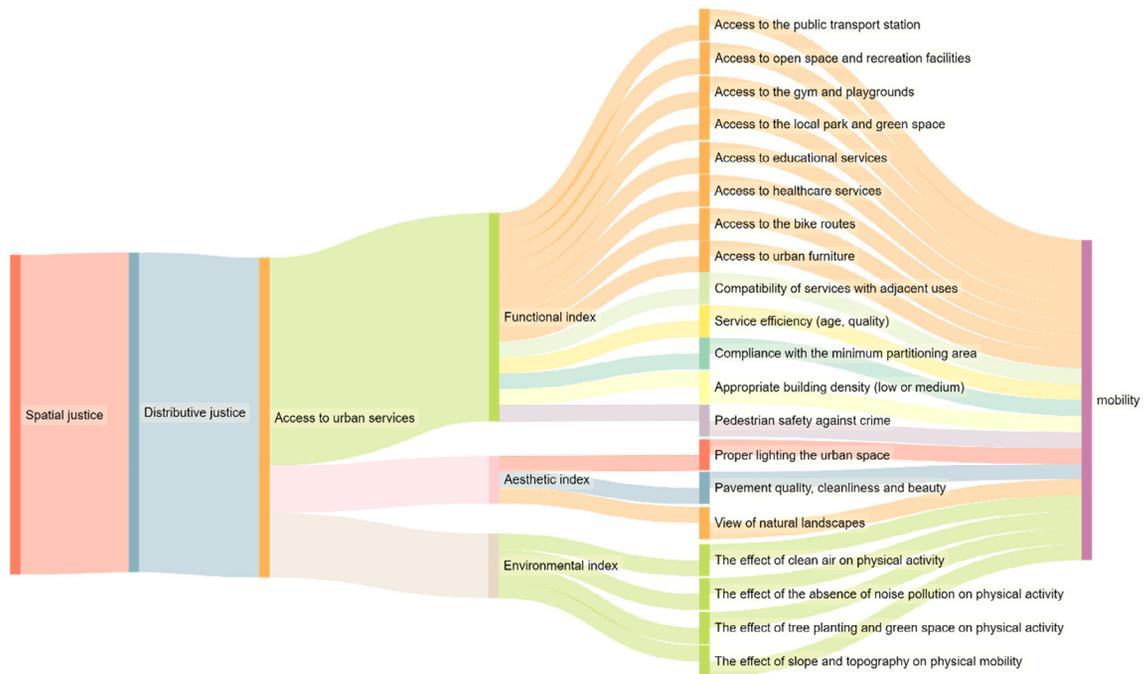


Fig. 6: Conceptual model of research

trend of the Ab o Bargh neighborhood is modern, and it is classified as one of the developed areas of Mashhad. The main uses of the neighborhood are residential, revolving around active commercial and administrative axes. In terms of access to the Light Rail Transit (LRT) transportation system, the citizens have access to LRT stations in the neighborhood, and the radius of spatial access to the LRT station is on average 234 m with a time interval of 2 min and 56 seconds. There are also dotted and linear public open and green spaces within the area with an average spatial distance of 233 m and a time interval of 2 min and 55 seconds. Educational and medical uses are also on average at a spatial distance of 327 m and 513 m with a time interval of 4 min and 55 seconds, and 6 min and 25 seconds, respectively. The attendance of different age groups, especially young people, and the commute of children and adolescents to educational centers, children’s playgrounds with suitable facilities, daily visits of citizens to commercial complexes to meet their demands, and the extensive use of green space have turned this neighborhood into a lively and dynamic center (peiravi et al., 2021b), thereby encouraging walking and mobility of citizens.

The analysis of indicators in the Navid neighborhood exhibited that restricted municipal services and improper distribution of services have been effective in undermining distributive and structural justice. In this neighborhood, there are no stations to access LRTs. The bulk of the land use is dedicated to horticulture and agriculture, along with urban and commercial buildings. In this neighborhood, there is a mean spatial distance of 252 m to green space, 950 m to medical use, 193 m to the bus station, and 638 m to the sports facilities, which reflect the paucity of service uses in Navid neighborhood compared to the Ab o Bargh. As regards the aesthetic index, the magnificent views of the Binaloud Mountains (tourist attraction), the watercourses, the desirable quality of the sidewalk, and the cleanliness of the urban space, as well as proper lighting have encouraged the mobility of the citizens. As for the environmental index, the mobility of the Ab o Bargh neighborhood is higher due to its green space with a satisfactory functional radius, access to public transportation (LRT), and Binaloud Heights as opposed to the Navid neighborhood, which has a relatively constrained green space, and fewer natural attractions (peiravi et

Table 2: Two-sample independent T-test and comparison of mobility of citizens

Independent Variable	Variable	Mean	SD	T	Df	Sig
Mobility	Ab o Bargh	19.35	2.07	58.734	588	0.001
	Navid	10.29	1.48			

Table 3: correlation coefficient and significance of spatial justice and mobility based on the Pearson model

Variable/index	Mobility	
	R (Correlation)	Sig (Significance)
Functional	0.466	0.000
Environmental	0.384	0.000
Aesthetic	0.145	0.000

Table 4: Coefficient of regression test for the effect of spatial justice components on mobility

Variable/index	R	R ²	R ² adj	F	Sig	B	Std	Beta	T	Sig
Constant value	0.896	0.802	0.801	790.151	0.001	1.833	0.447	-	0.948	0.001
Functional						0.422	0.032	0.466	13.152	0.001
Environmental						0.353	0.034	0.384	10.363	0.001
Aesthetic						0.216	0.044	0.145	4.877	0.000

al., 2021a). In Table 2, a comparison has been drawn between variables of mobility in two study areas.

Strength of Correlation Test

In measuring the correlation between variables, values close to 1 indicate a stronger correlation. Table 3 outlines the correlation between spatial justice indicators and citizens’ physical mobility based on the Pearson Correlation model. Accordingly, more favorable indicators of spatial justice promote physical mobility in citizens. Table 3 shows the correlation between the functional index and physical mobility (0.466), between the environmental index and physical mobility (0.384), and between the aesthetic index and physical mobility (0.145). Therefore, since the correlation value is close to 1, it can be inferred that the components of physical activity and mobility are correlated.

Regression test

To estimate the impact of each independent variable on the dependent variable (mobility), the stepwise multivariate regression analysis was used. The results of the regression suggest the relationship between the independent and dependent variables, as outlined in Table 4, based on the one-way analysis of variance, is linear, indicating that independent variables can explain the changes in the dependent variable (mobility), and therefore the regression model is confirmed. The

regression results for the variable of the impact of spatial justice components on mobility neighborhood showed that the functional component (0.466), environmental component (0.384), and aesthetic component (0.145) directly influenced mobility. The results suggest that variables of functional, aesthetic, and environmental indicators justify the changes in physical mobility. When the Beta coefficient is positive and close to 1, it shows the impact of the dependent variable (physical movement) on the independent variable (functional, aesthetic, environmental components).

Friedman’s test for prioritizing spatial justice components on physical mobility

As outlined in Table 5, there is a significant difference between the mean ranks of the items related to spatial justice (P<0.01) and ($\chi^2=742.543$). Pavement quality, cleanliness, and beauty have the highest average rating in the Ab o Bargh neighborhood, which has had the most significant impact on the physical mobility of citizens. Access to educational services use has the lowest on the physical mobility of citizens. In the Navid neighborhood, the highest average rating is for the index of air cleanliness, and the lowest average rating is related to the index of access to the bike routes. Table 5 presents the prioritization of indices in terms of spatial justice.

Table 5: The results of the Friedman test for the prioritization of *spatial justice* indicators

Index	Items	Mean ranks	
		Ab o Barg	Navid
Functional	Access to the public transport station	9.77	8.87
	Access to open space and recreation facilities	9.80	7.59
	Access to the gym and playgrounds	9.30	10.33
	Access to the local park and green space	11.32	5.45
	Access to educational services	8.34	5.26
	Access to healthcare services	8.39	8.68
	Access to the bike routes	8.91	5.00
	Access to urban furniture	8.73	5.80
	Compatibility of services with adjacent uses	10.88	11.14
	Service efficiency (age, quality)	10.03	13.81
	Compliance with the minimum partitioning area	11.16	14.24
	Appropriate building density (low or medium)	9.10	14.87
	Pedestrian safety against crime	13.73	9.19
	Environmental	The effect of clean air on physical activity	9.55
The effect of the absence of noise pollution on physical activity		9.47	16.06
The effect of tree planting and green space on physical activity		9.43	11.36
The effect of slope and topography on physical mobility		11.22	16.05
Aesthetic	Proper lighting the urban space	13.20	10.51
	Pavement quality, cleanliness and beauty	14.95	13.02
	View of natural landscapes	12.72	6.08
Chi-Square		742.543	2407.596
DF		19	19
Sig		0.000	

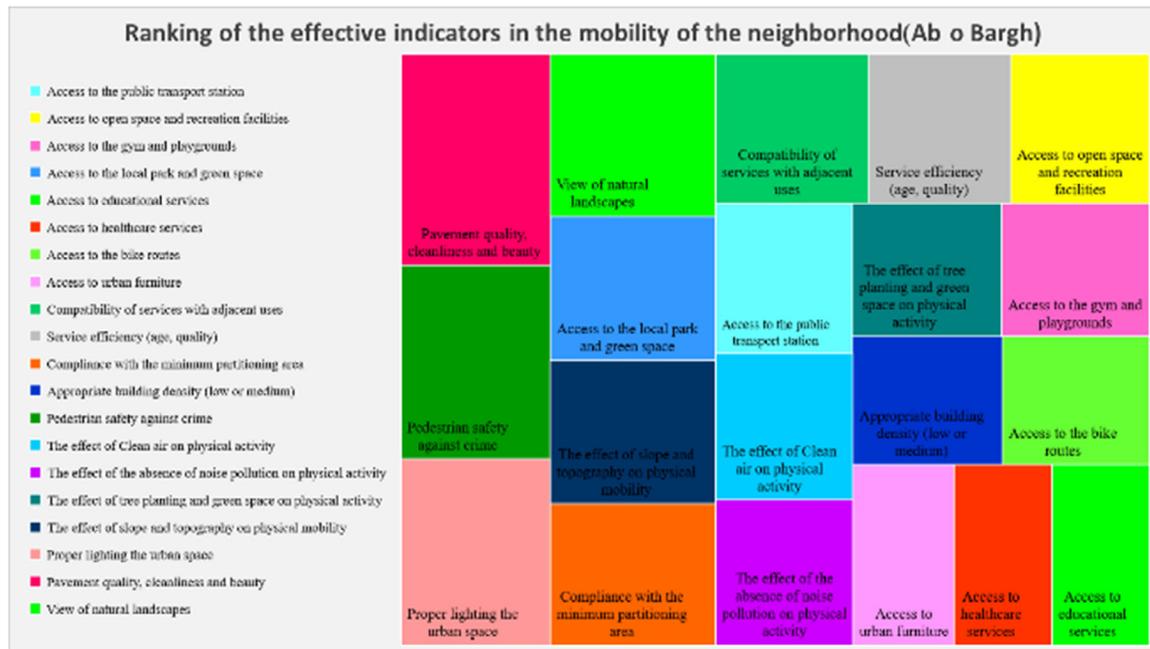


Fig. 7: Ranking of the influencing indicators in the mobility of the low-income neighborhood (Navid)

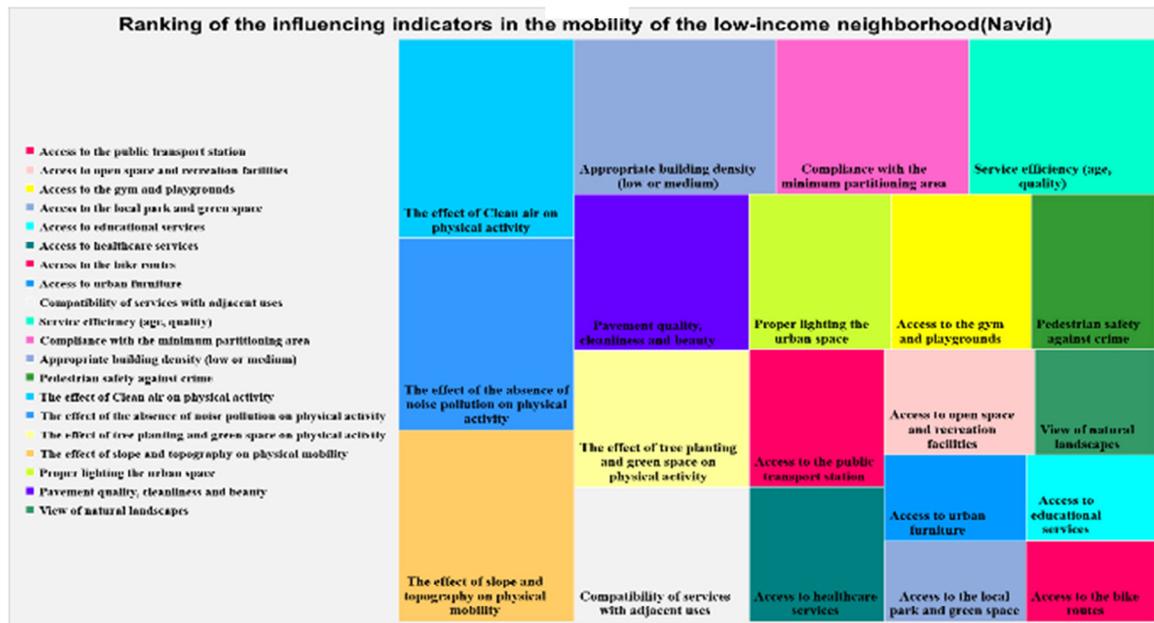


Fig. 8: Ranking of the effective indicators in the mobility of the neighborhood (Ab o Bargh)

Table 6: Prioritization of sub-criteria of variables using One-Sample T-test

Variable	Component	Mean		T		Sig	prioritize	
		Ab o Bargh	Navid	Ab o Bargh	Navid		Ab o Bargh	Navid
Spatial justice	Functional	17.2663	7.3400	17.2663	7.3400	0.00	2	3
	Environmental	16.9763	8.3400	16.9763	8.3400	0.00	3	2
	Aesthetic	18.0562	12.7680	18.0562	12.7680	0.00	1	1

Prioritizing sub-criteria of variables using One-Sample T-test

The analysis of indicators by T-test for greater clarity and comparison is presented in Table 6.

The data in Table 6 shows that the aesthetic index has a higher average than other indices in the water and electricity neighborhood and Navid. Therefore, paying attention to aesthetic principles in the design of urban spaces, such as the quality of sidewalks, cleanliness and beauty, lighting, visual proportions, human scale, and legibility, leads to an increase in citizens' desire to walk and be present in urban space. Also, to show the priority of the indicators in influencing mobility, Fig. 9 is presented.

The research has shown that increasing physical mobility in urban areas can reduce and prevent non-communicable disease-related deaths, and improve

the physical health of citizens. Access to public services is one of the main factors in enhancing citizens' physical and mental health. However, the unequal distribution of public services among urban neighborhoods leads to inequality and injustice in citizens' access to urban facilities and services. As a result, mobility in deprived areas is reduced. Therefore, urban planners and designers should always consider providing optimal access to urban spaces for the residents of underprivileged areas. In this study, according to the presented comprehensive research model, a comparative comparison has been made between the two neighborhoods of Ab o Bargh and Navid regarding aesthetic, functional, and environmental components. Among the innovations of this research, we can point out the development of a comprehensive research model based on the

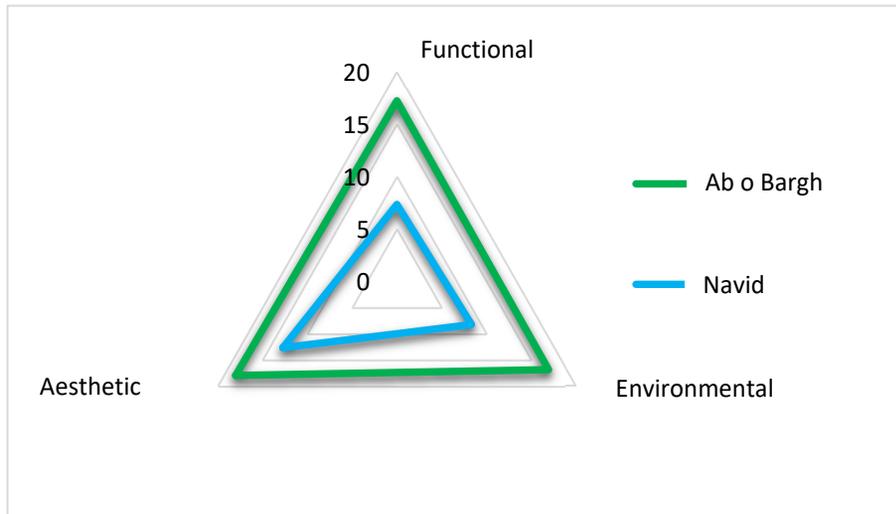


Fig. 9: Prioritization of sub-criteria of variables using One-Sample T-test

components of urban design, spatial justice, and physical mobility. The opinions of citizens as the main users of services and urban spaces between two underprivileged and privileged neighborhoods have been investigated and evaluated, and the results indicate that the amount of public services and mobility in underprivileged neighborhoods is less than that of privileged neighborhoods. The distribution of urban services among different neighborhoods is not fair and often leads to neglect of underprivileged areas, resulting in social gaps and violence. Therefore, it is crucial to optimize access to urban services in all localities to encourage walking and equitable mobility. Currently, there is a significant difference between neighborhoods that enjoy access to urban services and those that are deprived of these services. This inequality and unfairness often lead to feelings of mistrust, violence, and isolation in low-income neighborhoods. To prevent such unfavorable conditions, measures should be taken in all neighborhoods to ensure that all people can benefit from city services equally. This optimization is of great importance and should be taken seriously. By providing equal opportunities for access to urban services, it is possible to help create social balance in society. Therefore, all sections of society and city officials must work together to ensure that this becomes a reality and no region is deprived of

this right. Improving access to urban services will encourage people to walk and move more equitably, ultimately improving the quality of life and well-being of citizens. Urban planners and designers can promote spatial justice and mobility by providing a comprehensive model that considers functional, experimental, aesthetic, and environmental dimensions and examines the relationship between spatial justice in rich and poor neighborhoods and its impact on physical mobility.

CONCLUSION

Spatial justice is the idea of ensuring that services and opportunities in urban spaces are distributed fairly and equally. Each person and area of the city has different needs and facilities, and if these are not distributed fairly and equally, social and economic gaps between people and urban areas will increase. This can lead to social and economic inequalities and can result in increased insecurity, crime, economic incapacity, and unequal access to basic services such as education, health, and treatment. Moreover, increasing social and economic distance can intensify social tensions and contradictions, leading to social anomalies and differences between people and groups. On the other hand, the lack of proper distribution of urban services in localities forces people to travel to other areas using personal

transportation to meet their needs. This not only creates environmental problems but also causes citizens to be immobile in urban spaces, ultimately affecting their physical and mental health. The present study discusses the evaluation and comparison of spatial justice and its impact on mobility in two neighborhoods, one privileged and the other underprivileged. By conducting a systematic review, the study explains the factors that influence spatial justice and mobility. These factors were investigated using T-tests of two independent samples, Pearson's correlation, regression, Friedman, and T-test in the two neighborhoods. The investigation and results of this research show that there is a correlation between mobility and spatial justice concerning the investigated indicators. Studies and tests have shown that there is a strong connection between spatial justice indicators and the mobility of residents. In other words, neighborhoods with higher levels of spatial justice tend to have higher mobility and walking rates. Regression analysis results reveal that spatial justice indicators explain changes in residents' mobility in terms of three components: functional, experimental, aesthetic, and environmental. Moreover, these results show that residents' mobility affects spatial justice. The T-test of two independent samples indicates that the level of spatial justice in the water and electricity neighborhoods is higher than that in Navid, in terms of the three components mentioned earlier. As a result, these two neighborhoods differ in terms of mobility and walking, with the water and electricity neighborhood having a higher rate of walking due to its development, natural landscapes, and urban facilities and services. Enhancing spatial justice and researching its components in low-income areas remains a major challenge for urban planners and managers. The results of Friedman's test indicate that the water and electricity neighborhood has better quality indicators than the Navid neighborhood. The quality indicators are sidewalk quality, cleanliness, beauty, pedestrian safety against crime, proper lighting of urban spaces, view of natural scenery, access to bicycle paths, access to urban furniture, access to local park and green space, access to educational services, access to public transportation station, access to open space, and recreational facilities. On the other hand, the Navid neighborhood has a more favorable condition in indicators with low building density, the efficiency

of services (age, quality), compliance with minimum separation area, compatibility of services with nearby uses, the impact of air and noise pollution on physical mobility, the impact of trees and green space on physical mobility, the effect of slope and topography on physical mobility, access to the gym and sports field. However, it can be said that the low distribution of absorbent services and the provision of their needs from other localities can be a factor for the clean air and low noise pollution in these localities. The possibility of mobility in cities, and specifically in Mashhad, depends on the urban management system and the methods used for urban development plans, urban planning, urban design, and citizens' health. This means that mayors, city planners, architects, urban designers, and construction workers all play a role in improving the material and spiritual quality of people's lives and the improvement of their living space. It is important to take executive measures such as organizing urban affairs through attractive activities and strengthening sidewalks to improve the quality of life of the elderly and disabled. Additionally, parks and green spaces should be strengthened and urban furniture should be improved to encourage greater mobility among citizens. To promote spatial justice in deprived neighborhoods, several solutions can be implemented.

1. Developing social and economic infrastructure can help to increase the sense of security and social interaction in an area. This includes creating open and recreational spaces, local parks and green spaces, and cultural, educational, and sports centers.

2. Developing services that encourage walking is essential to creating a healthy and sustainable community. This includes improving access to public transportation stations, bicycle paths, and urban furniture, and ensuring that services are compatible with nearby uses. Other important factors include the efficiency and quality of services, safety of pedestrians against crime, reduction of air and noise pollution, proper lighting of urban space, sidewalk quality, cleanliness, and beauty.

3. Improving health and treatment facilities is crucial to improving the health conditions of the society. Providing appropriate health and treatment facilities and services to people in these areas can help in this regard.

4. Increasing cooperation and coordination between people and local institutions is important to

strengthen trust and solidarity in society. Establishing communication and cooperation between people and local institutions can help in this regard.

5. Creating employment opportunities is vital to increase the income and economy of society and reduce the level of poverty and inequality. Providing job and business opportunities in these areas can make a significant difference.

AUTHOR CONTRIBUTIONS

All authors contributed to the study's conception and design. Material preparation, data collection, and analysis were performed by Mahdieh RazmaraMina, Morteza Nazarabadian, and Ali Asghar Pilehvar. The first draft of the manuscript was written by Morteza Nazarabadian and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

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ABBREVIATIONS

α	Cronbach's alpha
CVCI	Content Validity Coefficient of Item
DF	Degrees of freedom
LRT	Light rail transit
R^2_{adj}	adjusted R-squared
R^2	Coefficient Of Determination
R	Correlation
R	Regression
SD	Standard Deviation
Sig	Significance
SPSS	Statistical package for social science
T-test	T student
T	Two independent sample t-test
U.S.	United States
WHO	World Health Organization
χ^2	Chi-Square

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