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A Framework for Elder-Friendly Public Open Spaces from the Iranian Older Adults' perspectives: A Mixed-Method Study

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Highlights

Public spaces promotes the health of the elder through active aging approach.

Identify the elders' preferences specially their use of public spaces in residential neighborhoods.

Highlights the preferences of the elder regarding attributes of Places Functional, Places Preferences, and Process in Environments.

Abstract:

The elderly's needs and preferences for public open space seem different from who are not in elderly time; also, ageing requirements should be taken into consideration to improve older adults' active life. In this respect, creating active ageing requires a new approach to engage older citizens in outdoor environments viewed as healthy and sustainable by the seniors. This study aims to identify the elders' preferences, especially their use of public open spaces (POSs) in Iranian urban neighbourhoods as well as identifying the association among the factors. The research was conducted in two steps; First, Grounded Theory (GT) by employing 64 semi-structured interviews in POS and then data analyzed to extract the main concepts. Second, a survey was conducted through a self-administered questionnaire based on extracted items, to which 420 elderly people responded. Partial least squares-Structural Equation Modelling (PLS-SEM) was employed for data analysis and developing the model. The results indicated that the process in environments (social environment, cultural environment and sense of belonging) - as the non-physical dimensions of POSs- significantly influence the demands of the elderly in outdoor environments. Among physical features of POSs, the place functions (access to amenities, urban landscape, and environmental cleanness), as well as place preferences (crime security, fear of falling security and the elders' image), are more likely to meet the elders' needs in urban spaces. These findings also revealed a significant causal relationship between the factors adopted from the developed model. The findings will highlight POSs both theoretical and practical implications for urban planners and designers as well as policy-makers.

Keywords: Public open spaces; Elders' preferences; Elder-friendly; Urban planning.

1- Introduction

The proportion of elder individuals ≥ 65 is expected to grow exponentially from 524 million in 2010 to approximately 1.5 billion by 2050 (World Health Organization, 2002). Emphasizing the increasing needs of elders such as their presence in the public areas is a new challenge for the development of public open spaces (POSs) in the 21st century (World Health Organization, 2007). In this regard, the World Health Organization (WHO) launched the Global Age-Friendly Cities project to present strategies and action plans that provides safe, inclusive, and accessible POSs to encourage elders to participate in public life (World Health Organization, 2016; Yung et al., 2016a).

Recent studies have confirmed the importance of POSs to promote the well-being and active ageing of older adults (Levy-Storms et al., 2018). There exist many approaches in devising age-friendly environments, ranging from an emphasis on physical environment and infrastructure to the quality of social relations that promote their participation in social activities (Buffel and Phillipson, 2017). It is necessary to investigate the relationship between built environments and the elders' public health and physical activity. To address this goal, it is essential to identify the features that would improve the quality of the built environment based on the elders' needs (Yung et al., 2016b; Zhu et al., 2017). According to Levy-Storms (2018), older adults' needs and choices for POSs remain rather unclear (Levy-Storms et al., 2018). POSs in residential areas are defined as urban open spaces near neighbourhoods, such as public spaces around people's homes (e.g. streets, squares), neighbourhood parks and community gardens (Camarinha-Matos and Afsarmanesh, 2010; Schmidt et al., 2019). POSs are claimed subjectively and objectively different from the seniors' perspective because of mental and physical problems as well as local socio-cultural differences based on the elders' quality of life approach (Cheraghi et al., 2019).

In this regard, the understanding of space qualities according to the seniors' preferences in built environments that could effectively enhance the engagement between elder users and the environment seems essential (Yung et al., 2016b; Zhu et al., 2017).

Recently, in much of the existing literature on ageing studies in different nations, especially developing countries, the preferences of elders' life are claimed as the main concern (Steels, 2015; Zhai et al., 2018), especially among qualitative (Trachsel et al., 2011) and mixed-method studies (Schmidt et al., 2019). As to achieve the actual needs of elders in POSs, we need to identify the local socio-culturally appropriate, evidence-based and context-based design approaches, mainly through the "person-environment" perspective. The mixed-method studies are likely particularly significant for the designing and implementation of interventions for unknown sub-groups of the population (e.g., the elder) as they are understudied and usually need approaches that differ from those that are effective in the main-stream population (Cerin et al., 2019; Schmidt et al., 2019).

" living in suitable places seems relatively necessary for elders to remain active in their neighbourhoods. Several studies demonstrated that creating elder-friendly POSs can help them achieve an active life to increase their physical activity, health, and quality of life (Sharifian and Rezaei, 2016). Although various studies have been conducted in the world about the preferences of older adults in neighbourhoods' POSs (Aspinall et al., 2010; Levy-Storms et al., 2018), there is a lack of knowledge about their needs and preferences in elders' point of view.

This phenomenon has not been thoroughly examined in Iran; several studies show that (Habibi Ghahfarrokhi et al., 2016; Lak et al., 2019). The existing gap in deeply understanding of local Iranian elders' preferences in the theoretical findings and the practical ongoing design and development of age-friendly POSs in Iran. (Bastani et al., 2016; Ghahfarrokhi et al., 2016; Sharqi et al., 2016).

Thus, this paper aims to narrow this by exploring the environmental preferences of elders in POSs to enhance the presence of the elders in desirable POSs in a deprived neighbourhood of Tehran (the capital city of Iran). Accordingly, this study aims to identify the elders' preferences in public open spaces (POSs) in Iranian urban neighbourhoods through two steps: (1) developing a conceptual framework of required indicators; (2) exploring the causal correlations among the factors.

In this research, we define the relationships among variables by developing a conceptual framework. The theoretical framework can show the causal relationships between the different domains of extracted variables and the preferred public open spaces (POS) (Burns et al., 2018). According to the results, we are able to fully infer causal associations between the qualities of POS and demands' of the elder in outdoor environments (Burns et al., 2018).

This was using a sequential exploratory mixed method design with equal emphasis on quantitative and qualitative aspects. In this study, first, the findings were analyzed through semi-structured interviews conducted with older adults based on the Grounded Theory (GT) approach to identify perceived essential attributes for POSs use. The qualitative phase was applied to develop the assessment tool to capture the appropriate features in the POSs based on the elders' perspectives. Second, we quantitatively assessed the relation among the extracted features of desirable POSs based on PLS-SEM technique to answer the question: what dimensions and attributes of the outdoor built environment make POSs more desirable based on the older adults' choices? PLS-SEM is used to determine the causal relationships and effects among the research variables. In this study, PLS-SEM has been used for several reasons. First, PLS-SEM does not require the normality assumption like covariance-based structural equation modelling (Lowry and Gaskin, 2014). Second, PLS-SEM is conducive for estimating path coefficients when the sample size is small (Chin and Newsted, 1999). Finally, PLS-SEM provides an alternate method to test theory (Lowry and Gaskin, 2014).

2- Elder-Friendly Public Open Spaces

The WHO has defined age-friendly environments with eight fundamental domains: "Areas of urban living: outdoor spaces and buildings; transportation; housing; social participation; respect and social

inclusion; civic participation and employment; communication and information; and community support and health services" (World Health Organization, 2002). Accordingly, an elder-friendly POS is defined as open spaces, such as streets, public squares, pocket parks, community parks, and linked spaces, in residential areas where older adults are actively involved, valued and supported with infrastructure and services that are effectively tailored to meet their physical and environmental needs and preferences (Alley et al., 2007; Levy-Storms et al., 2018). This place is created for senior people's relaxation, social contact, entertainment, leisure, and for elderly people to have a good time to improve their health simply, well-being and quality of life (Askari et al., 2015; Schmidt et al., 2019). Empirical studies on the seniors' needs and preferences not only emphasize the physical dimension of POS but also the other human demands and needs. These studies about the elders' needs for POS can be considered into five interrelated groups: promotion highlighted the older people's walking and other physical activities (Alley et al., 2007; Levy-Storms et al., 2018), enhancing participation (Wen et al., 2018), supporting social contacts and well-being (Yung et al., 2017), healing and stress reduction (Levy-Storms et al., 2018), and aesthetics and attractiveness green spaces (Levy-Storms et al., 2018; Wen et al., 2018).

Some recent studies reviewed outdoor environment features that affect the senior's preferences and needs. Yung et al. (2017) found that the elderly's satisfaction affected by proximity, accessibility, social inclusion, social connection, supporting facilities, and connection to nature (Yung et al., 2017). Yen et al. (2014) stated that environmental attributes influence mobility through safety, connectivity, aesthetics and shopping services (Yen et al., 2014). Some studies highlighted that the elderly's physical activities are likely related to safety, walkability, access to parks, natural and aesthetic pleasing scenery, and recreational facilities play roles (Barnett et al., 2017). Schmidt et al. (2019) found that the elders' walking in the outdoor environment was predicted by shade along with the quality of paths, seating, and landscaping that can help to engage in social activities.

Based on the relation between POS and socio-cultural environments, Richard et al. (2008) found that having a local environment that was unsupportive for walking might decrease social interaction, which consequently could lead to a decline in physical functioning due to less activity and an increase in isolation due to less social support (Richard et al., 2008). However, living in more age-friendly neighbourhoods with suitable POSs can support social interactions and provide built environment features that facilitate social interaction such as porches and benches. This has been related to fewer depressive symptoms, less anxiety and a higher quality of life (Schmidt et al., 2019). In addition to this, the relationship between green spaces and social interaction can support older adults, along with safety and maintenance that could help to decrease cardiovascular challenges by walking and talking in open spaces (Kemperman and Timmermans, 2014; Schmidt et al., 2019).

Zhu et al. (2017) stated that some POS that are designed based on universal design guidelines and principles could not adequately meet the needs of all users, due to their multiple socio-culturally context-based requirements. Thus, it is necessary to design elder-friendly POS principles according to

the specific requirements of each context. Some scholars have applied mixed methods of qualitative and quantitative analysis techniques to examine the elders' experience and needs in POSs. Zandieh et al. (2016), in a mixed-method study, highlighted "inequalities in perceived neighbourhood safety, pedestrian infrastructure and aesthetics in high- versus low-deprivation areas and demonstrated that they might influence disparities in participants' outdoor walking levels" (Zandieh et al., 2016).

Schmidt et al. (2019) used an exploratory sequential mixed-method study to investigate the association between built environment features, social interaction, and walking rate within open spaces. Interviews, as well as the Community Park Audit Tool, were used to capture quantitative and qualitative data. Discussions highlighted the importance of social interaction within neighbourhood open spaces (Schmidt et al., 2019).

In this study, the Grounded Theory (GT) method is applied to create a conceptual framework which reflects the elders' preferences of the Elder-Friendly Public Open Spaces in the first step. Next, this conceptual framework is also used for deriving hypotheses paths for the second part of the research, which is the quantitative half. For this second part, the conceptual framework from the previous step is used as a basis for the Structural Equation Modelling (SEM) method through PLS-SEM. PLS-SEM could show the factors that can potentially affect the elders' preferences of the outdoor environment. In the quantitative step, the survey focuses on examining the relevance of the categories, as well as the proposed interrelations between them. As the categories of the conceptual framework are latent constructs, they are observed and measured indirectly.

3- Mixed-Method and Research Process

An exploratory mixed-method employed in this study, through qualitative and quantitative methods, to develop the evidence base for designing POS and provide a more comprehensive context-based understanding of the elders' needs and wants. As such, the exploratory sequential mixed-methods study was conducted to develop a quantitative self-administrative measurement tool for the Iranian elders. This approach led to a culture or context-based quantitative instrument, which reflects the specific target population or setting being investigated. In this study, the data collection for Grounded Theory (GT) in the first step, then the questionnaire survey as the base of (PLS-SEM) was done to test the relations between each category of the developed conceptual framework.

The purpose of GT is claimed as the theory-building with any data. It was conceived for that purpose, rather than as a qualitative analysis method (Strauss & Corbin, 1998). PLS-SEM is claimed as part of a structural equation modelling based on the Partial Least Squares (PLS) method for assessing the measurement model as the outer model and a structural model as the inner model (Becker et al., 2012; Lak et al., 2019; Tenenhaus et al., 2005). According to Hair et al. (2006), PLS-SEM is known as a prediction-oriented, variance-based approach to Structural Equation Modelling (SEM) that makes no distributional assumptions about the variables and no identification issues with a small sample size

compared to more traditional maximum likelihood SEM techniques such as LISREL and AMOS (Hair et al., 2006). In PLS-SEM, the causal relationships among the latent variables, causal effect and the developed and non-developed variance level are determined (Henseler, 2017; Lak et al., 2019; Schermelleh-Engel et al., 2017). The PLS-SEM in this study aims to examine the causal relations between each category of the conceptual framework and explore the direction of the relations and their statistical significance.

Figure 1 shows the overarching methodology of the research in two phases which are explained in more detail as follows. This figure highlights the sequential steps of the study, including qualitative and quantitative phases. At first, the results of the qualitative phase is identified, and then these results are used in the quantitative phase. Finally, in the analysis step, the relation between the identified factors of phase one is examined with the preferred space of older adults. The final results are presented as the conceptual framework of this research.

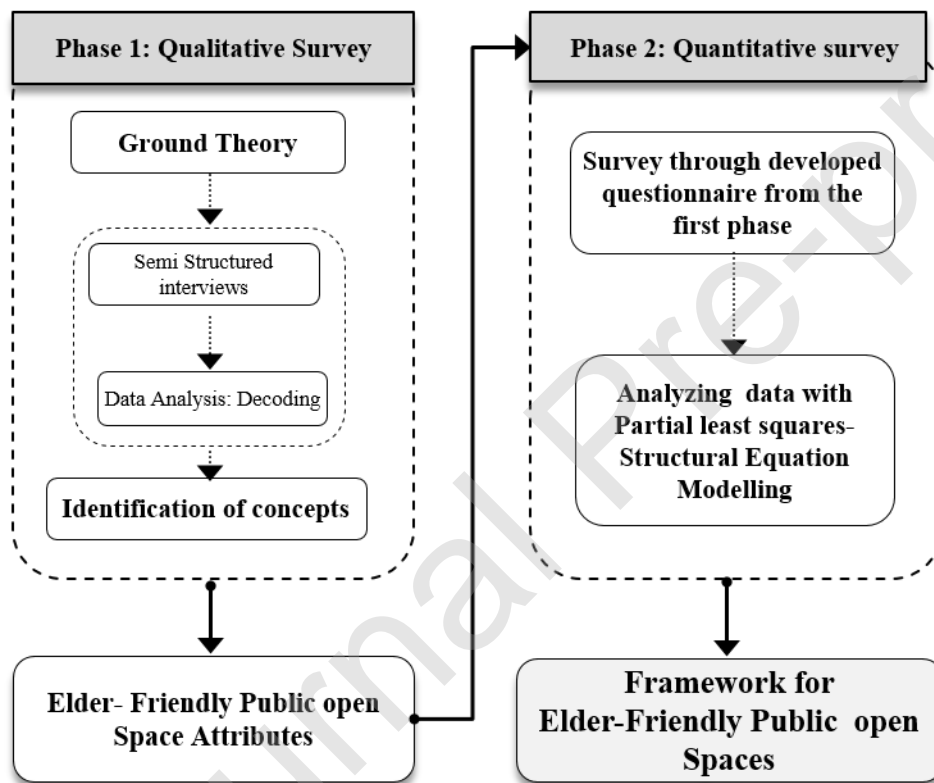


Figure 1- This diagram shows the overall methodology of this research

3-1- Phase 1: Qualitative research

3-1-1- Grounded theory

In this phase, Grounded Theory (GT) was employed for data analysis to explore the preferences of elders regarding the place quality among Iranian seniors, as this study was the first step in identifying elders' needs and desires to feel more comfortable in POSs. Adapting the coding strategy, that

integrated observational data, as well as focus group discussion (FGD), helped to gather information into the process of analysis. Such data was based on the experiences and perceptions of older persons who had related actual experiences in POSs in an Iranian context. GT approach was applied to analyze the gathered data from semi-structured interviews of the Iranian elders' experiences in POSs based on a systematic process, which offered a perspective not previously provided in research (Cohen et al., 1969). Thus, This study used GT methods advocated by Strauss & Corbin (1998) in which knowledge of extant research can enhance sensitivity to the emerging themes from the data (Reynolds, 2016).

The participants have recruited through purposeful sampling in different POSs in residential areas Tehran, the capital of Iran. Iran is experiencing a rapid momentum in population ageing. People aged 65 or older (≥ 65) made 20% of the total population in 2016, and the statistical predictions refer to a 25% growth by 2025 (Bastani et al., 2016). To conduct the semi-structured interviews, participants were selected concerning the maximum variation of age, literacy, gender, and self-rated health. Participants are in categories of illiterates, postgraduates, female and male, disabled and ill, good health to poor health (self-reported health conditions). The inclusion criterion was the age category of 65 and older, residing in Tehran, being present more than three times a week in outdoor spaces, and the desire to participate in the interview.

The place and time of the interviews were determined by the participants. 64 in-depth interviews up to theoretical saturation were conducted in the spring of 2018 (Table 1). The participants' age was within 65 to 85. The duration of the interviews was 30 to 45 minutes, depending on the participant's level of interest and cooperation. The participants were asked questions about the features of appropriate and desirable public spaces. The main issues, together with some of the questions, are mentioned in Table 1.

Table 1- The socio-demographic status of participants who attended the interview.

Feature	Participants (n = 64)	Number	Percentage
Age group	65-75	34	57 %
	75-85	30	43%
Gender	Female	33	52%
	Male	31	48%
Education level	Undergraduate	22	34%
	Graduate	23	36%
	Postgraduate	19	30%
General Health perception (self – reported)	Good Health	35	55%
	Moderate Health	17	27%
	Poor Health	12	18%
Socio- economic status	Middle- High	29	45%
	Poor- low	35	55%
Transportation to the park	Around 20 min walk	30	47%
	Around 30 min walk	20	31%
	Other means of transportation	14	22%

Visiting composition	Alone	20	32%
	2 people together	22	34%
	3 people and more	22	34%
Reason for visiting the park	Rest and relaxation	40	20%
	Physical exercise	40	20%
	Enjoy the planting	32	16%
	Leisure and entertainment	32	16%
	Communication with others	32	16%
	Accompanied by family and friends	24	12%

Moreover, a FGD with 12 older people (7 women and 5 men) among interviewees was held for trustworthiness in the City Council of District 10 in Tehran Municipality in July 2018. After conducting the FGD in Tehran's city council and finalizing the data gathering process, the data was analyzed through qualitative content analysis in the next step (Table 2).

Table 2- The Main questions and some of the follow-up questions of the interviews regarding a special place.

Question for the semi-structured interview
- What makes this place special or desirable?
-Why do you like this place?
-What do you like about this place?
-What do you dislike about it?
-What needs to be improved?
-What potential is there to enhance the place?

3-1-2- Qualitative data analysis (decoding)

All interviews were carried out in Persian, recorded, transcribed, approved by the participants and then analyzed line by line. The analysis was run according to the method suggested by Corbin and Strauss (Strauss and Corbin, 1998). Data collection and analyses were run in a way that data from each interview was analyzed before the next interview was conducted. Unanswered questions from the initial interview were emphasized more in the following interview. Accordingly, the first interviews addressed the questions of the next interviews (Strauss and Corbin, 1998).

All interviews were reviewed line by line and repeatedly in the open coding stage. The coding was made by the researchers by applying the related keywords and phrases. Codes and categories from each interview were compared with those from other interviews to find common links. These codes outlined the properties and dimensions of each category and sub-category (Appendix 1). Then, in the next step, the main situations that this group of people faced were revealed. A total of 120 initial codes are extracted at this stage. A total of 69 concepts, 15 sub-categories were identified after continuous comparison of codes in the axial coding stage. Three main categories are determined in the selective coding stage after comparing the sub-categories of the previous step to extract model features (Appendix 1 and Appendix 2).

The collected data were also analyzed by going through MAXQDA 2010 software (VERBI Software, 2017), which offers support for different approaches of combined qualitative and quantitative data and

allows for a free analysis of an increasingly diverse range of data types (Franzosi et al., 2013; Guetterman and Creswell, 2015). The extraction of codes and categories in MAXQDA was controlled by the authors before, during and after the data had been analyzed. All the extracted codes, sub-categories and categories are shown in Appendix 2. The last two interviews and a FGD were run after reaching the theoretical saturation for more certainty.

For the trustworthiness of the extracted items, the credibility of data was assured through peer checking and member checking. Peer checks were conducted via weekly research team meetings during which the emerging data was discussed and reviewed and analyzed within the research group. Member checks occurred by providing a summary of the analyzed interviews and extracted codes and concepts to participants so the research team could incorporate their feedback and ideas into revisions and corrections. The conformability was observed by considering the opinions of other researchers while transferability was checked by fully describing all the stages of the procedure (Schwandt et al., 2007). Moreover, multiple methods of data gathering, such as POSs observation, provided triangulation for improved validation of findings (Fig. 2).

The Ethical Committee of Iran University of Medical Sciences (IUMS 2018) approved the method used in this study. The ethical procedures for the study assured the confidentiality and autonomy of the participants by these two points that all participants were informed of the purpose of the research and the voluntary nature of their participation and all participants consented that the interviews record the interviews.

3-2- Phase 2: Quantitative research

In the quantitative phase, a questionnaire survey is prepared and conducted for the quantitative part (SEM analysis). In the present study, we applied SEM to model hypothesized as well as test the novel and causal relationships among constructs based on the proposed conceptual framework in the qualitative phase.

3-2-1- Questionnaire development

To define a framework in the quantitative phase, a questionnaire was formed based on the initial concepts emerging during the qualitative phase to be used in survey instrument development. A brief 50-item scale was devised to measure the elders' preferences of public spaces based on a 5-point Likert-type scale (almost always, often, sometimes, seldom, and never).

To ensure face and content validity in this empirical analysis of the constructs, the extracted items in phase one were first passed to 18 academic scholars with PhD in urban design, urban planning, gerontology, and geriatrics to review the developed instrument scale; and only then to be used for a pilot testing with a small number of elder individuals (32 people) who reside in Tehran. The results led to the modification and deletion of some of the items in the questionnaire. Some of the original items were not suitable in the context of older people and were modified so much so that they would

match the results of the experts' reviews as well as those of the pilot study. For example, survey questions about the way-finding and fear of falling make the seniors worried about their health conditions.

A brief 50-item scale is devised to measure the elders' preferences of public spaces based on a 5-point Likert-type scale (almost always, often, sometimes, seldom, and never). The scale's questionnaire of the elders' preferences in public space was based on the construct scales extracted from the GT study. The scale tested three sub-dimensions of the elders' preferences: place function, place preferences, and process environment. A range of 19 items was used to measure place function, while place preference is measured by 11 items. The final list of 11 items covered all process environments (i.e. social environment, cultural environment, sense of belonging, and life satisfaction).

Also, the completion of questionnaires was followed by a short face-to-face interview, aiming to gain feedback from urban seniors about public space conditions. Every interviewee was informed of the result of this study at the beginning of the survey. The composite reliability (CR) was measured in PLS. Finally, a questionnaire is formed based on the elders' preferences for POSs called the Elder-Friendly Urban Spaces Questionnaire (EFUSQ) in Appendix 3 (Lak et al., 2019). This study has provided the first validated psychometric tool for assessing older peoples' preferences in public spaces as age-friendly public places in Iran. The results indicated that the developed scale is valid and reliable to measure the corresponding constructs on a constant basis (Appendix 3) (Lak et al., 2019).

3-2-2- Study population

A total of 420 elders (≥ 65 years of age) who attended public spaces (streets, squares, and parks) at least three times a week in outdoor spaces in four neighbourhoods in district 10 of Tehran constituted the statistical population through purposeful sampling (non-random sampling). These 420 participants participated in this study in August and September 2018 (Table 3). Elders with severe physical disability and communication difficulties were excluded from this study. Nine trained researchers performed face-to-face interviews. Ethical approval of this study has been granted by the Ethics Board of Iran University of Medical Sciences (IUMS) and all study participants have formally consented to this research.

Table 3- Summary of participants (N = 420) for survey phases of the study

		Number of cases	Percentage of cases
Gender	Male	260	(62 %)
	Female	160	(38 %)
Marital status	Single	39	(1%)
	Widow	91	(30 %)
	Married	290	(69%)
Education	Illiterate	198	(47 %)
	No high school diploma	156	(37%)
	High school diploma	66	(16%)
	Academic	0	0
Occupation	Employed	50	(12%)
	Housewife	122	(29%)
	Retired	248	(59 %)

3-2-3- Quantitative data analysis

In the next stage, to estimate the proposed relations in the research model, the PLS-SEM was used. PLS-SEM is claimed as part of a structural equation modelling based on the Partial Least Squares (PLS) method for assessing the measurement model as the outer model and a structural model as the inner model (Becker et al., 2012; Lak et al., 2019; Tenenhaus et al., 2005). According to Hair et al. (2006), PLS-SEM is known as a prediction-oriented, variance-based approach to Structural Equation Modelling (SEM) that makes no distributional assumptions about the variables and no identification issues with a small sample size compared to more traditional maximum likelihood SEM techniques such as LISREL and AMOS (Hair et al., 2006). In PLS-SEM, the causal relationships among the latent variables, causal effect and the developed and non-developed variance level are determined (Henseler, 2017; Lak et al., 2019; Schermelleh-Engel et al., 2017). The average variance extracted (AVE) is proposed to assess the convergent validity of PLS-SEM. The AVE should be 0.5 or higher, composite reliability should be 0.7 or higher, and 0.6 or higher is acceptable for exploratory research (Bagozzi et al., 1998). Also, factor loading values of 0.70 or higher are preferred, and 0.4 or higher are acceptable for exploratory research (Hulland, 1999). Moreover, discriminant validity is examined by applying the criterion (Fornell and Larcker, 1981). For discriminant validity, the square root of AVE of each latent variable should be higher than the correlations amongst the latent variables (Fornell and Larcker, 1981).

The R-square (R^2) measure of endogenous constructs and the path coefficients should be evaluated as part of a preliminary assessment of the structural model (i.e., inner model) and the theoretical framework. The path coefficients must be significant, whereas R^2 is highly dependent on the research area (Chin, 2015) suggested 0.67, 0.33, and 0.19 were substantial, moderate, and weak measures for R^2 , respectively.

4- Empirical Analysis and Results

4-1- Case Study: Tehran's POSs

Tehran, as the capital city of Iran, has been claimed as the unwell-known city to provide suitable POSs for the vulnerable. Recently, the creation of new POSs especially urban green spaces and the improvement of existing parks and gardens is considered in the Tehran metropolitan area, during the last two decades (Daneshpour and Mahmoodpour, 2009). This strategy help not only to alleviate air pollution and increase public health level but also to enhance the quality of life in urban areas, particularly the elders. Accordingly, this study was conducted the qualities of POSs in four neighbourhood that known as the underprivileged neighbourhood in District 10 in Tehran (Asl and Lak, 2017).



Figure 2: The ambience of one of selected POSs in Tehran

4-2- Phase 1: Qualitative research

According to the full process related to the GT study, the two dimensions of place and process (procedure) were identified through the elders' experiences of desirable public spaces. In open coding, the primary categorization of codes was made based on commonalities (Table 4). The core variable in this study was the elders' preferences of the built environment. Studying these two dimensions shows that they can be presented in three main categories of places functional attributes (PF), places preferences attributes (PP), and process environments (PE). In this study, "Place function" includes how places work or how the elders used the POSs. This dimension emphasizes the use of public spaces, mixed uses, density, the pattern and the layout of urban spaces, accessibility, and

safety. "Place preference" is claimed as the awareness and appreciation of environmental perception, and in particular of understanding and lived experience of elderly people in "place" (built environment). This dimension is related to how seniors perceive, evaluate, value, draw meaning from, and add meaning to urban outdoor environments. "Process in the environment" is defined as an essential to conceive of 'space' without socio-cultural context and, equally, to conceive of society without a spatial component to identify the interrelated concepts of the elders, the 'public life' and quality of life (personal and communal identity, sense of belonging and life satisfaction).

Results showed that the participants experienced 15 major sub-categories related to these three main categories. Specific dimensions associated with each domain and the number of interviewees addressing them are tabulated in Appendix 1. Table 5 also indicates the scores of participants for each concept.

Table 4- Subjective features of the elders' preferences applied in devising the questionnaire

Dimension	Categories	Sub-categories	Percentage of interviewees mentioning this category
Place	Place's function (PF)	Density	72%
		Amenities (access to services)	85%
		Safety (traffic)	92%
		Aesthetics (objective)	68%
		Urban Landscape	65%
		Comfort	80%
		Environmental cleanliness	85%
	Place's preference (PP)	Security (crime)	87%
		Security (fear of falling)	95%
		Security (fear of losing/getting lost/way-finding)	85%
Process	Process in environment (PE)	Aesthetics (Image/subjective)	60%
		Social environment	85%
		Cultural environment	80%
		Sense of belonging	75%
		Life satisfaction	75%

4-2-1- Place dimension

This category includes two sub-categories of PF and PP, which are discussed as follows. The places functional attributes (PF) included 49 final codes and seven domains of density, amenities (access to services), safety (traffic), aesthetic (environmental aesthetic), urban landscape, comfort, and cleanliness. Almost half of the participants believe that place conditions, as well as the balance between the determinants and components of living conditions in a rational context, are very influential.

"If there was a place wherein the individual could attend in a suitable and natural environment with water and plants and wouldn't have to compete continuously, or where I could feel safe and comfortable, then I would have time to think about adequate walking and exercise. Otherwise, feeling unsafe, with dense traffic and litter everywhere one continuously faces different kinds of stress... this way, no time remains for enjoying the place." (Participant ID. 1020, a 72-year-old woman).

The places preferences attributes (PP) include four sub-categories of security (crime), controlling the fear of falling, way-finding ability and aesthetic features (place image). The majority of the participants confirmed the perceived fear of crime, falling and getting lost (way-finding), which affect the presence and walking in the streets, squares, and parks.

"I know that exercise and walking prevent osteoporosis. I'm 69 years old and don't have back pain or limb pain. I'm surprised when youngsters say their leg hurts or they have a backache. I used to exercise from an early age which was beneficial both in a spiritual and physical sense. Now I am afraid of falling due to the bad quality of the pavement..." (Participant ID. 1016, a 65-year-old man).

This participant also added:

"...human beings are like bicycles- when immobile, and they lose their balance that is if you don't move, you can't keep your balance. I always choose secure and orderly places to walk."

4-2-2- Process dimension

This dimension consists of four final sub-categories of the social environment, cultural environment, sense of belonging and life satisfaction. According to most participants, having social interaction and civic participation next to meeting friends (social environment), cultural appropriateness (gender separation and limitation for pets in public spaces), belonging to a place, sense of rootedness and sense of being at home are associated to emotional feelings to place which have a positive impact on being present and participating in social activities. Some of the participants believe that social interactions make their attachment (social and cultural) to the community and public place more significant.

In this regard, participant ID. 1023, a 67-year-old retired man said:

"The benefit of walking in the park is that it is both good for your health and that it lifts your spirits when you meet your friends... What's the use of sitting at home and feeling alone? I feel as if this park is my own yard?"

Moreover, participant ID.1017, a 69-year-old retired teacher, described the spiritual impact of feeling good when active in the community:

"Whenever I meet my friends and help them when I go to bed I say "God, thank You a million times; today I did this and that ..." This way, I become connected to the One above. That's when I feel better and healthier..."

4-3- Phase 2: Quantitative research

In this phase, to analyze the accuracy and validity of the extracted dimensions of the developed framework, the PLS-SEM analysis is implemented using 'SmartPLS 3.0' for the PLS-based Path Modelling (Ringle et al., 2015). Construct validity includes two categories: convergent and discriminant validity (Hair et al., 2006). Table 5 shows that three methods were applied to assess convergent validity: factor loading, composite reliability (CR) and average variance extracted (AVE). The most common method to examine discriminant validity is comparing the square root of the AVE

of each construct and the correlation estimate between constructs; the former must be higher than the latter (Fornell and Larcker, 1981). Table 5 represents the result of the measurement model.

Results showed that the Cronbach's alpha was 0.81, the Spearman-Brown coefficient 0.72, and the Guttman split-half coefficient 0.73, suggesting high stability and internal consistency of the items.

Table 3 shows the valid Cronbach alpha for each item.

Table 5- The Cronbach Alpha for the extracted dimensions

Dimensions	Domains	Cronbach alpha (%)
P.F. (function)	Density	0.88
	Amenities (access to services)	0.87
	Safety	0.75
	Aesthetic	0.79
	Landscape	0.87
	Comfort	0.91
	Cleanness	0.95
PP (preference)	Security (crime)	0.87
	Security (fear of falling)	0.87
	Security (fear of getting lost)	0.88
	Aesthetic (image)	0.84
PE (environment)	Social environment	0.78
	Cultural environment	0.90
	Sense of belonging	0.90
	Life satisfaction	0.81

Convergent validity shows the extent to which several items that measure identical concepts are consistent. A cut-off value for loadings of 0.4, as suggested by (Hair et al., 2006), is used to judge the loading of each item in reflecting the respective latent variable. The results showed that no item had multiple cross-loadings, which indicated preliminary discriminant validity. The AVE is suggested to have a value of 0.5 and above, which indicates adequate convergence (Fornell and Larcker, 1981). For composite reliability, a value of 0.7 and above is suggested and represents good reliability (Hair et al., 2006). Composite reliability estimates the degree to which the respective indicators are reflected by the latent construct. In this study, the CR exceeds 0.7, and the AVEs of all latent constructs compellingly exceed the cut-off value of 0.50 (Fornell and Larcker, 1981). Here, PP has the lowest AVE and CR values at 0.72 and 0.873, respectively. The Cronbach's alpha scores for all the factors were close to the recommended 0.7 cut-off value (Nunnally, 1994), indicating good scale reliability. Overall, the measurement model demonstrated adequate reliability and convergent validity, which suggested that all items were valid measurements of their respective constructs based on parameter estimates and statistical significance. The results show that reliability indicators are close to the preferred level of 0.7 in this study. Table 6 shows the results, and all of the constructs met these conditions.

Table 6- Model specification for analyzing the reliability—factor loadings and reliability indicator.

Elderly Preferences	Factor Loading	Alpha (a)	Composite reliability (CR)	AVE	
	Place	0.88	0.705	0.801	0.504
	Process	0.88	0.796	0.865	0.578
PF	Safety	0.56	0.869	0.911	0.82
	Aesthetic (environment)	0.59			
	Amenities	0.72			
	Cleanness	0.65			
	Comfort	0.69			
	Density	-0.42			
	Urban Landscape	0.60			
PE	Life Satisfaction	0.41	0.950	0.959	0.80
	Cultural Environment	0.51			
	Sense of Belonging	0.71			
	Social Environment	0.77			
PP	Way Finding (Getting lost)	0.47	0.827	0.873	0.72
	Aesthetic (Image)	0.53			
	Security	0.74			
	Fear of falling	0.79			

As shown in Table 7, the square root of the AVE and all constructs exceeds the inter-correlations of the construct with the other constructs in the model, in support of discriminant validity (Fornell and Larcker, 1981). In this study, the R^2 of PP and PLACE both are more than 0.09. All of the path coefficients were significant with an associated p-value lower than 0.01. These results are illustrated in Fig. 3 and Table 7.

Table 7- Fornell-Larcker criterion analysis for checking discriminant validity

	Elderly Preferences	Place	PF	PE	PP
Elderly Preferences	1	0	0	0	0
Place	0.87	1	0	0	0
PF	0.86	0.92	1	0	0
PE	0.88	0.56	0.57	1	0
PP	0.74	0.90	0.69	0.47	1

4-2-1- Structural equation model

The SEM is applied to determine the correctness of the study hypothesis by using Smart PLS (Kwong and Wong, 2013). The proposed model is constructed of two main hypotheses:

H1. The dimensions of the place, including function and preference, positively influence the elders' preferences in public space.

H2. The dimension of the process environment, which consists of the social environment, cultural environment, sense of belonging, and life satisfaction positively influences the elders' preferences in public open space.

Here, by determining the structural correlation among the concept variables, the hypotheses 1 and 2 are assessed. The results are shown in their standard sense in Fig. (3). To estimate the proposed effects in this research model, a bootstrap re-sampling routine is conducted, which is widely used in this context (Becker et al., 2012). Fig. 3 and Table 8 show the results of the structural model assessment. All the significant path coefficients are highlighted in this figure based on similar studies of PLS-SEM (Becker et al., 2012).

The results indicate that physical environment (as place dimension) had a significant positive impact on the elders' preferences in public space (path coefficient = 0.548, $p < 0.01$), while the effect of place dimension is insignificant on the elder peoples' desires in outdoor spaces. This would imply that place function and place preference adequately captures the old residents' perception of their active involvement and presence in public spaces (Fig. 3).

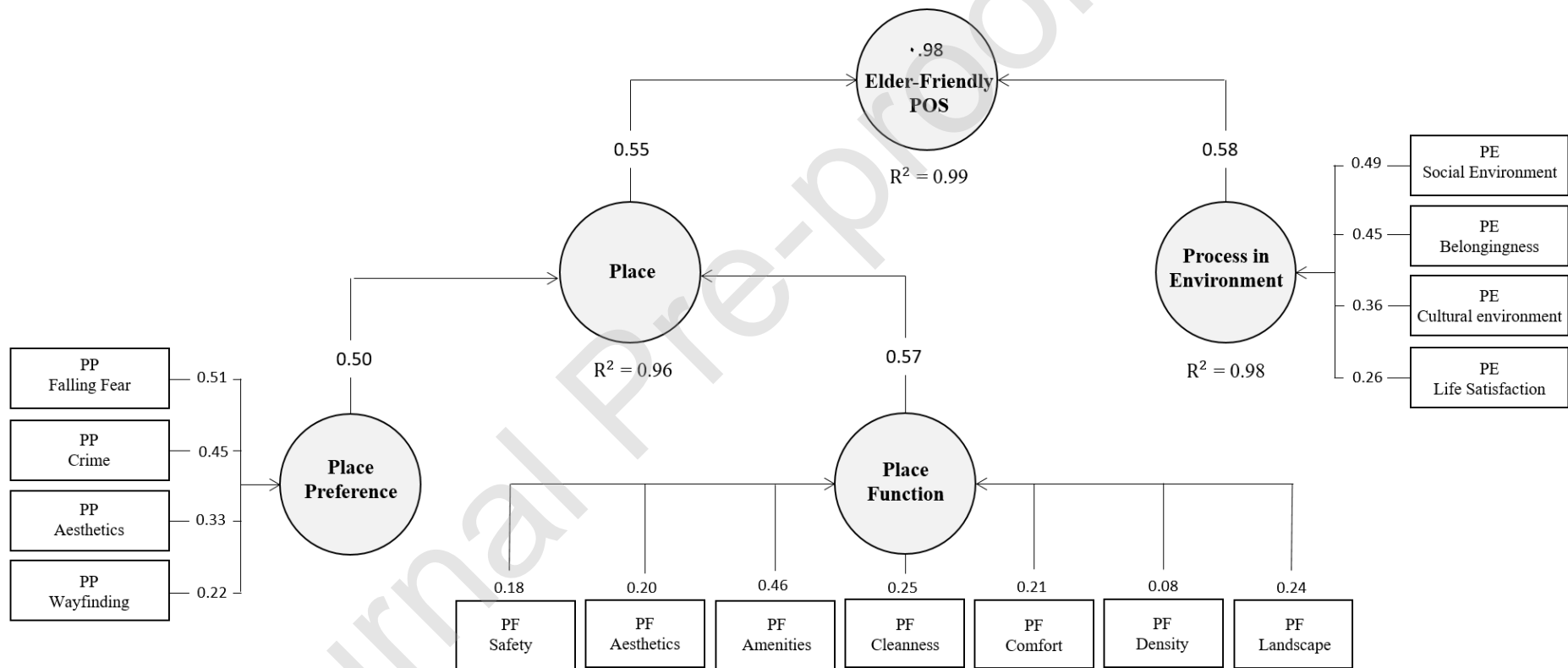


Figure 3- The developed framework of study to show the relations of features

Thus, the results partially supported hypothesis 1 that place dimension (function and preference) is positively related to elder residents' presence in their neighbourhood open spaces. This finding is relevant for urban policy management, and the following question should be asked: what should local authorities precisely do to prioritize place quality when encouraging the elders to be more active and present in public spaces? The result reveals that the functional quality of place (e.g. safety, aesthetics, amenities, cleanness, comfort, density, and urban landscape) and preferred quality of places like the ability of way-finding, subjective aesthetic, security, and the control of fear of falling would make the open spaces more desirable for the elder.

The second hypothesis is concerned with the effect of the process (environment) on elderly preferences, respectively. This is especially relevant in different contexts with different social environments (social interaction and civic engagement), cultural environments (cultural and religious beliefs), in addition to the attachment to place and life satisfaction. More importantly, cities like Tehran host different types of old residents who might be attached to urban spaces for different reasons and this then can influence which dimensions of the environment are more important in influencing being present in public spaces. The findings reveal that the environmental process significantly affected the elders' preferences (path coefficient = 0.5788, $p < 0.01$). Also, social environment positively and significantly affected the desirable place for them (path coefficient = 0.49, $p < 0.01$), sense of belonging (path coefficient = 0.451, $p < 0.01$), cultural environment (path coefficient = 0.362, $p < 0.01$) and life satisfaction (path coefficient = 0.268, $p < 0.01$). Thus, generally, the results on the effect of the environmental process on dimensions of the elders' preferences of urban spaces are supported in hypothesis 2.

Table 8- T values of path coefficients of the structural model for PF, PP, and PE

	Path coefficient	t- value	p-value	Supported
Place - Elderly Preferences	0.548	76.14	< 0.01	✓
PF - Place Function	0.5761	60.56	< 0.01	✓
Safety: PF	0.18	32.02	< 0.01	✓
Aesthetic (environment): PF	0.2	43.13	< 0.01	✓
Amenities: PF.	.46	60.04	< 0.01	✓
Cleanness: PF	.25	49.85	< 0.01	✓
Comfort: PF	0.21	45.12	< 0.01	✓
Density: PF	0.08	52.23	< 0.01	✓
Urban Landscape: PF.	.24	48.24	< 0.01	✓

PP - Place preferences	0.5037	62.55	< 0.01	✓
Fear of Falling: PP	0.55	63.12	< 0.01	✓
Aesthetic (image): PP	0.33	52.23	< 0.01	✓
Security(crime): PP	.45	58.24	< 0.01	✓
Wayfinding: PP	.22	51.22	< 0.01	✓
Process - Elderly preferences	0.5788	89.07	< 0.01	✓

The limitations in this study consist of its cross-sectional design, the causality of the observed associations which should be cautiously interpreted. The accuracy of questionnaire responses by the elders may be subject to recall bias and inaccuracy, and the self-reported data on subjective measures of the neighbourhood environment may contribute to a positive response bias favouring a way-finding association of the self-reported measure.

5- Discussion and Management Implications

According to the importance of non-physical dimensions in this study (Fig. 3), the process in the environment is claimed as the most crucial factor after since the seniors' desire to be more active in POSs. This finding reveals that in the older adults' minds, environmental preferences in urban spaces have not been limited only to physical features of that environment; rather, the elders' needs and choices depend on the personal experience achieved through a social sense of reciprocity between various social features such as social environment, cultural environment and eventually sense of belonging to make comfortable places for Iranian seniors. Among these elements, social environment, the sense of belonging to a place, cultural background and eventually life satisfaction are of highest priority, each informing us of older adults' perception and preference of urban spaces independently. The social environment, especially in neighbourhoods' parks, manifests itself in the form of social relations with family members, friends, and closer community, coupled with a sense of trust and belonging that will form the basis of the reliability of any urban open space for the elderly. Considering the input gathered from the participants, a continuous presence in POSs would result in a more profound sense of belonging for the older adults. Social isolation reduces the elders' health and increases the mortality rate (Ghahfarrokhi et al., 2016). Thus, providing adequate friendly seating and multifunctional spaces would promote the elders' well-being and sense of self-control through contact and talking which establish stronger social ties. Iranian elders, in particular, prefer to be respected in their social relationships (Ghahfarrokhi et al., 2016).

Moreover, most of the participants agree that social interaction and the need to talk to one another are their most important life needs. The elderly people also expressed that social activity in neighbourhoods' streets and squares is one of the main reasons for their attending public open spaces because they need space to walk and to do other physical activities in a group of friends in nearby

parks. For the elders, public spaces like the local park is a convenient place to meet and catch up with friends, rather than meeting up with one another in their small homes. The time that the participants spend in POSs help them establish their social networks and neighbourhood ties together with a sense of belonging to the places they live. The past experiences of the elders in enjoying public open spaces in social relationships and a sense of attachment to the POSs were confirmed (Yung et al., 2016a).

Another significant finding of this research in local parks was understanding the determining factor of the desirability of POSs among the Iranian seniors, manifesting itself as a cultural phenomenon among the elders. Special regulations for different genders, presence of pets as well as other norms would affect the elders' sense of comfort and contentment. Personal concerns such as contagious diseases from pets, ideological and cultural beliefs also affected the elders' sense of comfort.

Among physical dimensions, a place's function matters the most for participants, right after social and non-physical features of urban spaces. Elements such as landscape designing, providing amenities, and environmental cleanliness are known as the most important needs for Iranian elderly people. Based on the findings, older adults complain about the low standards of living and housing in their neighbourhoods, and their homes' qualities can impede them from being actively present in the neighbourhood's open spaces although previous studies mostly ignore this fact.

The elders prefer amenities (services, and public toilets) together with a well-designed landscape (pavement, urban furniture, planting, and lighting) in local parks as well as streets and squares in urban neighbourhoods. Their responses indicate a clear emphasis on these features when looking at the general planning, design guidelines and criteria for designing the public places for this group of urban residents as stated previously (Yung et al., 2016a). Based on the findings, accessibility and proximity to other amenities in the area are also essential to encourage the elderly to be present in POSs, particularly streets and squares. Elderly people may not be able to access different amenities within a short distance, and this makes it difficult for them to walk, especially those who suffer from low mobility. It is found that a walking distance of about 100–200 meters in the neighbourhood is already quite far and tiring for many elders in other countries (Lau, 1995).

Moreover, older people need to feel a sense of pleasure, enjoyment, have clean air, and no noise pollutions in POSs. This is, however, rather unlikely due to the relative limitation of the sanitary situation for older adults. This pleased feeling helps more senior people to increase their sense of comfort, which is linked to their psychological health aspect (Burton and Mitchell, 2006; Yung et al., 2016a).

These findings are different from previous studies, mixed land use and aesthetics are demonstrably associated with higher frequency in being in public spaces. Their findings are consistent with other reports, where residents are more likely to resort to walking if they live in neighbourhoods with higher- density housing, more available access to a range of destinations, well-connected street networks with aesthetic environments and have a mix of land-use zones (Oakes et al., 2007) as well as

safety. According to (Michael et al., 2006), for the elders maximizing the attractiveness or safety of a walking path is more important than minimizing the distance to a destination. Safety is the biggest concern that limits walking for everyday activities and exercise. It can be related to the lack of quality in designing outdoor environments in Iran due to the ignorance of the place-making approach and engagement of urban design to create public urban open spaces. Moreover, in Tehran, elders prefer not to be present in urban spaces due much to the very same reasons, namely, lack amenities (especially suitable toilets), air pollution, nuisances, barrier-free sidewalks, route patterns, insufficient lighting and seating.

Eventually, just like other physical dimensions of POSs, the issue of Place preferences as a subjective element of experiencing place preference had tremendously helped the elders' have a better perception of POSs, increasing the desirability of such space while at once improving their understanding of life quality. The elders' life experience and perception of urban space depended on various elements such as the fear of falling, security against crime, aesthetics, and abstraction of art as manifested in space and eventually navigation (way-finding) for the elders with dementia.

The insights on the participants' perception of public spaces' characteristics (streets, squares, and local parks) concerning security for fear of falling (especially in streets and squares), security (crime) and aesthetic (image) are pointed out to meet the elders' needs and preferences in POSs. These domains as psychological experiences, seem essential pathways to a perceived good life in the urban setting, which constitutes the person-environment relation (Lak et al., 2020; Sun et al., 2018). The social security levels, personal security by emphasizing on fear of falling (Clarke and Nieuwenhuijsen, 2009; Garin et al., 2014; Sugiyama and Thompson, 2007) and attraction (Aspinall et al., 2010) are of concern and may discourage walking outdoors among elders just they discourage Iranian older people.

Moreover, a highly perceived risk of crime has been found to reduce elderly people's incentive to walk through certain areas (Borst et al., 2009). In addition to security, which drastically improved the desirability of any space for elderly people, aesthetics and artistic attractiveness of spaces also contributed to their presence in urban spaces. Furthermore, this study emphasized the study by Borst et al. (2008) on the relationships between built environment characteristics and perceived attractiveness for walking reported by elderly people (Borst et al., 2009). Places that have these qualities are perceived as being attractive to walk along. Conversely, the presence of litter was perceived as unattractive for walking and was also found to be positively related to link resistance (Borst et al., 2009).

Design implications of elder-friendly POSs show that such spaces should provide elders with special socio-cultural restitution in addition to quality-oriented physical features. Providing spaces for socialization, community resorts, places to chat, and places to accompany elders are considered as the essential factors for elderly people. Large resorts in urban spaces too had appeared in previous

literature as a significant feature (Chen et al., 2013). Moreover, taking note of attractive elements in such spaces help them have a more profound sense of belonging. Remembering cultural perspectives such as personal spaces, territories, local people's respect for the elderly's beliefs and attitude, quiet spaces are also of high importance in designing elder-friendly environments, particularly in the Iranian context. Socio-cultural features were introduced in previous literature as the founding element in an age-friendly design (Bread, 2011; World Health Organization, 2007).

In the practical aspect of physical features of POSs, providing facilities for the elders such as commercial-recreational spaces in addition to toilets and public transportation will improve the elder-friendliness dimension of the design, enhancing the desirability of the space. Moreover, sanitation, environmental cleanliness, landscape design to design the way of making proper paths, greenery and providing seating, sufficient lighting, and shades at sunny locations are some of the elements that encourage the presence of older people. Additionally, a low rate of crime and security through natural surveillance, eliminating the fear of falling especially by eliminating any form of slope or puddles, proper lighting, smoothness of routes can all improve the desirability of urban spaces.

However, some of the study's limitations should be mentioned. First, when we use cross-sectional information, we are limiting the possibility of deriving any causal relationships between the outcome of frequency of presence and the different socio-demographic status and built environment variables (whether physical or non-physical). Second, using other observational tools for field study might have turned out to be more suitable for a review of older adults' POS preferences, since it could clarify the reason of the insignificance of many of the variables included in the quantitative analysis. Third, the data was obtained in spring and fall with participants reported to be healthy older adults, it is, therefore, unclear whether the results would have been similar if the data had been collected with relatively unhealthy seniors during winter or summer.

The dimensions of the Iranian elders' preferences in POSs focus not only on the physical aspect of place (function and preference) but also on the non-physical aspect as the process (social, cultural environment and sense of belonging). This extends the previous findings and offers new insights to the ongoing theoretical background of culturally elder-friendly POSs development in the Iranian context. These findings based on the elders' preferences and needs of Iranian urban seniors as an initial feature that can highlight the role of urban design and planning in Place-making for the elders and help the policy-makers to encourage practical design breakthroughs on elder-friendly public space development. This research can along with other such endeavours be beneficial in determining how to use mixed methods to develop POS's measurement tools that would help us determine the needs of older adults in POSs such as streets, parks and squares.

Taking the context-based nature of the study into account, our findings show very different needs and preferences for qualities of POSs, which highlight the necessity of the use of socio-culturally tailored measurement tools in future studies. The study further enhances the limited knowledge on improving

POs in urban neighbourhoods for older adults to encourage an active lifestyle among elderly people by promoting the elderly's presence in POs in their neighbourhoods (streets, squares and parks). POs designed to suit older adults should meet older adults' needs in physical and non-physical dimensions of place as well as being both comfortable and desirable so that they would promote walking and outdoor physical activity among the elderly.

Measures taken to achieve these ideals such as well-designed landscapes, well-maintained walking paths that would prevent falling, paying attention to the cleanliness and safety of neighbourhoods, access to seating and enhancing socio-cultural needs could have the drawback of causing older adults to become sedentary in these POs rather than walk or exercise. These factors are, however, beneficial to the health and happiness of older adults and local authorities can easily promote an urban design practice that implements them. In terms of urban design, one solution to enhance the degree of the elder's satisfaction from their use of POs is a collaborative design in which a team made up of urban old community members, practitioners and policy-makers at local levels to enhance active ageing in urban communities.

This study explores the several features of POs in urban neighbourhoods that affect the preferences and needs of Iranian older adults through mixed-method research. According to elderly Iranian's needs and preferences, three dimensions make POs suitable and desirable as "place function", "place preference" and "process in the environment". As "place function", "place preference" is rooted in physical features of POs and "process in the environment" is recognized as the non-physical dimensions of place. It is essential to mention that human behaviour is inherently content-based, which is embedded in physical, social and cultural contexts. These dimensions constitute the most critical design criteria for age-friendly POs, which are vital in enhancing older adults' well-being and active ageing (Fig. 3).

In this study, the desirability of POs in physical and non-physical characteristics was in the opinion of the participants considered to be the most notable element. For our participants, POs are only complementary spaces that would enhance their private, living spaces, addressing the features they could not solve in their personal lives. For some, neighbourhoods' parks are considered as their back yard; hence, their sense of home is even further complemented by attending to and reciprocating with such spaces.

6- Conclusion and Remarks

In recent years due to the increase in the elderly population in urban areas, much attention has been diverted to the creation of elderly-friendly environments, especially in outdoor settings to help older adults by increasing their health and well-being. This research has been conducted to develop a framework of the environmental preferences of Iranian elderly people and extract the cause and effect relations among these factors in POs. The results of this study emphasize the importance of procedures in an urban environment such as the social and cultural environment, personal interests

along with the importance of physical dimensions of urban spaces (including function and preferences, aesthetical- experiences aspects).

This research's innovation is in the implementing of a mixed method of qualitative and quantitative research to understand the primary needs and demands of Iranian elders and reflecting it in the designing and planning of elderly-friendly POSs. Limiting this study to urban spaces in selecting specific neighbourhoods of the city of Tehran can be considered as one of the restrictions of this research. It is necessary also to identify the preferences and needs of old adults in rural environments and other urban neighbourhoods with different socio-economic conditions. Obtaining a multi-dimensional understanding of the needs and demands of the elder living in various urban/rural settlements through future research could help promote active ageing among the elderly.

CONflict

There is no conflict of interest or funding to declare for this specific research.

statement

Azadeh lak has done the Conceptualization, desk study, Writing - original draft and revising.

Reihaneh Aghamolaei was responsible for Data gathering and Data analyzing.

Hamid R Baradaran has done the Conceptualization, analyzing the data and validation.

Phyo K Myint was responsible for Supervision and Writing - review & editing.

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Authors' contributions

All of the authors have made great contributions to the research design, field survey, data collection, data analysis, and drafting of the manuscript.

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All participants gave written informed consent. Ethics committee review approval was obtained from the Ethics Board of Iran University of Medical Sciences (IUMS) and all study participants have formally consented to this research.

Consent for publication

All participants gave written informed consent.

Competing interests

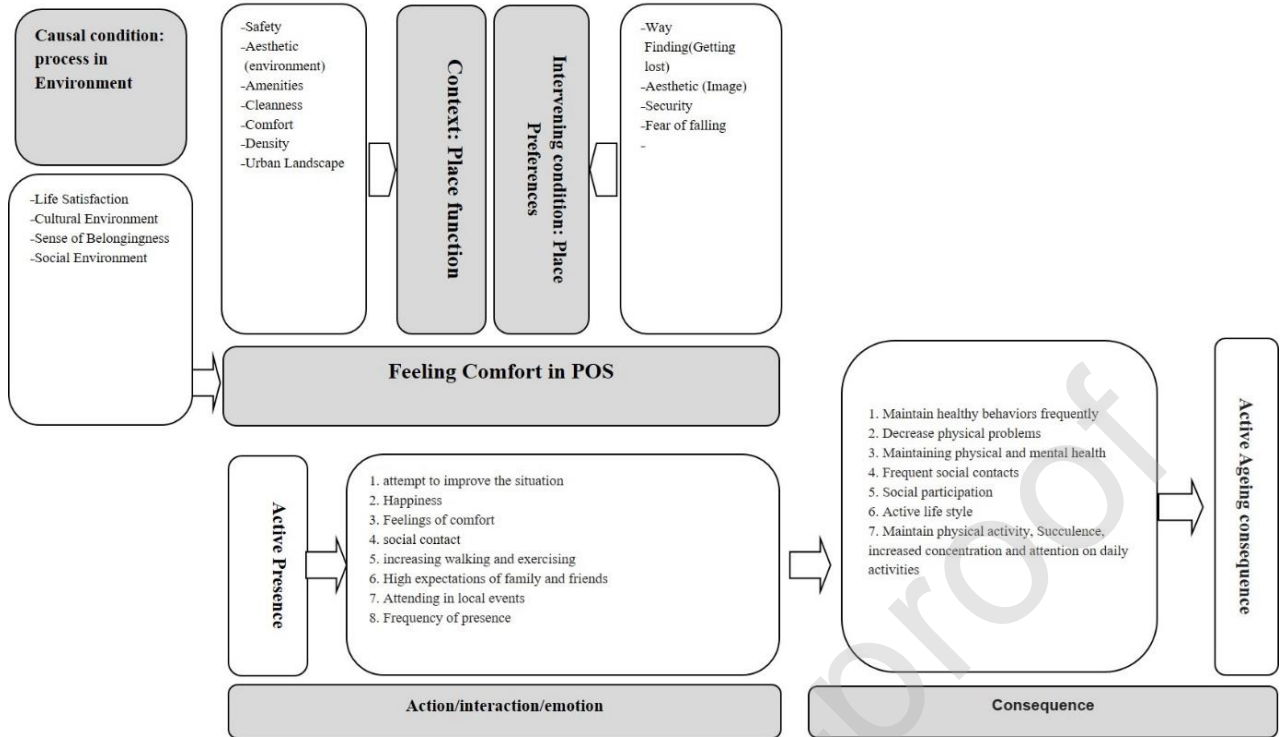
The authors declare that they have no competing interests.

Appendix 1- Concepts, Sub-categories and categories of Age-Friendly Public Spaces by interviewees

Place Dimensions		Process environment			
Conditions: Place Functional Dimension		Intervening conditions: place Preference Dimension		Causal conditions: process in environment Dimension	
Concepts	Sub-categories	Concepts	Sub-categories	Concepts	Sub-categories
Low density Low density of people Low density of buildings	Density	Green space Plant and water Tree Cosiness Openness Low enclosure Spatial variety Past memories Traditional design and old moments Sense of richness in hearing			
Sanitary service Closeness to home Easy commute to and from home Appropriate urban furniture Establish a library for older people Chess game Sporting equipment Weakness in service Need for sporting and training equipment	Amenities	Presence of artists, poet, Iranian idioms Public memories (sticking to old names) Need for space aesthetics Legibility	Aesthetic (Image)	Social interaction Friends and next of kin Social wealth Social strata (good people) Foreigner hater No street vendors Home space satisfaction	
Safety Safety traffic signs Proper walking path Security Relatively low population Congestion Need for space to sit Need for a hangout Need for traffic control Need for security (its generality) Need for security (for the health of animals in the park) Need for security (without police) Need for security (due to presence of too many rascals) Need for security (too many open access ways)	Safety	Not falling pavement Good pavement No slippery Surface No nuisance			Social Dimension
Need for environmental comfort Indoor space Protection from cold Need for illuminate (Natural or artificial) Need for calmness Need to be safe from possible harms due to Pets Civic misdemeanour, improper behaviour Civic misdemeanour, motor-bike in the park Civic misdemeanour, having pets in the park	Comfort			Segregated space for female and male Segregated space for older people and house pets	
Need for cleanliness Need for tidiness Need for law and order Noise pollution(non-traffic)	Cleanness		Fear of falling		Cultural Dimension

<p>Order design Greenery and planting Organic path design Colourful places Local architecture style Vernacular materials Well- designed detailed</p>	<p>Aesthetic (environment)</p>	<p>Easy to way-finding Order and symmetric design Familiarity</p>	<p>Fear of getting lost</p>	
<p>Need for small convenient stores Face lifting the old buildings Need for parking Need to reduce the slopes Need to separate older peoples' zone from the children's game yards children's playground Need for proper pavement, not slippery Urban furniture Lighting Seating</p>	<p>Urban Landscape</p>	<p>Security No crime No theft No graffiti No incivility Need to disperse the drug addicts Need to control the Youths</p>	<p>Keep old memories Old habits Friendly relations Social capital Social relations</p>	
		<p>Security</p>	<p>Sense of home Filling required space Sense of home yard Sense of calm at home</p>	<p>Sense of Belonging</p>
				<p>Life Satisfaction</p>

Appendix2: Iranians' preferences in POS



Appendix 3- Older people-Friendly Public Space Questionnaire

1.	Age					
2.	Marital status	Single	widowed		Married	
3.	Education level	Illiterate	lower than High school	Diploma	University	
4.	Monthly expenses					
5.	Occupation: 1-Employed, 2- Housewife, 3-Retired					
6.	How long have you lived in this neighbourhood?					
7.	Address: Ave., St., Alley?					
8.	Why did you choose this neighbourhood for living?					
9.	The congestion in the streets and public spaces prevent my walk.	Never	Rarely	Sometimes	Very often	Always
10.	Access to the store, bank, mosque, pharmacy, clinic from my home is an easy walk.	Never	Rarely	Sometimes	Very often	Always
11.	Access to path to bus-stop and metro-station is easy.	Never	Rarely	Sometimes	Very often	Always
12.	There are sufficient and clean public sanitary services in the green space of the neighbourhood.	Never	Rarely	Sometimes	Very often	Always
13.	The neighbourhood streets have sufficient sidewalks for pedestrians.	Never	Rarely	Sometimes	Very often	Always
14.	There are only one park and green space close to my house.	Never	Rarely	Sometimes	Very Often	Always
15.	The speed of motor bikes and automobiles in the streets and cross roads of the neighbourhood is low, thus walking is safe.	Never	Rarely	Sometimes	Very often	Always
16.	The pedestrian signs, street lines, and lights are helpful.	Never	Rarely	Sometimes	Very often	Always
17.	The streets of the neighbourhood are well-lit.	Never	Rarely	Sometimes	Very often	Always
18.	The lighting in the neighbourhood's green space is sufficient.	Never	Rarely	Sometimes	Very often	Always
19.	The public and green space here is safe and there are no drug dealers.	Never	Rarely	Sometimes	Very often	Always
20.	The street and green space sidewalks are smooth with no cracks or holes.	Never	Rarely	Sometimes	Very often	Always
21.	The sidewalks' slopes are acceptable.	Never	Rarely	Sometimes	Very often	Always
22.	The sidewalks are not slippery, and thus are appropriate and safe.	Never	Rarely	Sometimes	Very often	Always
23.	The width of the sidewalks is appropriate for pedestrians.	Never	Rarely	Sometimes	Very often	Always
24.	The billboards and the façade of the buildings help me to find my way in the neighbourhood.	Never	Rarely	Sometimes	Very often	Always
25.	I am familiar with the public spaces here and find my way easily.	Never	Rarely	Sometimes	Very often	Always
26.	The neighbourhood's public green spaces are neat and beautiful.	Never	Rarely	Sometimes	Very often	Always
27.	There are new and beautiful buildings here.	Never	Rarely	Sometimes	Very often	Always
28.	The tall buildings make the neighbourhood look boring.	Never	Rarely	Sometimes	Very often	Always
29.	The green spaces are cosy and refreshing.	Never	Rarely	Sometimes	Very often	Always
30.	The streets and green spaces are provided with clean and comfortable urban furniture.	Never	Rarely	Sometimes	Very often	Always
31.	The drinking water units, arbors, and recreational facilities in the public and green spaces are sufficient and accessible.	Never	Rarely	Sometimes	Very often	Always
32.	The green spaces of the neighbourhood are full of trees, flowers, and fountains.	Never	Rarely	Sometimes	Very often	Always
33.	The green spaces for children are separate from those of older people.	Never	Rarely	Sometimes	Very often	Always
34.	There are some shady sections in the open space to prevent extreme sunshine and cold.	Never	Rarely	Sometimes	Very often	Always
35.	The municipality maintains the good quality of the greenery in the park, streets, and sidewalks.	Never	Rarely	Sometimes	Very often	Always
36.	The municipality is responsible for maintaining the greenery and furniture in the park.	Never	Rarely	Sometimes	Very often	Always
37.	The air quality and temperature are fair here for taking walks.	Never	Rarely	Sometimes	Very often	Always
38.	The sidewalks and public spaces are clean with no garbage, thus there are no bad odours.	Never	Rarely	Sometimes	Very often	Always
39.	The public green space is the place for meeting friends.	Never	Rarely	Sometimes	Very often	Always
40.	In the public green space, people behave in a polite manner.	Never	Rarely	Sometimes	Very often	Always

41.	The neighbourhood residents are helpful and assist one another.	Never	Rarely	Sometimes	Very often	Always
42.	People in my neighbourhood take part in religious ceremonies.	Never	Rarely	Sometimes	Very often	Always
43.	In the public green space, house pets like cats and dogs do not disturb older people.	Never	Rarely	Sometimes	Very often	Always
44.	Space separation for men and women contribute to more comfort among older people.	Never	Rarely	Sometimes	Very often	Always
45.	I admire my neighbourhood and I will not leave it.	Never	Rarely	Sometimes	Very often	Always
46.	I have many great memories in this neighbourhood.	Never	Rarely	Sometimes	Very often	Always
47.	The green space makes me feel as comfortable as if I'm in my back yard.	Never	Rarely	Sometimes	Very often	Always
48.	People participate in protecting and cleaning the public spaces of their neighbourhoods.	Never	Rarely	Sometimes	Very often	Always
49.	My home is comfortable to live in with adequate space.	Never	Rarely	Sometimes	Very often	Always

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