

# The psychological benefits of urban public space for elderly living in a severe cold city of China

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## Abstract

*As urbanization and aging progress, older adults are at greater risk for mental and physical illness. In recent years, researches have shown that exposing older adults to urban public space can be beneficial to their health. To find a way to improve the psychological benefits of the elderly, this paper study the relationship between the urban public space environment and their psychological benefits. There were 1093 older adults (56.3% males) aged 60-94 years ( $M=70.0$ ;  $SD=7.57$ ) examined in this study. Based on a comparative study, this paper concludes that the benefits of urban public space on the elderly differ significantly from place to place, and that the effects are seasonal. It is best to have closed areas surrounded by tall trees in the winter and spring. The best time for open areas with tall trees and shrubs is in the fall and summer. In addition, this paper examines the relationship between the environment condition and psychological benefits in urban public space. Overall, in the spring, vegetation/greenery was the most effective method for improving the psychological recovery of the elderly (ROS score increased by 0.465). During the winter, vegetation/greenery, seats, fitness equipment, crowds, and recreational activities all significantly affected the psychological benefits of the elderly, and recreational activities is the most effective (ROS score increased by 0.295). In autumn, the sky, seats, fitness equipment, crowds and recreational activities significantly impact the psychological benefits of the elderly, and sky has the greatest effect on psychological benefits in the elderly (ROS score difference of 0.454). In summer, environmental conditions did not significantly influence on psychological benefits in urban public space.*

## Keywords

*Severe cold city, Urban public space, The elderly, Psychological benefits*

## 1. Introduction

Throughout the world, the population is rapidly aging, and by 2050, the number of people over 60 is expected to 22% of the population (Organization, 2018). There is evidence that older adults living in cities are more likely to be adversely affected by noise, urban heat islands, and air pollution, which can result in mental and cardiovascular diseases, such as worsening depressive symptoms and cardiovascular problems (Beard et al., 2010). Additionally, psychological disorders such as stress, depression or anxiety

have been found to increase the risk of cardiovascular disease (Piepoli et al., 2016), especially for older people living in cities (Peen et al., 2010).

During the COVID-19 epidemic, many countries or locations have taken measures such as physical isolation and distancing to limit its spread, which may have far-reaching effects on all aspects of society, including mental and physical health (Holmes et al., 2020), especially for the elderly (Pinsonnault-Skvarenina et al., 2021). In the United States, twenty percent of adults (46.6 million) suffer from a diagnosable mental disorder, and approximately 7.5 million older adults suffer from mental disorders, a number that is projected to double to 15 million by 2030 (Edelstein et al., 2022). In the world, approximately 15% of people over 60 suffer from psychiatric or neurological disorders such as depression, anxiety, and mood disorders (Organization, 2017). Global public health has become increasingly concerned with mental health (Patel and Prince, 2010).

Researchers are always searching for solutions to alleviate mental health problems due to their prevalence and impact (Yakınlar and Akpınar, 2022). In terms of healthy aging, urban public space may have an important role to play since they allow older adults to become more independent, as well as promote active and healthy lifestyles (Sánchez-González, 2018), and social interaction (Coley et al., 1997, Maas et al., 2009, Wan et al., 2020). It is possible for people's physical and mental health to be affected by their proximity to and use of these spaces (Kaplan, 1995, Wan et al., 2020). Nature is considered to have "restorative" effects on human mental health according to two basic theories: Attention Restoration Theory (ART) (Kaplan, 1995) and Stress Reduction Theory (SRT) (Ulrich et al., 1991). A number of studies have suggested that indirect exposure to nature enhances the physical and psychological well-being of older adults (Elsadek et al., 2021). The exposure to public space in urban areas has been associated with improved mood, perceived health, and an increase in physical activity (Dimitrov-Discher et al., 2022).

The public space in a city can be defined as the part of the city to which the general public has free and unrestricted access, irrespective of gender, race, ethnicity, age or socioeconomic standing (UNESCO, 2017, Carmona, 2015). In many countries, public space are accessible and free spaces for social interaction, physical activity, and relaxation. Studies have shown that urban public space promote physical, mental, and social well-being (Gladwell et al., 2013, Levy-Storms et al., 2017, Li et al., 2019).

Psychological recovery is associated with urban public space, but little is known about this association (Korpela et al., 2010). There is a correlation between the characteristics of urban public space and leisure walking, life satisfaction, positive environmental interaction, and mental health among the elderly (Sugiyama and Ward Thompson, 2008, Sugiyama et al., 2009). While many studies have examined the influence of physical surroundings (Robine et al., 2008), social interaction, and physical exercise on psychological recovery (Levy-Storms et al., 2017), the mechanism by which urban public space affect this effect remains unclear. Therefore, this paper systematically evaluates the impact of urban public space environment on the psychological benefits of the elderly in different seasons, that is, the degree to which different locations and environmental conditions influence the psychological benefits in the urban public space environment.

The purpose of this study is to answer the following questions: (1) Does the psychological benefits of the elderly differ in different urban public space? (2) Are there any environmental conditions that have a significant impact on the psychological benefits in different seasons?

## 2. Research methods

### 2.1. Urban public space selection

Harbin is a typical city in a region that experiences severe cold temperatures. As part of the questionnaire survey, in order to demonstrate the climate characteristics of Harbin. As part of our investigation, we measured the air temperature (using a BES - 01 temperature recorder). According to the results, the average air temperature in spring was 22.38°C, -10.07°C in winter, 12.99°C in autumn, and 29.11°C in summer. The study calculated the Sky View Factor at 1.5 meters above ground in summer in order to further illustrate the environmental characteristics around each measurement point (Fig. 1). Basically, the sky view factor determines how much of the sky is covered by trees and buildings from a given location on the ground (Martensson et al., 2009).

Six points were selected (Fig. 1), and all of them located in or near residential areas, which are the main public place for people to conduct daily leisure activities, including two parks, two streets, and two residential squares. We conducted field questionnaires on typical meteorological days during each season (winter (December), spring (May), summer (July), and autumn (October)).

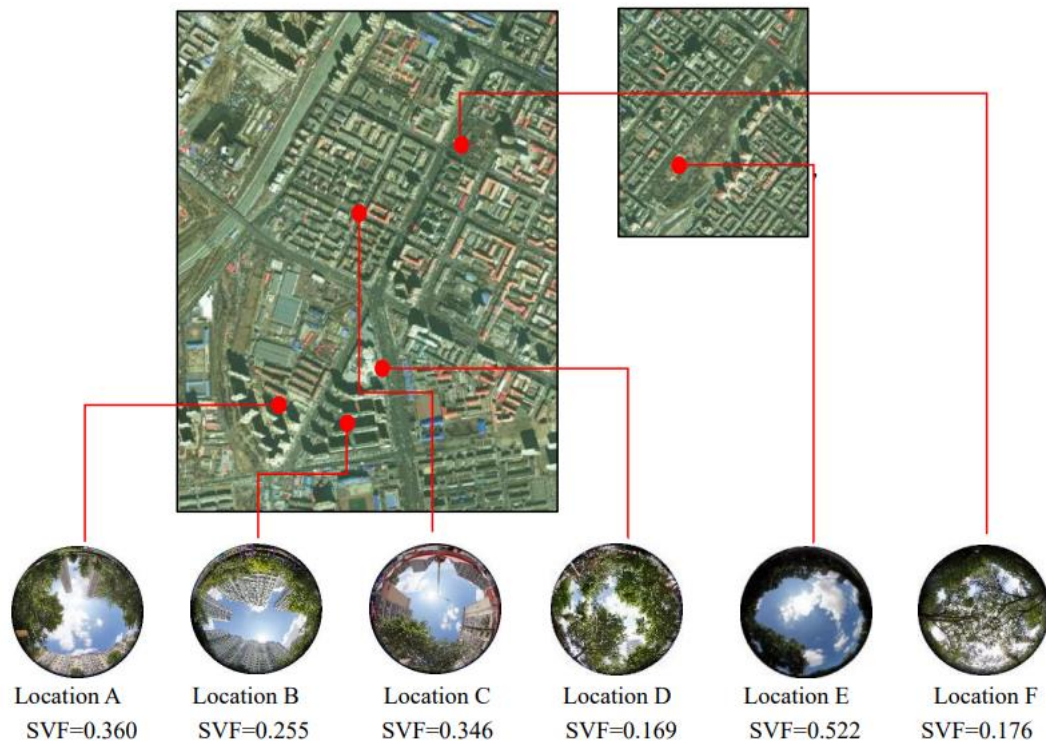


Figure 1. Distribution of measurement points and environmental characteristics

There are significant differences in the urban public space environment at each measuring point, as follows:

- (1) Location A: located in a residential square. The area consisting of trees, shrubs, and a small lawn. A variety of fitness equipment and chairs are available. In this area, there is no traffic noise.
- (2) Location B: located in a residential square. A large number of trees, shrubs, and lawns surround the property and provide both sunny and shady areas. It has fitness equipment and seating, and it is noise-free.

(3) Location C: Several trees and grasses grow naturally in the area. The sanitary conditions are generally poor (garbage on the road, etc.), and there is noise from traffic and hawkers.

(4) Location D: The area is surrounded by many trees, providing shade and sunshine. The property is well maintained and managed, but there is noise from traffic.

(5) Location E: There is a well-maintained children's playground, a table tennis court, and seats available in this area. A variety of trees, shrubs, and grasses are present, as well as areas that receive sun and shade. The area is crowded with people and there is no traffic noise.

(6) Location F: There are many trees, shrubs, and lawns surrounding the property. There are sun and shade areas with several seats. Recreational activities such as singing and playing musical instruments are often spontaneous. The property is well maintained and there is a slight amount of traffic noise (when there is no entertainment).

## 2.2. Involved environmental conditions

Urban public space have a variety of environmental conditions, including landscape elements, facility configurations, and human activities (Lu et al., 2022, Staats, 2012).

(1) Landscape elements. Generally, landscape elements can be divided into nature-based components and hardscape components, where natural components include trees, shrubs, flowers, and grasses (Booth, 1989). In addition to the land surface, the sky is also included in the study. Hardscape components are non-biological features created by humans such as buildings and roads (Davitt, 2008).

(2) Facility configurations. As the usage preferences of the elderly (Nordh et al., 2009), We select seats and exercise equipment to investigate in this paper.

(3) Human activities. The presence of people can cause respondents to perceive the environment differently, and thus achieve different benefits in the same physical environment (Staats, 2012). Additionally, this study examined the psychological benefits of different landscape components based on the influence of crowds and recreational activities.

## 2.3. Survey questionnaire

This study utilized the on-site questionnaire survey method, and questionnaires were randomly distributed to the elderly at six measuring points. It was conducted with 1093 older adults (229 in the spring, 380 in the winter, 240 in the autumn, and 244 in the summer), of which 56.3% were male, and their ages are from 60 to 94 ( $M=70.0$ ;  $SD=7.57$ ). Before completing the questionnaire, participants were asked to provide demographic information. All questionnaires for participants who did not complete all questions or who had incomplete demographic information were discarded.

A questionnaire survey was used in this study to obtain information about the elderly's preferences for environmental conditions, which were expressed in terms of "like" or "dislike" of certain environmental conditions, and then to determine the influence of environmental conditions on the psychological benefits of the elderly.

## 2.4. Measurement of the psychological benefits

The Restoration Outcome Scale (ROS) (Simkin et al., 2020, Korpela et al., 2008) was used to measure perceived psychological benefits. There are six items on the ROS scale (Ojala et al., 2019). There are three statements that reflect relaxation and calm (e.g., "I feel recovered and relaxed"), and one that reflects attention recovery (e.g., "I feel focused and alert"), and two that reflect clearing your mind (e.g., "I can

forget my daily worries"). To measure the psychological benefits, the average of the six ROS scales was calculated using a five-point Likert scale (1-rare; 3-fair; 5-a lot).

### 3. Results

This article use IBM SPSS Statistics 26to analysis the data. This paper use variance (ANOVA and post-hoc test) and independent sample T tests since the data follows a normal distribution approximately. ANOVA's F statistic is based on the realization of two assumptions: normality and homogeneity. Additionally, since some data sets do not satisfy the condition of equal variances, we use the statistical method of Welch and Brown-Forsythe as an alternative to the F statistic.

#### 3.1. Effects of urban public space on psychological recovery

According to the results (Table 1), there are significant differences in the psychological benefits of the elderly in different urban public space.

Table1 the psychological benefits of urban public space and a post-hoc test

season	Location	mean	SD	Homogeneity (Levene)		Equality of means			Tamhaini post hoc test
spring	A	4.220	0.591	2.398	0.038	Welch	22.356	<0.001	AC, AD, EC, ED BF, BC, BD, FC, FD
	B	3.804	0.682						
	C	3.034	0.728						
	D	<b>2.974</b>	0.832			Brown-Forsythe	23.831	<0.001	
	E	4.097	0.759						
	F	<b>4.303</b>	0.531						
winter	A	3.755	.404	5.194	<0.001	Welch	20.099	<0.001	A-F, A- C, E- F, B- F, F- C, F-D
	B	3.545	.851						
	C	<b>3.337</b>	.761						
	D	3.521	.677			Brown-Forsythe	17.838	<0.001	
	E	3.564	.586						
	F	<b>4.269</b>	.575						
autumn	A	3.253	1.072	8.864	<0.001	Welch	22.223	<0.001	A-E, A- F, E- B, E- C, E- D, B- C, B- D, F- C, F-D
	B	3.875	0.404						
	C	3.306	0.345						
	D	<b>3.167</b>	0.766			Brown-Forsythe	15,712	<0.001	
	E	<b>4,200</b>	0.585						
	F	3,950	0.588						
summer	A	3,930	0.410	6,390	<0.001	Welch	18,558	<0.001	AE, AB, AC, AD, BE, EF, EC, ED, FC, FD
	B	3,397	0.744						
	C	3,233	0.774						
	D	<b>3,131</b>	0.773			Brown-Forsythe	21,662	<0.001	
	E	<b>4.444</b>	0.718						
	F	3.761	0.600						

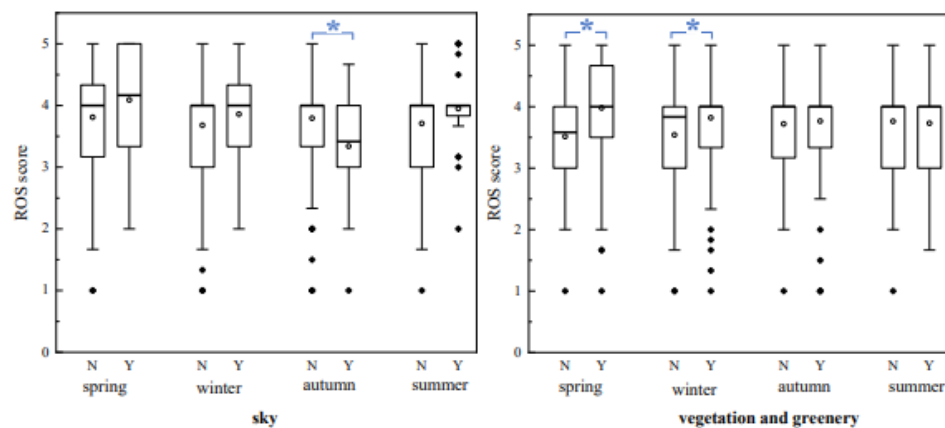
Position F has the largest psychological benefits on the elderly in spring, whereas position D has the smallest psychological benefits. The range of psychological benefits is [4.303, 2.974]. The psychological benefits of position F are the largest in winter, while the psychological benefits of position C are the smallest, and the range of psychological benefits is [4.269, 3.337]. Position E has the largest psychological benefit in autumn, while position D has the smallest, with a variation range of [ 4.200, 3.167]. Position E has the greatest psychological benefit in summer, while position D has the smallest psychological benefit, with a range of psychological benefits of [4.444, 3.131].



Psychological benefits of the elderly were significantly different in different urban public space, with the largest differences occurring in spring and summer (ROS differences of 1.329 and 1.313, respectively), followed by autumn (ROS difference of 1.313) and winter (ROS difference of 0.932). In general, the position D in spring promotes the least psychological recovery effect for the elderly, which is slightly lower than "fair", therefore, it is negatively impacted. Position E in summer is the most conducive to psychological recovery for the elderly, which is between "a little" and "a lot", which is very helpful for their psychological recovery.

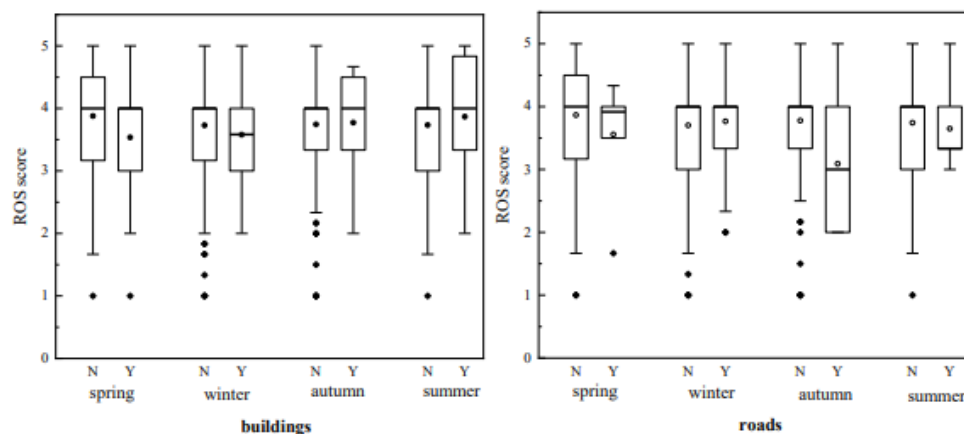
### 3.2. Psychological benefits of landscape elements

The psychological benefits of the sky were significantly affected in autumn (Fig.3a), and compared with the elderly "dislike" sky, the favourite sky would cause the ROS score to decrease by 0.454 in autumn. There was a significant difference between spring and winter psychological recovery benefits of vegetation/greenery (Fig.3b), as well as a significant difference between favourite vegetation/greenery and ROS scores (differences of 0.465 and 0.279). Buildings and roads did not have significantly different effects on psychological benefits during the four seasons (Figures 3c and 3d).



a) Sky influence on ROS score

b) Vegetation and greenery influence on ROS score



c) Buildings influence on the ROS score

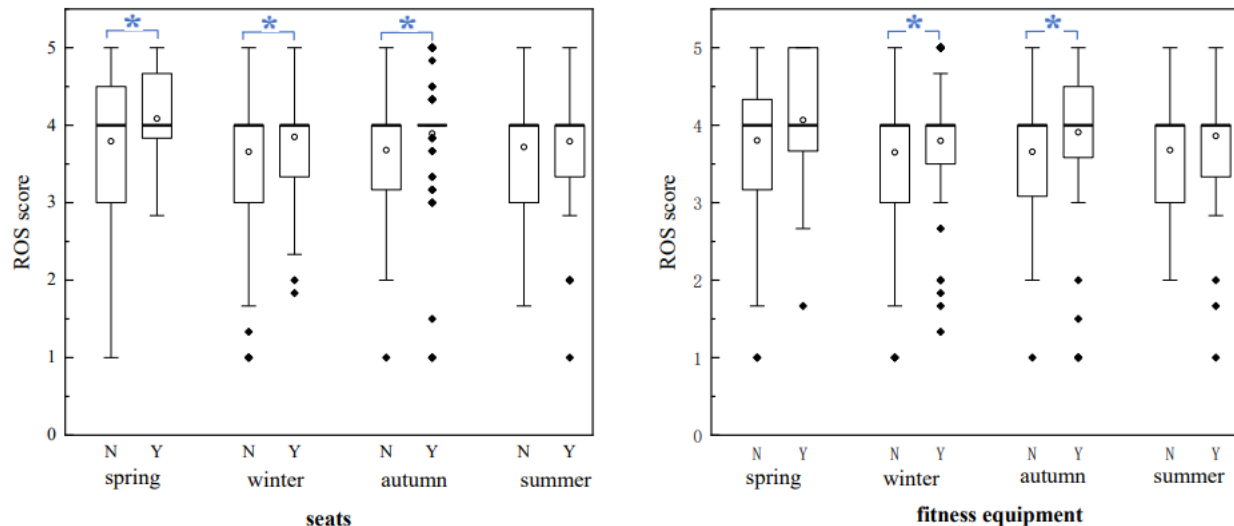
d) Roads influence on the ROS score

Note: "\*" means  $p < 0.05$ , N - not liked, Y - liked

Figure 3 Influence of landscape elements on ROS score

### 3.3. Psychological benefits of facility configuration

There is a significant effect of seats location on psychological benefits in spring, winter, and autumn (Fig. 4a), whereas favourite seats have a significant improvement in ROS scores (0.293, 0.191, and 0.212, respectively). As shown in Figure 4b, fitness equipment significantly influenced psychological benefits in winter and autumn, that is, favourite fitness equipment significantly increased ROS scores by 0.150 and 0.252 in winter and autumn, respectively.



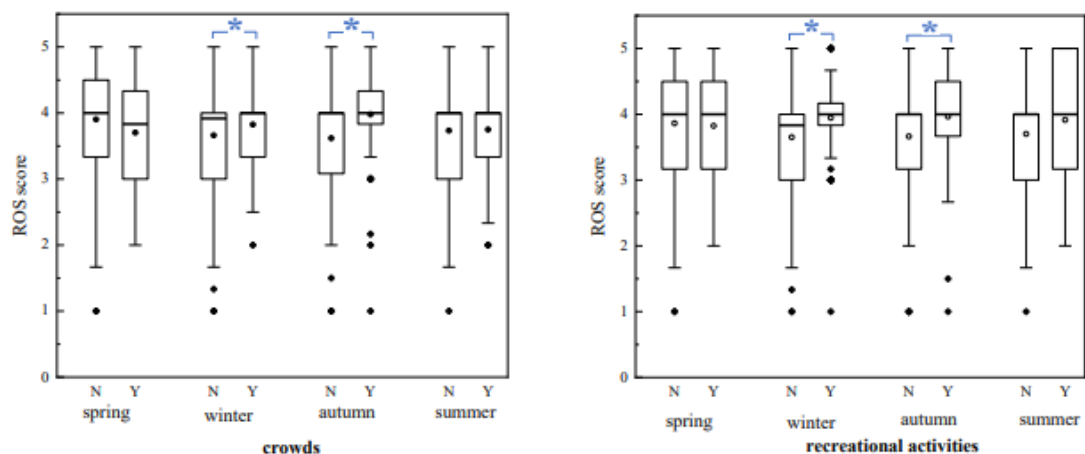
a) Chair influence on the ROS score      b) Fitness equipment influence on the ROS score

Note: "\*" means  $p < 0.05$ , N - not liked, Y - liked

Figure 4 Influence of facility configuration on ROS score

### 3.4. Psychological benefits of human activities

In winter and autumn, it was found that the favourite group increases its ROS score by 0.163 and 0.361 compared with the "dislike" group (Fig. 5a). Recreational activities significantly influenced psychological benefits during winter and autumn (Fig. 5b), whereas favourite recreational activities significantly increased the ROS score (0.295 and 0.300, respectively).



a) Crowds influence on the ROS score      b) Recreational activities influence on the ROS score

Note: "\*" means  $p < 0.05$ , N - not liked, Y - liked

Figure 5 Influence of human activity on ROS score

#### 4. Discussion

Specifically, this study examines the association between the urban public space environment and psychological well-being. According to the findings of this study, there is a significant difference in psychological benefits between different urban public space, which is consistent with previous studies (Triguero-Mas et al., 2017, Simkin et al., 2021, Holy-Hasted and Burchell, 2022), however, seasonal changes in urban public space cannot be ignored. Therefore, for the psychological benefits of the elderly, in spring and winter, the relatively closed area surrounded by tall trees is the most favourable (position F). During autumn and summer, a more open square with tall trees and shrubs, recreational facilities, and a more open square is most beneficial to psychological well-being (Position E). In spring, autumn and summer, semi-closed roads with high traffic volumes and many trees are the least conducive to psychological benefits (position D). In the winter, there are several trees, traffic flow smaller semi-closed streets are less conducive to psychological benefits (Location C). This means that in order to improve the psychological well-being of the elderly, it is necessary to begin by examining the seasonal characteristics of the urban public space environment. This paper provides a framework for an urban public space design and it is systematically analysed the elements of the environment throughout the year.

In winter, the elderly enjoy vegetation/greening, which has the potential to enhance their psychological well-being. Studies have also shown that vegetation and greenery in winter are beneficial for psychological well-being (Hidalgo, 2021). In autumn, the sky will have a significant effect on elderly people's psychological recovery. In spring, the sky will increase their popularity. The psychological benefits of vegetation/greening can be significantly enhanced. In some studies, flowers have been shown to enhance the psychological well-being of the elderly (Nordh et al., 2011), Consequently, spring-blooming vegetation and greenery can be considered when designing a garden.

During winter and autumn, seats and fitness equipment favourite by the elderly can effectively improve the psychological benefits of the elderly. There is evidence that the psychological benefits of spring seating can be enhanced for the elderly.

A number of studies have shown that increasing recreational items can help improve the life satisfaction of elderly individuals. For human activities, crowds and recreational activities favourite can enhance their psychological health in winter and autumn (Lloyd and Auld, 2003). In spring and summer, crowds and recreational activities did not significantly affect psychological recovery among the elderly.

#### 5. Conclusion

The purpose of this study is to provide some suggestions for improving the psychological benefits of elderly people in severe cold areas. The seasonality of urban public space has a significant impact on the psychological well-being of the elderly. In spring, the closed area surrounded by tall trees is the most beneficial, but semi-closed streets surrounded by trees and with high traffic flow are the most beneficial. Although closed areas surrounded by tall trees are most beneficial in winter, streets with fewer trees and less traffic are the most disadvantageous. The fall and summer months are characterized by tall trees and shrubs. An open square with entertainment amenities is the most desirable, whereas a semi-closed street surrounded by trees and having a large amount of traffic is the least desirable.

A discussion was also conducted regarding the degree to which urban public space environmental conditions have an impact on the psychological benefits of the elderly, as well as ways to improve the



psychological benefits of the elderly. Accordingly, in spring, vegetation/greenery and seating are the most effective ways to improve the psychological benefits of the elderly, among which adding vegetation/greenery that is preferred by the elderly is the most effective, such as increasing flowering plants in spring. As a result, the design of vegetation/greening, seats, fitness equipment, crowds and recreational activities, the psychological benefits of the elderly can be enhanced in winter and autumn. Increased participation in favourite recreational activities is the most effective method of improving the psychological health of the elderly. It has been shown that the design of the sky, seats, fitness equipment, crowds, and entertainment activities can improve the psychological benefits of the elderly, with the sky having the greatest impact. During the summer, environmental conditions do not have a significant effect on the psychological recovery of the elderly. In this paper, we provide a reference for improving the psychological benefits of the elderly.

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