Examining the Impact of Window on Users' Mental Health: A Case Study of the Elderly in the Sistan Region

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Abstract

More than 90% of people's lives unfold within the confines of buildings, underscoring the pivotal role of house design quality in the health and well-being of its inhabitants. Research indicates that features like adequate daylight, proper ventilation, and desirable views in housing design can simultaneously bolster mental and physical health. The World Health Organization (WHO) defines health holistically as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." Studies in health-related fields underscore the crucial role that windows play in buildings. For the elderly, windows can serve as a gateway to the world, particularly for those who spend significant time at home. This research focuses on identifying indicators that affect the mental health of older individuals and examining how windows can contribute to enhancing their mental health in the Sistan region. The research methodology involved a comprehensive review of texts and articles, alongside the design of a questionnaire, which was developed using the Laoche method based on expert opinions. The reliability of the questionnaire was evaluated using Cronbach's alpha method. Subsequently, analyses were conducted using the SECA analysis, a multi-objective nonlinear programming model. The research findings reveal that among all components involved in window design affecting the mental health improvement of older individuals in the Sistan region, the view and landscape exert the most significant influence, while window shape has a lesser impact. Regarding indicators of mental health among older adults in the Sistan region, communication with the outside environment emerges as pivotal, while peace holds relatively less importance.

Keywords: Window, Mental Health, Elderly, SECA, Sistan.

1. Introduction

The rising trend of the elderly population underscores the increasing importance of their health. Globally, it is projected that the proportion of individuals aged 60 years and above will reach approximately 22% by 2050 (WHO, 2007). According to Iran's 1390 census, the country is home to 3.4 million elderly individuals aged 65 and above, constituting 5.7% of the total population. Demographic forecasts indicate that by 1430, the number of elderly individuals aged 65 and over in Iran will surge to 18 million, with their population share reaching around 20% (Sadeghi, 2013). This trend underscores the need for studies on providing elderly services and recognizing the needs and health indicators of this age group (Asadi Noghabi et al., 2012). In addition to biological changes, retirement brings about shifts in the social roles of the elderly, accompanied by psychological consequences and mood changes that need to be addressed alongside physiological issues (Kevin & Lioyd, 2005). The World Health Organization notes that while developed countries commonly define old age as starting at 65 years, this criterion may not be suitable for developing countries like those in Africa. While there is no standardized criterion for

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defining old age, the World Health Organization advocates for using 60 years or older as the cut-off point to define the elderly population (UGBC, 2016). In Iran, due to the significant increase in life expectancy in recent years, 60 years is considered the beginning of old age for retirement, and the provision of integrated elderly services and care is set to commence at this age.

Most individuals spend about 90% of their time inside buildings, so every building significantly impacts our daily lives. The construction process in recent years, due to the one-sided economic approach to the multidimensional housing category, has caused a decline in the quality of life and the occurrence of many physical and mental diseases in humans today (Klepeis et al., 2001). Some also believe that part of the quality of life is related to the environmental characteristics and the condition of the person's residence (Garousi & Shamsaldini Motlagh, 2014).

The quality of home design is a critical factor for the health and well-being of those living there. The evidence shows that housing design features such as the amount of daylight, proper ventilation, and desirable views can positively affect mental and physical health at the same time. (UGBC, 2016) Meanwhile, as providers of daylight and a view into outer space, windows are standard and have received attention in the specialized fields of architecture, lighting, photobiology, and psychology (Veitch & Galasiu, 2012). This research seeks to identify the components of the mental health of the elderly and investigate and study the effect of windows on improving the mental health of the elderly in the Sistan region.

2. Theoretical Framework

2.1. Health concept and its different dimensions in housing

Home is where we live, sleep, and rest; our children have many of their best formative experiences in this space, so we often become emotionally attached to our homes. We spend time and money to make houses comfortable, safe, and personal places. So, we have a strong connection with our residential buildings, differentiating the house from other types of buildings. Therefore, not only should a house provide an indoor environment that enables physical well-being, but it should also improve the level of well-being of the user and provide a general feeling of happiness, empowerment, and health for its residents (UGBC, 2016).

Many factors affect human health, and various positive and negative factors have been mentioned. Identifying the influential factors related to health and, in other words, the determinants of health is essential. In the current century, due to the ever-increasing population of the world and the provision of solutions to maintain the health of society, creating a healthy and appropriate environment and housing is one of the most critical parameters in the health of residents. Because health in housing is considered a sustainability indicator and one of the basic human needs, planning for it is essential in every university. Being healthy is one of the most basic human needs and the basis of human progress and civilization. In Maslow's model of needs, this issue is placed on the first level of the pyramid. The health of societies is created from the health of each family and its members, and housing is the place where the family spends most of its time and housing conditions can have a positive or negative effect on people's health (Salehi, 2010).

The World Health Organization is one of the agencies of the United Nations whose most important goal is to coordinate and improve the public health situation in the world. Based on the definition of this organization, health is defined as the provision of complete physical, mental, and social well-being, which is not limited to the absence of disease and organ defects (Osborn, 1967). According to the World Health Organization (WHO, 2007) which can provide all three dimensions of health, i.e., physical, mental and social health for its residents.

Among the essential reasons for addressing the issue of mental health in the discussion of residential environments, the following can be mentioned:

1. Home is the most important space where people spend most of their time.
2. The necessity of society's health is considered the most critical factor in improving the quality of life of individuals and society, the housing of all strata of society and different ages, and if it is unhealthy, it affects a wide range of people.
3. It is necessary to discuss disease prevention in health and hygiene and consider healthy housing as a means to prevent various diseases.
4. Paying attention to health issues in housing and applying its principles and rules will result in economic savings due to the high cost of treatment at the scale of the family, society, and country. Therefore, with the knowledge that housing is an environment with multi-dimensional function and has different physical, economic, social, financial, psychological and medical dimensions (Cullingworth, 2004). It is necessary to extract planning principles and criteria to achieve desirable environments. In this way, residential environments affect people's physical and mental health differently (Ocampo, 2009). Architects have long understood the importance of health, safety, and well-being as part of their

mission. According to the American Institute of Architects (AIA) report, the health aspects of architecture are those that have beneficial or effective effects on the occupants and users of buildings (Andrew & Heather, 2018).

Among them, windows, as providers of daylight and a view to outer space, are standard and have received attention in the specialized fields of architecture, lighting, photobiology, and psychology. Energy and environmental concerns and health and well-being goals have each drawn new attention to the value of windows as a topic of discussion in practical life in these areas (Veitch & Galasiu, 2012).

2.2. Mental health definition

The World Health Organization defines mental health as a desirable physical, mental, and social state, not just the absence of disease (Najafi et al., 2013). The psychological aspect of health in housing includes all the mental and psychological effects of the physical environment on its residents. Low-quality houses lead to a decrease in the mental health of their residents (Shaw, 2004), and on the other hand, improving the quality of the home environment has a positive effect on improving their mental and psychological health (Thomson & Petticrew, 2005).

The psychological quality of health in housing seeks to create factors that, by achieving them, the possibility of living in peaceful, safe, and intimate homes for its residents and protect them from any mental and emotional harm. In addition to being compatible with behavioral patterns, such a place has features that respect the person and his personal space and permanently preserve its integrity. Adapting to the behavioral patterns of the residents forms an "adaptable and flexible place" (Lang, 2002) in which it is possible to make changes according to their mental and psychological conditions. Finally, it leads to dependence and attachment to the house and makes it possible to control the person (Hashempour & Keynejad, 2012).

2.3. Window's effect on mental health

The Encyclopedia defines a window as "an opening in the wall of a building to obtain light and air." This definition may show a simple diagram of one of the most complex components of a building, while in actual operation, the window has multiple functions. Therefore, it is impossible to agree on the exact role of the window because it has been designed to serve different functions throughout history, and its main role has changed over time. However, with more emphasis on energy conservation, the window is recovering its multifunctional features by providing daylight and movement for natural ventilation (Kheira & Tabet, 2012). Therefore, windows "in the 20th century are machines that combine several environmental features and should not be considered only as transparent parts of the wall but form a multifunctional element in the home" (UGBC, 2016). The city, the house, and the residential environment play a significant role in the health and determination of people's mental and emotional state. One of the house's goals is to ensure its residents' health (Rapoport, 2010); any contamination in the house can negatively affect their health (WHO, 2007).

It is worth noting that people spend the most hours of their lives at home (Masoudinejad, 2016); even in modern societies, working people (18-64 years old) do more than half of their daily activities at home (Bechtel & Churchman, 2002). Moreover, beyond these statistics, the house is the permanent residence of a large group of people in society: children, mothers, elderly people, disabled people, or people who have limited mobility. Therefore, the quality of the home environment is the most important. The place in our life is worthy of reflection (Gifford, 1987). In particular, the most crucial role of the house in today's world is its emotional and emotional role (Alexander, 1979). Moreover, it should be in harmony with the psychological needs of the residents (Gifford, 1987). So, beyond the functional aspects of the house and providing physical needs, it is essential to pay attention to its emotional aspect and the qualities that affect the mental health of the residents. Quality elements in the environment The house is a "window" which strongly affects the emotional, emotional and psychological dimensions of the residents (Masoudinejad, 2013).

The window that connects the inside and the outside area fulfills the needs of the residents from the outside area: the need for natural light, the need for fresh air, the need to get information from the outside environment, and the need for a good view, especially in today's houses. As the window is the only way for the residents to communicate with the outside world and the only house opening to the city, the window has always been considered in terms of urban planning and architecture. Especially in recent decades, the window has been considered one of the most sensitive architectural design elements, and principles and criteria have been established for its design (Tahbaz, 2014).

The window can provide the necessary opportunities for people's mental revitalization inside the home. Rachel Kaplan's study in residential environments showed that the window is a source of "revival," and this importance

depends not only on the existence of the window but also on the content of the view from the window (Kaplan, 2001).

Research in the fields related to the effects of health and well-being emphasizes that windows play a significant role in buildings. Empirical research also tells us that daylight through windows lets us see critical physiological functions in daily cycles and promotes positive emotions and alertness. The presence of windows in architectural spaces makes the spaces look pleasant. In addition to providing a tool to discover and perceive the environment, they also help the user's safety and comfort. The priority of windows is often related to the function of the space and even the resident's needs. If these variables are not congruent, people will change their space to fit their needs. Therefore, understanding the complexity of human-window interactions is essential in maximizing the fit between living and working spaces and those occupying them (Veitch & Galasiu, 2012).

2.3.1. Natural light

Windows that provide daylight and views of the natural environment are prominent features of the physical environment that promote occupant satisfaction and well-being. Regarding biological factors, the intensity and timing of light exposure can alter circadian rhythms. Body clock synchronization potentially improves peak cognitive performance and work activities in a process known as circadian resetting (Roberts, 2010). By changing circadian rhythms, exposure to light can increase body temperature, lower blood pressure (Badia et al., 1991), and decrease heart rate (Smolders et al., 2012).

Natural light allows the buildings to be illuminated without artificial light and shows the passage of time. Regarding psychological and behavioral factors, appropriate lighting can improve alertness, performance, mood, and social interaction through neuro-hormonal changes. Individual performance is regulated by the time of awakening, quality of light, previous sleep, and the individual's biological clock (cited by National Space Biomedical Research Institute, 2010). On an emotional level, people enjoy the feeling of well-being in daylight and sunlight. Prolonged lack of daylight can have psychological effects: for example, at the other end of the spectrum, some people are affected by conditions such as seasonal affective disorder (SAD) during dark winters (UGBC, 2016).

2.3.2. Circadian rhythm

The circadian rhythm (also known as the human body clock) gives people a sense of what time of day it is so that when it is morning, a person is potentially feeling tired but ready to start their day, for the evening is a sense of calmness and a moment that moves downwards. This rhythm is how people live naturally and healthily, and this is why having natural light is essential because windows allow the circadian system to work usually and consistently for humans (Zanier, 2021). Statistics show that people who spend most of their time in environments with artificial light may be more prone to mood disorders and sleep disorders. Therefore, having windows that bring natural light into our indoor spaces is vital to maintaining health (Boyce, 2003).

2.3.3. Natural ventilation

Natural ventilation can be beneficial because it can bring fresh air from outside into the space while recirculating stale air. Moreover, it is essential because a space's air quality can affect its occupants' health. Although the building code for the window sector focuses more on windows that provide natural ventilation, it is essential to note that having access to fresh air is generally a mandatory rule. Windows help ventilate indoor spaces, reduce the risk of respiratory problems, improve cognitive function, and enhance safety (Zanier, 2021).

2.3.4. Visual vision

Visual vision is an essential and beneficial aspect of windows that allow people to understand life outside the space. This aspect is one of the main components of windows that is hard to argue against, as people want a connection with the outside and a reminder of existing life. The sense of life outside the space in which one is located is an essential concept because it gives one a sense of reality (Farley & Veitch, 2001).

3. Background research

In a research entitled meta-analysis of the factors affecting the mental health of the elderly, Arabzadeh has examined all the research of quarterly journals and scientific research journals in the field of mental health of the elderly during the years 2005-2015 and individual, social, psychological and demographic factors are among the indicators (Arabzadeh, 2016). It has been mentioned as effective for the elderly. In an article called The Biophilic Approach as an Approach to Improving the Quality of the living environment of Residents of residential complexes stated that improving the quality of the living environment also means providing appropriate and

diverse responses through the environment to the different physiological and psychological needs of the users of that space (Bitraf et al., 2017).

If we want to talk about the evolutionary process of the role of the window in the present era, as it has been discussed since the past, we can say that one of the effective approaches in recent years is the multi-purpose optimization of the window with the aim of providing the user's comfort. Heidi Salonen team in an article titled " The impact of windows, daylight and views of nature on health and wellbeing in healthcare facilities" that the window is one of the most critical factors for designing the physical environment. The importance of the window as an influential factor in health and well-being has been known for a long time, and in the review of more than 40 research articles (23 authentic journal articles and 17 publications such as books, reports, and conference articles), on the impact and importance of daylight and visibility It has been mentioned on patients and medical centers and it has been stated that understanding the complexity of window and human interaction is essential to maximize its impact and window is considered a perfect tool for architects who design medical centers, however, more studies are needed in The field of optimization and providing solutions in window design for different users at different times of the day is in medical centers. Optimal window design can increase occupants' physical and psychological well-being (Salonen et al., 2014).

Today, excellent researches have been done in the field of multi-purpose window optimization to provide thermal and visual comfort and energy. Among others, Jiahe Wong, in their research, have provided a multi-purpose framework of thermal and daylight optimization in residential apartments based on window design and natural ventilation, and the results show that natural ventilation is adequate in simultaneously optimizing the goals and improving it (Jiahe et al., 2020). Also, in an article by Mohammadi and Shemirani, the multi-objective optimization of the window shape has been done to simultaneously provide the components of visual comfort and energy efficiency in educational buildings through a genetic algorithm (Mohammadi & Shemirani, 2020). In an article published in 2020, Pilechiha and and his colleagues presented a multi-objective optimization framework of daylight, energy, and quality of view in window design of office spaces. Saleh Nasser, in his research, Optimized visibility and light to improve human comfort in the educational process, has been investigated (Saleh, 2021). In an article in 2012 titled "Window design and performance, light, visual comfort, well-being", Aniseh Khaira refers to the role of windows in the quality of life and well-being, considering the conditions of energy optimization. Yingni Zhaia and his colleagues researched the multi-purpose optimization method for window design, considering energy consumption, ambient temperature, and visual performance (Yingni Zhaia et al. 2018). Also, extensive research has been done on the positive effect of daylight and good vision on improving people's health and mental health, and this has been emphasized by many researchers, such as Florence Nightingale, that direct sunlight is very effective in improving mental health conditions in hospitals. Although many research studies have focused on different aspects of windows, such as visibility, daylighting, and ventilation, no study has focused on the overall impact of a window on its occupants. (Veitch & Galasiu, 2012) Most of the conducted researches try to optimize light and, reduce energy consumption, and provide thermal comfort in the architectural space, while according to Kevin Steamer, "to truly improve human well-being, building design needs to move beyond the optimal Creating single parameters such as temperature, light and humidity and has a more comprehensive approach that shows its signs in human behavior (Steemers.k, 2015). Therefore, by reviewing the background of the research, we will reach the point that many studies have been conducted in the field of optimizing and examining the window from the approach of thermal, visual, and climatic comfort, stability, etc., and few studies have investigated the role of the window on mental health. Those who are dependent on the house, such as the elderly, have paid attention. Therefore, the present research is based on the hypothesis that there is a significant relationship between the factors involved in the design of the window and the improvement of the mental health of the elderly in the Sistan region, considering the importance of the window on the mental health of the elderly in residential environments.

4. Research's Question

What is the window's role in improving the mental health of the elderly in the Sistan region?

5. Methodology

Regarding the nature and purpose of this research, it is practical and its method is based on correlation. The research data was collected in a field study using two questionnaires to identify indicators of the mental health of the elderly and the influence of the factors involved in window design on the mental health of the elderly in the Sistan region. In this research, the authors investigate the effect of the factors affecting the design of windows in residential houses on the mental health of the residents. The main variable (dependent) of mental

health and the independent variable of the factors involved in window design are introduced. In the first step, a researcher-made questionnaire was prepared to identify the indicators of the mental health of the elderly using documentary studies, scientific articles, and previous research. This questionnaire consisted of 22 effective indicators on the mental health of the elderly, which were scored using a four-point Likert scale. In order to determine the validity of form and content according to Lawshe's method, the research was done based on the opinion of 12 psychological experts specializing in the mental health of the elderly. The reliability of the first questionnaire was evaluated based on Cronbach's alpha coefficient, which is the basis of reliability measurement in most research.

Twelve experts responded to this research. According to the table, the minimum acceptable value of CVR is 0.54, but to increase the accuracy of CVR, 0.60 was accepted (Tab. 1). On the other hand, according to the appropriateness of the alpha coefficients, the validity of the questionnaire is confirmed, and the internal consistency of the options (CVI) in the mental health index for this research is in the acceptable to excellent range (Tab. 2).

Tab. 1: Determining the minimum acceptable CVR based on the number of experts

Minimum acceptable CVR	Number of specialists
0.99	5
0.99	6
0.99	7
0.78	8
0.75	9
0.62	10
0.59	11
0.56	12
0.45	18

Tab. 2: Cronbach's alpha levels and evaluation of the questionnaire's reliability

internal consistency of the options	The value of Cronbach's alpha coefficient
Excellent	$0.9 \leq \alpha$
Appropriate	$0.8 \leq \alpha < 0.9$
acceptable	$0.7 \leq \alpha < 0.8$
suspicious	$0.6 \leq \alpha < 0.7$
weak	$0.5 \leq \alpha < 0.6$
unacceptable	$\alpha < 0.5$

From the 22 mentioned indicators, the values whose reliability was above 0.60 were accepted, and the rest were excluded (Tab. 3). Then, the accepted indicators were compiled according to their relationship with the independent variable (window) by the experts' Delphi method. The final number of 11 effective indicators on the mental health of the elderly was extracted and determined.

In the second step, the factors involved in window design were extracted from the articles and research, and according to the opinion of architectural experts and experts' Delphi method, 12 effective indicators in window design were extracted. Then, an analytical matrix was formed, from which a questionnaire with 132 questions was prepared and adjusted. Finally, the scores were analyzed by the arithmetic mean method of integration in the SECA analytical matrix system (Tab. 4).

The review of the findings begins with a description of the demographic characteristics of the case study, delineated based on frequency percentages. The demographic analysis was conducted using SPSS software, revealing that 54.5% of the participants were male, while 44.5% were female. In terms of age distribution, male

participants had an average age of 65 years, whereas female participants averaged 63 years. Regarding education levels, the breakdown among participants was as follows: 3.5% held a doctorate, 8.5% possessed a master's degree, 27% attained a bachelor's degree, 26% completed an associate's degree, 19% held a diploma, and 16% were classified as illiterate.

Tab. 3: Reliability and validity of mental health indicators of the elderly

No	Option	Reliability	Narrative
	To what extent are the following indicators related to the topic (mental health of the elderly)?	CVI	CVR
1	Anxiety	**0/9**	**1**
2	Depression	**1**	**0/8**
3	Sleep quality	**0/9**	**1**
4	Safety (physical and psychological)	**1**	**1**
5	Stress	**0/8**	**0/8**
6	Tiredness	**0/7**	**0/2**
7	Life satisfaction	**1**	**1**
8	Happiness	**1**	**0/8**
9	Privacy	**0/8**	**1**
10	Communication with the environment	**0/9**	**1**
11	Disability (mental, physical)	**0/7**	**0/4**
12	Isolation	**0/8**	**0/6**
13	Dementia	**0/8**	**0/2**
14	Physical health	**0/9**	**1**
15	Sense of wellness	**0/8**	**1**
16	Religious beliefs	**0/9**	**1**
17	Cultural issues	**0/7**	**1**
18	Connection with nature	**1**	**1**
19	Social activity	**1**	**1**
20	Social Welfare	**1**	**1**
21	Independence	**1**	**1**
22	Peace of mind	**0/7**	**0/6**

Tab. 4: Analytical matrix and average responses of the elderly to the indicators and criteria of the questionnaire

criteria's			Mental health indicators										
			Anxiety	Depression	Sleep quality	Mental and physical security	Stress	Privacy	Communication with outside	Sense of wellness	Cultural and religious beliefs	Physical health	Quietness
			C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
window Design Criteria	Window Material	A1	2.815	2.815	3.074	3.852	2.963	3.778	2.407	3.259	3.000	3.037	3.778
	Window ratio to wall	A2	3.444	3.630	3.407	3.963	3.185	4.259	4.037	3.852	3.481	3.630	3.889
	Window dimension	A3	3.630	3.556	3.556	4.074	3.481	4.111	4.222	4.000	3.593	3.889	4.111
	Window location	A4	3.444	3.370	3.593	3.889	3.481	4.333	4.111	3.667	3.963	3.333	4.037
	Window direction	A5	3.778	3.815	4.037	4.074	3.778	5.815	3.963	4.148	3.926	3.963	4.185
	Openability	A6	3.519	3.593	3.556	4.037	3.704	4.000	4.296	4.000	3.333	3.741	3.815
	view and scape	A7	3.963	4.074	3.889	4.259	3.741	4.407	4.444	4.296	3.852	4.000	4.185
	Awning	A8	3.111	3.148	3.704	3.741	3.111	3.556	3.593	4.074	3.037	3.630	3.778
	Glass panes	A9	3.259	2.926	3.407	4.111	3.407	3.741	3.519	3.444	3.148	3.444	3.852
	Window form	A10	3.148	2.852	2.704	3.185	2.815	3.074	3.222	3.074	3.222	2.778	3.333
	Glass color and texture	A11	3.741	3.556	3.407	3.852	3.333	4.111	3.852	3.704	3.741	3.148	3.630
	Sill level	A12	3.815	3.815	3.741	3.926	3.667	4.519	4.481	3.667	4.222	3.889	4.148

5.1. Location and time of research

The research's statistical population comprises residential houses in District One of Zabol in the Sistan region, where 80 elderly individuals reside. According to the necessity of determining the sample size, a minimum of 66 individuals were determined through the sample size estimation table of Krejcie and Morgan. To account for potential decreases in respondents, 72 elderly individuals with moderate to high mental health were randomly selected and allocated for participation.

In cases where respondents faced challenges such as illiteracy, advanced age, impaired vision, or difficulty comprehending the questions, the questionnaire was administered through face-to-face or in-depth interviews conducted by the authors with the elderly residents of the Sistan region.

For data analysis, both descriptive and inferential statistical methods were employed. Additionally, the SECA multi-purpose decision system was utilized for calculations and information processing.

5.1.1. SECA analytical method

This technique was initially introduced by Mehdi Keshavarz Ghorabaee and his colleagues in 2018. The SECA method represents a novel approach to weighting criteria and ranking options simultaneously, employing a multi-objective nonlinear mathematical model to achieve this objective. To develop the mathematical model, two types of references are defined for the criteria weight. The first type is based on the variation information within the criteria, determined by the standard deviation, while the second type is linked to the variation information between the criteria, determined based on the degree of correlation. The multi-objective model aims to maximize the overall performance of each option and minimize the deviation of the weight criteria from the reference points. Unlike other methods, in the SECA method, the decision matrix for weighting the criteria and ranking the options is calculated concurrently. In contrast, in other methods, the criteria weight must be calculated initially using other techniques and then provided as input to subsequent steps. The following steps outline the SECA method:

First step: creating the decision matrix

In this step, a decision matrix is created, displaying the ranking or values of each option for each criterion. The elements of this matrix are denoted by (xij). Suppose there are (n) options and (m) criteria, and the decision matrix takes the following form:

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1j} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2j} & \cdots & x_{2m} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{i1} & x_{i2} & \cdots & x_{ij} & \cdots & x_{im} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nj} & \cdots & x_{nm} \end{bmatrix}, \quad (1)$$

Second step: normalization

In this stage, the decision matrix undergoes normalization. The SECA method employs two normalization techniques for positive and negative criteria. BC encompasses positive criteria, while NC encompasses negative criteria. Subsequently, to construct the non-linear programming model, the standard deviation of the elements within each vector provides internal variable information for the criterion. To derive inter-criterion variable information from the decision matrix, the correlation between each pair of criterion vectors is calculated. This relationship illustrates the degree of disparity between the j^{th} criterion and other criteria.

$$X^N = \begin{bmatrix} x_{11}^N & x_{12}^N & \cdots & x_{1j}^N & \cdots & x_{1m}^N \\ x_{21}^N & x_{22}^N & \cdots & x_{2j}^N & \cdots & x_{2m}^N \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{i1}^N & x_{i2}^N & \cdots & x_{ij}^N & \cdots & x_{im}^N \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{n1}^N & x_{n2}^N & \cdots & x_{nj}^N & \cdots & x_{nm}^N \end{bmatrix}, \quad (2)$$

$$\pi_j = \sum_{l=1}^{m} (1 - r_{jl}).$$

where

$$x_{ij}^N = \begin{cases} \dfrac{x_{ij}}{\max_k x_{kj}} & \text{if } j \in BC, \\ \dfrac{\min_k x_{kj}}{x_{ij}} & \text{if } j \in NC, \end{cases} \quad (3)$$

Third step: standard deviation

As the variability within the vector of a criterion (j) increases, and the discrepancy between criterion (j) and others widens, the importance (weight) of this criterion grows. Therefore, the normalized values of (j) and (j) serve as reference points for weighting the criteria. These values can be calculated as follows:

$$\sigma_j^N = \frac{\sigma_j}{\sum_{l=1}^{m} \sigma_l},$$

$$\pi_j^N = \frac{\pi_j}{\sum_{l=1}^{m} \pi_l}.$$

Fourth step: Changeability

The variability of the nonlinear programming function is ultimately formulated as follows:

$$\max \; S_i = \sum_{j=1}^{m} w_j x_{ij}^N, \quad \forall i \in \{1, 2, \ldots, n\},$$

$$\min \; \lambda_b = \sum_{j=1}^{m} \left(w_j - \sigma_j^N\right)^2,$$

$$\min \; \lambda_c = \sum_{j=1}^{m} \left(w_j - \pi_j^N\right)^2,$$

$$\text{s.t.} \; \sum_{j=1}^{m} w_j = 1,$$

$$w_j \leqslant 1, \quad \forall j \in \{1, 2, \ldots, m\},$$

$$w_j \geqslant \varepsilon, \quad \forall j \in \{1, 2, \ldots, m\}.$$

Fifth Step: Optimization

To optimize the relationship, the objective function technique is utilized to create a single-objective relationship, as described below. The objective is to maximize the minimum overall performance score of the options, based on the performance of the relationship goal. To minimize deviation from the reference points, they are reduced by the factor β from the objective function (β ≥ 0). This coefficient influences the importance of achieving the reference points of the criteria's weight. Solving this relationship determines the overall performance score of each option (Si) and the target weight of each criterion (Wj) (Keshavarz Ghorabaee et al., 2018).

$$\max \; Z = \lambda_a - \beta(\lambda_b + \lambda_c),$$

$$\text{s.t.} \;\; \lambda_a \leqslant S_i, \quad \forall i \in \{1, 2, \ldots, n\},$$

$$S_i = \sum_{j=1}^{m} w_j x_{ij}^N, \quad \forall i \in \{1, 2, \ldots, n\},$$

$$\lambda_b = \sum_{j=1}^{m} \left(w_j - \sigma_j^N\right)^2,$$

6. Findings

In the current research, data related to the criteria, including factors involved in the design of the window denoted as A, and options related to the mental health indicators of the elderly denoted as C, have been collected and presented (Tab. 5). Following the formation and normalization of the decision matrix, a nonlinear optimization model was constructed and solved using Lingo software. This model was implemented for β values ranging from 0.1 to 7. In each implementation, the criteria weights and option scores were determined. The weights of the criteria (C) and the scores of the options (A) for different values of β are provided in (Tab. 6) and (Tab. 7), respectively.

Tab. 5: The creation of decision matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
A1	0.710	0.691	0.761	0.904	0.784	0.650	0.537	0.759	0.711	0.759	0.903
A2	0.869	0.891	0.844	0.930	0.843	0.732	0.901	0.897	0.825	0.907	0.929
A3	0.916	0.873	0.881	0.957	0.922	0.707	0.942	0.931	0.851	0.972	0.982
A4	0.869	0.827	0.890	0.913	0.922	0.745	0.917	0.853	0.939	0.833	0.965
A5	0.953	0.936	1.000	0.957	1.000	1.000	0.884	0.966	0.930	0.991	1.000
A6	0.888	0.882	0.881	0.948	0.980	0.688	0.959	0.931	0.789	0.935	0.912
A7	1.000	1.000	0.963	1.000	0.990	0.758	0.992	1.000	0.912	1.000	1.000
A8	0.785	0.773	0.917	0.878	0.824	0.611	0.802	0.948	0.719	0.907	0.903
A9	0.822	0.718	0.844	0.965	0.902	0.643	0.785	0.802	0.746	0.861	0.920
A10	0.794	0.700	0.670	0.748	0.745	0.529	0.719	0.716	0.763	0.694	0.796
A11	0.944	0.873	0.844	0.904	0.882	0.707	0.860	0.862	0.886	0.787	0.867
A12	0.963	0.936	0.927	0.922	0.971	0.777	1.000	0.853	1.000	0.972	0.991

Tab. 6: Weighting criteria for different β values

criteria	β											
	0.1	0.2	0.3	0.4	0.5	1	2	3	4	5	6	7
C1	0.2358	0.1709	0.1461	0.1338	0.1248	0.1052	0.0955	0.0921	0.0906	0.0896	0.0890	0.0885
C2	0.0010	0.0531	0.0674	0.0747	0.0774	0.0814	0.0834	0.0839	0.0844	0.0845	0.0847	0.0848
C3	0.0010	0.0103	0.0370	0.0506	0.0571	0.0686	0.0743	0.0761	0.0772	0.0777	0.0781	0.0784
C4	0.1242	0.1168	0.1112	0.1084	0.1051	0.0971	0.0931	0.0919	0.0911	0.0907	0.0904	0.0902
C5	0.1038	0.1004	0.0958	0.0938	0.0910	0.0837	0.0801	0.0789	0.0782	0.0778	0.0776	0.0774
C6	0.0010	0.0010	0.0010	0.0010	0.0162	0.0630	0.0863	0.0941	0.0980	0.1004	0.1019	0.1030
C7	0.0767	0.1050	0.1119	0.1147	0.1151	0.1144	0.1140	0.1139	0.1138	0.1138	0.1137	0.1137
C8	0.0475	0.0800	0.0877	0.0916	0.0923	0.0923	0.0923	0.0923	0.0923	0.0923	0.0923	0.0923
C9	0.1803	0.1538	0.1422	0.1360	0.1309	0.1191	0.1132	0.1113	0.1103	0.1097	0.1093	0.1090
C10	0.0010	0.0481	0.0650	0.0735	0.0770	0.0825	0.0851	0.0860	0.0865	0.0868	0.0870	0.0871
C11	0.2276	0.1605	0.1346	0.1221	0.1128	0.0928	0.0827	0.0795	0.0778	0.0767	0.0761	0.0756

Tab. 7: Scoring options for different β values

criteria	β											
	0.1	0.2	0.3	0.4	0.5	1	2	3	4	5	6	7
A1	0.7750	0.7588	0.7535	0.7510	0.7479	0.7400	0.7361	0.7348	0.7341	0.7337	0.7335	0.7333
A2	0.8833	0.8846	0.8840	0.8838	0.8813	0.8739	0.8702	0.8690	0.8684	0.8680	0.8677	0.8676
A3	0.9275	0.9258	0.9242	0.9235	0.9198	0.9088	0.9033	0.9015	0.9006	0.9000	0.8996	0.8994
A4	0.9172	0.9055	0.9013	0.8992	0.8957	0.8862	0.8815	0.8799	0.8791	0.8787	0.8783	0.8781
A5	0.9604	0.9574	0.9575	0.9577	0.9583	0.9602	0.9611	0.9614	0.9616	0.9617	0.9618	0.9618
A6	0.8999	0.9054	0.9066	0.9071	0.9041	0.8944	0.8895	0.8879	0.8871	0.8866	0.8863	0.8860
A7	0.9822	0.9840	0.9840	0.9841	0.9806	0.9700	0.9647	0.9629	0.9620	0.9615	0.9612	0.9609
A8	0.8247	0.8298	0.8336	0.8356	0.8332	0.8246	0.8202	0.8188	0.8181	0.8176	0.8174	0.8172
A9	0.8527	0.8417	0.8382	0.8366	0.8326	0.8215	0.8160	0.8142	0.8132	0.8127	0.8123	0.8120
A10	0.7680	0.7538	0.7471	0.7438	0.7387	0.7251	0.7183	0.7160	0.7149	0.7142	0.7137	0.7134
A11	0.8937	0.8838	0.8795	0.8773	0.8735	0.8632	0.8581	0.8563	0.8555	0.8550	0.8546	0.8544
A12	0.9692	0.9627	0.9600	0.9586	0.9550	0.9451	0.9402	0.9385	0.9377	0.9372	0.9369	0.9366

The weights of the criteria and the scores of the options are depicted schematically in (Fig. 1) and (Fig. 2). As evident from both the tables and graphs, the graphs converge for values of β greater than 5, exhibiting minimal changes thereafter. Therefore, β=6 can be deemed as the converged value, and the weights of the criteria and the scores of the options are determined at this value, remaining fixed for the problem.

As determined from the results of the Seka method, at β=6, the weights of the criteria and the scores of the options have been calculated and are provided in (Tab. 8) and (Tab. 9), respectively. The results are depicted in (Fig. 3) and (Fig. 4).

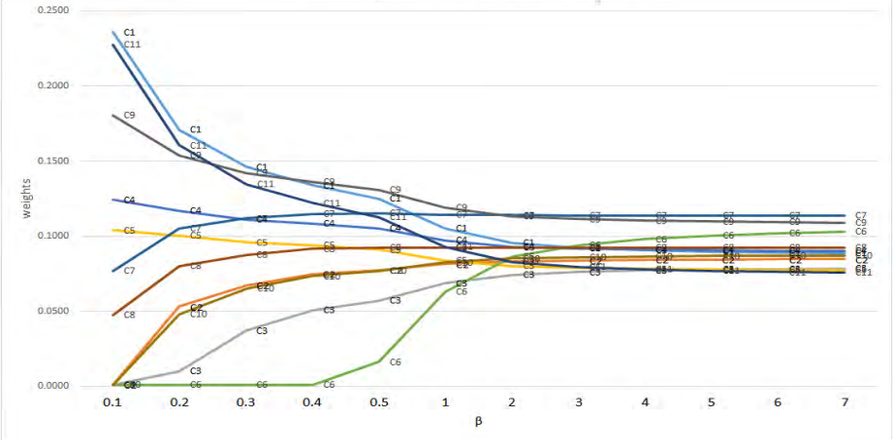

Fig. 1: Weight changes of criteria for different β values

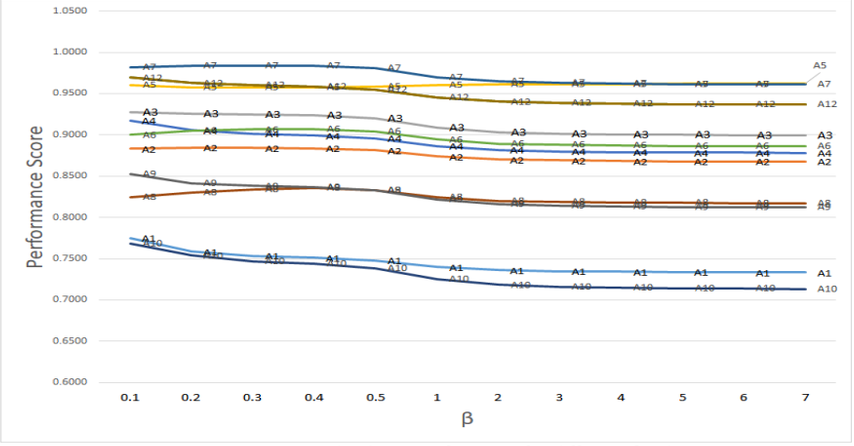

Fig. 2: Weight changes of options for different β values

Tab. 8: Weight and priority of criteria

Option name	Criteria Code	Criteria Weight	Rank
Anxiety	C1	% 8.96	6
Depression	C2	% 8.45	8
Sleep quality	C3	% 7.77	10
Safety	C4	% 9.07	5
Stress	C5	% 7.78	9
Privacy	C6	% 10.04	3
Communication with outside	C7	% 11.38	1
Sense of wellness	C8	% 9.23	4
Cultural and religious beliefs	C9	% 10.97	2
Physical health	C10	% 8.68	7
Quietness	C11	% 7.67	11

Tab. 9: Weight and priority of options

Option name	Normalized score (Weight)	Option score	Option code	Rank
Window Material	% 7.10	0.7337	A1	11
Window ratio to wall	% 8.41	0.8680	A2	7
Window dimension	% 8.72	0.9000	A3	4
Window location	% 8.51	0.8787	A4	6
Window direction	% 9.31	0.9617	A5	1
Openability	% 8.59	0.8866	A6	5
view and scape	% 9.31	0.9615	A7	2
Awning	% 7.92	0.8176	A8	9
Glass panes	% 7.87	0.8127	A9	10
Window form	% 6.92	0.7142	A10	12
Glass color and texture	% 8.28	0.8550	A11	8
Sill level	% 9.08	0.9372	A12	3

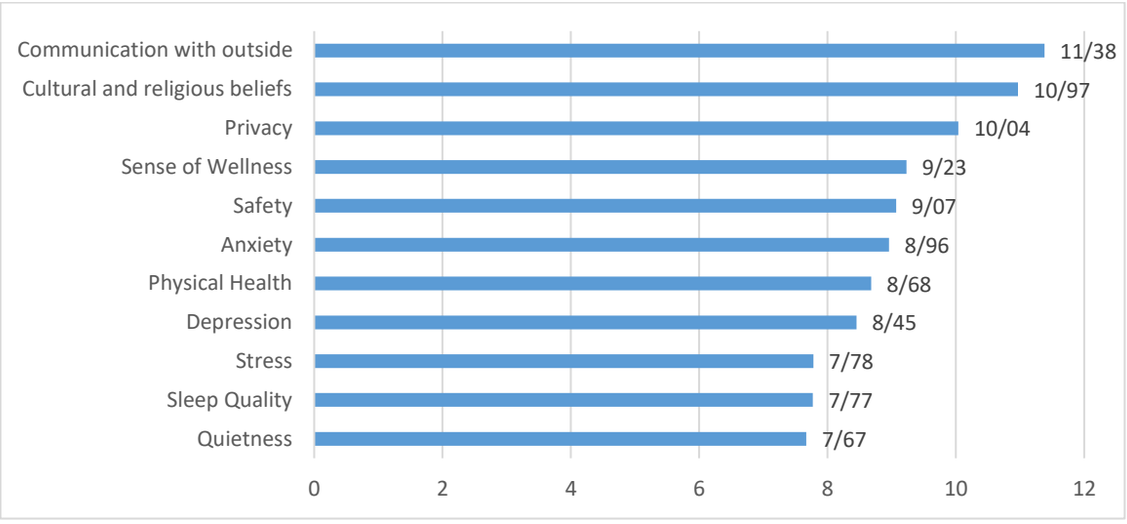

Fig. 3: Weight and Rank of criteria

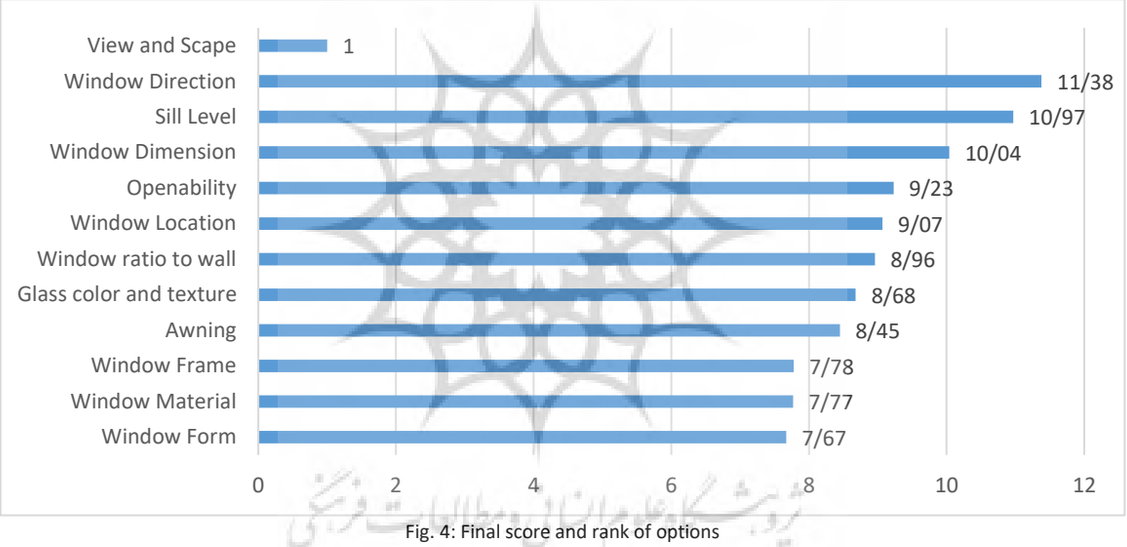

Fig. 4: Final score and rank of options

The results obtained from the analysis of the criteria for the mental health of the elderly in the Sistan region reveal that communication with outside, with 11.38%, secured the first place among the evaluated criteria. Cultural and Religious beliefs followed closely behind, ranking second with 10.97%, while privacy claimed the third position with 10.04%. Conversely, stress, sleep quality, and quietness obtained the lowest rankings, with 7.87%, 7.77%, and 7.67%, respectively.

Regarding the analysis of options (factors influencing window design), the view and scape and window direction option emerged as the first and the second priority with 9.31%, closely trailed by sill level with 9.08%. Conversely, the window frame, window material, and window form received the lowest rankings, with 7.87%, 7.10%, and 6.92%, respectively.

The analysis indicates a significant relationship between each criterion involved in window design and the mental health of the elderly in the Sistan region. Consequently, it can be inferred that the window design can potentially contribute to improving the mental health of the elderly in the Sistan region.

7. Conclusion

The increasing elderly population in Iran and globally underscores the critical importance of addressing elderly health issues. With Iran's elderly population projected to reach 18 million by 1430 according to population forecasts, the identification and prioritization of the psychological and spiritual needs of this demographic, as well as the provision of elderly care services, have become imperative.

Given that individuals spend a significant portion of their lives at home, the house and residential environment play a pivotal role in shaping their health and mental well-being. As such, the home environment, often regarded as "the most important place in our life," warrants thorough investigation, particularly considering its profound emotional and psychological impact on residents. Aligning the home environment with the psychological needs of its occupants is paramount.

Furthermore, the significance of windows in fostering health and well-being has long been recognized. Particularly for the elderly, who often spend much of their time indoors, windows serve as vital conduits for connecting with the external environment, fostering exploration, understanding, and appreciation of their surroundings. Additionally, windows can promote positive emotions and alertness among the elderly, further highlighting their importance in enhancing overall well-being.

The aim of this research was to identify the influential factors in window design that could enhance the mental health of the elderly in the Sistan region. Through the research findings, 11 factors were pinpointed as significant contributors to the mental health of the elderly, all of which are intertwined with window design considerations. According to feedback from the elderly participants, the factor of communication with outside emerged as the most impactful on their mental health, followed by religious and cultural beliefs in second place, and privacy in third. Subsequent priorities included the sense of wellness, safety, anxiety, physical health, depression, stress, sleep quality, and quietness, in descending order of importance. The degree of connection with the outside environment correlates directly with the mental health experienced by the elderly. Notably, the view and scape afforded by a window emerged as the most influential factor in establishing this connection. Conversely, quietness received the lowest weighting in the mental health equation for the elderly in the Sistan region. Viewed in detail, the significance of the view and panorama outweighs all other components in window design when it comes to improving the mental health of the elderly. Specifically, if communication with the external environment is prioritized, the impact of quietness on mental health improvement is diminished by a factor of eleven. In light of these findings, prioritizing the factors involved in window design becomes essential for enhancing the mental health of the elderly in the Sistan region. Thus, the order of importance from highest to lowest weight ratio should be as follows: view and scape, window direction, window-to-floor distance (sill level), window dimensions, openability, window location, surface-to-window ratio, glass color and texture, awning, window frame, window material, and window form. In another word, the view and scape emerges as paramount for fostering the mental health of the elderly in the Sistan region.

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بررسی تأثیر پنجره بر سلامت روان کاربر
(مطالعه موردی: سالمندان منطقه سیستان)

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چکیده

پژوهش حاضر بر شناسایی شاخص‌های مؤثر بر سلامت روان سالمندان منطقه‌ی سیستان و تأثیر پنجره بر بهبود این شاخص‌ها متمرکز شده و به این سؤال پاسخ می‌دهد که پنجره تا چه میزان بر سلامت روان سالمندان منطقه سیستان تأثیر دارد؟ روش تحقیق پژوهش مبتنی بر بررسی متون، مقالات و طراحی پرسشنامه است که روایی محتوایی به روش لاوشه و بر اساس کسب نظر خبرگان، پایایی به روش ضریب آلفای کرونباخ و کلیه تحلیل‌ها به روش تحلیلی برنامه‌ریزی غیرخطی چند هدفِ SECA مورد تجزیه و تحلیل قرار گرفته است. یافته‌های پژوهش نشان می‌دهد که در بین شاخص‌های سلامت روان سالمندان، ارتباط با محیط بیرون بیشترین و آرامش کمترین سطح تأثیر را دارند. همچنین، از میان تمام مؤلفه‌های مؤثر طراحی پنجره بر بهبود سلامت روان سالمندان منطقه سیستان، دید و منظر بیشترین و شکل پنجره کمترین تأثیر را دارند.

واژگان کلیدی

پنجره، سلامت روان، سالمندان، سکا، سیستان.

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۱. مقدمه و چهارچوب نظری مفهوم سلامت و تأثیر مسکن و پنجره در سلامت روان

برآورد شده در سطح جهان سهم جمعیت سالمندان ٦٠ سال و بالاتر در سال ۲۰۵۰ میلادی بـه حـدود ۲۲ درصـد برسـد (WHO, 2007). بر اساس سرشماری ۱۳۹۰ ایران، ٤/۳ میلیون و بر اساس پیش‌بینی‌های جمعیتی تا سال ۱٤۳۰، تعداد سالمندان ٦٥ سـال و بالاتر ایران به ۱۸ میلیون نفر افزایش می‌یابد (Sadeghi, 2013). فرآیند سالمندی پیامدهای روانی و تغییر خلق و خـوی را در کنـار مشکلات فیزیولوژیکی ایجاد می‌نماید. از سوی دیگر، ساخت و سازهای اخیر، موجبات افت کیفیت زندگی و بـروز بســـیاری از بیماری‌های جسمی و روانی در انسان امروز شده است (Garousi & Shamsaldini Motlagh, 2014). شواهد نشـان مـی‌دهـد کـه ویژگی‌های طراحی مسکن مانند میزان نور روز، تهویه مناسب و دید و منظر مطلوب می‌توانـد تـأثیر مثبـت هم‌زمـان بـر سـلامت روانی و فیزیکی داشته باشد. پنجره‌ها به عنوان تأمین‌کننده‌ی نور روز و دید به فضای بیرونـی در حوزه‌هـای تخصصـی معمـاری، روشنایی، فتوبیولوژی و روانشناسی مورد توجه قرار گرفته‌اند.

در پژوهش فراتحلیل عرب‌زاده در حیطه‌ی سلامت روان سالمندان در طی سـال‌هـای ۱۳۹٤-۱۳۸٤، از عوامـل فـردی، اجتمـاعی، روانی و جمعیت‌شناختی به عنوان شاخص‌های مؤثر بر سالمندان یاد می‌شود (Arabzadeh, 2016). ارتقای کیفیت محـیط زنـدگی به معنای عرضه‌ی پاسخ‌های مناسب از محیط به نیازهای متفاوت فیزیولوژیکی و روانـی کـاربران آن فضـا اسـت (Bitaraf et al., 2017). یکی از مهمترین عوامل برای طراحی محیط فیزیکی، پنجره بوده که اهمیت آن به عنوان یک عامل مؤثر در سلامتی و رفـاه از دیرباز شناخته شده است. اگرچه تحقیقات زیادی بر جنبه‌های مختلف پنجره مانند دید، نور روز و تهویه متمرکز شده است؛ امـا پژوهش خاصی به تأثیر کلی یک پنجره بر ساکنان آن متمرکز نشده است (Farley & Veitch, 2001). این در حالی است کـه بـرای بهبود واقعی رفاه انسان، طراحی ساختمان به حرکتی فراتر از بهینه‌سازی پارامترهـای کمـی نظیـر دمـا، نـور و رطوبـت و بـه یـک رویکرد جامع‌تری نیاز دارد که نشانه‌هایش را در رفتار انسان نشان دهد (Steemers, 2015). بـا مـرور تحقیقـات پیشـین می‌تـوان دریافت تحقیقات و مطالعات اندکی به بررسی موضوع نقش پنجره بر سلامت روان سالمندان پرداخته‌اند. از این‌رو تحقیـق حاضـر با توجه به اهمیت تأثیر پنجره بر سلامت روان سالمندان در محیط‌های مســکونی، مبتنی بر این فرضیه صـورت گرفتـه اسـت کـه رابطه معناداری بین عوامل دخیل در طراحی پنجره و بهبود سلامت روان سالمندان منطقه سیستان وجود دارد.

۲. روش‌شناسی و نتایج پژوهش

در تحقیق حاضر دو پرســشنامه‌ی شناسایی شاخص‌های سلامت روان سالمندان و میزان تأثیرگـذاری عوامـل دخیـل در طراحـی پنجره بر سلامت روان سالمندان منطقه سیستان به شیوه میدانی جمع‌آوری شده است. در گـام اول جهـت شناسـایی شـاخص‌های سلامت روان سالمندان با استفاده از مطالعات اسنادی، پرســشنامه‌ای شــامل معرفی ۲۲ شاخص مؤثر بر سـلامت روان سـالمندان با امتیازدهی بر مبنای مقیاس چهار عاملی طیف لیکرت تهیه شد. روایی پرســشنامه اول به روش لاوشه و بر اساس کسب نظـر از ۱۲ نفر از خبرگان روانشناسی متخصص در حوزه سلامت روان سالمندان و پایایی آن بـر اسـاس ضـریب آلفـای کرونبـاخ تعیـین گردید. طبق (جدول ۱)، حداقل مقدار CVR قابل قبول ۰/٥٤ است ولی برای افزایش دقـت CVR، مقـدار ۰/٦ مـورد پـذیرش قـرار گرفت. با توجه به مناسب بودن ضرایب آلفا، اعتبـار پرسشـنامه تأییـد مـی‌شـود و سـازگاری درونـی گویـه‌هـا، CVI، در شـاخص ســلامت روان برای این تحقیق در محدوده قابل قبول تا عالی قرارگرفته اسـت (جـدول ۲)؛ بنـابراین از ۲۲ شـاخص بیـان شـده مقادیری که پایایی آنها بالای ۰/٦۰ شد، مورد پذیرش و بقیه موارد حذف شدند (جدول ۳).

جدول ۱: تعیین حداقل CVR قابل قبول بر اساس تعداد متخصصین

تعداد متخصصین	حداقل CVR قابل قبول
۵	۰/۹۹
۶	۰/۹۹
۷	۰/۹۹
۸	۰/۷۸
۹	۰/۷۵
۱۰	۰/۶۲
۱۱	۰/۵۹
۱۲	۰/۵۶
۱۸	۰/۴۵

جدول ۲: سطوح آلفای کرونباخ و ارزیابی پایایی پرسشنامه

مقدار ضریب آلفای کرونباخ	سازگاری داخلی گویه‌ها
≤α۰/۹	عالی
۰/۹≤α<۰/۸	مناسب
۰/۸≤α<۰/۷	قابل قبول
۰/۷≤α<۰/۶	مشکوک
۰/۶≤α<۰/۵	ضعیف
۰/۵α<	غیرقابل قبول

جدول ۳: میزان پایایی و روایی شاخص‌های سلامت روان سالمندان

ردیف	گویه	پایایی	روایی
	شاخص‌های زیر تا چه میزان با موضوع سلامت روان سالمندان مرتبط است؟	CVI	CVR
۱	اضطراب	۰/۹	۱
۲	افسردگی	۱	۰/۸
۳	کیفیت خواب	۰/۹	۱
۴	امنیت (فیزیکی و روانی)	۱	۱
۵	استرس	۰/۸	۰/۸
۶	خستگی	۰/۷	۰/۲
۷	رضایت از زندگی	۱	۱
۸	شادی	۱	۰/۸
۹	حریم خصوصی (محرمیت)	۰/۸	۱
۱۰	ارتباط با محیط	۰/۹	۱
۱۱	ناتوانی (ذهنی، جسمی)	۰/۷	۰/۴
۱۲	انزوا	۰/۸	۰/۶
۱۳	زوال عقل	۰/۸	۰/۲
۱۴	سلامت جسمانی	۰/۹	۱
۱۵	حس تندرستی	۰/۸	۱
۱۶	اعتقادات مذهبی	۰/۹	۱
۱۷	مسائل فرهنگی	۰/۷	۱
۱۸	ارتباط با طبیعت	۱	۱
۱۹	فعالیت اجتماعی	۱	۱
۲۰	رفاه اجتماعی	۱	۱
۲۱	استقلال	۱	۱
۲۲	آرامش	۰/۷	۰/۶

در ادامه شاخص‌های مورد پذیرش حسب ارتباط آنها با متغیر مستقل پنجره از طریق روش دلفی خبرگان تجمیع و تعداد ۱۱ شاخص نهایی مؤثر بر سلامت روان سالمندان استخراج و تعیین گردید. در گام دوم عوامل دخیل در طراحی پنجره از مقالات و پژوهش‌های انجام گرفته استخراج شده و حسب نظر خبرگان معماری و روش دلفی خبرگان، ۱۲ شاخص مؤثر در طراحی پنجره مستخرج شد. ماتریس تحلیلی مرتبط تشکیل و از آن پرسشنامه‌ای با ۱۳۲ سؤال تهیه و تنظیم گردید. سپس امتیازها با روش میانگین حسابی ادغام در سیستم ماتریس تحلیلی SECA مورد تجزیه و تحلیل قرار گرفت (جدول ٤).

جدول ۴: ماتریس تحلیلی و میانگین پاسخ سالمندان به شاخص‌ها و معیارهای پرسشنامه

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
A1	۲/۸۱۵	۲/۸۱۵	۳/۰۷۴	۳/۸۵۲	۲/۹۶۳	۳/۷۷۸	۲/۴۰۷	۳/۲۵۹	۳/۰۰۰	۳/۰۳۷	۳/۷۷۸
A2	۳/۴۴۴	۳/۶۳۰	۳/۴۰۷	۳/۹۶۳	۳/۱۸۵	۴/۲۵۹	۴/۰۳۷	۳/۸۵۲	۳/۴۸۱	۳/۶۳۰	۳/۸۸۹
A3	۳/۶۳۰	۳/۵۵۶	۳/۵۵۶	۴/۰۷۴	۳/۴۸۱	۴/۱۱۱	۴/۲۲۲	۴/۰۰۰	۳/۵۹۳	۳/۸۸۹	۴/۱۱۱
A4	۳/۴۴۴	۳/۳۷۰	۳/۵۹۳	۳/۸۸۹	۳/۴۸۱	۳/۳۳۳	۴/۱۱۱	۳/۶۶۷	۳/۹۶۳	۳/۳۳۳	۴/۰۳۷
A5	۳/۷۷۸	۳/۸۱۵	۴/۰۳۷	۴/۰۷۴	۳/۷۷۸	۵/۸۱۵	۳/۹۶۳	۴/۱۴۸	۳/۹۲۶	۳/۹۶۳	۴/۱۸۵
A6	۳/۵۱۹	۳/۵۹۳	۳/۵۵۶	۴/۰۳۷	۳/۷۰۴	۴/۰۰۰	۴/۲۹۶	۴/۰۰۰	۳/۳۳۳	۳/۷۴۱	۳/۸۱۵
A7	۳/۹۶۳	۴/۰۷۴	۳/۸۸۹	۴/۲۵۹	۳/۷۰۴	۴/۴۰۷	۴/۴۴۴	۴/۲۹۶	۳/۸۵۲	۴/۰۰۰	۴/۱۸۵
A8	۳/۱۱۱	۳/۱۴۸	۳/۷۰۴	۳/۷۴۱	۳/۱۱۱	۳/۵۵۶	۳/۵۹۳	۴/۰۷۴	۳/۰۳۷	۳/۶۳۰	۳/۷۷۸
A9	۳/۲۵۹	۲/۹۲۶	۳/۴۰۷	۴/۱۱۱	۳/۴۰۷	۳/۷۴۱	۳/۵۱۹	۳/۴۴۴	۳/۱۴۸	۳/۴۴۴	۳/۸۵۲
A10	۳/۱۴۸	۲/۸۵۲	۲/۷۰۴	۳/۱۸۵	۲/۸۱۵	۳/۰۷۴	۳/۲۲۲	۳/۰۷۴	۳/۲۲۲	۲/۷۷۸	۳/۳۳۳
A11	۳/۷۴۱	۳/۵۵۶	۳/۴۰۷	۳/۸۵۲	۳/۳۳۳	۴/۱۱۱	۳/۸۵۲	۳/۷۰۴	۳/۷۴۱	۳/۱۴۸	۳/۶۳۰
A12	۳/۸۱۵	۳/۸۱۵	۳/۷۴۱	۳/۹۲۶	۳/۶۶۷	۴/۵۱۹	۴/۴۸۱	۳/۶۶۷	۴/۲۲۲	۳/۸۸۹	۴/۱۴۸

جامعه آماری شـــامل خانه‌های مسکونی منطقه یک شهرستان زابل از منطقه سیستان است که تعداد سالمندان ساکن در این منطقـه ۸۰ نفر هستند. با توجه به ضرورت تعیین حجم نمونه، از طریق جدول برآورد حجم نمونه کرجسـی مـــورگان حـداقل ٦٦ نفـر تعیین گردیده و با توجه به احتمال ریزش تعداد پاسخ‌دهندگان، ۷۲ نفر برای پاسخ از سالمندان با سلامت روان متوسط به بـالا بـه صورت تصادفی انتخاب و توزیع شد.

انجام محاسبات و پردازش اطلاعات از سیستم تصمیم‌گیری چند منظوره‌ی SECA استفاده شده است. در پژوهش حاضر، داده‌هـای مربوط به معیارها شامل عوامل دخیل در طراحی پنجره با A و گزینه‌های مربـوط بـه شـاخص‌های سـلامت روان سـالمندان بـا C گردآوری و نشان داده شده است (جدول ۵). پس از تشکیل ماتریس تصمیم، نرمال‌سازی آن و یک مـدل بهینـه‌سـازی غیرخطـی تشکیل و توسط نرم‌افزار Lingo حل شده است که در این مدل به ازای مقادیر β از ۰/۱ تا ۷ مدل اجرا شـده اسـت و در هـر بـار اجرا، وزن معیارها و امتیاز گزینه‌ها حاصل شده است. مقادیر وزن معیارها C، امتیاز گزینه‌ها A، به ترتیب در (جدول ٦) و (جـدول ۷) به ازای مقادیر مختلف β ارائه شده است.

جدول ۵: تشکیل ماتریس تصمیم

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
A1	۰,۷۱۰	۰,۶۹۱	۰,۷۶۱	۰,۹۰۴	۰,۷۸۴	۰,۶۵۰	۰,۵۳۷	۰,۷۵۹	۰,۷۱۱	۰,۷۵۹	۰,۹۰۳
A2	۰,۸۶۹	۰,۸۹۱	۰,۸۴۴	۰,۹۳۰	۰,۸۴۳	۰,۷۳۲	۰,۹۰۱	۰,۸۹۷	۰,۸۲۵	۰,۹۰۷	۰,۹۲۹
A3	۰,۹۱۶	۰,۸۷۳	۰,۸۸۱	۰,۹۵۷	۰,۹۲۲	۰,۷۰۷	۰,۹۴۲	۰,۹۳۱	۰,۸۵۱	۰,۹۷۲	۰,۹۸۲
A4	۰,۸۶۹	۰,۸۲۷	۰,۸۹۰	۰,۹۱۳	۰,۹۲۲	۰,۷۴۵	۰,۹۱۷	۰,۸۵۳	۰,۹۳۹	۰,۸۳۳	۰,۹۶۵
A5	۰,۹۵۳	۰,۹۳۶	۱,۰۰۰	۰,۹۵۷	۱,۰۰۰	۱,۰۰۰	۰,۸۸۴	۰,۹۶۶	۰,۹۳۰	۰,۹۹۱	۱,۰۰۰
A6	۰,۸۸۸	۰,۸۸۲	۰,۸۸۱	۰,۹۴۸	۰,۹۸۰	۰,۶۸۸	۰,۹۵۹	۰,۹۳۱	۰,۷۸۹	۰,۹۳۵	۰,۹۱۲
A7	۱,۰۰۰	۱,۰۰۰	۰,۹۶۳	۱,۰۰۰	۰,۹۹۰	۰,۷۵۸	۰,۹۹۲	۱,۰۰۰	۰,۹۱۲	۱,۰۰۰	۱,۰۰۰
A8	۰,۷۸۵	۰,۷۷۳	۰,۹۱۷	۰,۸۷۸	۰,۸۲۴	۰,۶۱۱	۰,۸۰۲	۰,۹۴۸	۰,۷۱۹	۰,۹۰۷	۰,۹۰۳
A9	۰,۸۲۲	۰,۷۱۸	۰,۸۴۴	۰,۹۶۵	۰,۹۰۲	۰,۶۴۳	۰,۷۸۵	۰,۸۰۲	۰,۷۴۶	۰,۸۶۱	۰,۹۲۰
A10	۰,۷۹۴	۰,۷۰۰	۰,۶۷۰	۰,۷۴۸	۰,۷۴۵	۰,۵۲۹	۰,۷۱۹	۰,۷۱۶	۰,۷۶۳	۰,۶۹۴	۰,۷۹۶
A11	۰,۹۴۴	۰,۸۷۳	۰,۸۴۴	۰,۹۰۴	۰,۸۸۲	۰,۷۰۷	۰,۸۶۰	۰,۸۶۲	۰,۸۸۶	۰,۷۸۷	۰,۸۶۷
A12	۰,۹۶۳	۰,۹۳۶	۰,۹۲۷	۰,۹۲۲	۰,۹۷۱	۰,۷۷۷	۱,۰۰۰	۰,۸۵۳	۱,۰۰۰	۰,۹۷۲	۰,۹۹۱

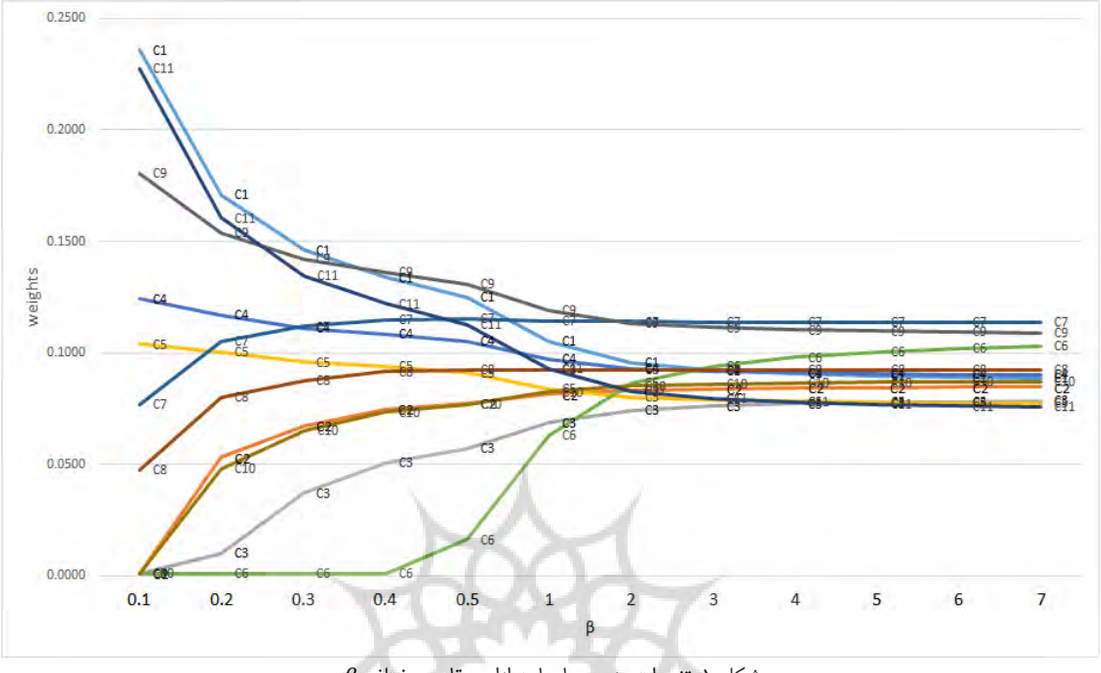
جدول ۶: وزن معیارها به ازای مقادیر مختلف β

معیارها	β											
	۰,۱	۰,۲	۰,۳	۰,٤	۰,٥	۱	۲	۳	٤	٥	٦	۷
C1	۰,۲۳۵۸	۰,۱۷۰۹	۰,۱۴۶۱	۰,۱۳۳۸	۰,۱۲۴۸	۰,۱۰۵۲	۰,۰۹۵۵	۰,۰۹۲۱	۰,۰۹۰۶	۰,۰۸۹۶	۰,۰۸۹۰	۰,۰۸۸۵
C2	۰,۰۰۱۰	۰,۰۵۳۱	۰,۰۶۷۴	۰,۰۷۴۷	۰,۰۷۷۴	۰,۰۸۱۴	۰,۰۸۳۴	۰,۰۸۳۹	۰,۰۸۴۴	۰,۰۸۴۵	۰,۰۸۴۷	۰,۰۸۴۸
C3	۰,۰۰۱۰	۰,۰۱۰۳	۰,۰۳۷۰	۰,۰۵۰۶	۰,۰۵۷۱	۰,۰۶۸۶	۰,۰۷۴۳	۰,۰۷۶۱	۰,۰۷۷۲	۰,۰۷۷۷	۰,۰۷۸۱	۰,۰۷۸۴
C4	۰,۱۲۴۲	۰,۱۱۶۸	۰,۱۱۱۲	۰,۱۰۸۴	۰,۱۰۵۱	۰,۰۹۷۱	۰,۰۹۳۱	۰,۰۹۱۹	۰,۰۹۱۱	۰,۰۹۰۷	۰,۰۹۰۴	۰,۰۹۰۲
C5	۰,۱۰۳۸	۰,۱۰۰۴	۰,۰۹۵۸	۰,۰۹۳۸	۰,۰۹۱۰	۰,۰۸۳۷	۰,۰۸۰۱	۰,۰۷۸۹	۰,۰۷۸۲	۰,۰۷۷۸	۰,۰۷۷۶	۰,۰۷۷۴
C6	۰,۰۰۱۰	۰,۰۰۱۰	۰,۰۰۱۰	۰,۰۰۱۰	۰,۰۱۶۲	۰,۰۶۳۰	۰,۰۸۶۳	۰,۰۹۴۱	۰,۰۹۸۰	۰,۱۰۰۴	۰,۱۰۱۹	۰,۱۰۳۰
C7	۰,۰۷۶۷	۰,۱۰۵۰	۰,۱۱۱۹	۰,۱۱۴۷	۰,۱۱۵۱	۰,۱۱۴۴	۰,۱۱۴۰	۰,۱۱۳۹	۰,۱۱۳۸	۰,۱۱۳۸	۰,۱۱۳۷	۰,۱۱۳۷
C8	۰,۰۴۷۵	۰,۰۸۰۰	۰,۰۸۷۷	۰,۰۹۱۶	۰,۰۹۲۳	۰,۰۹۲۳	۰,۰۹۲۳	۰,۰۹۲۳	۰,۰۹۲۳	۰,۰۹۲۳	۰,۰۹۲۳	۰,۰۹۲۳
C9	۰,۱۸۰۳	۰,۱۵۳۸	۰,۱۴۲۲	۰,۱۳۶۰	۰,۱۳۰۹	۰,۱۱۹۱	۰,۱۱۳۲	۰,۱۱۱۳	۰,۱۱۰۳	۰,۱۰۹۷	۰,۱۰۹۳	۰,۱۰۹۰
C10	۰,۰۰۱۰	۰,۰۴۸۱	۰,۰۶۵۰	۰,۰۷۳۵	۰,۰۷۷۰	۰,۰۸۲۵	۰,۰۸۵۱	۰,۰۸۶۰	۰,۰۸۶۵	۰,۰۸۶۸	۰,۰۸۷۰	۰,۰۸۷۱
C11	۰,۲۲۷۶	۰,۱۶۰۵	۰,۱۳۴۶	۰,۱۲۲۱	۰,۱۱۲۸	۰,۰۹۲۸	۰,۰۸۲۷	۰,۰۷۹۵	۰,۰۷۷۸	۰,۰۷۶۷	۰,۰۷۶۱	۰,۰۷۵۶

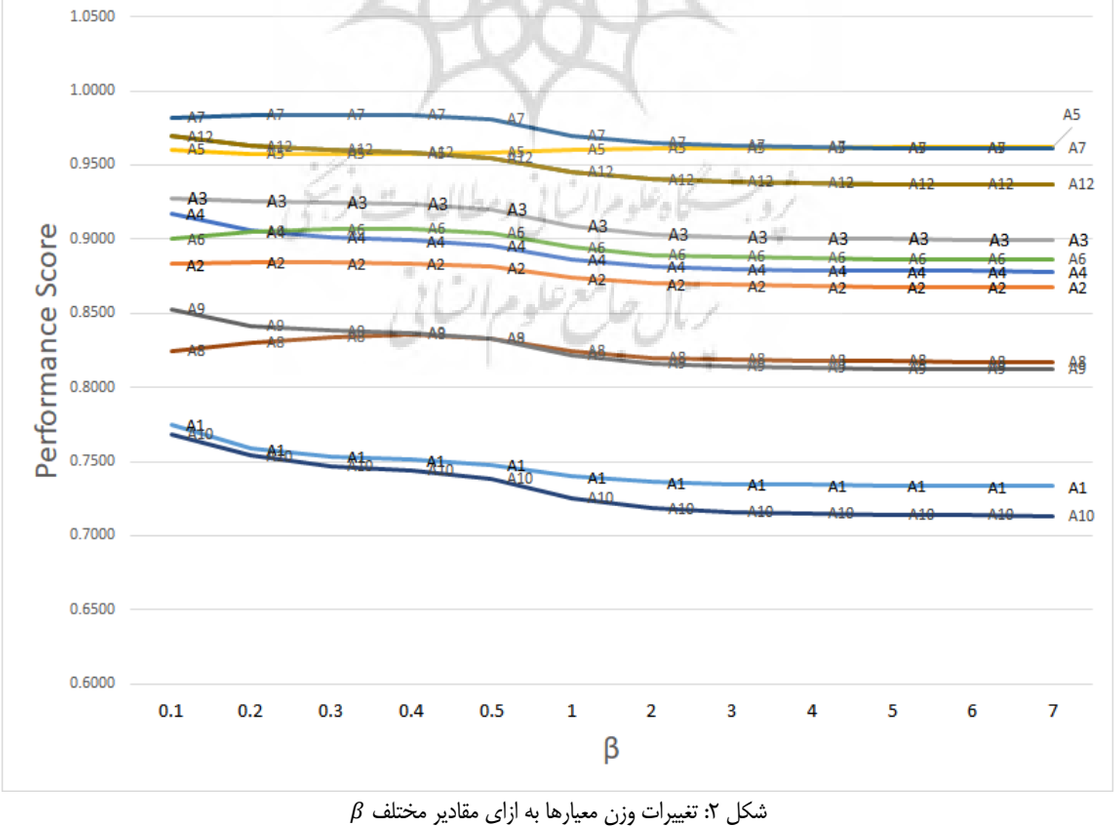
جدول ۷: امتیاز گزینه‌ها به ازای مقادیر مختلف β

	B											
	۰,۱	۰,۲	۰,۳	۰,٤	۰,٥	۱	۲	۳	٤	٥	٦	۷
A1	۰,۷۷۵۰	۰,۷۵۸۸	۰,۷۵۳۵	۰,۷۵۱۰	۰,۷۴۷۹	۰,۷۴۰۰	۰,۷۳۶۱	۰,۷۳۴۸	۰,۷۳۴۱	۰,۷۳۳۷	۰,۷۳۳۵	۰,۷۳۳۳
A2	۰,۸۸۳۳	۰,۸۸۴۶	۰,۸۸۴۰	۰,۸۸۳۸	۰,۸۸۱۳	۰,۸۷۳۹	۰,۸۷۰۲	۰,۸۶۹۰	۰,۸۶۸۴	۰,۸۶۸۰	۰,۸۶۷۷	۰,۸۶۷۶
A3	۰,۹۲۷۵	۰,۹۲۵۸	۰,۹۲۴۲	۰,۹۲۳۵	۰,۹۱۹۸	۰,۹۰۸۸	۰,۹۰۳۳	۰,۹۰۱۵	۰,۹۰۰۶	۰,۹۰۰۰	۰,۸۹۹۶	۰,۸۹۹۴
A4	۰,۹۱۷۲	۰,۹۰۵۵	۰,۹۰۱۳	۰,۸۹۹۲	۰,۸۹۵۷	۰,۸۸۶۲	۰,۸۸۱۵	۰,۸۷۹۹	۰,۸۷۹۱	۰,۸۷۸۷	۰,۸۷۸۳	۰,۸۷۸۱
A5	۰,۹۶۰۴	۰,۹۵۷۴	۰,۹۵۷۵	۰,۹۵۷۷	۰,۹۵۸۳	۰,۹۶۰۲	۰,۹۶۱۱	۰,۹۶۱۴	۰,۹۶۱۶	۰,۹۶۱۷	۰,۹۶۱۸	۰,۹۶۱۸
A6	۰,۸۹۹۹	۰,۹۰۵۴	۰,۹۰۶۶	۰,۹۰۷۱	۰,۹۰۴۱	۰,۸۹۴۴	۰,۸۸۹۵	۰,۸۸۷۹	۰,۸۸۷۱	۰,۸۸۶۶	۰,۸۸۶۳	۰,۸۸۶۰
A7	۰,۹۸۲۲	۰,۹۸۴۰	۰,۹۸۴۰	۰,۹۸۴۱	۰,۹۸۰۶	۰,۹۷۰۰	۰,۹۶۴۷	۰,۹۶۲۹	۰,۹۶۲۰	۰,۹۶۱۵	۰,۹۶۱۲	۰,۹۶۰۹
A8	۰,۸۲۴۷	۰,۸۲۹۸	۰,۸۳۳۶	۰,۸۳۵۶	۰,۸۳۳۲	۰,۸۲۴۶	۰,۸۲۰۲	۰,۸۱۸۸	۰,۸۱۸۱	۰,۸۱۷۶	۰,۸۱۷۴	۰,۸۱۷۲
A9	۰,۸۵۲۷	۰,۸۴۱۷	۰,۸۳۸۲	۰,۸۳۶۶	۰,۸۳۲۶	۰,۸۲۱۵	۰,۸۱۶۰	۰,۸۱۴۲	۰,۸۱۳۲	۰,۸۱۲۷	۰,۸۱۲۳	۰,۸۱۲۰
A10	۰,۷۶۸۰	۰,۷۵۳۸	۰,۷۴۷۱	۰,۷۴۳۸	۰,۷۳۸۷	۰,۷۲۵۱	۰,۷۱۸۳	۰,۷۱۶۰	۰,۷۱۴۹	۰,۷۱۴۲	۰,۷۱۳۷	۰,۷۱۳۴
A11	۰,۸۹۳۷	۰,۸۸۳۸	۰,۸۷۹۵	۰,۸۷۷۳	۰,۸۷۳۵	۰,۸۶۳۲	۰,۸۵۸۱	۰,۸۵۶۳	۰,۸۵۵۵	۰,۸۵۵۰	۰,۸۵۴۶	۰,۸۵۴۴
A12	۰,۹۶۹۲	۰,۹۶۲۷	۰,۹۶۰۰	۰,۹۵۸۶	۰,۹۵۵۰	۰,۹۴۵۱	۰,۹۴۰۲	۰,۹۳۸۵	۰,۹۳۷۷	۰,۹۳۷۲	۰,۹۳۶۹	۰,۹۳۶۶

(شکل ۱) و (شکل ۲) وزن معیارها و امتیاز گزینه‌ها آورده شده است. همان‌طور که اشکال نشان می‌دهند از مقادیر $\beta > 5$ نمودارها همگرا شده و تغییرات زیادی ندارند. در نتیجه می‌توان $\beta = 6$ را مقدار همگرا شده‌ای در نظر گرفت به نحوی که به ازای این مقدار، وزن معیارها و امتیاز گزینه‌ها برای مسئله ثابت است.



شکل ۱: تغییرات وزن معیارها به ازای مقادیر مختلف β



شکل ۲: تغییرات وزن معیارها به ازای مقادیر مختلف β

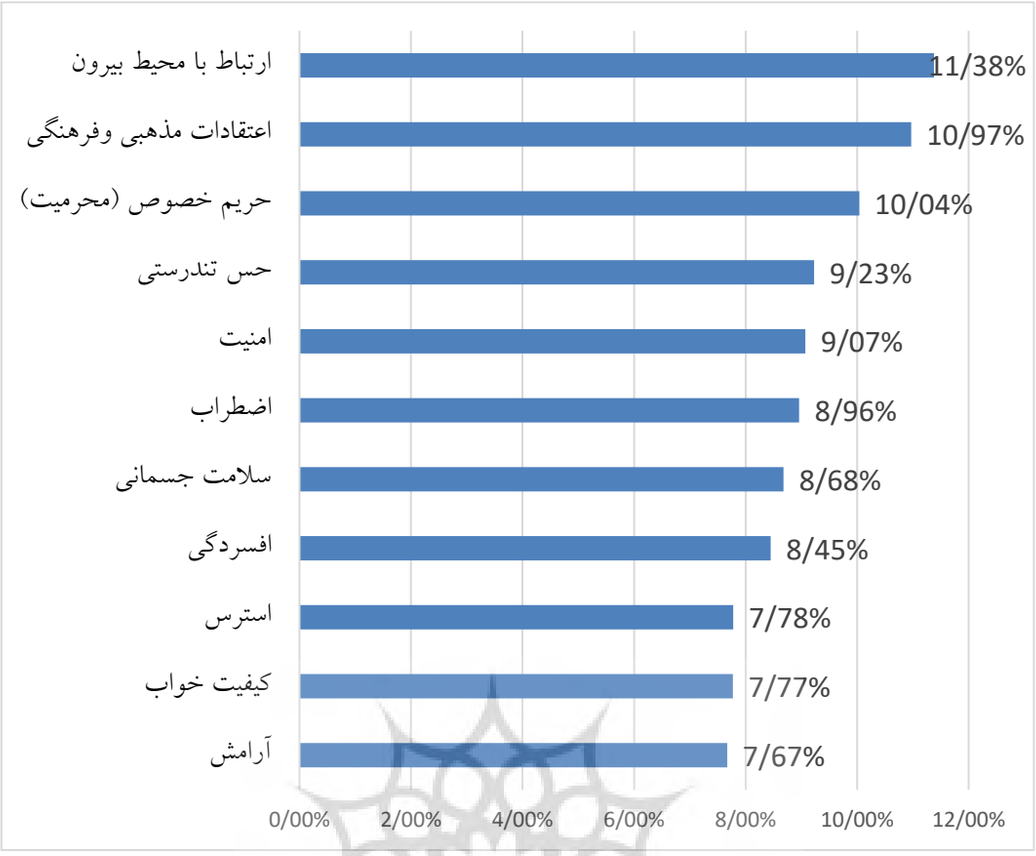
همان‌طور که از نتایج روش سکا مشخص شد، در $\beta = 6$ وزن معیارها و امتیاز گزینه‌ها محاسبه شده و در (جدول ۸) و (جدول ۹) آورده شده است. در نهایت، نتایج در (شکل ۳) و (شکل ٤) نیز ارائه شده است.

جدول ۸: وزن و اولویت معیارها

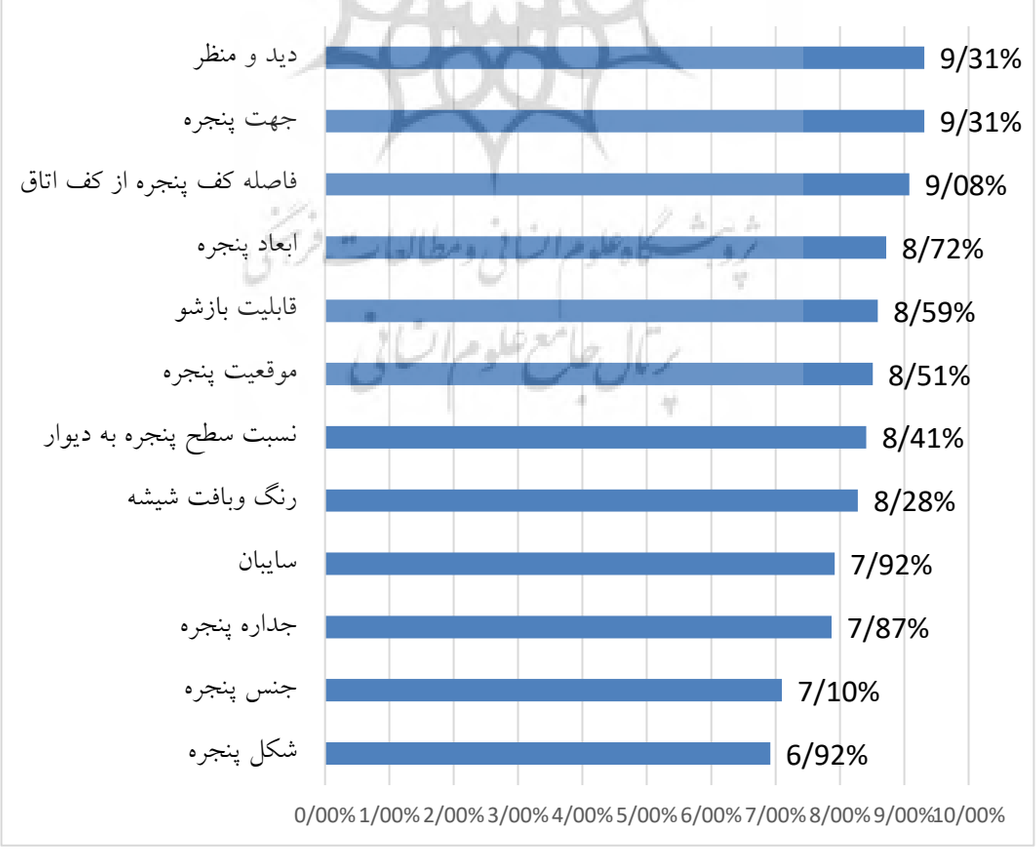
نام معیار	کد معیار	وزن معیار (درصد)	رتبه
اضطراب	C1	٪۸,۹۶	۶
افسردگی	C2	٪۸,۴۵	۸
کیفیت خواب	C3	٪۷,۷۷	۱۰
امنیت	C4	٪۹,۰۷	۵
استرس	C5	٪۷,۷۸	۹
حریم خصوص (محرمیت)	C6	٪۱۰,۰۴	۳
ارتباط با محیط بیرون	C7	٪۱۱,۳۸	۱
حس تندرستی	C8	٪۹,۲۳	۴
اعتقادات مذهبی و فرهنگی	C9	٪۱۰,۹۷	۲
سلامت جسمانی	C10	٪۸,۶۸	۷
آرامش	C11	٪۷,۶۷	۱۱

جدول ۹: وزن و اولویت گزینه‌ها

نام گزینه	کد گزینه	امتیاز گزینه	امتیاز نرمال شده (وزن)	رتبه
جنس پنجره	A1	۰,۷۳۳۷	٪۷,۱۰	۱۱
نسبت سطح پنجره به دیوار	A2	۰,۸۶۸۰	٪۸,۴۱	۷
ابعاد پنجره	A3	۰,۹۰۰۰	٪۸,۷۲	۴
موقعیت پنجره	A4	۰,۸۷۸۷	٪۸,۵۱	۶
جهت پنجره	A5	۰,۹۶۱۷	٪۹,۳۱	۱
قابلیت بازشو	A6	۰,۸۸۶۶	٪۸,۵۹	۵
دید و منظر	A7	۰,۹۶۱۵	٪۹,۳۱	۲
سایبان	A8	۰,۸۱۷۶	٪۷,۹۲	۹
جداره پنجره	A9	۰,۸۱۲۷	٪۷,۸۷	۱۰
شکل پنجره	A10	۰,۷۱۴۲	٪۶,۹۲	۱۲
رنگ و بافت شیشه	A11	۰,۸۵۵۰	٪۸,۲۸	۸
فاصله کف پنجره از کف اتاق	A12	۰,۹۳۷۲	٪۹,۰۸	۳



شکل ۳: وزن و رتبه‌ی معیارها



شکل ۴: امتیاز و رتبه‌ی نهایی گزینه‌ها

۳. نتیجه‌گیری

هدف از پژوهش حاضر شناسایی عوامل مؤثر در طراحی پنجره بر بهبود سلامت روان سالمندان در منطقه سیستان است. در یافته‌های تحقیق، یازده شاخص مؤثر بر سلامت روان سالمندان شناسایی شد که از عوامل دخیل در طراحی پنجره تأثیر می‌پذیرند. نتایج به دست آمده از تحلیل معیارهای سلامت روان سالمندان منطقه سیستان نشان می‌دهد که در بین معیارهای ارزیابی شده، ارتباط با محیط بیرون اعتقادات مذهبی و فرهنگی و حریم خصوصی به ترتیب با کسب ۱۱/۳۸، ۱۰/۹۷ و ۱۰/۰٤ درصد رتبه‌های اول تا سوم را دارند. از طرفی استرس، کیفیت خواب و آرامش به ترتیب با ۷/۸۷، ۷/۷۷ و ۷/٦۷ درصد، پایین‌ترین رتبه‌ها را کسب نموده‌اند. نتایج به دست آمده از تحلیل گزینه‌ها (عوامل مؤثر در طراحی پنجره) نشان می‌دهد که گزینه‌ی دید و منظر نسبت به عوامل دیگر دخیل در طراحی پنجره با ۹/۳۱ در اولویت اول و جهت پنجره با ۹/۳۱ درصد در رتبه دوم و فاصله کف پنجره از کف اتاق با ۹/۰۸ در رتبه سوم قرار گرفته است. از طرفی پایین‌ترین رتبه‌ها را جداره‌ی پنجره با ۷/۸۷ درصد و جنس پنجره با ۷/۱۰ درصد و شکل پنجره با ٦/۹۲ درصد کسب نموده‌اند.

تشکر و قدردانی

این مقاله برگرفته از رساله دکتری نویسنده اول با عنوان گونه‌شناسی و ارائه مدلی برای بازشوهای خانه‌های مسکونی در راستای بهبود سلامت روان مطالعه موردی سالمندان منطقه سیستان است که در دانشگاه آزاد اسلامی واحد بیرجند در حال انجام است.

مشارکت نویسندگان

در مقاله حاضر کلیه نویسندگان از سهم مشارکت یکسان برخوردار هستند.

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