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An Analysis of Influential Factors to the Elderly's Intention to Use Public Physical Exercising Facility Based on DEMATEL Approach

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ABSTRACT

The concept of keeping healthy through exercising is widely accepted by people. In parks or green lands in Chinese cities, public physical exercising facilities have been set up for the general public to improve their own health for free. In this paper, DEMATEL method was used to analyze the influence mechanism of the elderly's intention to use public physical exercising facilities. 16 influential factors were collected from viewpoint of the man-machine-environment system, and 11 senior citizens over sixty years old who had the habit of using public physical exercising facilities were invited to carry out the DEMATEL questionnaire survey. The findings show (1) 'the habit of physical exercise', 'the safety of public physical exercising facilities', 'versatility and convenience of public physical exercising facilities', 'the entertainment facilities around the public physical exercising facilities', and 'the solid ground around the physical exercising facilities ensuring the elderly stand firmly' have a significant impact on elderly's usage intention of public physical exercising facilities; and (2) among all the factors, 'the habit of physical exercise' is the most dominant influential factor. Finally, based on the findings, three design strategies that may enhance elderly's intention to use public physical exercising facilities were proposed: (1) incorporating the concept of keeping exercise into the design of public physical exercising facilities; (2) setting up public physical exercising places in or near the neighborhood; (3) building activity centers for the elderly around public physical exercising facilities.

Keywords: The elderly, Public physical exercising facility, Usage intention, DEMATEL, Influential factors

INTRODUCTION

The concept of keeping healthy through exercising is widely accepted by people. In parks or green lands in Chinese cities, public physical exercising facilities have been set up for the general public to improve their own health for free. However, higher requirements are put forward for the design of these facilities because of the special physical and mental conditions of the elderly (Xuan, 2011).

Many researches had been done in China, but few research abroad. Xuan focus on public physical exercising facilities' current situation and their university for the elderly, and proposed design criteria from four aspects of site

selection, space layout, styling and color. Inclusive design criteria for public physical exercising facilities for the elderly was proposed by Wang based on the analysis of existing facilities. A targeted plan for intelligent transformation of physical exercising facilities was proposed by Dong, which took the example of the physical exercising facilities in Tianjin University.

Researches on the use of physical exercising facilities by elderly are constantly deepening and expanding, but few research on the usage intention of the elderly.

ANALYSIS OF THE INFLUENTIAL FACTORS

Man-Machine-Environment System

The research on the influential factors of the elderly's intention to use public physical exercising facility focuses on the elderly, public physical exercising facility, the environment of facility and the interaction between them, which conform with the concept of man-machine-environment system. Therefore, the influential factors were sorted out based on the man-machine-environment system.

Construction of Influential Factors Index System

The influential factors were analyzed from seven aspects, which is the elderly, the public physical exercising facility, the environment the facility located, the interaction between the elderly and the facility, the interaction between the elderly and the environment, the interaction between the facility and the environment, and the interaction between the elderly. The final influential factors index system is shown in Table 1.

Analysis of the Influence Mechanism Based on DEMATEL Method

11 senior citizens over sixty years old who had the habit of using public physical exercising facilities were invited to carry out the DEMATEL questionnaire survey. The score of influential factors is 0 (no influence), 1 (small influence), 2 (medium influence) and 3(Great influence). DEMATEL method was used to calculate the results, and the relation between various factors was obtained.

According to the data in Table 2, the causal diagram of influential factors of the elderly's intention to use public physical facilities was drawn as shown in Figure 1.

In order to figure out a clear hierarchical relationship among the influential factors, four subdivision calculations of the cause factors were conducted. The rows and columns of the effect factors are crossed out in each subdivision calculation, and the matrix was rebuilt. Repeat the calculation until the subdivision cannot be continued.

The structural hierarchy diagram of influential factors was drawn according to the subdivision calculations. All influential factors are divided into four levels. The factors' degree of influence decreases from the first level to the fourth level (Li, 2020).

Table 1. Index system of influential factors to elderly's intention to use public physical exercising facility.

Man-machine-environment system	Influential factors	References
Elderly	C_1 Recent health status	Xie, M.H. (2007)
	C_2 The habit of physical exercise	Dong, Y. (2019)
	C_3 Attitude towards life	
	C_4 Others' thought of the facility	
Public physical exercising	C_5 The safety of public physical exercising facilities	Xie, M.H. (2007) Wang, Y.M. (2019) Dong, Y. (2009)
	C_6 Versatility and convenience of public physical exercising facilities	
	C_7 The bright color of the facility	
	C_8 Non-slip materials are used in facilities	
The environment the facility located	C_9 The location of the facility	Dong, Y. (2019)
	C_{10} The entertainment facilities near the facilities	Wang, Y.M. (2019)
Interaction between the elderly and the facility	C_{11} The elderly can use the facilities properly	Xuan, W. (2011)
	C_{12} The amount of time, money and energy the elderly expend while using facilities	
	C_{13} Elderly's satisfaction with facility	
Interaction between the elderly and the environment	C_{14} The ground allows the elderly to stand firmly	Dong, Y. (2009)
Interaction between the facility and the environment	C_{15} The facilities fit in beautifully with the surroundings	Xuan, W. (2011)
Interaction between the elderly	C_{16} Suitable distance between facilities	Xie, M.H. (2007)

DISCUSSION

Cause Factors and Effect Factors

The 16 influential factors can be divided into cause factors which are the media (Li, 2020) that affect elderly's usage intention and effect factors which are direct factors that affect elderly's usage intention. Focusing on cause factors in the design can effectively increase the intention of the elderly to use the facility. The effect factor can be changed by external influence easily, which makes it the most effective factor in a short term (Li, 2020). Therefore, short-term measures can be formulated based on effect factor.

The Causality of Influential Factors

The influential factors are distributed in a multi-level ladder pattern, among which 'The habit of physical exercise' is the most core influential factor while 'The safety of public physical exercising facilities', 'Versatility and convenience of public physical exercising facilities', 'The entertainment facilities near the facilities' and 'The ground allows the elderly to stand firmly' are deep

Table 2. The calculation results of the relationship between the influential factors.

Influential factors	Cause value (D_i)	Effect Value (R_i)	Centrality (D_i+R_i)	Causality (D_i-R_i)
C_1	3.7500366	4.920132	8.670168	–1.170095
C_2	3.9932325	3.7457418	7.738974	0.2474904
C_3	3.5295866	3.695379	7.224966	–0.165792
C_4	1.90572923	2.34615053	4.25188	–0.4404213
C_5	3.13761546	2.8236519	5.961267	0.3139639
C_6	2.92484214	1.73847567	4.663318	1.186367
C_7	2.13282084	1.84995915	3.98278	0.2828617
C_8	2.46189028	2.5902019	5.052093	–0.1283116
C_9	2.39232843	1.91933532	4.311664	0.4729933
C_{10}	2.2135042	1.31011764	3.523622	0.9033866
C_{11}	2.93852075	2.36565851	5.30418	0.5728621
C_{12}	2.43931177	2.38324655	4.822558	0.05606484
C_{13}	2.39109177	5.6142968	8.005388	–3.223205
C_{14}	3.3579409	2.13441828	5.492359	1.223523
C_{15}	2.02982222	2.3030752	4.332897	–0.2732532
C_{16}	1.98462518	1.84305862	3.827684	0.1415666

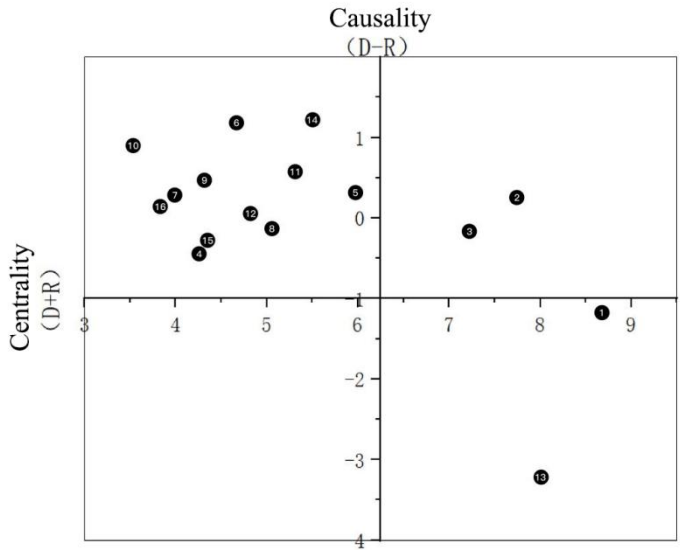

Figure 1: Causal diagram of influential factors of elderly's intention to use public exercising facilities.

influencing factors. These factors have a great impact on the intention of the elderly to use physical exercising facilities.

The Centrality of Influential Factors

The higher the centrality, the stronger the negative effect of the influential factors. 'Recent health status', 'Elderly's satisfaction with facility', 'The habit

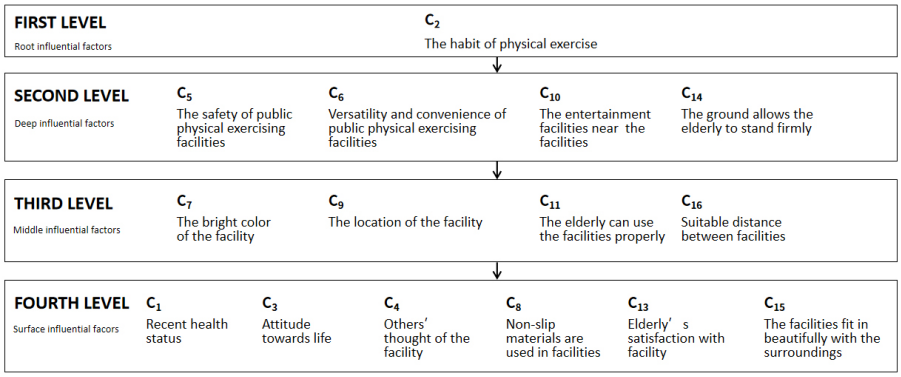

Figure 2: Structural hierarchy diagram of influential factors.

of physical exercise' and 'Attitude towards life' are factors with highest centrality, which makes them the key nodes to improve the intention of elderly to use public exercising facilities.

Comprehensive Analysis Based on the Causal Diagram of Influential Factors

According to the causal diagram, influential factors can be divided into four types: driving factors, core factors, independent factors and assisting factors.

'The habit of physical exercise' and 'Attitude towards life' are in the first quadrant, which means they are driving factors. They have high centrality value and are also the cause factors which should be focused on.

"Recent health status" and "Elderly's satisfaction with facility" are the core factors in the fourth quadrant. They are effect factors with high centrality value and low causality value, implying their effect on elderly's intention to use public physical exercising facilities is susceptible to other cause factors.

Twelve factors, including 'Others' thought of the facility' and 'The safety of public physical exercising facilities' are assisting factors in the second quadrant. They are factors with low centrality value and high causality value, implying they can affect elderly's intention to use public physical exercising facilities through influencing other factors.

DESIGH STRATEGIES

Incorporating the Concept of Keeping Exercise into the Design of Public Physical Exercising Facilities

'The habit of physical exercise' is not only the driving factor but also the cause factor of elderly's intention to use physical exercising facilities, which has the greatest impact on other factors. This means that whether or not the elderly use public physical exercising facility depends largely on their physical exercise habits. We can convey new exercise concepts to the elderly through labels and slogans on public physical exercising facilities to get them into the habit of exercising with these facilities.

Building Activity Centers for Elderly Around Public Physical Exercising Facilities

'Versatility and convenience of public physical exercising facilities', 'The entertainment facilities near the facilities' and 'The ground allows the elderly to stand firmly' are not only the second-level influential factor but also the cause factor, showing that the elderly extremely concern about public physical exercising facilities and their surroundings. To build exercise center for the elderly around public physical exercising facilities, where the elderly can not only exercise but also entertain and have a rest, can greatly improve elderly's satisfaction with these facilities.

Setting Up Public Physical Exercising Places in or near The Neighborhood

'The location of the facility' is not only the third-level influential factor but also the cause factor. In the survey, most of the elderly mentioned that they prefer public physical exercising facilities close to their home, which makes them not only take less time on the road but also provides convenience for social contact.

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