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A Study of Factors and Influences Relationship to Exercise Behavior of the Elderly in Lishui City

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Abstract

Background and Aim: Exercise behavior in the elderly is crucial for maintaining physical health, cognitive function, and overall well-being. Regular physical activity helps prevent chronic diseases, improves mobility, and enhances mental health, contributing to a higher quality of life and independence in aging populations. This study aims to examine the influence of physical activity behavior among elderly individuals in Lishui City. The research specifically explores the role of individual health status, demographic characteristics (age, gender, and education level), sports skills, family support, and environmental factors such as the accessibility of sports facilities in shaping exercise habits in physical activity among older adults.

Materials and Methods: The sample group of 497 elderly people using stratified random sampling was selected from 9 exercise points in 9 districts and counties of Lishui City. The questionnaire was from 10 expert people, and the reliability of the questionnaire with Cronbach's Alpha coefficient was 0.73, indicating high confidence in the questionnaire. Data analysis was performed using frequency, percent, correlation coefficients, and Pearson's, and survey data was performed using Kaplan-Meier Estimator & Cox Proportional Hazards Model.

Results: The results indicate that exercise skills (fitness skills and perceived exercise efficacy) and environmental factors (such as family support**)** significantly impact the rate at which older adults develop and maintain exercise habits.

Conclusion: This study identifies key factors influencing elderly exercise behavior in Lishui City, including physical, mental, social, and moral health, as well as sleep quality and diet**.** Age, gender, education, and economic status shape exercise participation, while fitness skills and family support significantly impact habit formation. Skill improvement enhances exercise efficiency, while family support fosters motivation and long-term adherence**.** The interaction between skill proficiency and social support plays a crucial role in accelerating and sustaining regular exercise habits among older adults.

Keywords: Influence Factor; Exercise Behavior; Elderly

Introduction

The 21st century has been recognized as the era of global aging, with the promotion of sports health, and physical activity among the elderly emerging as a critical issue worldwide. Many developed countries such as Canada, the United States, Germany, Japan, and South Korea have implemented systematic policies to encourage physical activity among older adults, first, they attach attention to the construction and improvement of the sports health promotion policy system for the elderly; second, they emphasize the synergistic effect of multiple governance subjects, in which social organizations play an important role; again, the coordinated development of the internal subsystems of the elderly; finally, the medical system and education system are considered important related systems for promoting the health promotion for the elderly. In addition, with the progress of information technology, the application of information systems also plays an increasingly important role in the governance of sports health promotion in the elderly. To solve the contradiction between the increasingly expanding sports and fitness needs of the elderly and the single supply subject, it is necessary to establish a top-down coordination mechanism of human, financial, and material support, as well as a supply system of demand-oriented sports and fitness service products for the elderly (Wang & Wei, 2022). (Molanorouzi et al., 2015) believes that the diversity of sports needs of the elderly comes not only from the internal motivation of "needing exercise", but also from the

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improvement of the external social support system. In addition to formulating sports policies for the elderly, it is also necessary to improve the social support system for sports development for the elderly. (Jung, et al., 2023) Believes that the sports health promotion system is composed of the target system, action system, and guarantee system, and sports health promotion should be governed from three aspects: enhancing individual sports awareness, improving sports lifestyle, and improving sports environment. (Jenkin, et al., 2017) Believes that to resolve the contradiction between the supply and demand of the sports and health needs of the elderly, it is necessary to build a synergistic relationship between multiple subjects and put forward the idea of building a collaborative mechanism of "optimizing the administrative mechanism, expanding the market mechanism, and introducing the community mechanism".

Previous studies have shown that regular physical activity is positive for improving chronic diseases such as obesity, cardiovascular disease, and type 2 diabetes in the elderly. Therefore, maintaining the elderly's continuous participation in physical activities has become the key to improving the effectiveness of exercise. This study aims to through theoretical research and empirical analysis, determine the factors affecting the elderly regular physical exercise behavior in Lishui City, analyze the relationship between these factors in physical exercise behavior and its possible indirect path, and propose the use of controllable factors to improve the elderly physical exercise ability strategy, to provide scientific basis and support for the cultivation of elderly physical exercise habits in Lishui city.

Objectives

1. The study and analysis of exercise behavior of the elderly in Lishui City, Zhejiang Province, China.
2. To summarize and follow up on the main factors affecting the long-term exercise habits of the elderly in Lishui City, Zhejiang Province, China.

Literature review

Physical activity is a crucial factor in maintaining the health and quality of life of the elderly. It plays a significant role in preventing chronic diseases such as cardiovascular conditions, diabetes, and arthritis while also enhancing mental well-being and social engagement. However, participation in physical activities among older adults remains low due to various barriers, including health conditions, motivation, and environmental factors. (Carrapatoso et al., 2020; Chen et al., 2022; Jung et al., 2023)

1. Individual Factors Affecting Exercise Behavior
   1) Health Status and Physical Ability Elderly
   2) Psychological and Motivational Factors
   3) Demographic Factors (Age, Gender, Education, and Economic Status)
2. Social and Environmental Factors Influencing Exercise Behavior
   1) Family and Social Support
   2) Accessibility to Exercise Facilities
   3) Climate and Environmental Conditions

Future research should focus on region-specific studies and the integration of digital health solutions to develop effective strategies for promoting physical activity among older adults.

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Conceptual Framework

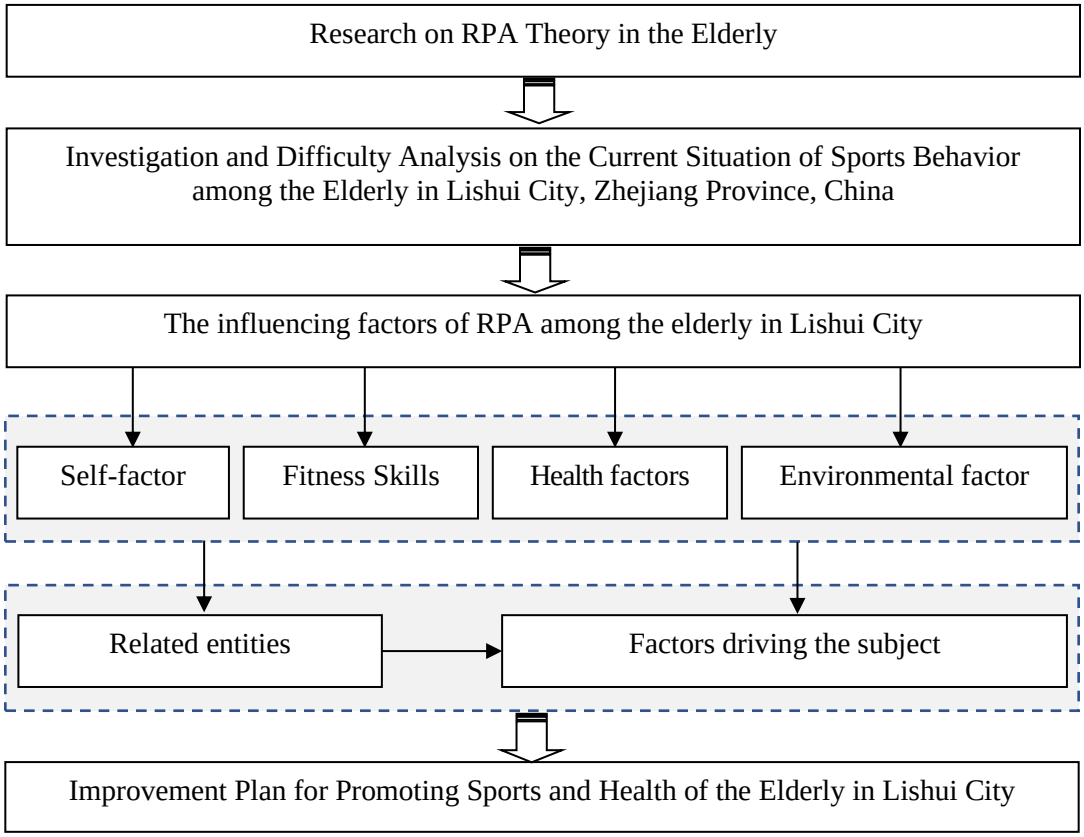

Figure 1 Conceptual framework

Methodology

1. Population and Sample Group

The study population is the elderly aged 60 and above in Lishui city. According to the 2022 Lishui Statistical Yearbook, the elderly population is about 576,000. Using (Yamane, 1967), the required sample size is 400 participants with a 5% margin of error (e = 0.05). The sample group of 497 elderly people using stratified random sampling was selected from 9 exercise points in 9 districts and counties of Lishui City.

2. Research Instruments

Professors of physical education training and 10 experts from the sports administration department were invited for the evaluation and revision of the questionnaire. The reliability and stability of the questionnaire, with a Cronbach's Alpha coefficient was 0.73, indicates high confidence in the questionnaire.

3. Data analysis

According to the statistical results of four dimensions of personal factors, fitness skills, healthy diet, and environmental factors in each dimension were selected as the indicators of a long-term follow-up survey. Data analysis was performed using frequency, percent, and correlation coefficients, Pearson's. Tracking survey data was performed using the Kaplan-Meier Estimator & the Cox Proportional Hazards Model.

Elderly people who were willing to continue in the survey were followed up for 32 weeks, and the relatively complete data of 83 respondents were finally retained. Statistical analysis of the tracking survey data using the Cox proportional hazards model to identify factors influencing the development of exercise habits in older adults. The above summarizes the methodology, sample selection, data collection tools, data analysis methods, and the process of follow-up investigation.

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Results

1. Study on the influencing factors of exercise behavior among the elderly in Lishui City

Table 1 Survey of the satisfaction and health demand of the elderly in Lishui City. (n=497)

		Frequency	Percent	Valid Percent	Cumulative Percent
Gender	M	216	43.5	43.5	43.5
	F	281	56.5	56.5	100.0
Age	60-65	187	37.6	37.6	37.6
	66-70	138	27.8	27.8	65.4
	71-75	117	23.5	23.5	88.9
	≥76	55	11.1	11.1	100.0
Educational level	Elementary school and below	111	22.3	22.3	22.3
	Middle school	174	35.0	35.0	57.3
	High school	160	32.2	32.2	89.5
	University and above	52	10.5	10.5	100.0
Residential Status	Living alone	82	16.5	16.5	16.5
	Living with one's partner	217	43.7	43.7	60.2
	Living with children	150	30.2	30.2	90.3
	Beadhouse	48	9.7	9.7	100.0
Health status	Healthy	124	24.9	24.9	24.9
	Having chronic diseases	277	55.7	55.7	80.7
	Unclear	96	19.3	19.3	100.0
Exercise habits	Never exercise	85	17.1	17.1	17.1
	Occasionally exercise	168	33.8	33.8	50.9
	Exercise 1-2 times a week	114	22.9	22.9	73.8
	Exercise 3-5 times a week	88	17.7	17.7	91.5
	Exercise every day	42	8.5	8.5	100.0

Table 1 shows demographic information for 497 elderly people in Lishui City, and the majority of the study sample was 56.5% female and 43.5% male. In terms of age index, the largest age group in the sample was 60-65 years, accounting for 37.6%; followed by 66-70 years, accounting for 27.8%; 71-75 years, 23.5%; and 76 years and above, 11.1%. In terms of education level, the elderly graduated from junior high school, 35.0%; followed by high school, 32.2%; primary school or below, 22.3%; and the least, only 10.5%. In terms of living status, 43.7% of the elderly lived with their spouses, 30.2% lived with their children, 16.5% lived alone, and 9.7% lived in nursing homes. In terms of health status, 24.9% of them thought they were relatively healthy, 55.7% had chronic noncommunicable diseases, and 19.3% had long-term diseases. In the survey of Lishui City, Zhejiang province, the elderly exercise habits found that 17.1% of the elderly said they never physically exercise, 33.8% of the elderly occasionally physically exercised 1-2 times a week of the elderly accounted for 22.9%, exercise 3-5 times a week of the elderly accounted for 17.7%, only 8.5% of the elderly almost physical exercise every day based on the social-ecological model of influencing factors of the elderly in Lishui city, including personal factors, sports skills, health level, environmental support four levels, therefore, to ensure the validity of the questionnaire, after delete item analysis failed the questionnaire structure analysis, using the level including factor adaptability test, the reliability of the indicators of the four dimensions KMO value> 0.7 (P <0.01), said the there are common factors between variables, suitable for factor analysis. The dimensions and observation priorities after the

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demarcated are shown in Table 2, the scale was named, and the data with a contribution rate of less than 40% were deleted.

Table 2 Adjusted Observation Scale

Index	Rename	Rotated Component Matrix[a]					
		Variable	Rename	Component			
				1	2	3	4
Health Factors	A	Physiological Health	A1	0.811			
		Mental Health	A2	0.811			
		Moral Health	A3	0.774			
		Social Health	A4	0.757			
		Sleep Health	A5	0.724			
		Reproductive Health	A6	0.534			
Self Factors	B	Age	B1		0.876		
		Gender	B2		0.793		
		Happiness index	B3		0.792		
		Degree of Education	B4		0.778		
		Economic Factors	B5		0.711		
Skill Factors	C	Fitness Techniques	C1			0.810	
		Fitness Effect	C2			0.786	
		Fitness habits	C3			0.781	
		Learning ability	C4			0.736	
		Fitness Knowledge	C5			0.686	
Environmental Factor	D	Family Support	D1				0.912
		Venue Environment	D2				0.841
		Climate and Environment	D3				0.839
		Convenience	D4				0.728

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

Table 2 further follows up on the factors affecting the formation of exercise habits by the elderly in Lishui City and explores which factors are the main factors among the personal factors, fitness skills, healthy diet, and environmental 29 factors. In this study, based on the questionnaire survey on the demand for physical exercise and health promotion for the elderly in Lishui City, the two indices from the four factors were used as the observation index of the continuous survey. The indicators for the follow-up survey were Health Factors (A) / Self Factors (B) / Skill Factors (C) / Environmental Factors (D)

2. Analysis of the influencing factors of sports behavior in the elderly in Lishui City

Through factor analysis, it was found that the factors influencing the exercise behavior of the elderly in Lishui, Zhejiang Province were determined by Self factors (Age, Gender, Degree of education, Happiness index, Economic factors) , Skill factors (Fitness knowledge, Fitness Techniques, Learning ability, Fitness Effect, Fitness habits) , Health factors (Physiological health, Mental health, Social Health, Moral Health, Reproductive health, Sleep Health, Environmental factor (Family support, Venue environment, Climate and Environment, Convenience) These four types of factors constitute. The associations between the groups are shown in Table 3.

Table 3 Correlation analysis among the variables

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		Health Factors (A)	Self-Factors (B)	Skill Factors (C)	Environmental Factor (D)
Health Factors (A)	Pearson Correlation	1	.461**	.407**	-.001
	Sig. (2-tailed)		.000	.000	.974
	N	497	497	497	497
Self-Factors (B)	Pearson Correlation	.461**	1	.345**	.105*
	Sig. (2-tailed)	.000		.000	.019
	N	497	497	497	497
Skill Factors (C)	Pearson Correlation	.407**	.345**	1	.008
	Sig. (2-tailed)	.000	.000		.860
	N	497	497	497	497
Environmental Factor (D)	Pearson Correlation	-.001	.105*	.008	1
	Sig. (2-tailed)	.974	.019	.860	
	N	497	497	497	497

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 3 shown significant positive correlation between health factors and self-factors (r=0.461, p <.001); health factors and skill factors (r=0.407,p<.001); self and skill factors (r=0.345, p<.001); self and environmental factors (r=0.105, p=.019); skill factors and environmental factors was close to zero (r=0.008, p=.860); health factors and environmental factors almost did not exist (r =-0.001, p=.974)

1) Driving factors affecting the physical education behavior and habit formation of the elderly. According to the results of the factor analysis, the Physiological health / Mental health / Age / Gender / Fitness Techniques / Fitness Effect / Family support / Venue environment 8 index was selected as the observation index of the long-term follow-up survey. Table 4. Each categorical variable in the model was coded as an indicator parameter to assess its effect on the “time to develop motor habit” variable.

Table 4 Variables in the equation

	B	SE	Wald	df	Sig.	Exp(B)
Physiological health (A1)			3.059	2	.217	
Physiological health (A1)(1)	-1.014	.689	2.166	1	.141	.363
Physiological health (A1)(2)	-1.157	.668	3.002	1	.083	.315
Mental health (A2)			1.578	2	.454	
Mental health (A2)(1)	.280	.667	.177	1	.674	1.324
Mental health (A2)(2)	-.438	.618	.501	1	.479	.646
Gender (B2)	-.016	.583	.001	1	.978	.984
Age (B1)	.241	.516	.218	1	.641	1.272
Fitness Techniques (C1)			12.611	2	.002	
Fitness Techniques (C1)(1)	2.445	.860	8.078	1	.004	11.532
Fitness Techniques (C1)(2)	3.430	.966	12.610	1	.000	30.868
Fitness Effect (C2)			13.598	4	.009	
Fitness Effect (C2)(1)	-1.788	1.161	2.369	1	.124	.167
Fitness Effect (C2)(2)	-1.848	.895	4.265	1	.039	.158

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	B	SE	Wald	df	Sig.	Exp(B)
Fitness Effect (C2)(3)	-2.745	.914	9.012	1	.003	.064
Fitness Effect (C2)(4)	-1.033	.899	1.322	1	.250	.356
Family support (D1)	1.613	.479	11.321	1	.001	5.015
Venue environment (D2)	.832	.591	1.978	1	.160	2.297

Table 4 shows the Kaplan-Meier Estimator analysis. Through Survival Function at the mean of covariates analysis, it was found that at around 20 weeks, older people began to establish long-term exercise habits. As shown in Figure 2.

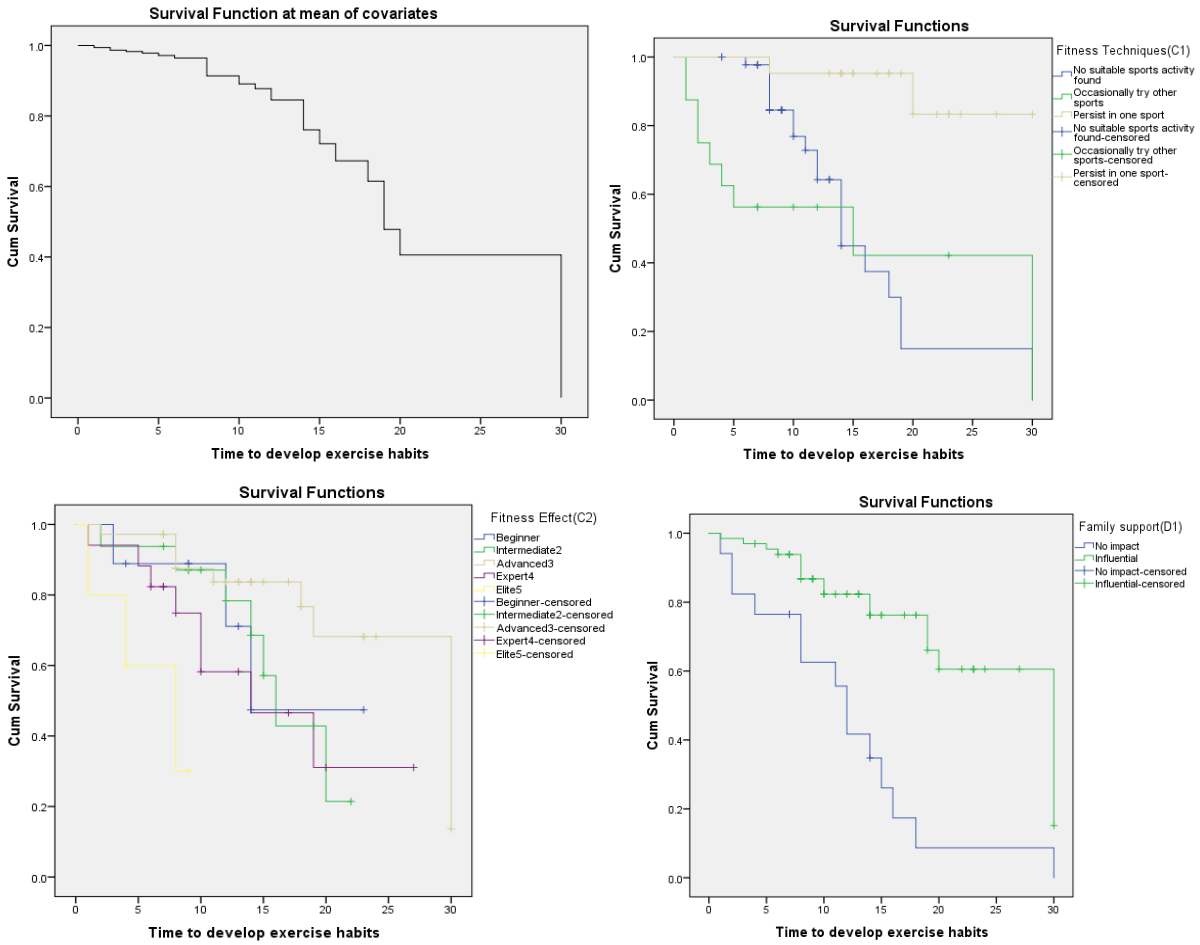

Figure 2 Survival Function at the mean of covariates

Conclusion

This study aims to deeply explore the factors influencing the physical exercise behavior of the elderly in Lishui City, the influence elements of multiple dimensions through systematic literature review, questionnaire survey, and data analysis, and propose corresponding health promotion strategies. The survival analysis revealed that after the intervention for exercise participation, the elderly were able to initially establish regular exercise habits.

In terms of health factors, physical health and mental health have significant effects on the exercise habits of older people. Healthy older people are more likely to participate in exercise, and mental health, especially the awareness of the happiness and health-promoting effects of exercise, significantly enhances the sustainability of exercise. In addition, social health and moral health indirectly promote exercise

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motivation through community participation and social activities (Bromell & Cagney, 2014). Sleep quality and eating habits have also been identified as important health factors that influence exercise performance and habit formation.

In terms of self-factors, age, gender, subjective well-being, education level, and economic status together shape the pattern of motor behavior in older adults. Although age increase may limit high-intensity exercise, it increases the importance of health maintenance in the elderly, and they prefer low-to moderate-intensity exercise. Gender differences influence exercise preference and participation motivation, whereas education and economic status significantly influence the ability of older adults to access exercise resources and the persistence of exercise participation (Chen et al., 2022).

In terms of skill factors, skilled fitness skills, and knowledge accumulation are the keys to improving the efficiency of exercise and reducing the risk of injury, promoting the internal fun and sense of achievement of exercise, and thus enhancing the sustainability of exercise. Learning ability maintenance, as motor effect perception, is equally important to establishing and maintaining exercise habits in older adults.

In terms of environmental factors, family support, sports field environment, climatic conditions, and exercise convenience are crucial for the formation of exercise habits among the elderly. The encouragement and companionship of family members, safe and convenient sports venues, a suitable climate environment, and the sports atmosphere in the community jointly promote the participation in sports and habits of the elderly (Roe et al., 2020).

Based on the research conclusion, it is suggested to carry out in-depth intervention on the exercise behavior habits of the elderly in Lishui City, Zhejiang Province, from three levels: "personalized exercise guidance and skill improvement, family participation and support network construction, and community and policy intervention".

Discussion

With the increasing aging of the global population, the health problems of the elderly have increasingly become a social focus. Exercise habits play an important role in promoting physical and mental health and improving the quality of life of the elderly. Regular physical exercise can effectively prevent and control common diseases in aging and improve cognitive function and mental health status (Hemmeter & Ngamsri, 2022). However, the sports participation of the elderly is generally not high, which is closely related to physiological, psychological, social, and other factors. This study aimed to systematically explore the multidimensional factors, including physical health, mental health, social health, and oral health, and analyze the correlation of age, gender, education level, economic status, and exercise behaviors. The survival analysis method was used to explore the influence of skill factors and environmental factors on the time to develop exercise habits in older adults and to provide evidence for developing effective health promotion strategies.

1. The influence of health factors on exercise habits

The results of this study are consistent with the studies that show that physical health and mental health are the key factors affecting the exercise habits of older adults. Older adults in good physical health are more likely to be active in exercise, and good sleep quality and eating habits also significantly promote exercise habits (Lerche et al., 2018). In addition, mental health is equally important in the elderly population, and older people with positive emotional experiences and health benefits brought about by positive cognitive exercise are more inclined to form regular exercise habits.

2. The relationship between self-factors and motor behavior

Self-specific factors, including age, gender, educational level, and economic status, have complex effects on motor behavior in older adults. (Lee, et al., 2017) Noted that older adults may prefer to choose low-to-moderate-intensity exercise with increasing age. Gender differences also play a role in exercise preference and participation, with older adults with higher education and income being more likely to understand the importance of and participate in exercise (Foley et al., 2011; Singh et al., 2020).

3. The role of skill factors in developing exercise habits

Fitness skills and exercise affect perception are crucial to the formation of exercise habits in the elderly. (Bai et al., 2023) and (Igarashi & Nogami, 2018) showed that older people with certain fitness skills are more likely to establish exercise habits. By tracking 83 elderly people for 32 weeks, we found that at around 20 weeks, skill factors significantly affected the formation time of their exercise habits, and older people with higher exercise skills were able to establish their exercise habits faster.

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4. Environmental factors and the exercise habits of the elderly

Family support plays a key role in the formation of exercise habits in older adults. (Wu, et al., 2022) And Zhou et al. (2023) showed that encouragement and companionship by family members significantly increased exercise participation in older adults. Our 32-week follow-up findings further confirm the interaction of family support and sociocultural factors, providing a more supportive and more exercise-conducive environment for older adults.

5. Association between skill factors and the time of exercise habit formation

The survival analysis method revealed a significant effect of skill factors on the formation time of exercise habits in older adults. The studies of Gooijers et al. (2024) and Norouzi et al. (2019) also pointed out that skill proficiency is one of the key factors in predicting the formation of motor habits. Our study further found that active encouragement and actual participation of family members significantly accelerated the formation of exercise habits in older adults.

Although this study provides new insights into the development of exercise habits in older adults, there are several limitations. The sample size and geographic range limitations may have affected the general applicability of the results. Furthermore, the cross-sectional design limits the inference of causal relationships. Future studies need to consider the differences in physical health, differences in sports culture, socioeconomic status, and personal preferences in different regions to further explore the exercise habits of the elderly.

Recommendation

1. Suggestions from research

1. Personalized exercise instruction and skill improvement. Provide personalized health and exercise capacity assessments for older people, and design exercise programs that fit their physical conditions, interests, and goals based on the assessment results. Organize regular skill improvement guidance, invite professional fitness coaches or sports coaches to guide the correct exercise skills and safety knowledge, and avoid sports injuries. Older adults are encouraged to find exercise partners to enhance social attributes and persistence of exercise through joint participation in sports.

2. Family participation and support network construction. Health education activities for family members to raise their awareness of the importance of exercise in the elderly and teach them how to provide practical exercise support for the elderly. Design a family exercise program to encourage family members to participate together in sports activities suitable for all ages. Establish online or offline family support platforms so that family members can share sports experiences and achievements, and encourage each other.

3. Community and policy-level intervention. Establish safe, accessible sports areas within the community and provide the necessary facilities. Provide diverse exercise options to meet the interests and abilities of different older adults. The government should introduce policies to encourage the movement of elderly people, such as providing sports subsidies and supporting non-profit organizations and community groups to hold sports activities for the elderly.

2. Future Research

1. Community and policy-level intervention. Establish safe, accessible sports areas within the community and provide the necessary facilities. Provide diverse exercise options to meet the interests and abilities of different older adults. The government should introduce policies to encourage the movement of elderly people, such as providing sports subsidies and supporting non-profit organizations and community groups to hold sports activities for the elderly.

2. The effect of the intervention was assessed through an interdisciplinary collaboration. Test the impact of specific interventions (e.g., health education programs, personalized exercise guidance, family support enhancement programs) on exercise habits and health outcomes in older adults. Build a multidisciplinary team, including experts in medicine, psychology, sociology, urban planning, sports science, and other fields, to promote the emergence of comprehensive innovative solutions.

3. Technology-assisted research, cultural background consideration, and environmental factors analysis. Using wearable devices, mobile applications, and other technologies to monitor the exercise behavior of the elderly, provide personalized feedback, and promote social interaction. To understand differences in older exercise habits in different socio-economic settings and to assess the impact of environmental changes on older exercise habits

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