Evaluation of Aging Adaptation of Slow traffic System in Community Spaces in Kunming

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Abstract. To reveal how the community space affects the satisfaction of urban seniors in daily slow traffic trips, the existing customer satisfaction index model is used to construct a slow traffic system aging evaluation system and put forward relevant hypotheses. Taking Kunming as an example, we describe and analyze the characteristics of the slow traffic travel of the elderly, and then validate the model hypotheses by using PLS-SEM. The results show that: (1) the elderly in Kunming have diversified modes of slow traffic travel, and the differences in family structure have different degrees of influence on the slow traffic travel behavior of the elderly. (2) The hypotheses were verified and it was learned that the factor most affecting the satisfaction of the elderly in slow traveling was the perceived quality of the elderly 0.444 ($P<0.001$). (3) Older people's perception of safety, road environment, comfort, and road continuity of daily slow traveling have a significant effect on their perceived quality.

Keywords: elder people; ageing of the slow traffic system; community space; ACSI; PLS-SEM

1 Introduction

In 2023, the number of people over 60 years old in Kunming was 1.39 million, accounting for 16.07% of the city's total population, of which the proportion of people over 65 years old was 11.47%. Compared with the census data of previous years, the aging trend in Kunming is rising sharply. The daily transportation of the elderly is a top priority, because "transportation" is a key factor in the development of active aging[1]. Short-distance travel has become indispensable in the transportation activities of the elderly. He Mingwei et al.[2] defined short-distance travel as travel within 4km, and because of physiological limitations, the travel activities of the elderly are mainly based on short-distance travel, and the short-distance travel activities of the elderly are often centered around the community space to carry out. The community contains spatial and social aspects[3], is the smallest measure of urban public space[4], but also directly for residents to provide travel, communication, and other places. Among the many short-

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distance travel modes, the elderly rely more on slow traffic transportation, which is mainly composed of walking and bicycle transportation.

Appraisal and evaluation are key tools for promoting high-quality urban development and testing the effectiveness of planning implementation[5]. Taking Kunming as an example, this paper considers constructing an aging evaluation system of community space short-distance slow walking system with active participation of the elderly in ACSI[6] and then utilizes Partial Least Squares (PLS) to make up for the shortcomings of the evaluation system in exploring and analyzing the influence effect and change rule among variables. Providing practical case references for the evaluation of the aging of slow traffic systems in community spaces.

2 Model Assumptions

As shown in Table 1. This paper has a total of 5 latent variables and 19 observational variables, and proposes the following hypotheses: H1: Older people's expectations positively affect older people's perceived quality; H2: Older people's satisfaction negatively affects older people's complaints; H3: Older people's satisfaction positively affects older people's loyalty; H4: Older people's complaints negatively affect older people's loyalty; H5: Older people's expectations positively affect older people's satisfaction; H6: Older people's perceived quality positively affects older adults' satisfaction; the evaluation system constructed in this paper is shown in Figure 1.

Table 1. Survey variables for the aging of older adults' slow taffic systems

Latent variable		Observed variable	
Level1indicators	Level2indicators	code	Observation variable specifics
Perceived Quality	Safety	SF1	Your comments on the separation facilities for non-motorized/non-humanized persons
		SF2	Your comments on the design of crossing signal duration
		SF3	Your evaluation of the installation of three-dimensional crossing facilities
	Comfort	CF1	Your evaluation of sidewalk/non-motorized lane widths
		CF2	Your opinion on the quietening of slow traffic
		CF3	Your evaluation of street leisure facilities
	Road environment	RE1	Your evaluation of the green landscape on both sides of the slow traffic roads
		RE2	Your opinion on the shade coverage of slow traffic roads
		RE3	Your evaluation of the lighting system on both sides of the road
	Continuity	CT1	Your evaluation of the smoothness of the road surface of the slow traffic roads

	CT2	Your evaluation of the integrity of the slow traffic road
Older people's satifaction	PS1	Satisfaction with the aging services of the community slow traffic system
	PS2	The gap between the current situation of the aging services of the community's slow traffic system and your expectations.
Older people's expectations	PE1	Your expectation of the overall performance of the slow walking system for the aged.
	PE2	Your expectation of more convenient travel brought by the aging of the slow traffic transportation system
Older Adults' Complaints	PC1	Have you ever complained about the slow traffic transportation infrastructure?
	PC2	Have you ever complained about the occupation of slow traffic roads?
Older people's loyalty	PL1	You will publicize the advantages of slow walking to others
	PL2	You will keep the habit of walking slowly every day

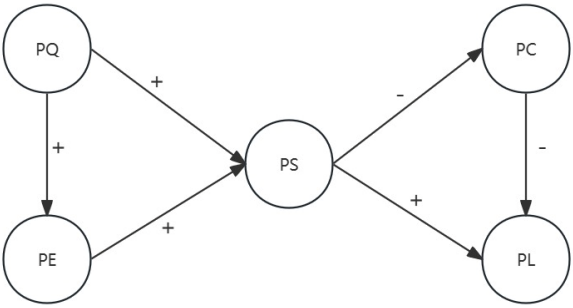

Fig. 1. Model Assumptions for Evaluating the Aging of Slow Moving Systems

3 Survey Design and Data Analysis

3.1 Survey Design

The survey focused on communities under the jurisdiction of Panlong District and Wuhua District. Face-to-face interviews, field observations and social media were utilized to obtain data. A total of 274 elderly people were involved in the survey, and 251 valid questionnaires were obtained after data processing, with the proportion of valid questionnaires being 91.6%. The proportion of valid questionnaires was 91.6%.A five-point Likert scale was used to evaluate the 19 indicators listed, while the section on complaints of the elderly was answered with 2 (yes) and 1 (no).

3.2 Analysis of Slow Travel Behavior of the Elderly

Table 2 shows the basic information of the interviewed elderly, the gender ratio of men and women is 120:131, a relatively balanced ratio. It is not difficult to find that the elderly in the mode of travel choose the highest proportion of slow groups, and the elderly are no longer limited to walking, the status quo of their choice of driving an electric car to travel is also not to be ignored. Family structure[7], travel purpose, time three cross analysis that the richer the family composition of the elderly, the more frequent their travel, but the daily travel purpose is also relatively single, mainly because China's older people in retirement is still in daily life choose to help their next generation to share the family chores. In terms of the distance of slow traveling, the distance of slow traveling for the elderly is usually within 3km, their travel distances are consistent with short-distance characteristics. In terms of the nature of travel, non-transportation travel behavior of the elderly occupies most of the time, and the purpose of their participation in slow walking in community space is more focused on recreational activities, with board games being the main choice. The number of travel time periods reflects the average daily travel frequency of the elderly, whose average number of trips per day is currently at 1.60, which is lower than the average number of trips per day for people in Kunming.

Table 2. Statistical analysis of personal attributes and travel attributes of urban elderly

Descriptive characteristics	Options	Number of persons	Proportion/%	Descriptive characteristics	Options	Number of persons	Proportion/%
Sex	Male	120	47.81		6:00-8:00	47	18.73
	Female	131	52.19		8:00-10:00	76	30.28
Age	60-64	65	25.9		10:00-12:00	91	36.25
	65-69	75	29.88		12:00-14:00	40	15.94
	70-74	82	32.67		14:00-16:00	62	24.7
	75 and above	29	11.55	Travel times	16:00-18:00	63	25.1
Family structure	Retirement households	47	18.73		18:00-20:00	76	30.28
	Nuclear family	74	29.48		After 20:00	47	18.73
	Main family	102	40.64		Within 1km	50	19.92
	Intergenerational family	28	11.16	Travel distance	1-2km	75	29.88
Travel modes	Walking	96	38.25		2-3km	77	30.68
	Bicycle	88	35.06		More than 3km	49	19.52

	Electric Vehicle	77	30.68		work	28	11.16
	Public Transpor-tation	111	44.22		Buying supplies	127	50.6
	Subway	95	37.85	Travel destination	Picking up and drop-ping off children at school	129	51.39
	Car or Taxi	20	7.97		activities	152	60.56
	Other	15	5.98		Receiving medica treatment	66	26.29

4 Evaluation of the Ageing of Slow Traffic Systems

4.1 Measurement Model Calibration

The measurement model, which reflects the relationship between latent and observed variables, was estimated in this paper using SmartPLS software. Table 3 demonstrates the results of the loading coefficients and significance analysis of the indicators, and the loading coefficients of all the indicators are greater than 0.7, indicating that all of them have reached the significance leve[8]. Table 3 also shows that the clombach coefficients for all dimensions are above 0.65, indicating that the reliability of the dimensions is acceptable. All values of the CR are above 0.7, indicating that the constructs perform well in terms of internal consistency. The AVE are all above 0.5, indicating that the constructs have good convergent validity. Using the Blindfolding function, the indicators are calculated to meet the requirement that the load on the relevant configuration is greater than all its loads on other configurations, which is in line with the cross-load indicator, indicating that the concepts have good discriminant validity.

Table 3. Measurement model analysis results

Latent variable	Observed variable	load-ings	Cronba ch's α	CR	A VE	Latent variable	Observed variable	load-ings	Cronba ch's α	CR	A VE
SF	SF1	0.844	0.776	0.871	0.692	RE	RE1	0.873	0.791	0.878	0.706
	SF2	0.776					RE2	0.809			
	SF3	0.872					RE3	0.837			
CF	CF1	0.851	0.764	0.864	0.68	PS	PS1	0.863	0.65	0.851	0.741
	CF2	0.8					PS2	0.858			

CT	CF3	0.821	0.75	0.889	0.8	PC	PC1	0.882	0.675	0.86	0.754
	CT1	0.895					PC2	0.854			
	CT2	0.894				PL	PL1	0.89	0.692	0.866	0.764
PE	PE1	0.86	0.682	0.863	0.759		PL2	0.858			
	PE2	0.882				PQ	-	-	0.923	0.935	0.865

4.2 Analysis of Structural Modeling Results

Older adults are the most detailed group in perceiving the level of service of the slow traffic system in the community neighborhood space, so the perceived quality is the core of analyzing the role of community neighborhood influence. Perceived safety (0.906, P<0.001), road environment (0.904, P<0.001), comfort (0.881, P<0.001), and road continuity (0.866, P<0.001) all had significant effects. The field survey found that the elderly often feel their safety is threatened by the ability to successfully pass through road intersections and unsignalized intersections within the green light time, especially non-motorized vehicles occupy the pedestrian crossing crossing facilities leading to the narrowing of the walking space for the elderly[9], so it is necessary to plan the crossing area of road intersections for bicycle traffic and pedestrian traffic to reduce the mutual traffic interference. Good road continuity helps to improve the efficiency of their travel and is a key factor in enhancing the travel experience of older people. The comfort of the elderly is more detailed outside the basic needs for slow traffic systems, the elderly tend to be more sensitive to noise and chaotic environments, reasonable planning of street layout and traffic flow within the community neighborhood space, reducing traffic conflicts and noise, and creating a peaceful travel environment for the elderly. Road environment is a reflection of the elderly focus on slow traffic space in addition to the basic passage function of the pursuit of landscape aesthetics, slow traffic roads on both sides of the green landscape to meet the needs of the elderly group of leisure and entertainment in the city home [10]. The comprehensive consideration of the above factors constitutes the perceived quality of the elderly on the level of aging service of the slow traffic system in the community space.T-tests were performed on the hypothesized paths. As shown in Table 4, all hypotheses are supported except H6 which is not valid.

The R^2 of the model's endogenous latent variables are all above 0.33, and the Q^2 is all greater than 0.25, indicating that the model has good explanatory power and predictive relevance.

Table 4. Results of path hypothesis testing

Hypothesis	Path	Path coefficient	P-value	Result	Hypothesis	Path	Path coefficient	P-value	Result

H1	PE→PQ	0.773	0.000	support	H4	PC→PL	-0.356	0.000	support
H2	PS→PC	-0.670	0.000	support	H5	PE→PS	0.141	0.133	Not support
H3	PS→PL	0.493	0.000	support	H6	PQ→PS	0.444	0.000	support

5 Conclusion

This paper is based on the community space slow traffic system aging evaluation system constructed by ACSI, and by taking Kunming as an example, the evaluation system has good predictive and explanatory ability from the various fitting indexes of the model, which provides a reference for the subsequent research on the travel behavior of the elderly. It is found that the urban elderly have diversified daily slow walking patterns, and the differences in family structure have different degrees of influence on their slow walking travel behavior, but the current pattern of slow walking activities for the elderly is relatively single. Perceived quality was found to be the most important factor influencing older adults' satisfaction with short-distance slow traffic system through PLS-SEM analysis, including perceived safety, road environment, comfort, and road continuity, all of which had a significant effect.

Compared with the severe situation of aging faced by the eastern coastal cities in China, the current aging level of Kunming is still at the middle level of the country, and it belongs to a relatively underdeveloped region, therefore, when exploring how to improve the slow travel environment for the elderly, we must take into account the characteristics of the region and the economic development situation, and adopt locally adapted and practicable strategies and measures.

Elder people's satisfaction with the aging of the slow traffic system can be increased by(1) Reasonable planning of the passage space of the community's slow traffic system, to ensure that the independent space of the elderly daily slow-moving is not infringed upon and that the signal lights are appropriately delayed in the areas where the elderly often travel, to ensure that the elderly have enough time to pass through the road. Thus improving the safety of their daily traveling. (2) In addition to meeting the basic transportation needs, suitable rest facilities can be set up, such as benches, pavilions, corner parks, etc., for the elderly to rest, recreate, and social interaction at the right time during the travel process, and to improve the social participation of the elderly. (3) Improve relevant facilities within the transportation system, such as green landscaping, shade coverage, lighting systems, etc., to provide a suitable and quiet traffic environment for the elderly. (4) Constructing and maintaining the slow-traffic road infrastructure around the community to ensure good continuity of the slow-traffic roads and enhance the accessibility of their daily trips.

The evaluation system constructed in this paper has certain practical significance for the aging transformation of slow transportation system. However, the data acquisition method is relatively single, deep learning, machine learning algorithms, automated

tools, and other methods can be attempted to deeply explore the travel behavior and preferences of older adults.

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