The Impact of Physical Features and Behavioral Patterns of Public Spaces on Older Adults' IADLs Performance: A Study of Macau Outdoor Environments

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Introduction

1. The rapid aging of populations worldwide creates urgent demands in policy, urban planning, and healthcare for age-friendly environments.
2. While IADLs are a key indicator of older adults' functional independence, research has seldom explored how public outdoor spaces directly shape these abilities.
3. Centered on Macau, this study investigates how physical features and behavioral patterns in public spaces influence IADLs, offering insights for more inclusive urban design.

Question

How do the physical features of public spaces and older adults' behavioral patterns interact to influence their IADL performance in Macau?

Objectives

1. To examine how physical features of Macau's outdoor public spaces influence older adults' IADL performance.
2. To explore how older adults' behavioral patterns within these environments affect their functional independence.
3. To provide evidence-based recommendations for designing more age-friendly outdoor spaces in dense urban contexts.

Methods

Study design

- Cross-sectional observational study conducted from December 1, 2024, to December 4, 2024
- Nine representative public spaces in Macau were selected based on diversity and accessibility to older adults
- Physical environmental data (e.g., green coverage, resting facilities) and behavioral observations were collected on-site

Participants

- Older adults (≥ 65 years) who regularly use the selected public spaces and had no severe cognitive impairments
- Voluntary participation in standardized IADL assessments (Lawton IADL Scale)
- Approximately four participants per time slot (five time slots per day) were surveyed in each public space

Statistical analysis

- Descriptive statistics characterized the distribution of observed behaviors and IADL scores
- Spearman's correlation examined associations between IADL scores, physical features, and behavioral patterns
- Multiple linear regression (with collinearity checks via VIF) identified significant predictors of IADL performance

Results

Figure 1. Statistical analysis of the percentage of occurrence for different behaviors

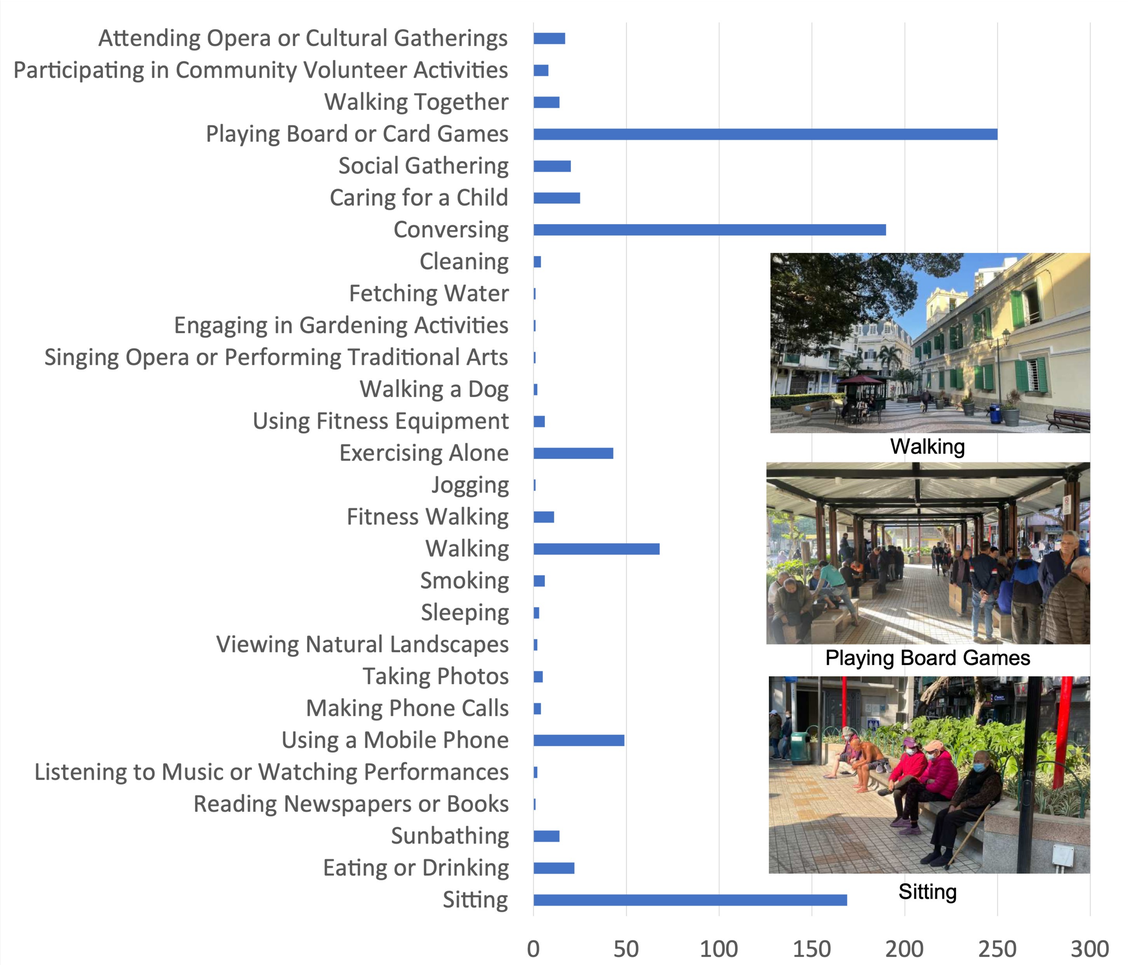

Table 1. Behavioral Activity Distribution Across Selected Public Spaces

		Sitting	Using a Mobile Phone	Walking	Exercising Alone	Conversing	Playing Board or Card Games
SPACE 1	Largo do Pagode do Bazar	2.4%	10.2%	10.3%	0.0%	5.3%	0.0%
SPACE 2	Flower City Park	9.5%	8.2%	8.8%	2.3%	7.4%	2.4%
SPACE 3	Triangular da Areia Preta Garden	32.5%	26.5%	16.2%	9.3%	35.3%	73.6%
SPACE 4	Largo do Lilau	6.5%	6.1%	0.0%	2.3%	7.9%	0.0%
SPACE 5	Largo Camoes	1.2%	0.0%	1.5%	0.0%	3.2%	0.0%
SPACE 6	Lou Lim loc Park	9.5%	18.4%	23.5%	53.5%	14.2%	0.0%
SPACE 7	Largo de Santo Agostinho	0.6%	2.0%	0.0%	2.3%	3.2%	0.0%
SPACE 8	Praca de Luis de Camoes	33.1%	22.4%	36.8%	25.6%	23.7%	24.0%
SPACE 9	Largo de Se	4.7%	6.1%	2.9%	4.7%	0.0%	0.0%

Table 2. Correlation Analysis Between Physical Feature, Behavior and IADL Scores

		IADL_Score	
		Pearson Correlation	Sig. (2-tailed)
1	Area (m2)	.118*	0.045
2	Percentage of Ground Pavement (%)	-.125*	0.034
3	Spatial Enclosure (%)	-.140*	0.017
4	Green Space Ratio (%)	.129*	0.029
5	Green Looking Rate (%)	.239**	0.000
6	Recreational Facilities (m2)	.251**	0.000
7	Density of Resting Facilities	.211**	0.000
8	Conversing	.211**	0.000
9	Playing Board or Card Games	.153**	0.009
	**. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed).		

Table 3. Optimized Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.353[a]	0.125	0.109	3.10701	0.125	8.079	5	283	0.000
a. Predictors: (Constant), Playing Board or Card Games, Spatial Enclosure (%), Density of Resting Facilities, Green Looking Rate (%), Conversing									

Table 4. Optimized Multiple Linear Regression Results for IADL Score Prediction

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
Spatial Enclosure (%)	-0.25	0.156	-0.111	-1.60	0.110	-0.140	-0.095	-0.089	0.650	1.538
Green Looking Rate (%)	1.16	0.269	0.499	4.31	0.000	0.239	0.248	0.240	0.231	4.325
Density of Resting Facilities	0.73	0.163	0.341	4.52	0.000	0.211	0.259	0.251	0.544	1.839
Conversing	-0.87	0.495	-0.204	-1.75	0.080	0.211	-0.104	-0.098	0.229	4.374
Playing Board or Card Games	-0.94	0.354	-0.252	-2.66	0.008	0.153	-0.156	-0.148	0.345	2.897

Conclusions

1) Higher Green Looking Rate correlated with better IADL scores, suggesting that simply seeing nature can boost older adults' functional abilities.

2) More resting spots improved IADL performance, underscoring the importance of comfortable, accessible seating for independence.

3) Frequent sedentary activities (e.g., board/card games) were linked to lower IADL scores, implying too much sedentary leisure may hinder functional ability.

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