SPACE MANAGEMENT IN PRIVATE DOMESTIC BUILDINGS: COMPARING ELDERLY AGE GROUPS IN HONG KONG

LEUNG, Mei-yung[1] and FAMAKIN, Ibukun[2]

[1]*Associate Professor, Department of Architecture and Civil Engineering, City University of Hong Kong, Tat Chee Avenue, Kowloon Tong, Hong Kong; bcmei@cityu.edu.hk*

[2]*Ph.D. Candidate, Department of Architecture and Civil Engineering, City University of Hong Kong, Tat Chee Avenue, Kowloon Tong, Hong Kong; iofamakin2-c@my.cityu.edu.hk*

Abstract

Private domestic (PD) buildings in Hong Kong involve mass housing estates provided by developers; these estates feature clusters of high-rise buildings. Although building regulations are followed by the construction professionals in the industry, there are no specific guidelines relating to space management (SM) for elderly people living in PD buildings in Hong Kong. Elderly people may need extra space for their daily life, due to their physical disabilities. This directly affects their affordability for renting and/or purchasing an apartment that meets their needs. To understand the potential cost of housing for the elderly, this study aimed to identify the importance of key SM items in PD buildings for elderly people belonging to different age groups.

A questionnaire survey was conducted among elderly people, of different age groups, living in PD buildings; data from a total of 89 respondents were purposively collected. This study identified 11 SM items, including distances between rooms, the size of various rooms, the width of doors, turning spaces at doors, and indoor barrier-free access. The results of the statistical analysis indicated a significant difference among the different age groups with respect to the respondents' satisfaction with the distances between rooms in their PD buildings; there was no significant difference among the different age groups with respect to their satisfaction with the size of their rooms. This may be because the energy needed for walking declines in later life. In addition, the satisfaction of the different age groups with the size of their rooms and the indoor barrier-free designs of their unit flats was lower than their satisfaction with the distances between their rooms. Therefore, construction professionals are urged to seriously consider the distances between rooms inside the unit flats for elderly people, in order to reduce the housing costs of the occupants.

Keywords: Elderly, Hong Kong, Private Domestic Buildings, Space Management.

INTRODUCTION

Increasing life expectancy and low fertility rates in Asian countries (rates that are among the lowest in the world) are resulting in a significant growth of the elderly population. The elderly in the Asia-

Pacific account for more than half (54%) of the world's elderly population, with an expected elderly population (those aged 65 years and over) of about 500 million by 2030 (United Nations 2006). The consequences of such growth of the elderly population provide reasons for addressing the issue of age-friendly built environments meeting the changing needs of elderly people. Due to the decline in their health and mobility, elderly people spend most of their time in their home and depend upon the spaces provided there for supporting their daily activities and maintaining good health (Tse 2012).

The increasing numbers of elderly people have prompted the Hong Kong government to formulate an aging-in-place policy to tackle the problems of the aging population. However, only about 46% of the elderly are beneficiaries of the various public and subsidized housing schemes available, leaving more than half (54%) of the elderly population in private domestic (PD) buildings (Hong Kong Housing Authority 2015). Moreover, a recent research study by the Jockey Club Institute of Ageing placed Hong Kong as the third poorest elderly population (out of 97 countries) in the Global Ageing Watch Index in 2015 (Yip 2015). Hence, retired elderly people with little income experience difficulties in renting or buying sufficient space (for their special needs) in PD buildings. The purpose of the study was therefore to identify the importance of key space management (SM) items for elderly people belonging to different age groups and living in PD buildings in order to understand their potential housing costs.

POVERTY AMONG THE ELDERLY

Household income has been the primary consideration in determining housing affordability; the quantity and quality of housing are also relevant (Tilly 2005). The main sources of household income for retired elderly people in Hong Kong are old-age allowances and financial support from their children (Oxfam 2010). Less than one-sixth (14.6%) of Hong Kong's elderly depend on the Old Age Comprehensive Social Security Assistance (CSSA); 38.8% rely on the Old Age Allowance (OAA; Social Welfare Department 2010). Currently, the CSSA and the OAA provide HK$2,590 (approximately US$334) and HK$1,000 (approximately US$129), respectively; but these cannot be taken simultaneously. The inadequate incomes of elderly people – who also have non-housing costs (buying food, clothing, health insurance, etc.) – makes it hard for them to rent a flat priced at between HK$246 and HK$427 (approximately US$32 to US$55) per m^2/month or to buy a flat that may cost around HK$6,050 to HK$32,420 (approximately US$780-4,180) per m^2. Elderly people on low incomes may find it difficult to rent or purchase sufficient space to meet their daily needs.

SPACE MANAGEMENT IN PRIVATE DOMESTIC BUILDINGS IN HONG KONG

Hong Kong is a small city in Southern China with one of the highest population densities, and among the highest housing prices, in the world (Hui et al. 2007). Due to the limited amount of land, private developers tend to build as much as possible on a small piece of land in order to maximize their return on investment (Wong 1993). Hence, SM is required to make the best use of land and to ensure the satisfaction of those who use the spaces within the buildings.

Size of spaces

In order to maximize the use of limited spaces for accommodating elderly needs, it is essential to define circulation patterns, develop layout plans, and understand the service dynamics (Addi and Lytle 2011). The solution to the space problem in private domestic flats for elderly people requires an iterative approach in order to design the layout properly (El Ansary and Shalaby 2014). Because of the disabilities of elderly people, extra space is required for additional facilities, such as wheelchairs

and specially designed toilet seats (Hong Kong Housing Society 2005). Hence, the process of designing housing units for the elderly should carefully identify elderly people's needs, set planning guidelines, design space layouts, define performance, and monitor space usage, in order to ensure that the unit flats for the elderly are affordable and meet their changing needs (Kaiser 1989).

Distance

Walking is not only a basic means of moving from place to place but also an indispensable activity required in daily life. The habit of walking is influenced by individual circumstances, physical health, preferences, and environmental factors (Mehta 2008). The physical changes in aging affect the amount of energy that elderly people have and reduce their ability to walk long distances (Schrack et al. 2012). In fact, walking long distances increases the risk of falling, due to elderly people's disabilities and physical impairment. Hence, elderly people's ability to walk certain distances within their living environment is critical to maintaining their health (Hardy et al. 2010).

Elderly people undergo a substantial decline in the tolerance of exercise, and fitness assessment serves (in clinical practice and for research purposes) as an early indicator of their impending functional limitations (Simonsick et al. 2006). Owing to their limited energy and mobility, the elderly may not be able to engage in vigorous activities (e.g., using a treadmill) for sustaining their health (Kerr et al. 2012). In fact, the ability of the elderly to take part in walking as a physical activity is essential for their longevity and for reducing both the number of hospital visits they need to make and their health-care costs; it is also pivotal to their ability to carry out activities of daily living independently (Hardy et al. 2010).

RESEARCH METHODOLOGY

A questionnaire survey was designed in order to investigate differences in the levels of satisfaction with SM items among elderly people belonging to different age groups in selected PD buildings in Hong Kong. The survey questions covered two areas: (1) demographic characteristics of the respondents; and (2) the respondents' degree of satisfaction with 11 SM items (see Table 1). The respondents were asked to indicate their level of satisfaction with the SM items using a 7-point Likert-type scale, ranging from 1 (*very dissatisfied*) to 7 (*very satisfied*). Since most of the elderly people in Hong Kong are Chinese (and mainly follow Chinese traditions and communicate in Chinese), the questionnaire was translated into Chinese in order to eliminate language barriers (Leung et al. 2013).

Out of the 18 housing districts in the Hong Kong region, four were selected because they met the criteria of (1) being territories in Hong Kong (Kowloon, Hong Kong Island, and the East and West New Territories); (2) being housing estates developed by private developers; and (3) having high-rise buildings. These four districts had a mix of various living environments that provided useful information about the SM conditions in PD buildings. In this research study, the elderly respondents (who were all at least 65 years old) were allotted (on the basis of their level of frailty) to three different groups: a young-old group (65 to 74 years), a middle-old group (75 to 84 years) and an old-old group (85 and above years). A total of 89 respondents (between 20 and 25 elderly people from each of the four districts) participated in the study; 41.6%, 44.9%, and 13.5% of them were aged 65-74, 75-84, and above 84, respectively; 62.9% were male and 37.1% female. It was found that 1.1% of the elderly respondents lived in flats with a floor space of less than 200 ft^2, while 44.9% occupied flats of 200-599 ft^2, 37.1% occupied flats of 600-999 ft^2, and 16.9% occupied flats of 1,000 ft^2 or more. Eighty-one percent of the elderly respondents were able to walk normally, without any assistance; 18% needed assistance with walking; and only 1% used wheelchairs.

The data collected were analyzed using the SPSS 20.0 software. Firstly, the mean scores of the three age groups, for previously identified SM items in PD buildings, were analyzed. Secondly, a one-way ANOVA was conducted, to compare the mean scores for the SM items among the three different groups. Lastly, a post-hoc test was conducted to identify the contribution of each age group to the differences identified in the ANOVA.

RESULTS

Comparison of the SM Items across the Three Age Groups

The mean scores for the room-size items (S6, S7, and S8) were generally low (indicating low satisfaction) in this study (the mean scores were 4.90, 4.84, and 4.83, respectively; see Table 1). Moreover, the respondents also rated the two items concerning barrier-free design – turning spaces at the doors (S9) and indoor barrier-free access (S10) – on the low side (4.88 and 4.50, respectively).

One-way ANOVA was also used to compare the level of satisfaction across the different age groups (see Table 1). The responses of the three age groups to the 11 SM items show that the levels of satisfaction were significantly different with the following: the distance between bedroom and bathroom and/or toilet (for S1, F=5.250, p=0.007); the distance between the bedroom and living room (for S2, F=5.037, p=0.009); the distance between the living room and bathroom and/or toilet (for S3, F=8.576, p=0.000); and the distance between the living room and kitchen (for S4, F=4.881, p=0.010). Surprisingly, there was no significant different among the three age groups in the levels of satisfaction with the size of the different rooms, the width of doors, and the turning space at the doors.

Table 1 One-way Between-group ANOVA of the SM Items

SM Items	Age group	Mean	SD	F	Sig.
Distance between rooms					
S1 – Distance between bedroom and bathroom and/or toilet	65-74	5.19	0.616	5.250	**0.007****
	75-84	5.80	1.043		
	85+	5.25	0.866		
	Total	5.47	0.906		
S2 – Distance between bedroom and living room	65-74	5.11	0.658	5.037	**0.009****
	75-84	5.73	1.037		
	85+	5.42	0.669		
	Total	5.43	0.890		
S3 – Distance between living room and bathroom and/or toilet	65-74	5.00	0.707	8.576	**0.000****
	75-84	5.78	0.947		
	85+	5.42	0.669		
	Total	5.40	0.888		
S4 – Distance between living room and kitchen	65-74	5.19	0.701	4.881	**0.010***
	75-84	5.80	1.091		
	85+	5.17	0.937		
	Total	5.46	0.966		
Size of rooms					
S5 – Size of bedroom	65-74	4.92	0.862	0.658	0.520
	75-84	5.20	1.344		
	85+	4.92	1.240		
	Total	5.04	1.147		
S6 – Size of living room	65-74	4.86	0.918	0.182	0.834
	75-84	5.03	1.387		
	85+	5.00	1.279		
	Total	**4.96**	1.186		
S7 – Size of bathroom and/or toilet	65-74	4.73	1.122	0.704	0.497
	75-84	5.00	1.155		
	85+	4.67	1.155		

	Total	**4.84**	1.137		
S8 – Size of kitchen	65-74	4.78	1.004	0.070	0.932
	75-84	4.88	1.137		
	85+	4.83	1.030		
	Total	**4.83**	1.058		
Barrier-free design					
S9 – Width of door	65-74	4.86	0.822	2.081	0.131
	75-84	5.25	0.870		
	85+	5.00	0.739		
	Total	5.06	0.844		
S10 – Turning space at the doors	65-74	4.70	0.740	1.529	0.223
	75-84	5.00	0.847		
	85+	5.00	0.739		
	Total	**4.88**	0.795		
S11 – Indoor barrier-free access (e.g., at doorways)	65-74	4.51	0.870	1.896	0.156
	75-84	4.70	1.018		
	85+	4.08	1.084		
	Total	**4.54**	0.978		

Note: SD=standard deviation; Sig.=significant; bold items are significant values; **=ANOVA is significant at the 0.01 level (two-tailed)

In order to ascertain which of the age groups contributed to the significant difference in the levels of satisfaction, post-hoc tests were conducted. The result of the post-hoc tests indicates that the significant difference in the satisfaction levels occurred between the group aged 65-74 and the group aged 75-84. Furthermore, there were no significant differences between the satisfaction levels of the group aged 75-84 and the group aged 85 and over.

Table 2 Post Hoc Tests of the SM Items

SM Items	Age group		Mean Diff.	S.E.	Sig.
	x	y	x-y		
Distance between rooms					
S1 – Distance between bedroom and bathroom and/or toilet	65-74	75-84	-0.611	0.197	**0.007****
		85+	-0.061	0.287	0.976
S2 – Distance between bedroom and living room	65-74	75-84	-0.617	0.194	**0.006****
		85+	-0.309	0.283	0.523
S3 – Distance between living room and bathroom and/or toilet	65-74	75-84	-0.775	0.187	**0.000****
		85+	-0.417	0.273	0.283
S4 – Distance between living room and kitchen	65-74	75-84	-0.611	0.211	0.013
		85+	0.023	0.308	0.997

Note: S.E=standard error; Sig.=significant; bold items are significant values; **=post-hoc test is significant at the 0.01 level (two-tailed)

DISCUSSION

The results of the comparison of the means show that satisfaction with room sizes (S6-S8) and barrier free designs (S10-S11) were low, compared with satisfaction with the distance between rooms. Similarly, the levels of satisfaction with the distances between rooms (S1-S3) in the unit flats were significantly different among the elderly respondents; but the post-hoc test shows that there was a significant difference only between the group of young-old elderly people and the group of middle-old elderly people.

Size of rooms and turning spaces

The current study reveals that the levels of satisfaction with the size of the different rooms and the barrier-free designs in the PD buildings were not significantly different among the elderly respondents.

A small living room (S6) discourages both visits from family members during festivals and social gatherings /interactions with friends, and it causes low satisfaction among the elderly. A small bathroom and/or toilet (S7) prevents the provision of assistive bathing equipment (e.g., bathing seat) and affects the installation of handrails and grab bars for frail elderly people. In addition, the spine of elderly people becomes curvy, due to weakness of the spinal bones, resulting in an inability to stand upright and reach standard heights. The provision of a small kitchen space (S8) reduces the size of the worktop surface used for preparing food and limits the installation of kitchen cabinets at accessible heights.

Due to a decline in the muscle strength of the elderly and pain in their joints, they have a tendency to lose balance and are at risk of falls and collisions (Donoghue et al. 2003). Therefore, barrier-free access designs (S11) such as handrails are necessary to provide support in order to help elderly people maintain their balance. A small living space makes it difficult to install handrails in the kitchens and living rooms of the elderly, which affects the barrier-free access within their unit flats and in turn induces dissatisfaction of the elderly. Similarly, the turning space at the doors – for supporting mobility (S10) – is also reduced when the different rooms are small.

Distance

The findings of the study reveal that the responses to *distances between different rooms* (S1-S3) in PD buildings were significantly different across the three age groups. Due to advances in the health-care system and the increase in life expectancy to about 80 years, elderly people may be bright and energetic when they are 65 to 74 years old (Orimo et al. 2006). Hence, elderly people may have the ability to engage in energetic or moderately energetic physical activity that maintains their health (Lindsey 2002). However, their living environment in Hong Kong may limit them from walking within their ability and specified activity requirements, contributing to the low satisfaction level of the young-old group (65-74 years). As elderly people grow older, their ability to engage in physical activity drops, due to energy limitations. The deterioration in the physical ability of the elderly people aged 75-84 may positively influence their satisfaction with the distance between the various rooms in their compact living environment. On the other hand, when elderly people become frail (as had those in the old-old group of respondents aged 85 and over), the deterioration of multiple physiological systems and vulnerability to poor health results in low physical activity, exhaustion, weakness, and a decline in their desire to walk long distances (Kim et al. 2013).

RECOMMENDATIONS

Practical Implications

This study establishes differences in the levels of satisfaction with SM items among elderly people living in Hong Kong and belonging to different age groups. Based on the findings of the study, practical recommendations are proposed for construction professionals, in order to ensure an affordable and comfortable living environment for the increasing numbers of elderly people. The study suggests that the distance between rooms should be shortened for frail elderly people (people more than 85 years old). This can be achieved by modifying the interior design of the unit flats for elderly people. For instance, the bathroom and/or toilet should be positioned between the living room and the bedroom so that elderly people can easily and safely use the toilet during the day and during the night. In fact, modification of the design of homes may provide sufficient space to increase the satisfaction of the elderly within the available space in their unit flats. Furthermore, the findings of the study suggest that an activity room should be provided within the living environment of elderly people, in order to enable energetic elderly people to perform exercises and engage in physical activity for maintaining their physical and psychological health (Lindsey 2002). Although the cost of renting or purchasing a flat is increased by the repositioning of rooms and the provision of activity rooms, it is believed that the health costs of the elderly would be greatly reduced, which could eventually reduce the overall expenses incurred by the elderly.

Further Research

The current study has collected data from only four of the 18 political districts in Hong Kong; this could affect generalization of the findings and may have introduced bias into the study. However, certain measures were taken to reduce the possibility of bias in the study; for instance, high-rise housing estates in Hong Kong were purposively selected and all the respondents were aged 65 years or above during the period of the survey. To improve the allocation of room space to meet elderly people's needs, subsequent studies could introduce the use of objective data measurement involving computerized devices (such as Jamar or Kratos) for measuring the muscular strength of the elderly, in order to determine how far elderly people can walk. This could then form a basis for determining the appropriate distance between the various rooms in flats designed for the elderly.

CONCLUSION

The changes in elderly people's functional and physical abilities affect the space needed for them to perform activities of daily living independently. To satisfy their varying needs (at different ages) for space at an affordable cost, the SM of PD buildings in Hong Kong is essential. Thus, the study identified the importance of key SM items for elderly people belonging to different age groups and living in PD buildings. The results reveal that the distances between the rooms in elderly people's unit flats make a significant difference when they reach 75 years old, while room size does not significantly affect the satisfaction levels among elderly people belonging to different age groups. In addition, satisfaction among the elderly respondents (belonging to the three different age groups) with the size of their rooms and the indoor barrier-free designs of their unit flats was low, compared with their satisfaction with the distances between their rooms. Therefore, construction professionals are urged to seriously consider the distances between rooms inside the unit flats for elderly people in order to reduce the elderly occupants' housing costs. In addition, an activity room (for moderately energetic physical exercise) can help the elderly occupant of a flat maintain his or her health as well as, over time, reduce the amount he or she needs to spend on health care.

ACKNOWLEDGEMENT

The work described in this paper was fully supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, China (Project No. CityU 115113).

REFERENCES

Addi, G. and Lytle, J. (2011) *Space Planning*. Washington, D. C.: American Institute of Architects.

Chiu, R. L. H. and Ho, M. H. C. (2006) Estimation of elderly housing demand in an Asian city: methodological issues and policy implications. *Habitat International*, 30, 965-980.

Department of Health and Human Services (2008) *Physical Activity Guidelines for Americans*. Washington, D. C.: US Department of Health and Human Services.

Donoghue, J., Graham, J., Gibbs, J., Lewis, S. M. and Blay, N. (2003) Validating components of a fall risk assessment instrument. *International Journal of Health Care Quality Assurance*, 16(1), 21-28.

El Ansary, A. M. and Shalaby, M. F. (2014) Evolutionary optimization technique for site layout planning. *Sustainable Cities and Society*, 11, 48-55.

Hardy, S. E., Kang, Y., Studenski, S. A. and Degenholtz, H. B. (2010) Ability to walk ¼ mile predicts subsequent disability, mortality and health care costs. *Journal of General Internal Medicine*, 26(2), 130-135.

Hong Kong Housing Authority (2015) *Housing in Figures* 2015. Retrieved from https://www.housingauthority.gov.hk/en/common/pdf/about-us/publications-and-

statistics/HIF.pdf viewed October 29, 2015.

Hong Kong Housing Society (2005) *Universal Design Guidebook for Residential Development in Hong Kong*. Retrieved from http://hkhs.com/eng/info/udg.asp viewed June 30, 2015.

Kaiser, H. H. (1989) *The Facilities Manager's Reference: Management, Planning, Building Audits, Estimating*. Kingston, MA: RS Means Co.

Kerr, J., Rosenburg, D. and Frank, L. (2012) The role of the built environment in healthy aging: community design, physical activity, and health among older adults. *Journal of Planning Literature*, 27(1), 43-60.

Lindsey, C. (2002) Fighting frailty in the elderly. *Biomechanics*, 9(7), 20-30.

Liu, E. and Wong, E. (1997) *Health Care for Elderly People*. Hong Kong: Provisional Legislative Council Secretariat.

Mehta, V. (2008) Walkable streets: pedestrian behavior, perceptions and attitudes. *Journal of Urbanism*, 1, 215-245.

Orimo, H., Ito, H., Suzuki, T., Araki, A., Hosoi, T. and Sawabe, M. (2006) Reviewing the definition of elderly. *Geriatric Gerontology International*, 6, 149-158.

Oxfam (2010) *Policy Paper on the Living and Health Conditions of Poor Elderly not on Comprehensive Social Security Assistance and their Attitudes towards Social Security*. Retrieved from http://www.oxfam.org.hk/content/98/content_8814en.pdf viewed July 17, 2015.

Schrack, J. A., Simonsick, E. M. and Ferrucci, L. (2012) The relationship of the energetic cost of slow walking and peak energy expenditure to gait speed in mid-to-late life. *American Journal of Physical Medicine and Rehabilitation*, 91(9), 1-8.

Simonsick, E. M., Fan, E. and Fleg, J. L. (2006) Estimating cardiorespiratory fitness in well-functioning older adults: treadmill validation of the long distance corridor walk. *Journal of the American Geriatrics Society*, 54(1), 127-132.

Tilly, C. (2005) *The Economic Environment of Housing: Income Inequality and Insecurity*. Retrieved from https://www.uml.edu/docs/Housing-Tilly%20chapter-GRBT106-2299G-01-020-037_tcm18-75299.pdf viewed July 22, 2015.

Tse, Y. F. (2012) *A Study of the Living Environment and Elderly Services in the Old Urban Areas of Hong Kong* (Master's Thesis, University of Hong Kong). Retrieved from http://hdl.handle.net/10722/174588

United Nations (2006) *Population Ageing 2006*. Retrieved from www.unpopulation.org viewed May 19, 2015.

Wong, F., Hui, E., Chung, K. W., Li, T. and Lui, E. (2012) *Housing for the Elderly in Hong Kong – Affordability and Preferences*. Hong Kong: Hong Kong Institute of Surveyors.

Wong, Y. C. R. (1993) *Property and Housing Markets in Hong Kong: Issues and Analyses*. Retrieved from http://www.wangyujian.com/papers/journals/21_Property%20and%20Housing%20Markets%20in%20Hong%20Kong-%20Issues%20and%20Analyses.pdf viewed December 6, 2015.

Yip, A. (2015, July 17) Hong Kong's elderly fare badly in global comparison of poor. *South China Morning Post*. Retrieved from http://www.scmp.com/news/hong-kong/economy/article/1840622/hong-kongs-elderly-fare-badly-global-comparison-poor viewed November 25, 2015.