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The impacts of dwelling conditions on older persons' psychological well-being in Hong Kong: the mediating role of residential satisfaction

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Abstract

About 11% of Hong Kong's population of 7 million people are aged 65 and over and many of them live in old urban areas. Many of these areas have been subjected to urban redevelopment and some of the residents have been relocated to newer estates in peripheral new towns. Previous studies have focused on the challenges the urban environment has placed on older persons in terms of capability to cope with the demands that the environment places upon them. This paper suggests that dwelling conditions can act as stressors and become contributing factors that impact on older persons' residential satisfaction and psychological well-being (subjective well-being). This study examines the role of residential satisfaction (satisfaction with dwelling unit, estate and district) in mediating the effects of dwelling conditions (interior environment and exterior environment) on psychological well-being. A sample of older persons was recruited from a sampling frame of 16 urban sub-areas located in old urban areas and new towns. 518 older persons (224 males, 294 females) aged 60 and over were interviewed and the findings indicated that residential satisfaction was determined by assessment of both the interior environment and the exterior environment, although these were appraised differently. The interior environment had a greater impact on residential satisfaction than the exterior environment. It appeared that environmental dwelling conditions mainly affected older persons' psychological wellbeing indirectly and, hence, probably influenced their opportunities for successful ageing. However, subsequent tests revealed that dwelling conditions had no direct impact on psychological well-being. In light of these findings, it is proposed that the role of environmental factors and their relation to older persons' psychological well-being depends on the extent to which a person's expectations of residential satisfaction are met. Some implications of these findings for local housing and social care policy are discussed.

Keywords

Residential satisfaction; Older persons; Dwelling conditions; Psychological well-being; Hong Kong; China

Introduction

Psychological well-being has been noted as being associated with successful and active ageing in a

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number of recent studies as well as in the recent WHO active ageing policy framework (Phillips & Yeh, 1999; Siu & Phillips, 2002; WHO, 2002). It has been well documented that dilapidated dwelling conditions adversely affect older persons' psychological well-being. Many studies have found that, among older persons, the more favourable the environment, the more positive its impact on psychological well-being (Brown (1995) and Brown (1997); Lawton, 1983; Lawton & Nahemow, 1973; Magaziner & Cadigan, 1989). One reason why poor environmental factors adversely affect older people may be that environmental stressors constantly remind those living in dilapidated conditions with the "dogged evidence of their own failure...and with inescapable proof of their inability to alter the unwanted circumstances of their lives" (Pearlin, Menaghan, Lieberman, & Mullan, 1981, p. 340). This comment implies that the perception of the physical environment—that is, the failure to meet one's preferred standard of living and the perception of one's inability to escape from adverse situations—may mediate the effect of the physical environment on older persons' psychological well-being. Yet, few researchers have identified the underlying mechanism (or the mediator) of this effect. Perhaps certain cognitive processes are at work that provide older persons with meaningful attributions of the physical environment. The observations by Pearlin et al. (1981) indicate that the mediator is an evaluative mechanism that uses aspects of the living environment as the sources of input.

Residential satisfaction as a mediator

Brown (1995) and Brown (1997) adopted the urban ecological model of ageing to study older persons' residential satisfaction and psychological well-being (positive and negative affect) and incorporated in it the importance of suprapersonal environment (neighbourhood poverty). However, inconclusive results were obtained. For instance, out of six negative social conditions, only perceived neighbourhood victimization was a predictor of residential satisfaction; perceived neighbourhood female-headed households was a predictor of positive affect and perceived neighbourhood unemployment was a predictor of negative affect (Brown, 1997). The study also showed that residential satisfaction was a predictor of negative affect but not positive affect. These results suggest that residential satisfaction might take a mediating role between suprapersonal environment and psychological well-being.

There are good reasons to believe that residential satisfaction mediates the effects of environmental stressors on psychological well-being. Initially, residential satisfaction refers to individuals' appraisal of the conditions of their residential environment, in relation to their needs, expectations and achievements (George & Bearon, 1980; Gentile, 1991; Amérigo & Aragonés, 1997). Such an evaluative process is at the heart of residential satisfaction. It implies that high satisfaction would occur when the surrounding environment meets the individual's needs or expectations. Empirically, residential satisfaction has been operationalized as comprising various features of the home and its surroundings. For instance, the comfort of the kitchen and bathroom is a source of

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reference for residential satisfaction. Other features have included the level of lighting and the insulation inside the dwelling unit. Some residents are also concerned about exterior features such as the conditions of the street, congestion in car-parking areas, road-works, building location and the availability and adequacy of nearby natural elements (Kaplan, 1985; Perez, Fernandez–Mayoralas, Fernandez, & Abuin, 2001). The prevalence of school-age children residing in the neighbourhood (Brown, 1995) and residential and community crowding (Gomez-Jacinto & Hombrados-Mendieta, 2002) are some of the important social features that can also affect residents' evaluations of their surroundings. Others have also suggested that the evaluative outcome of residential satisfaction is important to psychological well-being (e.g., Levy-Leboyer & Ratiu, 1993; Schwirian & Schwirian, 1993). These researchers have argued that the subjective environment exerts greater influences than does the objective environment. This is consistent with Brown (1995) and Brown (1997) urban ecological model of ageing, which postulates that an individual's adaptive behaviour and subjective well-being are in balance when the demands (or press) of the environment do not exceed the level of individual ability (or competence) to manage the demands. In other words, the older persons' well-being is said to be in "a state of balance" provided that their needs are met (or satisfied) with respect to the demands stemming from the surrounding environment. Studies that have examined residential satisfaction and psychological well-being in the context of older persons' housing needs have reported high inter-correlation between these measures (see, for example, Brown, 1997; Lawton, 1983; Phillips, Siu, Yeh, & Cheng, 2004).

Theoretical perspectives

Carp and Christensen (1986) categorized characteristics of the older people's housing environment based on basic human needs, which included resources for food, sleep/rest, personal hygiene, resources for harm avoidance, maintaining order, affiliation and aesthetics. The strength of this 'needs' approach is that it can address any possible environmental deficiencies that would pose a risk to the older people's mental well-being. Aspects that are necessary include need for adequate temperature control, need to be protected from bothersome level of noise, need for security, need for personal space and need for adequate lighting (Amérigo & Aragonés, 1997; Huttman, 1977; Jirovec, Jirovec, & Bosse, 1985). There should also be structures that facilitate social interaction, such as common areas or parks. In the present study, the measure of environmental factors in the dwelling conditions, in terms of interior and exterior environment, will reflect such needs. Furthermore, environmental stressors in the dwelling conditions could vary with the degree of perceived control. It is, for example, possible to exert some control over the temperature and noise level of our indoor environments. However, it is very difficult or even impossible for an individual to exert control over some external stressors. Because of this, it is inappropriate to assess satisfaction on dwelling conditions by lumping together measures of interior and exterior environment into one variable.

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The present study

Today, Hong Kong is prominent among the many countries in the Asia–Pacific region that are experiencing rapid demographic ageing but in very different socio-economic and physical environments to those in the West (Phillips (1992), Phillips (1995) and Phillips (2000); Phillips & Yeh, 1999). Life expectancy at birth for many Asia–Pacific countries is now among the highest in the world and, for Hong Kong's citizens, life expectancy has increased from 72.3 years for males and 78.5 years for females in 1981 to 78.6 and 84.3 years for males and females, respectively, in 2003 (Census and Statistics Department, 2003). To date, most published studies on environment–ageing relations among older persons have been conducted in Western cities where densities, services, cultures and support networks are somewhat different from those in Asia, where the majority of older people now live. Further, while Hong Kong is often considered as a Westernized society (due to its colonial past), its value systems are very much entrenched in those of Eastern philosophy (Hofstede & Bond, 1984; Ng, Phillips, & Lee, 2002). In view of the history of urban development in the Asia–Pacific and its varied cultural features, a direct replication of Western findings in the region's cities is likely to be rare. Therefore, the present study, which investigates the underlying mechanisms contributing to environment–psychological well-being relationships for older persons in Hong Kong, is pioneering and will provide an initial benchmark for future studies in the region.

In residential terms, the local environment, which includes the internal home environment and surrounding neighbourhood, is of great importance for older persons who tend to have a more locally focused or restricted action space than younger age groups. As with other age groups, older persons households' activity patterns can be envisaged as an hierarchy of progressively larger spaces: personal space, neighbourhood space, activity space and action space (Golledge & Stimson, 1997; Phillips & Yeh, 1999). However, older persons tend to have more restricted activity spaces than younger people, due to a combination of factors including the lack of a need to travel far for work, possibly restricted physical mobility and other local activity patterns, so they are on average more likely than younger people to remain in their local environment. Therefore, older persons will concomitantly tend to be more affected by their local living environment and the nature of the facilities and services to hand, which can facilitate or impede many activities (Phillips & Yeh, 1999). As a result, this study expected that interior environmental features and very local factors might exert a greater impact on older persons' residential satisfaction and psychological well-being than would features of the wider exterior environment.

The aims of the present study were two-fold: first, to investigate the mediating role of residential satisfaction on the relation between dwelling conditions and psychological well-being and, second,

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to examine the differential impact of interior and exterior environment on psychological well-being via residential satisfaction. Based on the existing literature in environmental psychology and related disciplines, it was expected that residential satisfaction would play a mediating role in the relationship between the older persons' residential environment and their psychological well-being. Further, some aspects of the environment such as the internal home were likely to be more important in determining psychological well-being. These could be envisaged older as an hierarchy of spaces moving progressively from personal space (interior/internal environment) to neighbourhood space (exterior/external environment). The findings from the study were intended to contribute to interdisciplinary understanding across a range of areas, including environmental psychology, medical geography and social gerontology. They would illustrate the possible impacts of physical and social environmental factors on mental health and well-being and suggest possible mediators of psychological well-being among older persons in similar Asian settings.

Methods

Participants and procedures: an areal sampling framework

A face-to-face interview method with older respondents was designed. Participants were identified by a multi-stage quota areal sampling method (Yeh, 1999) which enables a stratification and typology of urban sub-areas to be devised in the absence of population lists that give information on age of residents. The study restricted itself principally to the lower income groups who comprise by far the majority of Hong Kong's older population at present and for whom there is less choice of where and how to live. Initially, four general areas (two in old urban areas and two in new towns1) with high concentration of low-income population, overcrowding households and high concentration of elderly people were identified by using a Geographic Information System (GIS). In terms of overall distribution of its elderly population, Hong Kong tends to have more older persons living in established metropolitan area districts than in other districts (Phillips & Yeh, 1999). The percentage of older persons in metropolitan areas was 1.3 percentage points higher than that of the total population, whereas in the relatively more rural areas in the New Territories it was 2.5 percentage points lower (Yeh, 1999). A major concern is that the environments in the densely populated old metropolitan areas are relatively poor and potentially not friendly to older persons, especially the low-income groups that largely inhabit them.

As a first stage of the sampling method, using the 2001 Hong Kong Population Census2 as the source of socio-economic data, large street blocks of the whole of Hong Kong were classified and mapped with the geographic information system (GIS) software, ArcView, based on three criteria—low income, over-crowdedness and elderly persons. Large street blocks with a high concentration of low-income households3 were defined as those with percentages of monthly domestic household incomes of less than HK$9,999 (US$1280; US$1=HK$7.8) that are higher than

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the Hong Kong's average percentage of 24.03%. Overcrowdedness involved large street blocks with percentages of domestic households with main tenants, sub-tenants and co-tenants higher than the Hong Kong's average of 3.58%. Large street blocks with high concentrations of elderly population were defined as those with percentages of population aged over 60 years old (a widely accepted retirement age in Hong Kong) higher than the Hong Kong average of 11.13%. The analysis enabled four clusters of such general areas to be selected, two in the old urban areas (Sham Shui Po and Kwun Tong) and two in the new towns (Tuen Mun and Tai Po), with elderly services nearby. The selected areas thus represented overcrowded, low-income locations, with a high concentration of elderly population.

The second stage of the areal sampling frame involved the identification in each of the four selected general areas of four more specific types of housing areas: old public housing, new public housing, old private housing, and new private housing. These were the research sub-areas. Areas with buildings over 30 years old were classified as "old housing areas" and those with buildings aged from 5 to 10 years old were classified as "new housing areas". Buildings less than 5 years old were not used in the study as it was felt that residents might still be experiencing adjustment problems which could distort their perceptions of the environment. It can be argued that a period of 5 years or more was sufficient for residents to have adjusted to a new environment, even if they were new to the area, such as having moved from the old urban areas to the new towns under the various urban renewal programmes of the Hong Kong government. Public housing and private housing areas were identified within each of the four selected general areas. Public rental housing schemes, which housed approximately 30% of Hong Kong's population in 2003, are clearly identifiable locally. When overlaying public and private housing areas with building age, the framework identified the old public housing, new public housing, old private housing, and new private housing areas in each selected general area. This yielded a total of 16 different research sub-areas from the four selected general areas.

Within each of the 16 selected research areas, detailed maps showing the outline of street blocks/housing estates were prepared for the researchers to conduct site observations before the survey. To cross-check the reliability of data found by the GIS, the researchers selected the final housing estates in each research area based on their knowledge and judgment of the accessibility of local facilities and services for older persons in the various areas. Within each estate, the buildings and selected units in each selected building were chosen by systematic sampling procedures, as follows. A list of the number of buildings in each selected housing estate was devised after direct observation and the buildings were chosen by a systematic sampling method with a random start, say every fifth building in the total list. Once a building was selected, the selected units were again chosen by a systematic sampling method with a random start. For instance, every second unit on each of the 5th, 10th, 15th, 20th floors, etc. would be selected.

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Interviewers were then recruited and trained to conduct face-to-face interviews with about 30 older respondents selected from apartments adopting the systematic sampling procedures. If the selected unit did not have a target respondent (age 60 or above) or no one responded, the interviewers would proceed to the apartment next door. Further measures were taken to ensure the data reflected an even distribution of residents living within a selected research area. That is, each building or living block within a selected research area was allowed two successfully completed participants. Once this quota was filled, the interviewers moved on to another building within the selected research area. An overall response rate of 59% was achieved, which is a reasonable rate given the need for detailed interviews with older respondents. A total of 518 respondents participated, whose demographic characteristics are summarized in Table 1.

Table 1
Summary characteristics of the 518 respondents

Demographic variables	Sub-categories	Frequency	Percentage (%)
Gender	Male	224	43.2
	Female	294	56.8
Districts	Old urban areas	272	52.5
	New towns	246	47.5
Housing types	Public housing	272	52.5
	Private housing	246	47.5
Age of interviewees	60–64	85	16.4
	65–69	107	20.7
	70–74	134	25.9
	75–79	116	22.4
	80+	74	14.3
Marital status	Married with a spouse in HK	300	57.9
	Married with a spouse in China/elsewhere	8	1.5
	Cohabitating	6	1.2
	Widowed	166	32.0
	Divorced/separated	6	1.2
	Single/never married	13	2.5
Education	Illiterate	144	27.8
	Very basic/village school	102	19.7
	Completed primary	171	33.0
	Junior secondary	51	9.8
	Senior secondary	17	3.3
	Professional training	4	0.8
	University or above	14	2.7
Living arrangement	Living alone	83	16.0
	Living with spouse	136	26.3
	Living with closed relatives	175	33.8
	Living with an unrelated person	4	0.8
	Others	4	0.8
Monthly income (HKD)[a]	$0–1499	69	13.3
	$1500–2999	175	33.8
	$3000–4499	126	24.3
	$4500–5999	62	12.0
	$6000+	54	10.4

Note: The totals may not add to 518 because there were non-responses for some categories.
[a]HK$7.8 = US$1.0.

Measures

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Independent variables

Initial research by Siu and Wong (2001) and Loo (2000) suggested that assessment of dwelling conditions includes at least 10 dwelling characteristics (such as lighting, levels of crowding and temperature) and 10 neighbourhood characteristics (such as lighting in corridor/lobby/public space, stairs, lift/escalator and air/noise pollution). Table 2 summarizes these general characteristics. After considerable discussion and drafting, as well as consultation with a steering group of professionals and academics (see Acknowledgements), a set of questions was determined which asked the extent to which the residents were satisfied with various environmental factors. Each item was rated from most satisfied (5) to least satisfied (1). According to Veitch and Arkkelin (1995), it is conceptually more meaningful to group the living environment in terms of the perception of inner area, outer areas and security concerns. To assess whether this structure applied to the present study, a principal components analysis (PCA) was conducted which extracted three factors associated with older persons' living environment. Initial results of the PCA showed that one item on local air pollution (shown in italics in Table 2) shared similar component loadings with interior (0.55) and exterior environment (0.50). The 19 items were re-analysed with the "air-pollution" item removed. The results of the PCA were consistent with Veitch and Arkkelin's (1995) suggestions (Table 3).

Table 2
Dwelling characteristics of the living environment

Interior dwelling characteristics	Exterior dwelling characteristics
1. Indoor lighting	11. Lighting in public spaces
2. Lighting in corridor	12. Green areas/parks
3. Crowdedness	13. Recreational or sitting & rest areas
4. Temperature	14. Passages
5. Ventilation	15. Flyover/subways
6. Security devices	16. Road crossing/traffic density
7. Stairs	17. Management and security of estate/community
8. Lift/escalator	18. *Air pollution in estate/community*
9. Security/management in block	19. Noise pollution in estate/community
10. Special facilities (e.g. alarm system)	20. Background of residents (e.g. aged, social class, etc.)

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Table 3
Older persons' perceptions of the dwelling environment

Rotated component matrix	Components		
	1. Interior environment (IE)	2. Exterior environment (EE)	3. Security concerns (SC)
Indoor lighting	0.82	0.02	0.00
Ventilation	0.70	0.26	0.17
Crowdedness	0.64	0.12	0.28
Lighting in corridor	0.61	−0.05	0.31
Temperature	0.51	0.39	0.10
Lighting in public spaces	0.48	0.39	0.33
Noise pollution in estate/community	0.39	0.32	0.02
Green areas/parks	0.25	0.75	0.01
Flyover/subways	0.18	0.74	0.27
Passages	−0.09	0.74	0.27
Recreational or sitting & rest areas	0.32	0.73	−0.06
Road crossing/traffic density	0.28	0.60	−0.01
Stairs	−0.08	0.44	0.28
Security/management in block	0.11	−0.11	0.87
Management and security of estate/community	0.15	0.09	0.82
Security devices	0.35	0.11	0.68
Special facilities (e.g. alarm system)	0.30	0.25	0.65
Background of residents (e.g. aged, social class, etc.)	0.29	0.26	0.53
Lift/escalator	−0.19	0.31	0.42
Extraction method: principal component analysis Rotation method: varimax with Kaiser normalization			

The interior environmental component (factor) included indoor lighting, ventilation, crowdedness, temperature, lighting public spaces, and noise pollution. The exterior factor included green areas/parks, passages, flyover/subways, recreational/sitting/rest areas, road crossing/traffic density, and stairs. The security concerns factor included security/management in block, management and security of estate/community, security devices, special facilities (such as alarm system), background of residents, and presence of a lift/escalator.

The items were re-grouped according to this structure and scored by taking the mean scores of the items for each environmental factor. Subsequently, the Cronbach's alphas for interior, exterior and security concerns were calculated which were 78, 0.76, and 0.72, respectively. In the following section, interior environment, exterior environment and security concerns are abbreviated as IE, EE, and SC, respectively.

Mediating variable

Residential satisfaction was assessed by levels of satisfaction with livability in the dwelling, block/estate, and district: "All in all, are you satisfied with the following living environments?" (a) Dwelling unit, (b) Block/estate, (c) Community/district. Each item was scored from very satisfied (5) to very dissatisfied (1). The Cronbach's alpha of this scale was 0.76. In this study, residential satisfaction is abbreviated as RS.

Dependent variable

Psychological well-being is sometimes referred to in research literature as "subjective well-being"

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(Diener, 1984; George, 1981). Bradburn (1969) and Lawton (1983) identified different antecedents for positive and negative psychological well-being. In the present study, psychological well-being included measures of "positive" and "negative" effective states. For a measure of psychological well-being, five items were extracted from the WHO brief quality of life (QOL) scale (World Health Organization Quality of Life (WHOQoL) Group, 1998), with 4 items measuring positive effect and one item measuring negative affect.

The original WHOQoL scale consisted of 8 domains with 24 facets (WHOQoL Group, 1998). The psychological domain measures five facets: "positive feelings", "thinking, learning, memory, and concentration", "self-esteem", "bodily image and appearance", and "negative feelings". Each facet is operationalized by four items for measurement. A short version of the WHOQoL has been translated and tested in Hong Kong (Leung, Tay, Cheng, & Lin, 1997). This shortened version contains 28 items, retaining items from each of the five facets mentioned above. In the present study, one item from each of the facets in the shortened version was extracted. This selection approach mirrors the original WHOQoL structure, which measures the five facets from "positive feelings", "thinking, learning, memory, and concentration", "self-esteem", "bodily image and appearance", and "negative feelings". The result of this consideration led to the selection of four items that measure positive effect and one item for negative affect. The decision to use an even shorter version of the WHOQoL was pragmatic and based on the low education and high illiteracy rates among the older generation in Hong Kong today and represented an attempt to balance detail and time they would be willing to spend on responses. Essentially, items were reduced in order to avoid fatigue among the older respondents. Each item was scored from very often (5) to never (1). Scores on negative affect were recoded and a summation of scores of the five items measures Psychological well-being, abbreviated as PWB. The Cronbach's alpha of this scale was 0.77.

Following the suggestions of Brown (1997) and Burnette, & Mui (1994) and Burnette, & Mui (1996), demographic variables were included so that the results would not be confounded by any demographic influence. These included districts (old urban areas vs. new towns), housing types (public vs. private housing), age, marital status, education, living arrangement, income, life stressors, activities of daily living (ADL) and self-reported health status.

Results

Descriptive statistics and intercorrelations for the main variables are shown in Table 4. Overall, all of the variables are correlated at varying levels of significance. Of particular interest are the correlations between residential satisfaction (RS) and each of IE, EE, and SC (which ranged from 0.40 to 0.57). This suggests that environmental factors can be heavily tied to residents' satisfaction

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with their dwelling environment. In addition, Table 4 shows that psychological well-being is tied to the three environmental factors as well as residential satisfaction.

Table 4
Means, standard deviations and inter-correlations among variables

	Mean (SD)	PWB	RS	IE	EE	SC
Psychological well-being—PWB	3.62 (0.59)	0.77				
Residential satisfaction—RS	3.61 (0.56)	0.28***	0.76			
Interior environment—IE	3.42 (0.57)	0.27***	0.57***	0.78		
Exterior environment—EE	3.44 (0.51)	0.22***	0.46***	0.54***	0.76	
Security concerns—SC	3.41 (0.61)	0.16***	0.40***	0.53***	0.48***	0.72

Note: Diagonal cells contain Cronbach's alphas.
*Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed); ***Correlation is significant at the 0.001 level (2-tailed).

The mediating effect was tested according to the procedures outlined by Baron and Kenny (1986). The procedures, which involved a series of regression models, followed three steps: Step-1, regressing the mediator on the independent variable; Step-2, regressing the dependent variable on the independent variable; and Step-3, regressing the dependent variable on both the independent variable and on the mediator. In the present study, in order to demonstrate whether residential satisfaction mediates the effects of the dwelling environment (that is, IE, EE, or SC) on psychological well-being, the standardized beta value for IE, EE or SC in Step-2 needs to be substantially larger than the same variable in Step-3.

As there were three independent variables—namely, IE, EE, and SC—they were all included in the mediated regression model to ensure common covariance among them did not produce misleading findings. The mediating effect for each independent variable was tested individually. The first stage of the mediating model included variables that represented the respondents' demographic information (ordinal and nominal variables were dummy coded), a self-reported health measure and two independent variables that were not tested. To illustrate if IE was the variable under examination (see Table 5), EE and SC were entered along with the demographic variables in stage one of the mediating model (or the first row in each step). The testing variable—in this case, IE—was entered at the second stage of the mediating model (or the second row in each step; see Table 5).

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Table 5
Testing procedures for the mediating effects of residential satisfaction

		Criteria	Predictors	Adjusted R^2	F (change)	P
IE as independent variable						
	Step 1	RS	Demographics, EE, SC	0.27	6.63	0.0005
			Demographics, EE, SC & IE	0.36	68.28	0.0005
	Step 2	PWB	Demographics, EE, SC	0.20	4.58	0.0005
			Demographics, EE, SC & IE	0.20	7.04	0.01
	Step 3	PWB	Demographics, EE, SC	0.20	4.65	0.0005
			Demographics, EE, SC, IE & RS	0.22	8.17	0.0005
EE as independent variable						
	Step 1	RS	Demographics, IE, SC	0.34	8.69	0.0005
			Demographics, IE, SC & EE	0.36	20.28	0.0005
	Step 2	PWB	Demographics, IE, SC	0.20	4.67	0.0005
			Demographics, IE, SC & EE	0.20	4.68	0.05
	Step 3	PWB	Demographics, IE, SC	0.20	4.77	0.0005
			Demographics, IE, SC, EE & RS	0.22	6.66	0.001
SC as independent variable						
	Step 1	RS	Demographics, IE, EE	0.36	9.38	0.0005
			Demographics, IE, EE & SC	0.36	5.99	0.05
	Step 2	PWB	Demographics, IE, EE	0.21	4.86	0.0005
			Demographics, IE, EE & SC	0.20	0.03	n.s.
	Step 3	PWB	Demographics, IE, EE	0.21	4.93	0.0005
			Demographics, IE, EE, SC & RS	0.22	4.62	0.01

Note: Demographics = gender, age, marital status, education, income, housing type, district, living arrangements, self-rated health. IE = Interior environment; EE = Exterior environment; SC = Security concerns; RS = Residential satisfaction; PWB = Psychological well-being; n.s. = Non-significant.

Table 5 and Table 6 illustrate the three steps involved when assessing the mediation effect of residential satisfaction. The first column of Table 5 and Table 6 indicate which particular environmental factor (such as the interior) is the independent variable when the effects of the other two environmental factors (such as the exterior and security concerns) are held constant along with demographic variables in the first stage of the mediated regression model. Table 5 shows that the effect of the confounded variables, namely those entered at stage 1 of the regression model, did not affect the mediating role residential satisfaction plays for IE and EE (but not SC). Taking IE, for instance, the second stage of each step contributed significant variance when the effects of demographic variables as well as EE and SC variables were accounted for ($\Delta F=68.28$, $p<0.0005$; $\Delta F=7.04$, $p<0.01$; $\Delta F=8.17$, $p<0.0005$ for Steps 1, 2 and 3, respectively). The F -change (ΔF) indicated that the variables entered at successive stages of the regression model added significant contribution to the overall variance. By referring to the testing criteria for mediating effect outlined in the analysis section, Table 6 clearly shows that residential satisfaction mediated the effect of interior and exterior environment but not security concerns. It appears that residential satisfaction fully mediated the effect of interior and exterior environment, as there was no direct link between environment and psychological well-being when residential satisfaction was included in the regression model. Specific results are shown in Table 6, which indicate that the addition of RS—entered in conjunction with IE (or EE, SC) in the regression model—led to the direct effect of IE on psychological well-being becoming insignificant. This meets the condition set forth by Baron and Kenney (1986) for a variable to become a fully mediated variable. These analyses were repeated to test whether the effects of EE and SC were mediated by RS (see Table 6).

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Table 6
Regression coefficients for the mediation testing models

		Criteria	Predictors	*B*	SE(*B*)	*β*	*P*
IE as independent variable							
	Step 1	RS	IE	0.39	0.05	0.40	0.0005
	Step 2	PWB	IE	0.14	0.05	0.14	0.01
	Step 3	PWB	IE	0.01	0.06	0.08	n.s.
			RS	0.16	0.05	0.16	0.005
EE as independent variable							
	Step 1	RS	EE	0.24	0.05	0.21	0.0005
	Step 2	PWB	EE	0.13	0.06	0.11	0.05
	Step 3	PWB	EE	0.01	0.06	0.07	n.s.
			RS	0.16	0.05	0.16	0.005
SC as independent variable							
	Step 1	RS	SC	0.10	0.04	0.11	0.05
	Step 2	PWB	SC	0.01	0.05	0.01	n.s.
	Step 3	PWB	SC	0.00	0.05	−0.01	n.s.
			RS	0.16	0.05	0.16	0.005

Note: n.s. = Non-significant; IE = Interior environment; EE = Exterior environment; SC = Security concerns; RS = Residential satisfaction; PWB = Psychological well-being.

The effect of the interior and exterior environment on psychological well-being was fully explained by the mediator. The effect size of residential satisfaction on psychological well-being was 0.16. This effect was small but statistically significant. Unlike findings from studies such as that of Perez et al. (2001), the results of this study suggest that the effect of interior environment has more influence on psychological well-being than the exterior environment (β=0.40, 0.21, respectively). The impact of the interior and the exterior environments on psychological well-being (mediated by residential satisfaction) were demonstrated irrespective of demographic, socio-economic or geographical factors (such as residence in new towns or old urban areas).

The findings suggest that psychological well-being was influenced by the result of subjective appraisal of the environment. In particular, older persons' experience of psychological well-being was poorer if they perceived their housing environment as unsatisfactory with respect to their dwelling expectations or needs. Fig. 1 shows a graphical illustration of the effects in terms of standardized beta weights.

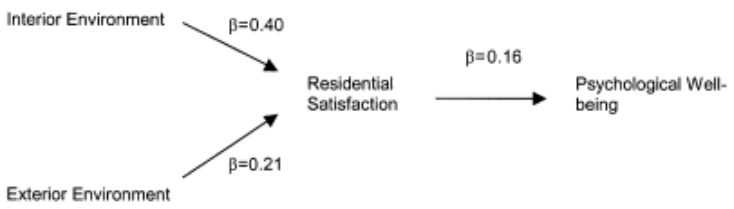

Fig. 1. The mediating effects of residential satisfaction between dwelling conditions and psychological well-being.

Discussion

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In light of the findings of the present study, it is proposed that the role of environmental factors and their relations with older persons' psychological well-being depends on the extent to which a person's expectations of residential satisfaction are met. This could have important implications for local housing and social care policy for older persons, as people's expectations will need to be assessed and taken into account if successful ageing is to be encouraged and environments suitable for successful ageing are to be developed. One of the purposes of the present study was to investigate the mediating role of residential satisfaction on the relations between dwelling conditions and psychological well-being. The results of the study confirm that the impact of the physical environment, if it is to have any effect on older persons' psychological well-being, seem to operate through an evaluative process—in this case, it operates through people's residential satisfaction. In particular, older persons' experience of psychological well-being would diminish if they perceived their housing environment as unsatisfactory with respect to their dwelling expectations or needs. In other words, psychological well-being is, overwhelmingly, the result of subjective appraisal of the environment. As noted in earlier studies, residential satisfaction refers to individuals' appraisal of the conditions of their residential environment, in relation to their needs, expectations and achievements (for example, Amérigo & Aragonés, 1997).

The results from this study in Hong Kong appear to verify that high levels of satisfaction occur when the surrounding environment meets an individual's needs or expectations. This means a person's psychological well-being is based on him/her appraising his/her residential settings according to some value-related criteria. One way to enhance people's psychological well-being could be by changing the point of reference that they use when evaluating their dwelling conditions. This could perhaps be done by lowering expectations or making expectations more realistic. For instance, residents may be persuaded that their living environment is apparently better than a lot of people. Possibly, residents will evaluate their environment more positively if they can compare their conditions with some normative reference points rather than one that is idiosyncratic or even idealistic. This is an approach in accordance with Festinger's (1954) social comparison process. Alternatively, rather than changing the level of expectation, the expectation may even be devalued to such an extent that it becomes less important or irrelevant in the eyes of the residents. After all, they may feel a poor living environment is difficult to escape from because (in this study) older persons living in dilapidated conditions also generally lack financial resources. This is, of course, one theoretical contribution rather than a policy contribution of the present study to the fields of medical geography and social gerontology. In reality, the aim would normally be to build up older persons' self-esteem and feelings of self-worth, which are comparatively poor in many Asian societies, especially among low-income groups. It is often argued that there are cultural differences in happiness and well-being, as well as in self-evaluation, with people in individualistic cultures viewing these human virtues more positively than those in the collective cultures found in many Asian settings (e.g., Suh, Diener, Oishi, & Triandis, 1998).

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The policy objective would more usually be to improve living conditions and enable older persons to move towards achieving their envisaged living environments with a view to enhancing well-being.

Another purpose of the study was to examine the differential impact of interior and exterior environment on psychological well-being via residential satisfaction. As expected, we found that the interior environment accounted for more of the total variance than the exterior environment in explaining psychological well-being via residential satisfaction. This result supports the assertion that elderly households' restricted local activity patterns can be represented as an hierarchy of spaces moving progressively from personal space (interior environment) to neighbourhood space (exterior environment). It seems that the Hong Kong government, with appropriate policies, could focus its limited resources on older peoples' homes such that their interior residential environments are less hazardous and less run-down. Other sources of assistance may come from family members, non-government organizations (NGOs) and volunteers. This could enable a more effective use of scarce resources for a policy which aims to enhance the well-being of older citizens. In Chinese settings, financial assistance from families or relatives is generally likely since the traditional value of filial piety are still entrenched and to some extent practised by younger people. On the other hand, Western values also influence the value structures of many people so profoundly that older persons often no longer expect their children to follow the traditional obligations of support as they would have done in previous generations. This is compounded by the financial difficulties suffered by many young adults in Hong Kong, who often struggle to look after their own family and do not have much money to spare to devote to their older parents or relatives (Ng et al., 2002).

The current study suggests the importance of improving, renovating or at least maintaining older persons' homes and the morale and well-being boost that this will entail. It also suggests that safety design aspects of the interior environment as well as thoughtful design of domestic appliances are essential. A range of home improvements can be suggested such as gas-detecting sensor over gas ranges; cut-off switches or timer on burners, ovens, and heating pads; better labelling of hot water controls and/or installation of temperature regulators to prevent scalding water from being delivered; and glare-resistant coverings for instrument panels (Charness & Bosman, 1990). Clearly, some of these aspects are beyond the realm of urban planning and architectural design per se, but inter-sectoral involvement in the designer of homes and appliances is essential. The study has identified the importance of both the interior and the exterior environment in the design of housing for older persons. The design of both the interior and the exterior environment may enable or disable older persons and poorly designed environments are even likely to contribute to accidents. Furthermore, the results of the current study indicate significant inter-correlations among the three dimensions of environment. It is without doubt that

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future research should address the possible interactions between these dimensions. In a study on the effects of variations in housing conditions on residential satisfaction (Phillips et al., 2004), it was noted that public housing residents tended to use interior environment as the basis of their evaluation for residential satisfaction while private housing residents used both interior and exterior environments. This was explained by the suggestion that exterior environments tend to be better managed in private housing and so private housing residents "take-on" aspects of the exterior environment when evaluating the extent to which they are satisfied with their housing conditions. On the other hand, public housing residents do not personally own any part of their housing environment (other than the furniture and their personal possessions in their homes). In addition, the exterior environment tends to be comparatively more utilitarian and sometimes less well maintained (or equipped) compared to that in private housing. As a result, public housing residents appeared to detach themselves from the exterior environment and used the interior environment almost exclusively as the basis of their evaluation. Therefore, it appears that the interaction between interior and exterior environments as well as the interaction effect are not simple matters. This suggests that future research efforts are warranted.

A further point to emphasize is that the current study does not indicate the basis underlying the evaluative mechanism. That is, it is not known whether the evaluative process is guided by social comparative norms (Festinger, 1954) or idiosyncratic-derived standards. Residents who live in objectively lavish apartments may still be dissatisfied with various environmental factors. Therefore, the present study emphasizes the importance of residents' appraisal of their dwelling environment, as opposed to the objective environment in which they reside.

A technical issue that could have affected the findings in the present study is the choice of close-ended responses, since both measures (the environment factors and residential satisfaction) asked the extent to which respondents were 'satisfied' (or dissatisfied) with aspects of the housing environment. Since the two sets of measures were obtained under the same conditions, this may explain, in part, why the correlations between measures shown in Table 4 are quite high. One might speculate whether this is the result of common method variance. Furthermore, self-rated residential satisfaction may be open to criticism as being relatively non-discriminating since most older respondents tend to give very high and sometimes uncritical satisfaction scores (Chong, 2003). Finally, the target sample of the study included older persons in low-income public and private housing. Therefore, further cross-sectional research may be needed to generalize the findings to cover all older persons, that is, those living in middle to high-income housing.

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