Facilities

Emerald Article: Investigating Key Components of the Facilities Management of Residential Care and Attention Homes

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Article Title Page

Investigating Key Components of the Facilities Management of Residential Care and Attention Homes

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Structured Abstract:

Purpose – The proportion of the population aged 65 and over is rapidly rising and is expected to reach 24.3% by 2031, from 12% in 2006. As a result, the Hong Kong government is facing challenges in meeting the growing demand for residential care homes. To provide a clear picture for construction professionals engaged in the future design and operation of such homes, it is first necessary to understand the opinions of end-users in existing facilities. The paper aims to identify key facilities management (FM) components in three particular areas of residential care homes.

Design/methodology/approach – In order to collect data from end-users, a questionnaire survey of 119 end-users (both elderly residents and staff) based on post-occupancy evaluation (POE) was used to evaluate the FM performance of the homes and establish the relationships between the comfort levels of FM components and the satisfaction of elderly residents.

Findings – The finding in the questionnaire survey indicated that all 16 key FM components were significantly related to the satisfaction with the home, while space planning, temperature, ventilation, privacy, finishes, and staff were the factors predicting satisfaction with different areas.

Practical implications – The paper makes a number of practical recommendations to government and construction professionals for improving the residential care environment, including a wide corridor with short distance and a low-speed air-conditioning machines in the common areas. In the bedroom, designers are recommended to install some partitions in terms of privacy and consider the microclimate carefully. In the bathroom, the use of lifting devices, louver doors, sufficient ventilation and stable hot water supply are beneficial for the elders' satisfaction.

Originality/value - Post-occupancy evaluation is a commonly used tool to evaluate the FM performance based on the end-user's perspective. The study innovatively investigates the impact of different FM components on the elder's satisfaction degree by application of POE.

Keywords: Care and Attention Homes, Designers, Elderly, Facilities Management, Post-occupancy evaluation, Satisfaction.

Article Classification: Research Paper

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INTRODUCTION

There are over 893,500 people aged and over 65 living in Hong Kong, comprising about 12.8% of the population in 2009 (Census and Statistics Department, 2009). The proportion of the population in this age bracket is rising significantly, from 12% in 2006 to 24.3% in 2031. As a result, Hong Kong faces real challenges, brought about by an ageing population and the resulting increase in demand for residential care homes.

Hong Kong is one of the regions with a large wealth gap (Tsui, 2008). A study conducted by the Hong Kong Council of Social Services found a record number of people living below the national poverty line. This included more than half of elders over 65 (Earth Times, 2009). Hence, under the principles of "Aging in Place" and "Continuum of Care," the Hong Kong government has made a great effort to respond to the needs of the elderly by providing them with adequate services and residential care homes (HKSAR, 2009, 2010).

In addition to the quality of the care services provided in such homes, the quality of the living environment is another key factor that directly influences elderly residents' quality of life (Pearson et al., 1993). Most research studies have focused on the building environment and elderly services (Barnes, 2002; Riemersma-van der Lek et al., 2008), while comprehensive research on the impact of facility management (FM) on the quality of life and the satisfaction of the elderly remains rare, especially research that seeks to understand the perspective of the elderly. This research aims to investigate FM in residential care and attention homes using post-occupancy evaluation (POE). POE is an end-user basis method of assessing building performance (Preiser, 1995). In order to achieve this aim, the paper identifies the major FM components, based on the perspective of end-users, and investigates the relationships between them and the satisfaction of elderly residents of such homes.

MAJOR COMPONENTS OF FM IN CARE HOMES

As the demand for residential care services has increased, there are now a total of 23,640 residential care homes for the elderly, comprising about 82% of all the service units in Hong Kong (The Hong Kong Council of Social Services, 2009). Therefore, the government needs to pay more attention to enhancing the satisfaction of elderly residents in such facilities.

In theoretical terms, FM refers to the process by which an organization delivers and sustains support services in a quality environment for meeting strategic needs (Alexander, 1996). Therefore, in a residential care home, FM plays a key role in providing a comfortable environment for service users. Many studies have investigated the relationships between resident satisfaction and the physical environment (Kruzich et al., 1992; Sikorska, 1999; Toseland and Rasch, 1978; Zinn et al., 1993). Improving the quality of the facilities provides a comfortable and healthy environment for elderly residents, and also staff. The facilities management in residential care homes can be categorized into three groups, namely architecture, building services, and supporting facilities (Ho et al., 2004; Mckenna and Co., 1993).

Architecture

The architectural category refers to the layout and design of the building that seeks to enhance the environmental quality (Cotts, 2009). Space management, privacy, fixtures and furniture, as well as finishes have been identified as architectural components of FM that relate to the level of satisfaction of elders (Barnes, 2002).

In residential care homes, *space management* refers to the space allocated for daily living (Robson el al., 1997) including the living- and dining-rooms and the bedrooms, the distance between them and between these rooms and the bathrooms (Torrington, 1996), and the width of all corridors. Appropriate space planning can help to fully utilize the limited area available, especially in Hong Kong, and fulfill the varied requirements of end-users, including movement or assistance.

Privacy is a basic human need that relates to effective individual and group functioning and

its converse, lack of privacy can result in a range of problems, both psychological and interpersonal (Alalouch and Asinall, 2007). Therefore, it is the most important environmental item for the elderly (Morgan and Stewart, 1998). In fact, an elderly resident often prefers to be surrounded by his or her own furniture and photographs of family members in a private space, in order to establish a sense of dignity and security (The Hong Kong Council of Social Service, 2009).

Good quality and appropriate *fixtures and furniture* not only ensure the comfort of the elderly in residential care homes, but also reduce risks (Myers et al., 1991). For example, reclining chairs, either electric or manual, can enable a resident to sit or stand with minimal effort; and handrails on both sides of corridors can assist them to walk independently (Leibrock, 2000). Due to mental problems, some elderly residents may encounter further difficulties finding their way around to other locations such as the dining-room or even their own bedroom. Therefore, *signage* performs a role in giving clear directions to residents and helping them to participate in both special events and daily activities.

Finishes to the floors, walls, and ceilings can decorate the care homes and consequently enhance the comfort of end-users. While the emphasis in bedrooms is on the aesthetic value of finishes, in bathrooms people are normally concerned with the possible risks, such as falling and collapse (Carter et al., 1997). Previous research has shown that using light colors can establish a family-type, warm feeling for the residence in general (Mahnke, 1996).

Building Services

Building services concern how the building can function and fulfill the needs of the elderly (Bitner, 1995). Lighting, ventilation, temperature, noise, safety and security, as well as firefighting services are considered to be building services components that affect the living environment of elderly occupants (Robson et al., 1997).

People's eyesight alters with age. The elderly's visual abilities largely rely on the performance of *lighting* in particular areas (Mahnke, 1996). To provide a better visual environment, both artificial and natural lighting should be combined in order to avoid excessive brightness or glare, to easily establish an "intermediate" lighting area for walking

and chatting, and to ensure sufficient illumination for reading and sewing (Leibrock, 2000).

Good *ventilation* in the rooms provides better indoor air quality and improves the health of the elderly as it can avoid airborne contaminants. In general, older people prefer natural ventilation (Ward, 2002). Due to modern Hong Kong's serious levels of air pollution and overcrowding, it is necessary for care homes to combine natural ventilation (which raises questions about matters such as the position and size of windows) with mechanical systems such as fans and exhausts (Race, 1982; Research Group on Urban and Culture, 1999).

Temperature is divided into two types: ambient and effective. The ambient temperature means the temperature in the surrounding environment, and is affected by the air-conditioning or radiation systems and the natural lighting. The effective temperature, which refers to the individual's perception of the ambient temperature, is easily influenced by humidity levels (McAndrew, 1993). The elderly's perception of the temperature directly influences their feelings, which can subsequently cause them both physical and attitudinal problems (Rose, 1994).

Elderly residents who have partial or total deafness normally wear hearing aids to amplify sound. Therefore, they also hear unwanted sounds, which are often perceived as *noise* (McAndrew, 1993). Excessive noise may not directly influence an elderly person's physical health, but it can have a serious impact on their mental health causing problems such as depression and dizziness (Robson et al., 1997). Therefore, it is necessary to develop higher levels of sound insulation and to control background noise in the living and communal areas.

Safety and security in a care setting always seems to be the antithesis of independence (Regnier, 1999). Care must be taken to avoid creating unexpected obstructions such as misalliances and unlocked safety doors to enable escape as any obstruction may endanger the blind or partially sighted resident. However, at the same time, security should also be carefully considered in order to avoid crimes such as theft, vandalism, personal attack, or intrusion into the home (Booty, 2009).

Ageing also causes deterioration in the sensitivity of the sense of smell. This can be dangerous for the elderly, as they cannot detect smoke, fire, natural gas, spoiled food, and

so on (Kathleen, 2005). Although current regulations are sufficient to cover the installation of *firefighting services*, special attention must be drawn to the danger caused by fire, by means such as installing aural and visual fire alarms (Robson et al., 1997).

Supporting Facilities

Supporting facilities aim to satisfy elders and improve their quality of life (Duncan-Myers and Huebner, 2000). FM components such as hygiene, well-trained staff, and catering and recreation are applied to support elders' daily life and improve their level of satisfaction (Chou et al., 2001).

Hygiene is an important concern in residential care homes. Sufficient cleanliness not only affects physical and mental health, but can also reduce risks such as infection and falling. More attention should be paid to areas such as toilets, floor finishes, chair covers, and so on (Shaw, 1991).

Since the elderly need frequent and varied assistance, adequate human resources and well-trained *staff* are important components of holistic FM. Well-trained staff should have the ability to optimize overall performance by allocating appropriate resources for particular tasks /activities in order to meet the challenges of providing a caring service for as many elderly as possible (Okoroh et al., 2001).

Furthermore, there are many different facilities in the homes to facilitate the care of physical health (such as cooking devices in the kitchen and dining-rooms for *catering*), mental health through *recreation* (such as a swimming pool, gymnastic equipment (Torrington, 1996), and various types of equipment to move residents between bed, chair, toilet, and bath (such as adjustable beds, hoist lorries, and nippier machines) (Miller, 2002).

FM AND SATISFACTION

POE is defined as the systematic assessment (review, feedback, and evaluation) of building products (Zimring, 2002) based on user satisfaction with the building's performance (Carmon, 1997; Leung and Fung, 2005). Preiser (1995) suggests that facilities managers can apply POE to continuously improve the quality and performance of the facilities which

they operate and maintain. It is a formal way of determining whether an occupied, remodeled, or built environment is performing to expectations. POE is an end-user basis method for assessing FM (Eley, 2001). It focuses on residents' **satisfaction** with the actual performance of FM in particular areas (Atkinson, 1998). Of the many different rooms in a residential care home, the elderly spend most of their time in the common areas, bedrooms, and bathrooms. This study therefore concentrates on the FM components of these three functional areas. It may be hypothesized in the POE that a better performance generally results in higher satisfaction (Leung et al., 2005). Analysis of the performance of facilities and of FM in residential care homes can be used to support the elderly and, as a result, improve their satisfaction with daily life.

RESEARCH METHODOLOGY

To identify the key components of FM in residential care homes, a questionnaire survey was conducted with both elderly residents and staff. The aim was to identify both groups' level of comfort with the care home. Based on extensive literature, the questionnaire consisted of three main sections: (1) background information on the elderly resident or staff member; (2) his or her level of comfort with each of the 16 FM components measured by 54 items; and (3) his or her degree of satisfaction with the common areas, bedroom, and bathroom, measured by 27 items. The FM components were measured by three scales, namely architectural, building services, and supporting facilities. Architectural FM components, which were validated in and adopted from previous studies, included space management (e.g., distance between rooms, width of corridor, and circulation space in rooms), privacy (e.g., in the bedroom, toilet, and bathroom), and finishes (e.g., the number and type of non-slip finishes provided in the common areas, the bedroom and the bathroom) (Carter et al., 1997; Chou et al., 2001; Leibrock, 2000). Building services FM components, which were also validated in and adopted from previous studies, included lighting (e.g., natural daylight, artificial daylight, and artificial nightlight), ventilation (e.g., natural and mechanical), and noise (e.g., noise levels in the bedroom, common areas, and the bathroom) (Carter et al., 1997; Gill et al., 2007). Supporting FM components, which were validated in and adopted from previous scales, consisted of staff (e.g., the number and attitude of staff), hygiene (e.g., cleanliness of the bedroom, bathroom, common areas, and other facilities), catering (e.g., the choice and quality of food), and recreation facilities (e.g., physiotherapy facilities and leisure facilities) (Chou et al., 2001; Zimmerman et al., 2002).

On the other hand, the overall satisfaction with common areas, the bedroom, and the bathroom was measured by 27 items, including plenty of space for movement, adequate facilities for assistance, and clean environment (Chong, 2003; Lawton, 1980). The items that were employed to measure the FM components and satisfaction with different areas have been shown to be reliable in various previous studies.

The elderly in Hong Kong are mainly traditional Chinese persons who can normally only read Chinese. For this reason, the questionnaire was drawn up in Chinese. Because elders may have experienced a decline in cognitive competence and attentiveness (Baltes, 1987), the respondents might have difficulty answering a complex questionnaire and differentiating their comfort level clearly on a scale consisting of a large number of items (e.g., a seven-point scale or a nine-point scale). Thus, the five-point Likert scale was employed for parts 2 and 3 of the questionnaire. Indeed, this scale is widely adopted in studies targeting elders (Farquhar, 1995; Grant, 1996; Vaarama et al., 2007), because it discriminates the level of ratings, unlike simple Yes-No questions. It also makes respondents less likely to choose the neutral or mid-point than if they were using a three-point Likert-type scale (Matell and Jacoby, 1972; Garland, 1991). Numerical scores ranging from 1 (very uncomfortable) to 5 (very comfortable) were used to enable the respondents to express their degree of comfort with each of the FM components and their level of overall satisfaction with the three specific rooms (that is, the common areas, bedroom, and bathroom). As different facilities are normally present in different rooms, comfort levels for some FM factors were omitted in some instances; for example, the respondents were not asked about privacy in regard to the common areas; about fixtures and catering in the bedroom; or about furniture, equipment, noise, and catering in the bathroom.

Purposive sampling (Adams and Schvaneveldt, 1985) was adopted to select the residential care homes based on five criteria: (1) operating types (subsidized versus non-subsidized); (2) operating year (from 1981 to 2005); (3) the whole size (from 40 m^2 to 5591 m^2); (4) capacity (from 56 to 272); and (5) building type (public housing versus purpose built). Finally, seven representative homes were chosen in which to conduct the questionnaire survey with both elderly residents and staff. Due to the elders' limited abilities to read and write, a trained interviewer carried out a face-to-face structural interview with each respondent, in private, so as to provide an opportunity to explain each item in the questionnaire and to reduce the chance of discrepancies in understanding; for example, the privacy items in the survey were

intended to gauge the elderly's level of comfort with their general privacy in different areas. The interviewers then explained the items by giving the same examples, including accessibility privacy (e.g., a lock on the bedroom door), auditory privacy (e.g., sound insulation of the walls), and visual privacy (e.g., partition walls /curtains between each bed), and so on (Barlas et al., 2001). All the elderly persons were introduced to the researcher by the care home staff in order to make sure that each respondent possessed (1) the ability to move around his or her living environment; (2) the ability to communicate with the researcher; and (3) a cognitive level sufficient to understand the questionnaire. At the same time, an identical survey was distributed to the staff to be self-completed and returned within two weeks. The opinions of the staff were also important for the study as both the elderly and the staff are end-users of residential care homes. The total sample size of the study was 119, of which 81 were elderly residents and 38 were staff. This sample size (n=119) was considered acceptable and adequate compared with those of other, similar studies on facilities management (McLennan and Bennetts, 2003; Stoy and Johrendt, 2008; May and Pinder, 2008). Ninety of the respondents were female. The data collected from the questionnaire survey were analyzed using SPSS 15.0.

Of the 81 elderly respondents, 7% were between 71 and 75 years of age, 68% were between 76 and 80, and 25% were over 80. Approximately 90% of the participants had stayed in the centre for more than a year, and over 60% for more than three years. Hence, the respondents were expected to have a good knowledge of their homes and environment.

RESULTS

Spearman Correlation

All FM components and the satisfaction degree were measured by aggregating all related items and tested by reliability analysis. All factors had an acceptable Cronbach's alpha value greater than 0.6 and were considered reliable (refer to Table 1) (Hair et al., 1998). The result of checking the outliers indicated that there were no outliers existing among all FM components and satisfactory variables. Moreover, given the similar value of the original means and the 5% Trimmed Mean of all variables, the impact of outliers would not influence the correlation and regression analysis in this study (Pallant, 2005).

As the variables were not normally distributed, Spearman correlation was conducted to investigate the intercorrelations between the 16 FM factors and satisfaction with the common areas, the bedroom, and the bathroom (Ho, 2006). In studies including variables that are not normally distributed, Spearman correlation is widely adopted to obtain a reliable result (Pallant, 2005). As facilities in common areas are expected to be shared with other residents, recreation and catering facilities to be located in the common areas, and noise to be a concern mainly in the common areas and bedroom, correlation coefficients between these variables and satisfaction with those specific areas were not excluded from the data analysis.

Spearman correlation coefficients between the 16 FM factors and satisfaction with the common areas, the bedroom, and the bathroom are presented in Table 1. The correlation coefficient is widely used as a key index of effect size (Meyer et al., 2001; Rosenthal, 1994). According to the commonly accepted guideline proposed by Cohen (1988), correlation coefficients over 0.1 represent a small effect size, those over 0.3 represent a medium effect size, and those over 0.5 represent a large effect size. Although a large effect size is preferable, a medium effect size is good enough in psychology, business, and certain other disciplines (Len, 1997; Stice et al., 2004). Several FM factors in the study had a large effect size, while others had a medium effect size with regard to the degree of satisfaction with residential care homes. The results indicated that a few FM factors were significantly related to satisfaction of a large effect size, including space planning (F1: 0.545) and staff (F13: 0.521) in the common areas; space planning (F1: 0.508) in the bedroom; and finishes (F4: 0.543), security (F11: 0.516), and staff (F11: 0.505) in the bathroom; all remaining FM factors were significantly correlated to satisfaction of a medium effect size.

< Table 1 >

Multiple Regression

To predict the satisfaction of the elderly with the different locations of the residential care homes, an ordinary least squares forward stepwise multiple regression analysis (MRA) was also conducted. The multicollinearity was tested by collinearity diagnostics using the variance inflation factor (VIF), which represents multicollinearity with a value greater than 10 (Ho, 2006). It was found that the VIF value for each variable was less than 2.6, so there was no problem of multicollinearity among all the variables. Table 2 summarizes the

results.

< Table 2 >

All the regression models obtained the value of Cohen's f^2 in a range from 0.531 to 0.916, representing a relatively large effect size (e.g., over 0.35 represents a large effect size) (Cohen, 1988). The results showed that space planning and temperature were factors that influenced the level of satisfaction of the elderly with the common areas (refer to Model 1b in Table 3), while temperature, ventilation, privacy, and finishes were factors that predicted optimized satisfaction with the bedroom (refer to Model 2f). It was interesting to note that for the bedroom, the space planning factor could also form an acceptable model with the R^2 of 0.43 in Model 2c, which involved the FM factors of space planning, temperature, and ventilation. Staff, temperature, and ventilation were the factors that influenced satisfaction with the bathroom (Model 3c).

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DISCUSSION

The correlation coefficients clearly indicate that all FM factors are significantly related to the satisfaction of elderly people living in residential care homes. Hence, both designers and facilities managers need to consider FM from the design through to the operation stages.

The results of the regression analysis highlight that satisfaction with different areas of residential homes was most accurately predicted by space planning (F1) and temperature (F10) in the common areas; privacy (F2), finishes (F6), ventilation (F8), and temperature (F10) in the bedrooms; and ventilation (F8), temperature (F10), and staff (F13) in the bathrooms. Therefore, particular attention should be paid to improving these factors in these areas by both designers and facilities managers.

Common areas

As pointed out by Scott-Webber and Koebel (2001), the design and construction of residential homes need to take into account the people, noises, lights, and action in a room. From the healthcare point of view, careful attention should be paid to **space planning** to enable the elderly to move around and to be assisted (Robson et al., 1997). Due to their loss

of mobility (Gilderbloom and Markham, 1996), the elderly generally need some special equipment, such as a walking stick, frame, or wheelchair, to assist their movement around the common areas. Therefore, both circulation width and the distance between the dining-room and bedrooms are important for a satisfying daily life.

Temperature is the only FM factor which appears in all three optimized regression models covering the three different areas. Due to the limited size of windows and the specific location of the air-conditioning system in the large common areas, the microclimate in different parts of the common areas may be extremely varied. For example, it may be too cold in the areas under the diffusers and too hot in the areas far away from them, or near the windows. It is easy for the elderly to catch infections and become sick in an environment where the temperature fluctuates.

Bedrooms

A bedroom in residential home is a private place where residents sleep at night or relax in the daytime. However, residential care homes in Hong Kong normally only meet the current basic space requirements (6.5 m^2 per person, including all sleeping and common areas) stated in the Code of Practice for Residential Care Homes (Elderly Persons) in Hong Kong (Social Welfare Department, 2005). With limited spaces, it is impossible to retain **privacy**. Furthermore, some of the beds are not enclosed by any partition or curtain, so that staff can easily take care of each resident at any time. The **space** in the bedroom can thus be considered as simply another part of the common area, and one that directly influences the privacy of elderly residents in their daily lives.

The body **temperature** of elderly residents can be thought of as an internal clock controlling the sleeping cycle (Simon et al., 1998). The change of temperature can influence sleep; for example, a higher temperature reduces deep sleep and a lower one increases wakefulness and sleep latency (Harrington and Lee-Chiong, 2007). A typical recommended temperature in bedroom is between 18 and 23 degrees Celsius (Bach et al., 1994). As three of the seven residential care homes in this study accommodated five to nine elderly persons together in a single bedroom, the temperatures of the different beds may vary considerably. This will directly affect comfort.

Ventilation gives human comfort to elderly persons to meet their primary needs. Discomfort can be caused by increased levels of airborne contaminants which may lead to shortness of breath. Ventilation can be improved by either natural design or mechanical systems, but the elderly generally prefer the former. In fact, the process of liberation from mechanical ventilation may affect the sleep quality of the elderly (Cooper et al., 2000). Due to the crowded environment in these seven care homes, only one or two beds can be located beside windows and thus fully enjoy the natural ventilation. Therefore, ventilation is considered as an important FM component, predicting the comfort of the elderly in their bedrooms.

Vinyl tiles can establish a warm environment with different colors and a smooth surface; they are also relatively inexpensive. As a result, all homes in the study had laid vinyl tiles on the bedroom floors. However, the results of both the correlation and regression analyses indicate that the elderly significantly prefer nonslip, rather than simply aesthetic, floor **finishes** in the bedrooms. This indicates that end-users consider safety as the most important criteria in their daily lives.

Bathrooms

For older, disabled people, the bathroom is the room where they are most likely to have an accident, such as a fall. It is interesting to note that nonslip floor finishes are not significantly related to satisfaction in the bathrooms. It may be that they took it as a given that this would be present, and that all homes from our observation have actually been using nonslip, ceramic floor tiles in their bathrooms.

Due to physical and/or mental impairment, it is common for the elderly to be assisted, especially when bathing (Gill et al., 2007). Although all care homes employed registered social workers and qualified caretakers, some elderly respondents still complained that there were not enough **staff** in their care homes. In fact, the requirements of residents will be changing all the time, depending on their physical and mental condition (Hardy et al., 2005). They may prefer to take a bath or go to the toilet by themselves (that is, to be independent) if their health allows, but they may also expect someone to give them a hand if their health is worsening, perhaps due to the weather or sickness. Hence, support from the staff is important for the elderly in residential care homes.

Since there is a decline in heat storage capacity with age, the elderly cannot easily maintain and adjust their body **temperature,** resulting in hypothermia (Stokes, 1992). In practice, the temperature in the bathroom should be kept constantly when bathing (Torrington, 1996). *A stable hot water system and heater are, thus, essential facilities* in the bathroom to maintain a consistent temperature and serve the elderly in a comfortable environment. However, some staff complained that the bathroom environment was too hot for them to provide their services easily, and others that the length of the pipework between the boiler and the bathroom leads to an unreliable hot water service. Hence, both elderly residents and staff consider temperature to be a major FM component influencing their comfort.

Due to the requirement for a higher temperature, the **ventilation** system is the other essential FM component predicting comfort with the bathroom. In this study, the windows in the bathrooms were generally very small from our observation. With the poorly performing ventilation system, it is difficult to reduce humidity and prevent condensation for elders (Torrington, 1996). Staff who assist with bathing have a really hard job. In fact, vaporized water often condenses on any cold surface, like the floor, which induces a potential falling hazard in bathrooms (Clemson et al., 1996). Humidity in the home can also enter the walls and cause mildew and mold growth, which may affect physical health (Baughman and Arens, 1996).

RECOMMENDATIONS

Practical Implications

As mentioned by Cooper (2001), POE can be considered as a ‘design’ and ‘management’. This study has used POE to identify key FM components from the views of end-users in residential care homes. It will clearly assist architects and facilities managers to improve these services during the design and operation stages, especially with regard to the common areas, bedrooms, and bathrooms.

The study results acted as practical references for designers and facilities managers to design or manage the various facilities in residential care homes for enhancing the satisfaction of the elderly residents. The elderly generally need some special equipment such as a walking

stick, frame, or wheelchair, to assist them with movement in the **common areas**. Accordingly, a corridor wide enough to allow *two people in wheelchairs or walking with frames to pass* (Robson et al., 1997) and a short distance between living- and dining-*rooms, bedrooms, and bathrooms are required to ensure the convenience and mobilization of elderly in the home*. Since there is a decline in heat storage capacity with age, it is difficult for the elderly to maintain and adjust their body temperature (Stokes, 1992). *Designers and facilities managers also need to consider natural sunshine and the mechanical air-conditioning system together at the building design stage. It is recommended that a number of low-speed air-conditioning machines be installed, rather than a single high-speed system, where there is a big dining-room and various common areas*. This will help to avoid uneven degrees of temperature at different points in a big room.

Due to the limited residential places for elderly residents in Hong Kong, they normally end up living in a crowded area. It is not unusual for them to have only a low private cabinet beside the bed to store all of their own property, with most living together with three to nine others in a single **bedroom**. To improve this worst-case situation in terms of privacy, *designers and facilities managers are strongly suggested to install some demountable partitions dividing each bed, while the government urgently needs to review the minimum size per elderly in homes*. To maintain a stable environment in the home, designers and facility mangers also need to pay special attention to those who are sleeping in different areas or corners of the bedrooms. It is suggested that they should *consider the microclimate carefully at the design stage (in terms of, for example, building orientation, the size of windows and doors, and so on)* (Givoni, 1994) *and at the operation stage (such as thinking about airflow during the allocation of beds in the bedrooms). Split-type systems with a quiet air-conditioner and a small heater* (Avara and Daneshgar, 2008) *are recommended* rather than a single, high-speed ventilation system, in order to establish a comfortable environment with an even temperature across the bedroom. On the other hand, designers and facilities managers also have *to consider the physical impairment of the elderly; it is suggested that nonslip floor finishes should also be used in the bedrooms to reduce any risk of falling there*.

Elderly persons are usually assisted during bathing, due to their physical impairments. Designers therefore have to consider the requirements of both staff and elderly together. *Facilities such as a Sit & Stand Lifter for changing residents' diapers, and a Hoist /Overhead Lifting Device for lifting and moving them from their bed to the* ***bathroom*** *can reduce*

workload and ensure staff safety (Engst et al., 2005), while the use of a louver door and sufficient ventilation can improve airflow in bathrooms. To maintain a stable hot water supply, it is also *recommended* that *the boiler be located close to the bathrooms rather than being centralized far away from them.* Furthermore, *facility managers should regularly review the workload of staff and the health of the residents, in order to match the particular requirements of each according to age. Additional staff may be required for older or more disabled elders*.

Research Implications

Although this study has important findings, several potential limitations of its design should be noted. The *relatively small sample,* with 119 respondents from 7 care homes, may limit the generalizability of the results; there is also the risk of common method variance. However, several factors reduce this possibility. Firstly, the homes included both subsidized and non-subsidized facilities, and those which were both attached to public housing and individually located in a purposed building. In total, over 800 respondents were represented across the 7 homes. Secondly, all the elderly respondents in this survey were identified by staff as being healthy. Thirdly, a researcher conducted the survey face-to-face with each elderly respondent, taking an average of an hour to do so, to ensure that they understood each question clearly. Fourthly, all elderly participants had direct experience of the application of FM components in residential homes. In fact, 90% had stayed in the home for more than a year. Finally, all our factors were statistically tested as reliable (that is, within the acceptable alpha ranges which are greater than 0.6 (Hair et al., 1998)). Therefore, we feel confident that our results are not biased by different responses to the measured variables.

This research has confirmed the positive relationships between comfort levels with all 16 FM components and the satisfaction of elderly residents. However, different results may be obtained depending on the size of the home, the type of house (attached to public housing or in an individual, purposed building), the types of financial support (subsidized or non-subsidized), and the gender of residents. The current study has provided a platform for future, more detailed research. To gain an overall picture for the detailed design and operation of residential care homes with *different backgrounds*, clustered data analysis is necessary. Therefore, it is strongly recommended that a large-scale survey be conducted based on the current research.

The study has significant implications for the design and development of residential care homes. As indicated above, efforts should be directed toward promoting residents' satisfaction by enhancing space planning, privacy, ventilation, temperature, finishes, and staff. We suggest further investigation of the technical requirements of these FM components in particular (e.g., Nicol and Roaf, 2005), as the needs of elderly change and vary as they grow older.

The Hong Kong Housing Society (2004) has indicated that there are many *risks* hidden in residential care homes, including falling, collision, twisting, scalding, infection, getting lost, behavioral disorders, fire, security, and so on. Hence, it is valuable to investigate the impact of FM components (architectural design, building services, and supporting facilities) on the occurrence of these risks in order to build a healthy environment for our elders.

CONCLUSIONS

Both architects and facilities managers in residential care homes have to understand the expectations of elderly people during the design and operation stages. The POE has uncovered some important issues, including the distance of circulation, the size of the living-rooms and their seating arrangements, the furniture in bedrooms, the provision of natural lighting and ventilation, the adjustment of air-conditioning systems, and the installation of nurse call systems in bedrooms and bathrooms. Residential care providers should ensure that effective management services are maintained during the operational period.

Residential homes should not just provide residential care, meals, personal care, and limited nursing support for elderly residents. Instead, it should be about giving responsive care that reflects the person's view of a "good life." Based on an interview survey of 119 respondents (elderly and staff) in 7 residential care homes in Hong Kong, our study has shown that all components of FM in the homes were significantly related to satisfaction, while different components predicted satisfaction in different areas. For example, space planning and temperature are the key FM factors in the common areas; space planning, temperature, ventilation, privacy, and finishes are the issues in bedrooms; and staff, temperature, and ventilation are particularly important in bathrooms. To meet the expectations of elderly

residents, a number of recommendations are suggested with regard to these three particular room types. Designers and facilities managers need to allow sufficient space for the elderly to mobilize around the homes, to apply nonslip tile finishes in the bedrooms to reduce the risk of falling, and should also seriously consider installing demountable partitions dividing each bed. The government urgently needs to review the minimum space provision per resident. An appropriate building orientation with sufficient window areas and mechanical systems (exhaust fan) is also important for improving ventilation and microclimate in both bedrooms and bathrooms. To maintain a stable temperature for the elderly as well as a comfortable environment for staff, it is suggested that the building be designed to maximize natural sunshine penetration and a split-type ventilation system, with quiet air-conditioning and small heaters, be installed in preference to a single, high-speed system. The boiler of the hot water system should also be located close to the bathroom in order to avoid condensation inside the building and minimize the possible risk associated with this. Finally, designers need to add facilities such as hoists and hooks to help staff with their daily work, and facilities managers should regularly review the workload of staff in response to the changing physical and mental health of each elderly resident.

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Table 1 Correlation between FM Factors and Satisfaction

FM factor		Alpha	Common area	Bedroom	Bathroom
			Coefficient	Coefficient	Coefficient
F1	**Space planning**	0.835	***0.545****	***0.508****	0.438**
F2	Privacy	0.831	/	*0.349***	0.402**
F3	Color & Decoration	0.758	0.319**	0.310**	0.381**
F4	Furniture & Fixture	0.904	0.461**	0.441**	0.440**
F5	Signage	0.751	0.301**	0.385**	0.359**
F6	**Finishes**	0.934	0.315**	*0.302***	**0.543****
F7	Lighting	0.870	0.305**	0.314**	0.340**
F8	Ventilation	0.746	0.363**	*0.348***	*0.461***
F9	Noise	0.868	0.472**	0.479**	/
F10	Temperature	0.975	*0.377***	*0.428***	*0.367***
F11	**Security**	0.601	0.455**	0.419**	**0.516****
F12	Safety	0.917	0.375**	0.323**	0.427**
F13	**Staff**	0.897	**0.521****	0.482**	***0.505*****
F14	Hygiene	0.935	0.399**	0.300**	0.418**
F15	Recreation facilities	0.783	0.458**	/	/
F16	Catering	0.916	0.418**	/	/

Note: Coefficient represents the Spearman correlation coefficient between FM factors and satisfaction.
** – correlation is significant at the 0.01 level (two-tailed).
"/ " – the item was not considered in that area.
XXX – large effect size with significant correlation coefficient higher than 0.5.
XXX – significant relationships are also found in the regression models (refer to Table 2).

Table 2 Regression Model for Predicting the Satisfaction of Elderly in Different Areas of Care Homes

		Model	B	Std. Error	*t*	Sig.	VIF	f^2	R	R^2	$\triangle R^2$
		In the common areas									
1a.		(Constant)	7.208	.674	10.688	.000		.629	.626	.386	-
	F1	Space planning	0.483	.056	8.678	.000	1.000				
1b.		**(Constant)**	**5.948**	**.772**	**7.708**	**.000**		**.745**	**.661**	**.427**	**.041**
	F1	**Space planning**	**0.328**	**.074**	**4.427**	**.000**	1.876				
	F10	**Temperature**	**0.369**	**.121**	**3.049**	**.003**	1.876				
		In the bedrooms									
2a.		(Constant)	6.823	.762	8.949	.000		.531	.594	.347	-
	F1	Space planning	0.503	.063	7.989	.000	1.000				
2b.		(Constant)	5.511	.829	6.651	.004		.667	.641	.400	.053
	F1	Space planning	0.331	.079	4.175	.000	1.876				
	F10	Temperature	0.807	.240	3.364	.001	1.393				
2c.		**(Constant)**	**4.040**	**.979**	**4.128**	**.000**		**.754**	**.667**	**.430**	**.030**
	F1	**Space planning**	**0.229**	**.086**	**2.661**	**.009**	2.283				
	F10	**Temperature**	**0.686**	**.238**	**2.878**	**.005**	1.970				
	F8	**Ventilation**	**0.373**	**.140**	**2.660**	**.009**	1.865				
2d.		(Constant)	3.806	.967	3.937	.000		.818	.685	.450	.020
	F1	*Space planning*	0.127	.096	1.329	.187	2.563				
	F10	Temperature	0.576	.239	2.408	.018	1.970				
	F8	Ventilation	0.381	.138	2.761	.007	1.752				
	F2	Privacy	0.462	.203	2.281	.024	2.223				
2e.		(Constant)	3.753	.969	3.873	.000		.808	.679	.447	*-.003*
	F10	Temperature	0.679	.227	2.993	.003	1.992				
	F8	Ventilation	.454	.127	3.588	.000	1.775				
	F2	Privacy	.588	.180	3.272	.001	2.548				
2f.		**(Constant)**	**3.543**	**.959**	**3.693**	**.000**		**.862**	**.694**	**.463**	**.016**
	F10	**Temperature**	**0.529**	**.234**	**2.261**	**.026**	2.191				
	F8	**Ventilation**	**0.385**	**.129**	**2.989**	**.003**	1.865				
	F2	**Privacy**	**0.550**	**.178**	**3.096**	**.002**	2.278				
	F6	**Finishes**	**0.393**	**.183**	**2.145**	**.034**	2.427				
		In the bathrooms									
3a.		(Constant)	6.533	.791	8.263	.000		.570	.607	.363	-
	F13	Staff	0.505	.061	8.258		1.000				
3b.		(Constant)	5.345	.795	6.723	.000		.786	.670	.440	.077
	F13	Staff	0.339	.070	4.857	.000	2.243				
	F10	Temperature	0.796	.193	4.134	.000	1.847				
3c.		**(Constant)**	**4.189**	**.855**	**4.899**	**.000**		**.915**	**.701**	**.478**	**.038**
	F13	**Staff**	**0.242**	**.075**	**3.243**	**.002**	2.347				
	F10	**Temperature**	**0.645**	**.192**	**3.355**	**.001**	1.874				
	F8	**Ventilation**	**0.355**	**.116**	**3.072**	**.003**	1.572				