

Research Article

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Ergonomically Designed Studio Apartment: A Residential Housing Option for Elderly People to Age in Place

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ABSTRACT

The desires to live independently during old age throw challenge to designers to think up suitable dwelling that facilitates the elderly to age in place. The present research aimed at identifying the gap between existing housing conditions and the housing needs of the elderly and design a studio apartment a self-contained housing unit that places a whole lot of activities in a single room except the bathroom. The standard design guidelines served as a yardstick to identify the existing features and for proposing the design of the studio apartment. The houses in which the elderly were residing were found lacking in space allowances for circulation and wheelchair use. The Majority of the houses may not facilitate the elderly to age in place. The bath rooms in existing elderly houses were found lacking in features like sufficient space for wheel chair, fittings and fixtures to ensure safety and convenience in usage. The clearance space for making bed, for movement around bed, for making use of space on one side of the bed was found to be satisfactory in slightly more than half of the study sample. No extra effort was taken to make flooring non-slippery in the existing elderly houses. The results revealed that there exists a significant association between existing conditions of living room, bathroom and flooring with design needs the of elderly. Housing needs and requirements of the elderly people were taken into account and the design of a studio apartment was developed as per the standard guidelines.

Keywords: Ergonomics, Elderly People, Housing, Design needs, Studio Apartment, Age in Place

INTRODUCTION

Ergonomics in housing helps to design homes that are accessible to, and usable by, as many people as possible without the need for special adaptation or specialized design. The main goal of Ergonomics is to understand interactions between people and everything that surrounds us, and based on such knowledge to optimize human well-being and overall system performance. By an ergonomic perspective, a built environment may be considered as a facility able to support people during their everyday life. People tend to change from their own large houses to small rental houses as they age. In addition, older adults tend to move to more comfortable houses that need less maintenance. Elderly people tend to live and remain at their own place and group, this phenomenon is called "Ageing in Place". This is achievable only when the environment provided has ample opportunities for fulfilling their day-to-day needs.

Many studies related to elderly housing revealed that the exiting housing conditions of the elderly people dwellings failed to cater to the requirements of residents. Bathroom and kitchen were the places that had limited elderly people to perform their tasks. Most of the elderly houses included the furniture and equipment that were not in use. In kitchen provision of unnecessary storage cabinets, and positioning of shelves that cannot be reached by elderly people were noticed and most of the bathrooms were not provided with support fixtures such as handrails, grab bars which had also affected the elderly people to live comfortably. Various spaces or rooms provided in the elderly house has to be ergonomically designed so that the elderly may participate in their activities without any physical discomfort. As people age they encounter physiological health problems which result in the decline of their capability to perform activities. Home hazards such as uneven level of flooring, heavy furniture and objects, slippery surfaces and poor lighting are also some of the facilities that may raise the risks of falls in elderly housing. As elderly people spend much time in homes, the rooms should be provided with age-friendly furniture and furnishings to avoid harm and injuries. Kitchen should be designed ergonomically with elderly -friendly equipment that are easy to handle and operate. Bathroom in elderly housing is considered as hazardous place as most elderly

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people encounter difficulties, hence it should be provided with assistive fixtures and fittings such as grab bars, sink at proper height, faucets to have maximum efficiency for the elderly to operate. The wish to live independently among people of different age groups resulted in the emergence of a residential model as single-room flats in European countries. These houses which are called "studio apartments" are in great demand with the new way of life throughout the world as well as in our country. A studio apartment comprised of a single large room that performs multiple functions of a living room-cum-dining area-cum-bedroom and a kitchenette, except a separate bathroom with no walls separating the spaces. This sort of residence can accommodate needs of elderly people. Since the elderly population is steadily increasing in India, alternative arrangements for housing for all sections of people are required to be planned and developed. Hence the current study is undertaken to design a Studio Apartment which fulfills all the housing needs, and requirements and enable elderly to facilitate age in place.

Materials and Methods

The ex post facto research design, one type of descriptive research which can be defined as an empirically based investigation that does not involve the researcher's direct control over variables was adopted for conducting the present investigation. The area selected to conduct the study was Kurnool district of Andhra Pradesh. The elderly women in the age of sixty and above who were able to carry out their daily chores independently and living in a separate dwelling without children with or without a spouse was the criteria for the selection of sample. Purposive sampling technique was adopted to draw the sample from the randomly selected study locations. The sample that met the criteria set for selection of sample was included in the study. From the selected study locations 60 elderly women who met the criteria and were willing to participate in the study were chosen as a sample. The standard design guidelines evolved through research by various Government, Non-government organizations and researchers such as the National building code of India[10]; Model building byelaws[7]; Central public works department[14]; Model guidelines for regulation and development of retirement homes[8]; Housing for elderly published and authored by Parker in the book Time saver standards for building types[11]. The standard design guidelines for elderly housing were given for different spaces and areas in the house viz. living room, bathroom, bedroom, kitchen, dining area and flooring. Various rooms and features in the house of the respondent was evaluated in terms of these standard design guidelines. An interview cum observation schedule was designed for collecting information about the existing housing conditions and housing needs of the respondents. Depending on the presence and absence of the design feature, scoring was given. Score 3 was given in case the existing feature was 'above the recommended guidelines', score 2 was given in case the existing feature was 'exactly as per the recommended guidelines' and score 1 was given in case the existing features was 'below the recommended guidelines'. After the researcher evaluated the existing housing conditions in which the elderly were residing, asked the inmates for their suggestions on the housing needs to age in place. Keeping in view of the design guidelines the respondents were asked to express their housing needs in terms of essential, preferred and neutral and scores 3,2,1 were allotted respectively. Chi-square analysis was done to find out the

association between existing housing conditions and design needs of the respondent. The association between existing housing conditions and design needs of the respondents to age in place served as a base to develop the design of a Studio apartment for elderly to age in place. Taking into consideration the housing needs and requirements of the elderly a studio apartment was developed.

Results and Discussion

1.Existing housing conditions of the elderly

The standard design guidelines for elderly housing proposed by various institutes and researchers were gathered through literature survey. The existing housing conditions of the elderly respondents were assessed in terms of these design guidelines. The houses of the elderly selected for the present study were physically observed and gathered information on different spaces and provisions made in the housing and assessed whether the design of these spaces and provisions were above the recommended guidelines or exactly as per the recommended guidelines or below the recommended guidelines. The data is presented below.

Living room

The houses in which the elderly were residing were found lacking in space allowances for circulation and wheelchair use. The essential distance between the television set and seating and clearance space between facing seating in most of the houses was found to be below recommended guidelines. Living room that lack sufficient clearance space create discomfort in day to day living. The houses were not built keeping in view of the needs of the elderly when they age. The majority of the houses may not facilitate the elderly to age in place.

Bathroom

Though some of the bathrooms were provided with grab bars or supporting rails, they were installed at a height above the recommended guidelines that may cause discomfort in use. The diameter and capacity to withstand hanging load of these supporting rails was below the recommended guidelines. The bath rooms in existing elderly houses were found lacking in features like sufficient space for wheel chair, fittings and fixtures to ensure safety and convenience in usage. A study conducted by Andes and Beemish also found similar lacking features in Bathroom. While designing houses due thought was not given to plan bath rooms to accommodate the needs that may arise in old age[1].

Bedroom

The clearance space for making the bed, for movement around bed, for making use of space on one side of the bed was found to be satisfactory in slightly more than half of the study sample. Electrical fittings and provisions for storage were found suitable in fifty per cent of the houses. None of the bed rooms were provided with security features and communication devices. Bedrooms were recognized as places with the highest rate of older adults indoor falls in other studies as well [3,12].

Kitchen

The design of existing kitchens in the majority of the elderly houses were found with counter at appropriate height. Provisions made for storage were not as per the recommended design guidelines. Lighting fixtures, provision of exhaust fans,

floor coverings were found as per design standards in most of the houses. Three fourth of the existing kitchens were found with standard fixtures and as per the design guidelines.

Dining room

Space allowances for easy circulation was found as per the recommended design guidelines in fifty per cent of the dining rooms. Space allowance per person on dining table was found adequate in case of the majority of the houses. Storage in the dining room was found below recommended standards in most of the dining rooms. Dining rooms were found with both direct and indirect accessibility.

Flooring

No extra effort was taken to make flooring non-slippery in the existing elderly houses. Similar findings regarding bathroom flooring were reported in the study conducted by Naganandha [9]. The provisions to make the floor safe and assist the elderly to lead a comfortable life in old age were not made. The flooring was one of the component in the housing highly neglected to suit to the needs of the elderly [2].

2.Housing needs of the elderly to age in place

The elderly were asked for their preference and needs in designing different spaces and provisions in the houses to age in place. The respondents were asked to state their requirements with reference to the design guidelines suggested by various institutes and authors in elderly houses. The requirements of the elderly were categorized as 'essential', 'preferred' and 'neutral'. The investigator after physical observation of existing housing conditions, discussed with respondents and asked them to suggest their requirements for comfortable and independent living during old age. The data was presented and discussed below.

Design needs in living room

The respondents desired to have clearance spaces between furniture to have free movement in the living room. Provision of spacious living room with limited and movable furniture was recommended by the elderly people. The elderly felt that the living room was the most used space and this space has to be designed in elderly friendly manner to enable them live comfortably with all the provisions. Hence, provisions for enough clearances should be made in living room for elderly to age in place. The living room is large enough to accommodate several types of furniture, such as sofas and tables, which are often used by older adults for support when walking or standing up [2].

Design needs in the bathroom

The elderly people are recommended to have space to allow wheel chair users and elderly using crutches to take a rotation and to enter or exist out comfortably. Bathrooms with grab bars or supporting rails at reachable height were felt as essential by the respondents. The elderly desired to have bath rooms with features like sufficient space for wheel chair, fittings and fixtures to ensure safety and convenience in usage. So while designing houses thought should be given to plan bath rooms to accommodate the needs that lessen their difficulties in old age.

The design needs in bed room

The clearance space for making the bed, for movement around bed, for making use of space on one side of the bed, and shelves

at proper height was preferred by more than half of the elderly. More than three fourth of the study sample desired to have additional space to perform other activities in the bedroom and bedrails on the sides of the bed, buzzer on the sides of the bed and alarm system.

Design needs in the kitchen

More than half of the total study sample preferred to have electric equipment, a separate area in kitchen to accommodate light dining, provision of storage shelves, cooktop, sinks at proper reachable height to enable easy use of the kitchen in old age. More than three fourth of the respondents preferred to have non-slippery flooring, cooktop with front controls. The elderly preferred to avoid base cabinets, overhead cabinets as they may encounter difficulties while using. The elderly felt that kitchen should be designed in a way that enable the users to perform activity without any discomfort.

Design needs in dining room

Convenient accessibility was felt most essential design feature by the elderly. The elderly felt essential to have both direct and indirect access between dining space and living space, entry/exit and private outdoor. The sample felt sufficient table space was essential. Provision of circulation Space in the dining area was felt neutral by more than half of respondents. Most of the elderly preferred dining area in every house with recommended features.

The design needs in flooring

The elderly preferred to have non-slippery flooring, provision of sound absorbing materials, floor with different colors and to avoid loose carpets and rugs. The aged individuals felt neutral for flooring that contrast with wall. The elderly felt flooring as one of the important feature that should be taken care of while designing.

3.Hypothesis testing

The chi-square statistical test was used to test the association between the existing housing conditions and the design needs of the respondents to age in place. The null hypothesis and the sub-hypotheses formulated were listed below.

H_0 : There exists no significant association between existing housing conditions and housing needs of the elderly

Sub hypotheses

H_{01} : There exists no significant association between existing living room design and needs of the elderly with reference to living room design

The Chi-square value was found to be non significant. Hence, the null hypothesis was accepted. There is no association between the existing living room design and the needs of the respondents with reference to living room design. Existing living rooms were found lacking in space allowances for circulation and wheelchair users. Irrespective of the provisions made in their existing living room, respondents wanted to have a living room with standard design features.

H_{02} : There exists no significant association between existing bathroom design and needs of elderly with reference to bathroom design

The Chi-square value was found to be non-significant. Hence, the null hypothesis was accepted. There is no association between the existing bath room design and the needs of the

respondents with reference to bath room design. The bath room design in the existing households was found to be deficient in space allowances for wheel chair users. Irrespective of the existing design, the elderly respondent wanted a bath room as per the recommended design guidelines. The findings of the research are supported by the findings of the study [4,5,6] had revealed that bathroom with the provision of support systems that ensure safety was preferred by the elderly.

H₀3: There exists no significant association between existing bedroom design and needs of elderly with reference to bedroom design. The Chi-square value was found to be highly significant. Hence, the null hypothesis was rejected. There is an association between the existing bed room design and the needs of the elderly respondents with reference to bed room design. The design of bedrooms in relatively more numbers of houses was found to be satisfactory in terms of clearance spaces between beds, space for bed making, and space for least used side of the bed. Similar findings for clearance space was found in the study [6]. Majority of the houses provided bed at proper height. The respondents who were enjoying the comfort in bedroom wanted to have a bed room as per the recommended design features.

H₀4: There exists no significant association between existing kitchen design and needs of elderly concerning kitchen design. The Chi-square value was

found to be highly significant. Hence, the null hypothesis was rejected. There is an association between the existing kitchen design and the needs of the respondents to age in place with reference to kitchen design. The work counters in the majority of the existing kitchen were found at the appropriate height. Lighting fixtures, provision of exhaust fans, and floor coverings were found as per design standards in most of the houses. Almost the entire sample selected for the study preferred kitchen strictly as per the design guidelines. Similarly, in a study conducted it was found that older women need elderly friendly kitchen [13].

H₀5: There exists no significant association between existing dining room design and needs of elderly with reference to dining room design. The Chi-square value was found to be highly significant. Hence, the null hypothesis was rejected. There is a strong evidence against the null hypothesis. Thus, there is an association between the existing dining room design and the needs of the respondents to age in place with reference to dining room design.

H₀6: There exists no significant association between existing flooring design and the needs of elderly with reference to flooring design. The Chi-square value was found to be non-significant. Hence, null hypothesis was accepted. There exists no association between the existing flooring design and needs of the respondents to age in place concerning flooring design.

Table 1: Association between existing housing design conditions and needs of elderly people

Association between existing housing design conditions and needs of elderly people					
S.No	Existing housing condition and needs of elderly	Chi-square value	Probability value	Significance (at probability value of (<0.005) 1 percent level	Null hypothesis
H ₀ 1	Living room	5.3741	0.1493	Non-significant	accepted
H ₀ 2	Bathroom	0.2871	0.5921	Non-significant	accepted
H ₀ 3	Bedroom	48.2612	0.0005	Significant	rejected
H ₀ 4	Kitchen	11.1864	0.0008	Significant	rejected
H ₀ 5	Dining room	72.7262	<0.0001	Significant	rejected
H ₀ 6	Flooring	2.5579	0.2332	Non-significant	accepted

Designing Studio apartment for elderly to age in place

Various spaces or rooms provided in the elderly house has to be ergonomically designed so that elderly people may participate in their activities without any physical discomfort. As people age they encounter physiological health problems which results in decline of their capability to perform activities. Housing needs and requirements of the elderly people were taken into account and the design of a studio apartment was developed. The term apartment refers to cluster of flats, building containing more than one dwelling unit. The studio apartment consists of cellar and 4 floors. Each floor has eight flats. The floor plan of Studio apartment was presented below. Plot area of Studio apartment is 11766 square feet. It was planned as per the standard dimensions in consideration of elderly people's needs.

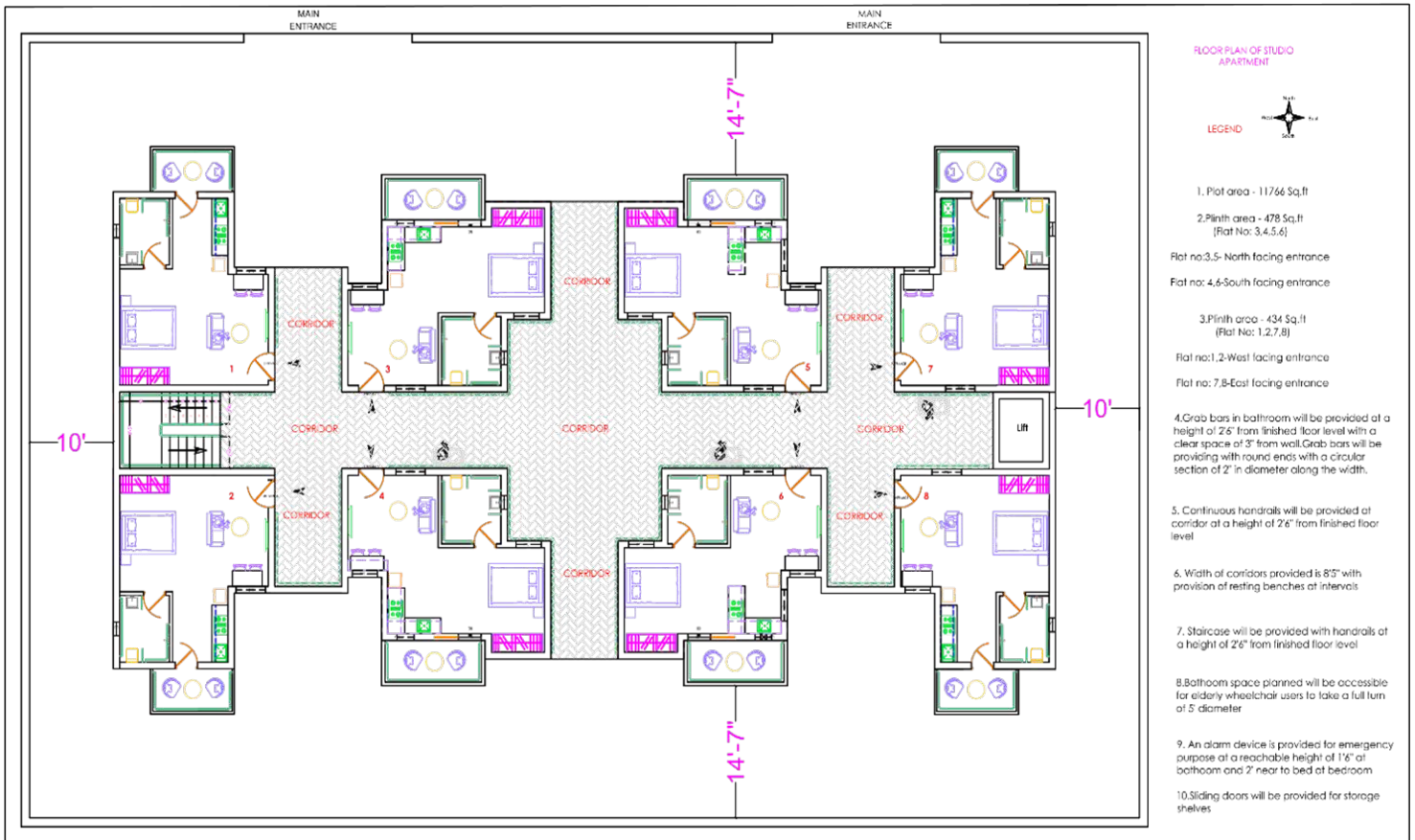


Figure 1. Studio apartment floor plan

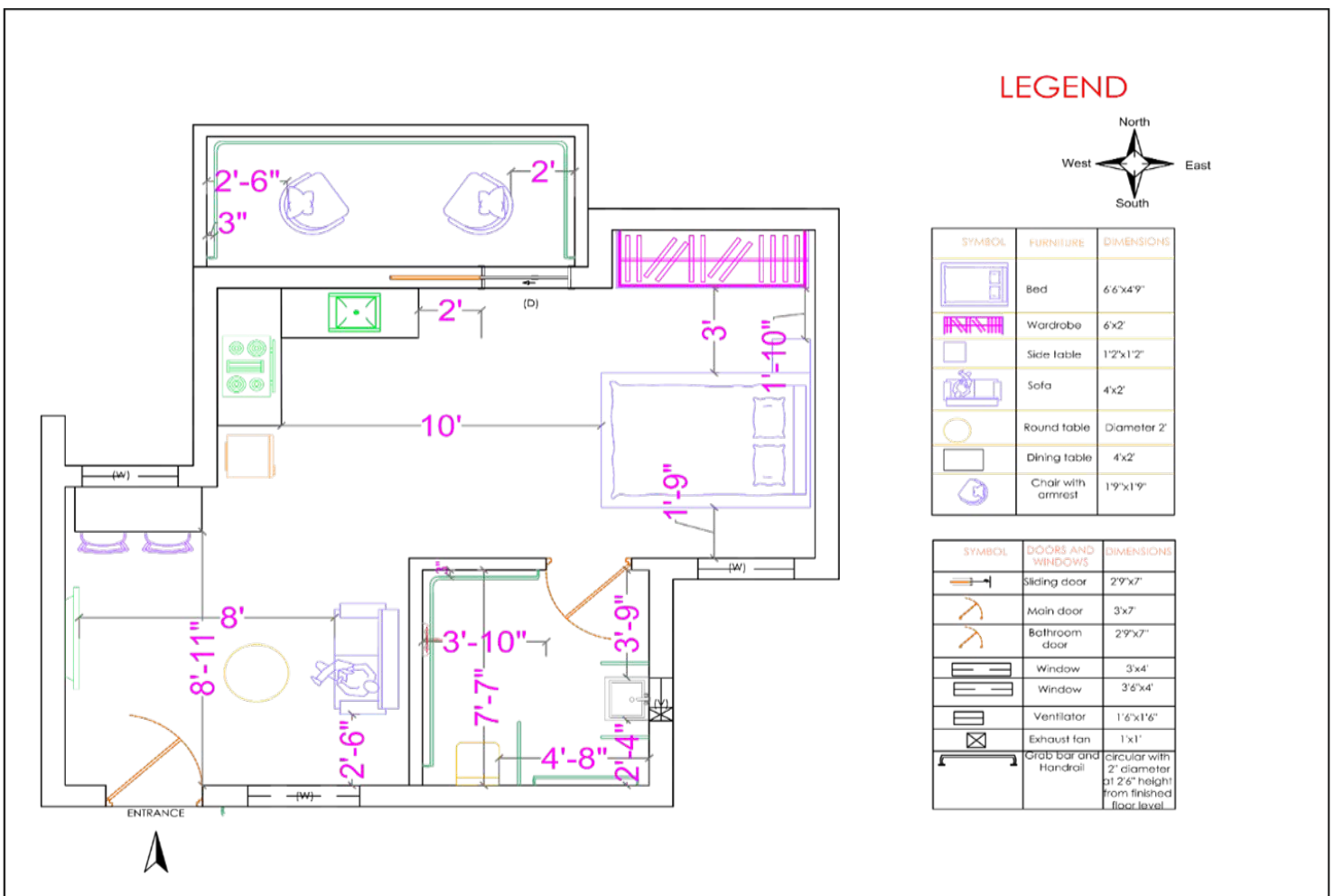


Figure 2. Furniture plan with clearance spaces



Figure 3.3D floor plan

Conclusion

The houses in which elderly people were residing were found lacking in space allowances for circulation and wheelchair use. Majority of the houses may not facilitate elderly to age in place. The bath rooms in existing elderly houses were found lacking in features like sufficient space for wheel chair, fittings and fixtures to ensure safety and convenience in usage. The clearance space for making bed, for movement around bed, for making use of space on one side of the bed was found to be satisfactory in slightly more than half of the study sample. No extra effort was taken to make flooring non-slippery in the existing elderly houses. The results revealed that there exists a significant association between existing conditions of living room, bathroom and flooring with design needs of elderly. A studio apartment comprised of a single large room which performs multiple functions of a living room-cum-dining area-cum-bedroom and a kitchenette, except a separate bathroom with no walls separating the spaces. Housing needs and requirements of the sample under investigation were taken into account and the design of a studio apartment was developed as per the standard guidelines.

Future scope of the study: Similar type of research can be done for developing housing for specially abled people such as wheelchair users, people with low vision and so on. Using the same methodology similar study can be taken up for rural elderly households. Studies can be taken up to develop detailed drawings for various activity area and different income groups using the standard design guidelines reviewed.

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