Alternative housing options for older New Zealanders: the case for a life-cycle study

Fatemeh Yavari and Brenda Vale
Victoria University of Wellington, Wellington, New Zealand
faeze.yavari, brenda.vale@vuw.ac.nz

Abstract: This paper makes a case for the resource assessment of housing alternatives for an ageing population that could make better use of existing housing in New Zealand. Limited housing choices for older people as well as personal factors have led to a demand for ageing in place. This requires finding effective design solutions for redeveloping the existing housing stock or designing new buildings to achieve a better quality of life, wellbeing and independence for those aged 65+. Research also suggests a considerable proportion of the ageing population live in large houses with two or more spare bedrooms, which implies large houses occupied by small households. Furthermore this age group, often on restricted incomes, does not necessarily maintain or heat these houses as much as needed. This is a potential health issue that can have implications for the national health budget. As a consequence, ways of altering such dwellings require more investigation to find those which have the lowest life-time resource use and are, at the same time, more energy efficient and affordable. This paper outlines a proposed research project to address these issues by undertaking life-cycle resource and cost assessments of design solutions for ageing in place in more suitable accommodation.

Keywords: Ageing population; housing alternatives; life cycle analysis; ageing in place.

1. Introduction

Housing plays a significant role in people’s lives by providing financial and psychological security as an investment and as shelter. Consequently, making appropriate housing choices is one of the most important decisions in the life of the 65+ age group, many of whom are no longer in full time employment, while having such choices can lead to greater life satisfaction and health (Office for Senior Citizens, 2013). According to Statistics New Zealand, the rate of home ownership for people aged 65+ is expected to decline (Office for Senior Citizens, 2013) while by 2050 numbers of older people with some form of disability are projected to increase by 60% (Statistics New Zealand, 2007). These two trends coupled with forecasts of more people in this age group living alone in the community (Statistics New
Zealand, 2015a; Office for Senior Citizens, 2013) lead to the growing need to address the issue of appropriate housing, one aspect of which is ageing in place rather than moving to a specially designed elderly residential facility, such as a retirement village. This paper explores this issue for New Zealand and suggests that renovation and redesign of houses that are too large for ageing households is worth investigating, and could lead to reduced resource and financial costs and better quality of life through retaining community ties.

2. An ageing population and the housing stock

2.1. Housing stock characteristics

In New Zealand 75% of dwellings have 3 or more bedrooms, with the number of one bedroom dwellings forming less than 6% in the last three censuses, and 1 and 2 bedroom dwellings less than 25% (Statistics New Zealand, 2001, 2006a, 2013a). Statistics New Zealand (2015a) suggest that in 2013, more than half of people aged 65+ in private dwellings (51.1%) were couple-only householders and just under one-third of this age group (28.8%) were one-person households, meaning that nearly 80% (79.9%) of people aged 65+ were in small households. Considering the growth in the number of one-person and couple-only households, mainly driven by the ageing population (Saville-Smith et al., 2008), the data demonstrate a mismatch between current and projected household characteristics and the existing housing supply (figure 1).

![Figure 1: Occupied private dwellings by number of bedrooms (Statistics New Zealand, 2001, 2006a, 2013a)](image)

The other problem is that new houses are added to the existing stock at a slow rate. Dwellings under construction comprised less than 1% of New Zealand housing stock in the census (Statistics New Zealand, 1998, 2006a, 2008, 2013b), so new affordable homes for older people are not an option, despite the fact the government is giving priority to the provision of affordable housing and making this available to those aged 65 and over (Office for Senior Citizens, 2013).

2.2. Ageing in place

The 65+ age group in New Zealand has nearly doubled since 1981 and a quarter of New Zealand’s population will be in this group by mid-century (Statistics New Zealand, 2015a). Taken with the
information in figure 1, this suggests a mismatch between small older person households and the existing housing stock, something also observed in Australia (Judd et al., 2014). Even if people wish to move from a house that is too large to something more suitable, the latter is generally not available (Davey et al., 2004).

Given this lack of new appropriate housing more older people are likely to remain in their family home in the future, leading to the need to ensure these houses are properly insulated and heated, have easy access and are safe, and are affordable (Davey, 2006). Living in the community in this way would be combined with the many assistive programmes in New Zealand that allow older people to remain in their current house safely and autonomously. These home support services enable ageing in place as long as possible by providing assistance with household tasks, shopping and other chores, and retaining or maintaining supportive social networks, providing certain eligibility criteria are met. The number of people aged 65+ who received financial assistance with equipment or housing modifications, between 1 July 2012 and 30 April 2013, was slightly less than 30,000 at a cost of $11.2 million (Office for Senior Citizens, 2013). Statistics New Zealand suggest that in 2006, 68% of people 65 and over made housing modifications, with those to improve access or moving within the home as a result of age related disabilities accounting for 37% of total housing modifications in 2006 (Statistics New Zealand, 2006b).

Numbers moving to residential care obviously increase with age and the higher levels of disability that come with this. However, living in the community is still appealing for some aged 85+, even with substantial disabilities (Davey, 2006). Around 75% of people aged 65 and over own or partly own the dwelling they usually live in (Statistics New Zealand, 2015a). Results from the 2013 Census show 92% of those aged 65+ lived in private dwellings, suggesting older people are choosing to remain in the community as long as possible.

### 2.3. Housing and maintenance

Saville-Smith et al. (2008) believe that poor New Zealand housing conditions and maintenance and repair problems are the main barriers for ageing in place and hence maintaining community ties, and further suggest that along with the population, the housing stock is also ageing. BRANZ’S Housing Condition Survey (HCS) showed houses occupied by older people tended to be in better condition compared to those of the under 65s. However, the average condition of some components of older people’s houses (fasteners, steps/ramps, windows, carport, roof cladding, kitchen linings, kitchen joinery, stove, laundry linings, laundry fittings, and bedroom linings) were in a poorer condition (Clark et al., 2005; Saville-Smith et al., 2008).

Evidence from the New Zealand general social survey conducted in 2014/2015 suggests that in 2014/2015, 50.7% and 3.8% of New Zealanders over the age of 65 lived in dwellings which required minor/some and immediate/extensive repairs and maintenance respectively (Statistics New Zealand, 2015b). On the other hand, in 2008, 2010 and 2012, people aged 65 and over who had major problems with their house accounted for 32.3%, 19.8% and 17.5% of the population respectively (Statistics New Zealand, 2009, 2011, 2013c). It should be noted that the figures for 2008 include any major problem in either house or neighbourhood but for 2010 and 2012 only houses have been considered, which may explain the large drop.
2.4. Design characteristics of housing for older people

The Organisation for Economic Co-operation and Development (OECD) (2003) suggest an ageing population needs smaller houses to cope with later life, and these need to be in the community and specifically close to family members and relatives to reduce the need for residential care. Housing should also be designed considering “lifetime” standards to accommodate people of all ages and all levels of disabilities. Many countries are also seeking approaches that integrate housing and care in non-institutional accommodation. This supported accommodation reduces the need to move to residential care.

In New Zealand Davey (2006) has stated special attention should be given to heating and ventilation problems, which have a negative impact on the health and well-being of the elderly. Low-maintenance buildings are also important.

3. Existing research into resource efficient housing for an ageing population

3.1. Housing studies in New Zealand and overseas

Of the many New Zealand studies on the provision of housing for the elderly, most have dealt with affordable and suitable dwellings and improving the condition of existing houses in order to age in place rather than sustainable or more resource efficient housing (Davey et al., 2004; Davey, 2006; Boston and Davey, 2006; Saville-Smith et al., 2008; Saville-Smith et al., 2009; James et al., 2012; Saville-Smith and Fraser, 2014). A number of studies have also dealt with the energy performance and environmental impact of housing in New Zealand (Baird and Chan, 1983; Wright and Baines, 1988; Johnstone, 2001; Mithraratne et al., 2007). While in New Zealand a number of studies have evaluated the efficacy of energy efficient upgrades of existing residential buildings and the utility of sustainability features (Lloyd and Callau, 2006; Zhang, 2010), overseas several attempts have also been made using life-cycle analysis (LCA) to examine the resource implication of retrofitting existing buildings (Crawford et al., 2002; Vale and Vale, 2006; Itard and Klunder, 2007; Page, 2010). In order to further investigate cost-effectiveness, cross comparison has been carried out in a number of these studies (Vale and Vale, 2006; Zhang, 2010; Page, 2010). However, very little New Zealand research has examined the environmental impact of renovation involving substantial changes in the building layout. In a recently published study by Leah (2015), the embodied energy of transforming and upgrading two comparable residential complexes in New Zealand and the UK over time was examined. Despite disparities in terms of layout, style, building materials and methods of construction, shared components included occupant characteristics, planning and time of construction. Comparative study of an initial typical residential design with the proposed improved design in terms of reducing life cycle energy has been the focus of some research (Bagley and Crawford, 2015). In this case redesign emphasized reducing embodied energy in terms of using alternative construction materials and systems as well as sustainability features including passive thermal devices. Together these studies provide important insights into the resource implications of buildings using various scenarios and tools. However, far too little attention has been paid to the financial and environmental burden of possible housing alternatives for the ageing population who wish to age in place. Thus, this study aims to examine the environmental impact of housing alternatives for older people and their lifetime resource use. This means considering the preferences of older people for ageing in place and investigation of possible design solutions based on converting existing dwellings.
These solutions need to consider sustainability principles to help older people remain warm and comfortable as well as being able to afford the solutions.

3.2. Environmental impact assessment of retrofitting versus new build

Utilising energy efficient features such as double glazed windows and effective insulation generally feature in retrofitting dwellings to make them more comfortable. Page and Fung (2008) highlighted the significance of the environmental impact of the renovation and upgrading of existing houses in New Zealand. They argued that renovation and insulation upgrades in order to extend the life of an existing house are superior to demolition and replacement in terms of life cycle costs (Page, 2010).

As demonstrated by De Angelis et al. (2013), retrofit practices have not been sufficiently studied in terms of life cycle analysis. De Angelis et al. (2013) compared two scenarios for an Italian six-storey building (demolition and reconstruction and envelope refurbishment). External and internal thermal insulation, slab insulation, roof insulation and window substitution were considered for the second scenario. They found building refurbishment is more sustainable in terms of reducing energy consumption and life cycle costs. While this type of renovation has been identified as the cheapest and most environmentally friendly, the possibly better acoustical, structural and architectural performance of new constructions have not been considered in analyses (De Angelis et al., 2013). However, from the economic and environmental perspective, energy refurbishment activities are deemed to be the better strategies for existing buildings that are structurally and architecturally valuable. On the other hand, Bullen (2007, in Bullen and Love, 2011, p.34) compared the potential functional differences between new and adapted buildings, demonstrating that an adapted building does not necessarily have a better performance than a new one.

A similar investigation has been conducted in the Netherlands where four scenarios were examined for two typical residential buildings: “ordinary building maintenance, consolidation (insulation measures), transformation (change floor plan to accord with new needs), and rebuilding (demolition of the old building and reconstruction with new floor plan)” (Itard and Klunder, 2007, p.266). Environmental impact determinants measured included material, energy and water use, demolition waste, and total environmental impact using an LCA approach. In their study, it was argued that transformation of the existing housing stock is a much more environmentally efficient way to achieve the same results compared to demolition and redevelopment. However, transforming the design of existing buildings by changing the floor plan needed to be done in a way that would be sufficiently flexible to allow for any alterations to meet the new and changing needs of occupants. As yet no similar studies have been found for changing existing houses to make them suitable for use by an ageing population.

3.3. Using a life-cycle approach

Life cycle analysis (LCA) is “a quantitative assessment of resource uses (raw materials and energy) and waste discharges for every step of the life of products, services, activities and technologies, and thereby provides a way to evaluate and quantify the environmental impacts of a wide range of products and activities” (Mithraratne et al., 2007, p.23).

The utility of life cycle investigations in developing more sustainable building design practices has been acknowledged by many researchers (Ramesh et al., 2010; Stephan et al., 2012; De Angelis et al., 2013; Cabeza et al., 2014; Goh and Sun, 2016). As suggested by Mithraratne et al. (2007, p.32) “the
longer the useful service life of the building, the less will be the burden on the environment”. This statement has been advocated by many studies implying that increasing emphasis needs to be placed on the preservation and reuse of the existing building stock for meeting sustainability goals (Itard and Klunder, 2007; Kohler and Yang, 2007; Page and Fung, 2008).

LCA has generally been used for comparative life cycle energy studies in order to identify the critical factors influencing the lifetime energy and cost of residential buildings, thereby leading to improvement in building performance (Fay, 1999; Fay et al., 2000; Mithraratne & Vale, 2004; Mithraratne et al., 2007). Various approaches for comparing case studies have been used for this purpose including comparing alternative designs (Fay, 1999; Fay et al., 2000) and comparing various applications of different materials and construction components in a single standard house (Mithraratne & Vale, 2004; Mithraratne et al., 2007).

Since LCA studies are dependent on a considerable quantity of data, there is always an uncertainty about the credibility of them, with possible misleading results (Hendriks and De Hoog, 1998). Harsch et al. (1996) describe the limitations of LCA analysis as the influence of boundary conditions, system definitions and importantly, data quality. Nevertheless, as indicated by Mithraratne et al. (2007) the uncertainty of the results stemming from data quality can be assessed using statistical methods and presented as a range or standard deviation. Utilising LCA provides a good opportunity for assessing alternatives in the decision-making process, and it has “transparency and reproducibility”, but also areas that could be improved (Harsch et al., 1996).

Saville-Smith (2008, p.5) suggested the initial purpose of retrofitting the existing New Zealand housing stock is enhancing the energy performance of existing buildings. Many studies have focussed on enhancing energy efficiency (Figueres and Philips, 2007 in Shen, 2012). Crawford et al. (2002) evaluated the embodied energy of a small detached building which had undergone refurbishment aiming to make it more energy efficient and found that in terms of energy “the energy efficiency features generally paid back within the lifetime of the building” (Crawford et al., 2002, p.93). Research from the life cycle cost perspective suggests the cost of reusing and renovating existing buildings can be lower than demolition and rebuilding the same volume (Itard and Klunder, 2007, Page, 2010, Bullen and Love, 2011). Bullen and Love (2011) also highlighted the significance of adaptive reuse from the sustainability perspective. Bekker (1982) has suggested that renovation is an appropriate method of extending a building’s life in order to protect valuable resources and reduce the environmental impact.

4. Housing alternatives for an ageing population

Statistics New Zealand (2013d) suggest there is an increasing demand for communal dwellings driven by the ageing population. Communal residential buildings such as cohousing have the capacity of attracting older people as they can provide assistance and companionship. Although most existing co-housing acts as multi-generational communities, senior co-housing is seen as a new trend (Gottberg, 2016), an example in New Zealand being Abbeyfield House where 8-12 residents share a family-style home. Types of co-housing also include houses shared with family members or boarders, (Davey, 2006). The subdivision of existing sections (plots of land) in New Zealand is common in urban areas, especially to stop urban sprawl by housing more people on the same plot of land. Accessory Dwelling Units (ADU) have been developed in California in the form of proposed plans. An ADU is defined as “a completely independent living facility with separate cooking, eating, sanitation and sleeping facilities that is either in or added to an existing dwelling or in a separate accessory structure on the same lot as an existing dwelling’ (Montgomery County Maryland, 2005 in Duff, 2012, p.33). This approach recognises the
problem of small households living in large houses and often on large plots, by suggesting ways to subdivide both. Duff (2012) studied the environmental impact of accessory dwelling units demonstrating that they contribute to reducing housing and land resources by accommodating a greater number of people through increasing density and avoiding infrastructure expansion.

5. Research justification: LCA in the context of gerontology

This research aims to address the collective impacts of an ageing population in terms of demographic changes and the preference of older people for ageing in place. The purpose of the proposed research is to investigate how to make existing housing more suitable for ageing generations and the environmental and economic implications of making such housing. This will need to be compared with the impact of building new appropriate housing. All designs will have to include features appropriate for housing the elderly.

One problem with ageing in place in small households of one or two people is that research suggests these “…are less efficient in terms of resource use per capita than larger households” (Liu et al., 2003 in Williams, 2007, p.331). Williams (2007) sees the growth in one-person households in England and Wales as leading to an increase in domestic resource consumption of energy, water, land and materials, something he considers the UK has in common with many developed countries. In order to tackle this problem, Williams (2007) investigated a number of design solutions including ecological homes (incorporating energy-efficiency measures and renewable energy technologies), communal homes (sharing resources between household members) and collaborative dwellings (sharing resources within a community such as in co-housing). He studied the resource implications of these solutions for England and Wales and found substantial resource savings for those living in both shared and co-housing arrangements (in terms of land, direct energy and household goods), mainly due to sharing resources in daily living. He estimated average resource savings of 44% and 57% in communal and collaborative housing respectively (Williams, 2005 in Williams, 2007). In addition to sharing resources it seems these types of housing encourage a wide range of environmental behaviours in terms of energy conservation and waste recycling.

This project will first look at typical house types found in New Zealand. Initially, four New Zealand house types will be investigated (early 20th century villa with central corridor, 1920-30s Californian bungalow, 1930-50s single storey state houses, and 1960-70s Keith Hay Homes). Examples will be selected based on floor areas and number of bedrooms. To make a comprehensive comparison, a new house designed for the older household will also be selected. All the houses will have 3 or 4 bedrooms as the 65+ age group currently tend to live in larger houses (Statistics New Zealand 2013a; 2015). Each selected example will be redesigned, with options ranging from separate units of 1 or 2 bedrooms, separate units with a shared guest room and entry, to private ensuite bedsits with shared living/dining area, kitchen and spare room(s) for visitors, hobbies, or a live-in carer. All designs will contain the features appropriate for dwellings for older people, including being warm, safe and affordable. This will draw an overseas works such as UK Lifetime Home Standards and universal design principles which ensure housing is accessible and appropriate for all life stages and disabilities. The aim in the alternative design strategies is to retain the same standards of comfort and wellbeing found in new housing for the elderly as well as reducing energy and resource use.

All designs will then be subject to life-cycle resource and cost analysis and the results compared with new small houses. The outcomes of this evaluation will identify whether, in terms of resource and
energy consumption as well as cost benefits, there is any difference between housing for older people so they can age in place and the new developments which government and policy makers are encouraging and which mean senior citizens have to move.

6. Conclusion

This paper sets out to make a case for a life-cycle assessment of ways of allowing ageing in place in more suitable houses. This approach acknowledges that houses in New Zealand are under occupied, especially when it comes to the small households of an ageing population (Davey et al., 2004). The traditional housing model is likely to change because of changes in family size and lifestyle and population composition. Furthermore, the possibility of emigrants now of retirement age returning to New Zealand is another trigger in the growth of the ageing population and its influence on the property market (Statistics New Zealand, 2013d). The current market response of private retirement villages is not suitable for many older people who want to stay in their own communities and other ways have to be found of making appropriate types of housing, of which this project is a small step in this search.

References


Alternative housing options for older New Zealanders: the case for a life-cycle study


