



*Final Report*

# **The costs and benefits of using private housing as the 'home base' for care for older people: secondary data analysis**

authored by

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**Australian Housing  
and Urban Research Institute**

Sydney Research Centre

April 2008

AHURI Final Report No. 115

ISSN: 1834-7223

ISBN: 1 921201 51 7



## **ACKNOWLEDGEMENTS**

This material was produced with funding from the Australian Government and the Australian States and Territories. AHURI Ltd gratefully acknowledges the financial and other support it has received from the Australian, State and Territory governments, without which this work would not have been possible.

AHURI comprises a network of fourteen universities clustered into seven Research Centres across Australia. Research Centre contributions, both financial and in-kind, have made the completion of this report possible.

We also wish to acknowledge the NHMRC and University of Sydney for funding the MELSHA data collection and analyses reported in chapter 3. Thanks are due to Stephanie Mathews who assisted with editing and to Dr Robert Pedlow and Associate Professor Dave Grayson who contributed to the data analysis and synthesis within chapter three. The helpful input of Professor Helen Bartlett from UQ and the Reference Group also need acknowledgement: Christopher Banks (Queensland Department of Housing), Helen Fletcher (Commonwealth Department of Families, Community Services and Indigenous Affairs), Dr. Len Gray (The Australasian Centre for Ageing at the University of Queensland), and Ann Peut (AIHW). Thanks also to Dr. Vivienne Milligan, the AHURI Sydney Research Centre director, and to Jim Davison, Dr. Andrew Hollows and Simone Finch of AHURI Ltd.

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# CONTENTS

<b>GLOSSARY</b> .....	<b>IV</b>
<b>EXECUTIVE SUMMARY</b> .....	<b>1</b>
Introduction .....	1
Project aims .....	1
Structure of this report .....	1
Research context.....	2
Analysis method, assumptions and limitations .....	3
CHAID analysis.....	3
Longitudinal analysis.....	3
Cost-benefit summary.....	4
Policy implications summary.....	4
Conclusion .....	4
<b>1 CONTEXTUAL BACKGROUND TO THE RESEARCH</b> .....	<b>5</b>
1.1 Introduction .....	5
1.2 Research questions .....	5
1.2.1 Key research questions.....	5
1.2.2 Outputs.....	5
1.3 The Positioning Paper.....	6
1.4 Evidence regarding cost-benefit analysis of housing and care from the literature... 6	
1.5 Research procedures.....	7
1.6 Structure of the paper .....	7
<b>2 THE HOUSING MODEL: ANALYSIS METHOD, ASSUMPTIONS AND LIMITATIONS</b> .....	<b>8</b>
2.1 Introduction .....	8
2.2 Disability Aged and Carers Survey (DACs).....	8
2.2.1 The DACs older population sub-sample .....	9
2.2.2 The DACs sub-sample dwelling characteristics.....	11
2.2.3 DACs sub-sample home support characteristics .....	13
2.3 Estimating the cost of support.....	14
2.3.1 Costing home modifications .....	15
2.3.2 Developing a cost algorithm .....	15
2.4 The housing model .....	16
2.4.1 Selecting the focus variable for the model .....	17
2.4.2 CHAID modelling results .....	18
2.5 Summary and implications.....	19
<b>3 HOUSING, SERVICES AND ENTRY TO RESIDENTIAL CARE</b> .....	<b>21</b>
3.1 Introduction .....	21
3.2 Data sources and methods .....	21
3.3 Findings .....	23
3.4 Directions and implications .....	26

<b>4 COST-BENEFIT ANALYSIS.....</b>	<b>28</b>
4.1 Introduction .....	28
4.2 Estimating the costs of home-based care .....	28
4.3 Incremental cost analysis based on best and worst case scenarios .....	30
4.3.1 Bob .....	30
4.3.2 Carole .....	31
4.3.3 Ted and Alice .....	32
4.4 How do different aspects of housing contribute to the financial costs and benefits of using private housing as the home base for the provision of care services for older people? .....	33
4.5 Conclusion .....	35
<b>5 HOUSING POLICY IMPLICATIONS .....</b>	<b>36</b>
5.1 Introduction .....	36
5.2 Economic value of housing for older persons .....	36
5.3 Growing demand for home-based care .....	37
5.4 Appropriateness of residential housing design for older persons .....	38
5.5 Housing policy changes needed to secure the future for older people .....	39
5.6 Conclusions .....	41
<b>REFERENCES .....</b>	<b>43</b>
<b>APPENDICES.....</b>	<b>48</b>
Appendix 1: DACS variables used in analysis .....	48
Appendix 2: Residential care admission calculation .....	53
Appendix 3: Cost of support by state and region .....	54

## **GLOSSARY**

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AHURI	Australian Housing and Urban Research Institute
AIHW	Australian Institute of Health and Welfare
AIP	Ageing In Place
ATSI	Aboriginal and Torres Strait Islander
CACP	Community Aged Care Package
CDSA	Commonwealth State Disability services Act
CHP	Community Housing Program
CPI	Consumer Price Index
CSDA	Commonwealth State Disability Agreement
CSHA	Commonwealth State Housing Agreement
CURF	Confidentialised Unit Record Files
DACS	Disability, Ageing and Carers Survey
DDA	Disability Discrimination Act
DSA	Disability Services Act
DSP	Disability Services Program
DVA	Department of Veterans Affairs
EACH	Extended Aged Care at Home
FACS	Department of Family and Community and Community Services
HAA	Housing Assistance Act
HACC	Home and Community Care Program
ICER	Incremental Cost Effectiveness Ratio
MELSHA	Melbourne Longitudinal Studies on Health Ageing
NSW	New South Wales
NT	Northern Territory
PRA	Private Rental Assistance
RA	(Commonwealth) Rent Assistance
SA	South Australia
SAAP	Supported Accommodation Assistance Program
SHA	State Housing Authority
TAS	Tasmania
VIC	Victoria
WA	Western Australia

# EXECUTIVE SUMMARY

## Introduction

This paper outlines research by the Australian Housing and Urban Research Institute University of Sydney Research Centre into the relationships between the costs and benefits of using private housing as the 'home base' for care for older people. Residential care requires relocation to the institution but provides both housing and care to older persons, whereas home-based care means that care is brought to the older person within their own home. The absence of economic evaluations of care at home for older people in Australia is significant, given that policy and care arrangements vary substantially from country to country.

To date, cost-benefit studies associated with home care for older people have used inconsistent terminology and inconsistent methodologies. They have not viewed costs and benefits from similar perspectives or considered the same dependent or independent variables. As a consequence, the results have at times been contradictory. One significant limitation of prior research is its focus on either care or accommodation, without analysing the relationship between the two. The present project aims to overcome these limitations by considering the impact of potentially significant variables on the costs and benefits of home care in a context that will allow assessment of the interrelationships between housing, care and personal characteristics.

## Project aims

This project aims to inform policy and program delivery issues associated with achieving the most appropriate health care and housing interventions. It does this by answering three research questions:

1. What are the financial costs and benefits to individuals and governments of using private housing as the home base for the provision of care services for older people?
2. How do the different aspects of housing, such as tenure, dwelling type, location and access to support, contribute to the financial costs and benefits of using private housing as the home base for the provision of care services for older people?
3. How do different forms of housing assistance and related programs affect the costs and benefits of using private housing as the home base for the provision of care services for older people?

## Structure of this report

This report provides the cost-benefit summary results stemming from the secondary analysis of two data sets: the Disability, Aging and Carers Survey (DACs) and the Melbourne Longitudinal Study on Healthy Ageing (MELSHA). The secondary data analysis provided the means of determining the costs and benefits of providing care in the home for older persons in Australia. To reveal the economic relationship between housing and care, a number of methods were applied, including: the development of a pivot table merged from the relevant DACs Confidential Unit Record Files (CURF) that could be interrogated to determine costs; Chi-square Automatic Interaction Detection (CHAID); and Cox Hazard regression analysis. These results are structured into chapters, as described below.

Chapter 2 outlines the strengths and weaknesses of the DACS and presents the methodology adopted in the analysis, our cost sources, cost assumptions and their implications. It also presents the results of the CHAID analysis. The CHAID output revealed a robust model that clearly identified the importance of tenure and housing type in determining the overall cost of care for older persons dwelling in the community.

Chapter 3 reviews a longitudinal data set (the MELSHA) in order to identify the predictors of entry to residential care. This exploratory analysis concludes that housing tenure, housing type and use of community services are statistically correlated to a greater likelihood of early entry to residential care. However, additional factors affecting residential care entry also included the respondent's age, the number of medical conditions identified, the level of social activity recorded and the presence of cognitive impairment.

Chapter 4 describes the results of the cost-benefit comparisons for older (60–74) and old-old (75+) groups in relation to housing tenure, housing type, and assistance type. It also outlines the incremental cost analysis based on best and worst case scenarios for four older persons. Using CHAID, it summarises the different aspects of housing that are most significant in explaining the care costs. It concludes that housing variables are critical in determining the cost of home-based care and that home-based care has the potential to reduce care costs in the longer term when compared to residential care.

Chapter 5 describes the cost-benefit insights in terms of their implications for housing policy, including the targeting of housing assistance.

## **Research context**

A better understanding of the costs and benefits of providing home-based care to older adults can inform policy making, so that care costs can be better predicted and housing intervention more appropriately targeted. In particular, a better understanding of the impact of tenure type, dwelling appropriateness, dwelling fitness, and geographic locale is needed. International research indicates that such knowledge is necessary to guide policy decisions, but because policies, culture and geography also are critical variables, we cannot extrapolate from this international body of knowledge without consideration of the unique Australian environment.

The systematic literature review presented in the positioning paper provided the background for developing a model to determine the influence of housing tenure, type and location on the cost of aged care (Bridge et al., 2007). In Australia, tenure defines the nature of the occupants' property rights and often determines which older people can have care provided within their homes and locale. This is particularly important for older people because the proportion of those living alone without access to care services from a partner increases with age.

While a considerable body of research regarding economic evaluations of in-home care for older people already exists, much of it was conducted outside Australia, and the features posited as significant and the formulas used to calculate their respective economic impacts varied widely. We found, in accord with other recent systematic reviews, that there was insufficient evidence and/or data to fully estimate the relative benefits, harms, and costs of residential or in-home care for older people.

Our review of the literature also found that a number of methodological issues require careful thought in regard to any future studies. Future research should include clear methods to control for several situations:

- variation of effect in relation to amount of care provided
- variation of effect in relation to the type of care received
- the lack of a clear distinction between respite and hospital care
- the lack of information about supportiveness of the home environment.

## **Analysis method, assumptions and limitations**

In order to understand the costs of (private) home-based care provision compared with residential care, the cost of residential care provides a benchmark against which the relative costs of home care can be assessed. Standard cost imputation methods were applied to the data derived from the Confidential Unit Record Files (CURF) collected by the Australian Bureau of Statistics (ABS) for the 2003 Disability, Ageing and Care Survey (DACS). This data provided the foundations for the development of our data cube (i.e. a pivot table), which could be interrogated regarding housing and care characteristics. The data cube we created for this project was a subset of the DACS containing all the CURF for respondents aged 60 years and older. The DACS is a snapshot in time and, as such, is silent about change over time; costs and time are not presented in discrete temporal units (e.g. hours, minutes). Although costing can be achieved by melding data sets and by generalising a number of unique cost variables, the DACS is limited because it was never intended as a costing source. The lack of consensus about the costing of informal care and the value of social benefits are shortcomings of earlier research that influences the present study. For instance, it has meant that reliable quantitative data was unavailable, so we were unable to impute the economics of the benefits of home-based care. Finally, respite cost was not included in our analysis. There were insufficient responses from older adults to the DACS inquiry about respite care to yield statistically valid results.

## **CHAID analysis**

CHAID was chosen for this research, as it is a method designed for the analysis of large categorical data sets. The output from a CHAID analysis is a tree-like structure built from the most statistically significant socio-demographic variables associated with the focus variable. In order to determine whether housing or care should be the focus variable, the focus question was subject to a CHAID validation process. The model resulting as a part of this research analysis revealed that tenure type was the most critical aspect of the model in predicting home-based care costs. Further, dwelling type was also significantly associated with support type.

## **Longitudinal analysis**

Based on data from the Melbourne Longitudinal Studies on Healthy Ageing (MELSHA) program, an exploratory analysis was conducted on how the personal and housing characteristics of older people in 1994 were related to their chances of subsequently entering residential care in 2005. Multivariate 'survival analysis' (e.g. Cox regression) was conducted in order to identify the statistically most important predictors of entry to residential care and their relative importance. Survey findings confirmed that the vast majority of older people remain in the community throughout later life and never enter residential care. However, it also appears that the most vulnerable people – those in social housing flats – were the most likely to enter residential care, while those in owner-occupied housing were the least likely to enter residential care.

## **Cost-benefit summary**

The average annual cost of formal care per older person is about \$7,500,<sup>1</sup> while the average annual cost of informal care is about \$10,900.<sup>2</sup> For those receiving formal and informal care, the average annual cost of support is \$11,370.<sup>3</sup> Further, the cost-benefit results confirm that insecure tenure and dwelling type can increase care costs. While age and presence of a partner have long been accepted as components in the analysis of aged care costs, housing must now also be included. Nevertheless, the analysis is limited in that it does not attempt to match the level of care delivered in the home with that provided in institutional settings, and nor does it use a control group or a quasi-experimental approach. However, our findings are consistent with the results of previous research. Further, they are underpinned by a logic that demonstrates the importance of informal care and lack of accommodation costs within a home-based setting resulting in large savings to both government and older people.

## **Policy implications summary**

We have shown that there is a nexus between housing and the cost of in-home care. Home ownership affects the potential to modify existing dwellings and the potential for elders to remain in the community. Dwelling condition and type may impose functional limitations that increase care costs or make in-home care difficult, if not impossible. Key policy themes that are directly associated with our cost-benefit findings are the economic value of housing, growing demand for home-based care, and the appropriateness of housing design. Further, housing is one of the key factors affecting older people's chances of early entry to more costly residential care services.

## **Conclusion**

Knowing that housing is a key aspect of care costing means that cost efficiencies may be gained and maintained by increasing policies designed to improve housing security for older people (e.g. assistance to help older adults get and maintain an appropriately located and usable home base). In addition, policy and practice designed to improve existing dwelling stock for older people should be re-evaluated. Urban planning policies will be crucial in implementing improved new construction; more and enhanced home modification and retrofit strategies can make existing housing stock more suitable for in-home care. Clearly, more work needs to be undertaken within Australia to better understand what strategies are likely to be most cost-effective for which groups of older people. Future research should address older peoples' perspectives on their housing needs, their preferred methods to ensure appropriate housing, and the development and implementation of cost-effective and sustainable adjustment strategies. Closer examination of various state-based service delivery models also will be essential if an effective national strategy is to be deployed..

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<sup>1</sup> The DACS does not distinguish whether an older person's care is privately purchased or government provided, and so these figures are silent in terms of the relative cost distributions between individuals and government.

<sup>2</sup> Ibid.

<sup>3</sup> Ibid.

# 1 CONTEXTUAL BACKGROUND TO THE RESEARCH

## 1.1 Introduction

This paper outlines research by the Australian Housing and Urban Research Institute University of Sydney Research Centre into the relationships between the costs and benefits of using private housing as the 'home base' for care for older people. While ageing, disability, housing and care policies are important in themselves, this study aims to provide an understanding of housing as a key issue across these policy areas. The project has a strong focus on the relationships between accommodation and other circumstances of older people. This final report presents primary results from the secondary analysis of confidential unit record data from the 2003 Disability, Ageing and Carer (DAC) and Melbourne Longitudinal Studies on Healthy Ageing (MELSHA) surveys. This chapter outlines the principal research questions, summarises the earlier positioning paper, and reviews the research methods and key tasks in the research.

## 1.2 Research questions

This project aimed to determine the costs and benefits to individuals and governments of in-home delivery of non-shelter services to elders. To accomplish this, the project set out to answer the following research questions.

### 1.2.1 Key research questions

1. How do the different aspects of housing, such as tenure, dwelling type, location and access to support, contribute to the financial costs and benefits of using private housing as the home base for the provision of care services for older people (Chapters 2 and 3)?
2. What are the financial costs and benefits to individuals and governments of using private housing as the home base for the provision of care services for older people (Chapter 4)?
3. How do different forms of housing assistance and related programs affect the costs and benefits of using private housing as the home base for the provision of care services for older people (Chapters 5)?

### 1.2.2 Outputs

- A robust method to determine the financial costs and benefits to individuals and governments of in-home delivery of non-shelter services to elders (Chapter 2).
- An understanding of how different aspects of housing (such as tenure, type, location and access to support) affect the financial costs and benefits to individuals and governments of in-home delivery of non-shelter services to elders (Chapters 2 and 3).
- An estimation of the financial costs and benefits to individuals and governments of in-home delivery of non-shelter services to elders (Chapter 4).
- An understanding and estimation of how different forms of housing assistance and community care programs affect the financial costs and benefits to individuals and governments of in-home delivery of non-shelter services to elders (Chapters 4 and 5).
- Identification of the information's implications for housing policy, including the targeting of housing assistance (Chapter 5).

### **1.3 The Positioning Paper**

The Positioning Paper provided a broad context for the study. It used a systematic review technique to examine the existing national and international research regarding the costs and benefits of in-home care for older adults. While our review revealed that there was a considerable body of academic research relating to economic evaluations of in-home care for older people, the selection of variables for study and the formulas used to calculate their economic impact varied widely. Most recent systematic reviews concluded that there was insufficient evidence to estimate the relative benefits, harms and costs of residential and in-home care for older people.

Our literature review also revealed a number of methodological issues that will require careful thought in future research:

- variation of effect in relation to amount of care provided
- variation of effect in relation to the type of care received
- the lack of clear distinction between respite and hospital care
- the lack of information on supportiveness of the home environment.

### **1.4 Evidence regarding cost-benefit analysis of housing and care from the literature**

The Positioning Paper highlighted the lengthy debate about the costs and benefits of in-home care for older adults. Early research, particularly the North American research, was fairly pessimistic about the benefits of home-based care. Although clients usually expressed satisfaction with home-based care, there was a lack of evidence that home-based care led to a reduction in institutional care. Much of this early work is summarised in a major review of 700 articles published between 1960 and 1985 on the relative costs of home-based and institutional care (Weissert, Cready & Pawelak 1988).

By the late 1980s, American researchers had generally concluded that enhanced home care did not ultimately reduce the demand for residential care. However, as Chappell et al. (2004, p. 390) point out, researchers in the 1990s recognised that earlier research often focused on costs associated with the introduction of new or enhanced home-care services. Canadian research during the 1990s suggested that in-home care could be cost-effective when in-home care and institutional care were compared directly.

One Canadian research team, Ostbye and Crosse (1994) examined the cost of care for people with dementia and estimated that the annual net cost of providing in-home care was \$10,100, compared to an institutional care cost of \$19,100. Later in the 1990s, Weissert, who had been very negative about the potential of home-based care to generate savings, published a major evaluation of the Arizona long-term care system and concluded that home care could be cost-effective when designed as an alternative to institutional care. Weissert et al. (1997, p. 1330) concluded that home- and community-based services appeared to be substantially less costly than nursing home care and that the savings estimates were very robust and did not appear to decline over time.

Chappell et al. (2004) identified the failure to include the cost of informal care as one of the weaknesses of many studies that endeavour to compare the costs of institutional and home-based care. The significance of informal care was well documented by Access Economics (2005), which concluded that the value of informal care in Australia ranges from \$5 billion to \$30 billion. Once a person enters

institutional care, the level of informal care reduces. Max, Weber and Fox (1995) reported that people with Alzheimer's disease living in the community received an average of 286 hours of unpaid care per month, while those living in long-term care facilities received an average of 36 hours of unpaid care per month.

In another Canadian study, Hebert et al. (2001) concluded that home care is less expensive than institutional care only when the cost of informal care is excluded. In contrast, Chappel et al. (2004) found that, even allowing for the cost of informal care, care in a residential facility for someone was about twice as expensive as home-based care. Matching levels of care for at-home and institutionalised participants was an important improvement on previous research. Earlier studies sometimes compared the cost of care for people receiving different levels of care. Usually people in institutional settings required higher levels of care, which could result in an overestimation of the advantage of home-based care.

Thus, despite earlier reservations, there appears to be a growing consensus that home-based care is cost-effective and generates considerable benefits for governments that are funding health budgets for seniors. The financial benefits to governments of home-based care are driven by two major factors:

1. the large amount of informal care that occurs in a home-based setting
2. the relatively low cost to the government for the accommodation component of home-based care (where the major cost is often home modification) compared to the substantial public funding of the accommodation component of institutional care.

## **1.5 Research procedures**

The statistical information in this report is based on the 2003 Disability, Ageing and Carers (DAC) Survey conducted by the Australian Bureau of Statistics. The DAC Survey provides a data bank that is representative of people living in Australia who have a disability, are older adults, or who provide care for an older adult or someone with a disability. The DACS results include details about respondents' dwelling type and home modification uptake. All the CHAID and cost analyses within this report are based on the DACS Confidential Unit Record Files (CURF). More information on the DACS survey, analysis methods and findings is provided in Chapter 2.

## **1.6 Structure of the paper**

This Final Report provides a summary of key findings from the project and presents policy implications. Chapter 2 draws from the DACS survey to present the cost imputation methodology and the housing model resulting from the CHAID exploration. Chapter 3 presents findings from the longitudinal analysis. Chapter 4 presents cost-benefit findings, and Chapter 5 discusses the policy implications of these findings, which point to new directions for improved housing and care policies. The earlier Positioning Paper comprises the systematic literature review that underpins the strategy employed in the research reported here.

## **2 THE HOUSING MODEL: ANALYSIS METHOD, ASSUMPTIONS AND LIMITATIONS**

### **2.1 Introduction**

This chapter outlines information about the housing model, the data sources and methods used. First, the Disability Aged and Carers Survey (DACs) Confidential Unit Record Files (CURF) data set sample is presented, and the construction of the data cube specific to the research questions is explained. Second, the method for costing is discussed. Third, the method of model development is presented. The model sets out specifically to address the research question relating to understanding the different aspects of housing that contribute to the financial costs of home-based care for older people. Finally, the results of the statistical analysis and the resultant final housing model are presented (i.e. research question 1).

### **2.2 Disability Aged and Carers Survey (DACs)**

The 2003 Disability Aged and Carers Survey (DACs) was the fifth comprehensive national survey conducted by the Australian Bureau of Statistics (ABS) to measure disability, following similar surveys in 1981, 1988, 1993 and 1998. The DAC survey comprised a representative weighted sample and was conducted throughout Australia from June to November 2003. It included people in both urban and rural areas in all states and territories, except those living in remote and sparsely settled parts of Australia. The survey included people in both private and non-private dwellings, including people in cared-accommodation establishments, but excluding those in jails and correctional institutions (Australian Bureau of Statistics, 2003a,b, 2006a).

The household component included people in private and non-private dwellings such as hotels, motels, boarding houses, short-term caravan parks and self-care sections of retirement villages. The cared-accommodation component included residents of hospitals, nursing homes, hostels and other group living accommodations.

Trained interviewers, who conducted computer-assisted personal interviews, collected data for the household component of the survey. A series of screening questions were asked of a responsible adult in a selected household, to establish whether the household included:

- people with a disability
- people aged 60 years or over
- those who provided care for another because of the other's disability or old age.

Where possible, a personal interview was conducted with people identified in any of the above populations. Proxy interviews were conducted for people with a disability that prevented them from having a personal interview.

The survey collected basic demographic and socio-economic information for all participants and additional specific information for the three major groups of respondents:

- for people with a disability – information about their long-term health conditions, need for and receipt of assistance, use of aids and equipment such as hearing aids or wheelchairs, and participation in community activities
- for people aged 60 years and over – information about their need for and receipt of assistance and their participation in community activities

→ for carers – information about the type of care they provide, the support available to them, and the effects that the caring role has had on their lives. These people completed a self-enumeration<sup>4</sup> form during the interview that collected information about their attitudes towards and experience of their caring role.

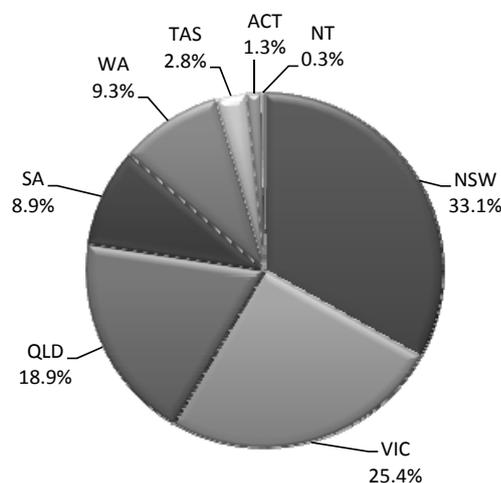
The DACS is a complex survey; it collected information on 1052 variables across 10 files. As the present research focused solely on older adults, only a subset of the total data was required – for example, 5,742 confidential unit record files (CURF) were used. An SPSS data file was created that included household, care, and individual variables from the DACS (see Appendix 1 for the full range of variables used).

### 2.2.1 The DACS older population sub-sample

The data cube we created for this project was a subset of the DACS containing all the CURF of respondents aged 60 years or older. Within our subset, 53 per cent were female and 47 per cent were male. This is not unusual, as women generally survive longer than men; however, the higher proportion of women may affect costing, as older women are more likely than men of the same age to experience mobility and self-care impairments (Arber & Cooper, 1999).

Figure 2.1 illustrates the geographic distribution of the DACS sub-sample. New South Wales has the largest proportion (n = 1,013,989), followed by Victoria (n = 779,924) and Queensland (n = 576,698), with the smallest numbers of older persons in the Northern Territory (n = 8,317). About 63 per cent of DACS respondents aged 60 or over were from the major cities of Australia; but 24 per cent were from regional Australia, and another 13 per cent were from other areas. While the DACS CURF files contain postcode area data, analysis at the micro level was problematic because of the weighted nature of the representative sample and the geographical reattribution employed to protect privacy of individuals in smaller communities.

**Figure 2.1: Geographic distribution of DACS respondents aged 60+ years**



<sup>4</sup> Self-enumeration refers to the completion of census survey questionnaires by the respondents themselves.

About 69 per cent of the DACS respondents aged 60 or over were aged between 60 and 74 years, and about 31 per cent were aged 75 or older. The age proportions are significant because, as shown in Table 2.1, the amount and mix of home support changes dramatically with age. The old-old group receives more formal assistance and there are far fewer people who do not receive any home support. This finding is consistent with the notion of a linear correlation between ageing and an increase in functional impairments (Australian Institute of Health and Welfare, 2002).

**Table 2.1: Home support usage by age**

<i>Age (years)</i>	<i>Formal assistance only</i>	<i>Mixed assistance</i>	<i>Informal assistance only</i>	<i>No assistance</i>	<i>Total</i>
60–74	119,822	86,119	364,109	1,543,543	2,113,593
75+	172,860	91,540	257,162	423,189	944,752
Total	292,682	177,659	621,271	1,966,732	3,058,345

Source: DACS (2003).

Figure 2.2 shows the dramatic impact of age on the need for care. For instance, it can be seen that there is an inverse relationship between age and care need, with the vast majority of older people under the age of 75 not requiring any care services, whereas over two-fifths of people aged 75 years or over accessed formal care services. Taking the data from Table 2.1 by rows, with percentages as a breakdown of the total numbers surveyed for that age group, it can be seen that nearly three-quarters (73%) of older persons under 75 years stated that they required ‘no assistance’ but this percentage drops to less than half (45%) for those aged 75 and over. Further, usage of formal care services is significantly greater (i.e. 18% versus 6%) for those aged 75 or older.

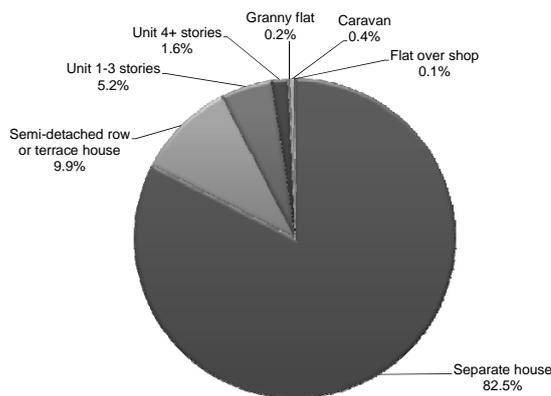
**Figure 2.2: Care type comparison by age category (older adult versus old-old adult)**



### 2.2.2 The DACS sub-sample dwelling characteristics

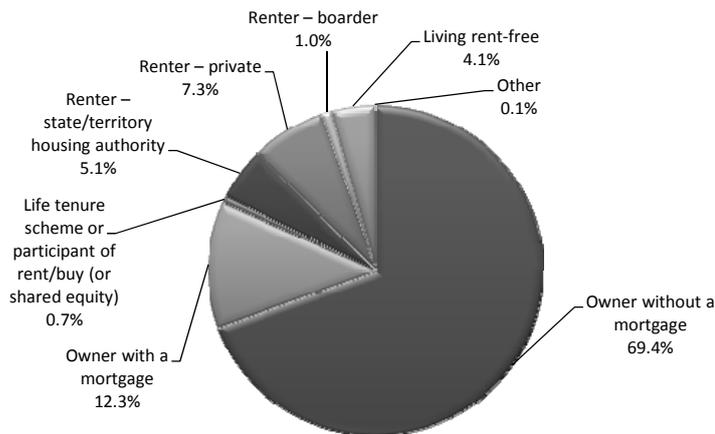
Currently, about three-quarters of Australian dwellings are separate houses. This is less than the 85 per cent figure cited in the 1950s (Cornish, 1993). Since that time, other dwelling types such as flats and townhouses have increasingly accounted for more of the total dwelling stock. Nevertheless, as can be seen in Figure 2.3, this is not so for those Australians aged over 60 years, of whom nearly 83 per cent currently dwell in separate houses. This may be because a greater proportion of them are home owners and purchasers who bought when separate housing was the most common dwelling type, and/or this older cohort may have a greater social preference for this type of housing.

**Figure 2.3: Dwelling type distribution of DACS respondents aged 60+**



As illustrated in Figure 2.3, of the 60+ sub-sample, only 10 per cent dwell in a semi-detached house, row, terrace or townhouse, with the remaining 7 per cent living mainly in flats, units or caravans. As shown in Figure 2.4, the majority of DACS respondents aged 60 or over were outright owners or owners with a mortgage; about 5 per cent were tenants of state housing authorities; about 7 per cent were private renters; and about 4 per cent lived rent-free. The prevalence of home ownership is significant, as home ownership provides a secure home base into which support can be brought, and it facilitates home modification.

**Figure 2.4: Housing tenure type distribution of those 60+ by percentage**



Further, as evident in Table 2.2, the vast majority of older people currently have reasonable security of tenure via home ownership, public housing rental or life tenure. The numbers of older people with secure tenure is important, as a lack of secure tenure for those in the private rental market places them at greater risk of institutionalisation should either a housing or health crisis occur (Kendig & Bridge, 2007).

**Table 2.2: Tenure type**

<i>Tenure type</i>	<i>Percentage</i>
Owner without a mortgage	69.4
Owner with a mortgage	12.3
Life tenure scheme or participant of rent/buy (or shared equity)	0.7
Renter – state/territory housing authority	5.1
Renter – private	7.3
Renter – boarder	1.0
Living rent-free	4.1
Other	0.1
Total	100.0

Source: DACS 2003.

### 2.2.3 DACS sub-sample home support characteristics

Within the DACS CURF the care provided within the home was categorised into formal,<sup>5</sup> informal<sup>6</sup> and mixed (both informal and formal care). As can be seen in Table 2.3 (which shows all people aged over 60) about 9.6 per cent of DACS respondents in our sub-sample received only formal home support services; 20.3 per cent received only informal home support; and 5.8 per cent received a mix of formal and informal support. The majority, however, stated that they received no home support (64.3 per cent). Previously, formal and informal home support services were considered substitutive but nowadays may be better seen as being complementary (Hollander et al., 2002).

**Table 2.3: Home support type**

<i>Assistance type</i>	<i>Number of recipients</i>	<i>Percentage</i>
Formal assistance only	292,682	9.6
Formal and informal assistance	177,659	5.8
Informal assistance	621,271	20.3
Receives no assistance	1,966,732	64.3
Total	3,058,345	100.00

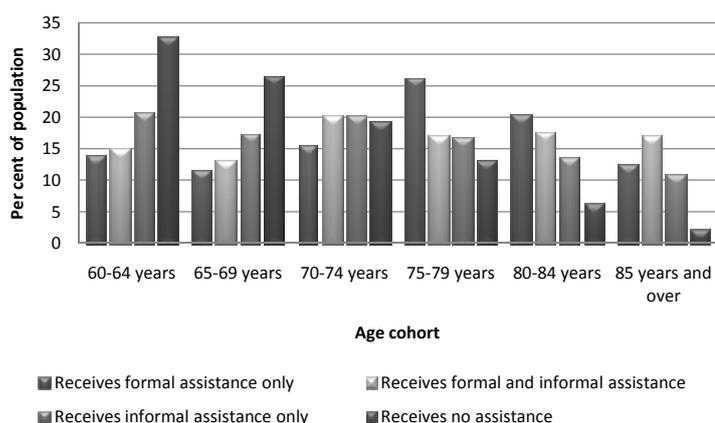
Source: DACS 2003.

Figure 2.5 shows the percentage of people receiving forms of care for those aged 60 or above, in five-year age categories. As the figure shows, the in-home support profile changes sharply with age. In the youngest age group (60–64 years), most respondents received no assistance, and the smallest percentage received formal assistance only. In contrast, most respondents in the oldest group (85+ years) received a mix of formal and informal assistance, and the smallest percentage received no assistance.

<sup>5</sup> Help provided to persons with one or more disabilities by: organisations, or individuals representing organisations (whether for profit or not for profit, government or private), or by other persons (excluding family, friends or neighbours as described in informal assistance), who provide assistance on a regular, paid basis and who are not associated with any organisation.

<sup>6</sup> Informal assistance is unpaid help or supervision that is provided to persons with one or more disabilities or persons aged 60 years and over living in households. It includes only assistance that is provided for one or more of the specified tasks comprising an activity because of a person's disability or age. Family, friends or neighbours may provide informal assistance. For this survey, any assistance received from family or friends living in the same household was considered to be informal assistance regardless of whether or not the provider was paid.

**Figure 2.5: Age by type and amount of care assistance**



## 2.3 Estimating the cost of support

Although the DACS was not intended to provide detailed cost information, it does yield data on the type and frequency of assistance that respondents received. Formal care costs can be estimated based on the type and frequency data from DACS and published formal care costs. The costing of informal and mixed care is more contentious. Access Economics (2005) identifies two methods that could be used to cost informal and mixed care:

- an opportunity cost method, which measures the cost of time devoted to informal care as the reduction in paid employment due to caring
- a replacement valuation model, which estimates the resources that would need to be diverted from the formal economy to replace the work done by informal carers.

In its report on the economic value of informal care, Access Economics chose to use both the above methods, with the opportunity cost method being used to estimate the lower bounds of the value of informal care and the replacement valuation model being used to evaluate the upper bounds of the value of informal care. Given the paucity of data within the DACS on the nature of the care in regard to loss of paid employment by the carer, we allocated the cost of informal care on the basis of a standard market valuation of the cost of care. The replacement value approach applies the formal care rate (e.g., for a nurse, a cleaner or a companion) to informal carers who undertake the same function. We consider the replacement valuation model to be the most methodologically robust, based on the assumption that the informal care provided was of equal intensity and value to that provided by formal carers (Pickard, 2004). Further, applying the same market-based valuation of informal care as that developed by Access Economics was deemed appropriate as this cost was higher than other Australian studies and, unlike some other cost-evaluations, explicitly acknowledges the contribution of informal care in making the findings more equitable. Further, as Schneider et al. (2003) note in their work on examining the cost of informal care in dementia, costing the value of informal and formal support at the most current and relevant market rates is fundamental to credibility.

Costing in-home community care also presented challenges, as on commencement of this research study, the only available published resource on community care unit costing was a NSW Home and Community Care study (Australian Healthcare Associates (AHA), 2005). This study provided a clear and up-to-date understanding of the cost of services and was conducted with the cooperation of 133 HACC service providers who provided the raw cost data. However, with the costing available from the Australian Healthcare Associates study<sup>7</sup> and type and frequency data available from DACS CURF, we were able to impute a market value for in-home care regardless of the mode or mix of delivery.

### *2.3.1 Costing home modifications*

The costs for home modification were based on the Cordell Housing Building Cost Guide as it contained over 6,500 supply and fixed prices across 41 separate trade categories broken up into its various labour, material and plant hire costs (Reed Construction Data, 2006).

### *2.3.2 Developing a cost algorithm*

A number of unique cost variables had to be generated for this project. DACS does not contain cost data and reports time in irregular units (i.e. ranging from “less than once per day” to “6 or more times per day”). To provide consistent, comparable and reliable cost data, the time units were based on mapping from the DACS CURF variables to the most recent time-use estimates supplied by the Australian Bureau of Statistics in its report, ‘How Australians use their time’ (ABS, 1998b). Combining information from these two data sources made it possible to generate duration of support values. In order to estimate costs of care reported in DACS, a standard approach was developed, which was as follows:

#### **Phase 1: Establish the cost of the major care activities from a variable in the DACS called BRASCODE.**

- Use frequency values from DACS (BRFREQ) and the ABS Time survey to estimate an imputed time value (in minutes) for each of the major care activities.
- Convert the time values to annualised dollar values using the Australian Healthcare Associates study (2005).
- Sum the major cost values.

#### **Phase 2: Establish the cost of the minor areas of support from the eight minor care activity codes in the DACS**

- Impute a time for each of the care activities.
- Convert the time values to annualised dollar values using the Australian Healthcare Associates study (2005).
- Sum the minor cost values.

#### **Phase 3: Establish the cost of home modifications**

- Attribute standard cost to type of modification.
- Sum all modifications for each case.

#### **Phase 4: Summation of costs**

- Sum minor and major support/care into new variable (i.e. total\_cost).

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<sup>7</sup> There may be some associated limitations for other states and territories as it remains unclear whether costs derived from a NSW study are fully applicable to all Australian states and territories, especially where their labour supply and geography are significantly different.

→ Sum home modification costs and total\_cost into new variable (i.e. overall\_cost).

Within the DACS CURF, each person had a unique combination of housing and support. Using this costing procedure, it was possible to derive cost estimates for each individual and groups of individuals with combinations of characteristics, such as housing type and tenure. Unfortunately, respite costs could not be included in our analysis as informants for the respite data available within the DACS were predominantly parents or carers of younger people with disability; consequently, the respite item was not well answered for the older population, yielding numbers that were not statistically sufficient for analysis. The failure to include respite costs is, therefore, a limitation of this analysis, which might understate the overall costs of home-based care compared to residential care, where all care input costs are amalgamated into a single cost unit. Further, the overall social costs to carers such as having to give up full-time work in order to provide home-based care were not a part of this analysis as this data is unavailable within the DACS CURF.

## 2.4 The housing model

Isolating critical cost drivers and better understanding the relationships between multiple socio-demographic variables linked to individual care and accommodation costs is critical but difficult. The Chi-square Automatic Interaction Detection (CHAID) technique was the tool determined to be most useful for developing a robust housing and care cost model using the DACS CURF data after cost and time imputations had been made. This is because CHAID allows for the analysis of categorical data sets and is particularly well suited to the analysis of larger data sets (Statistica, 2003). In determining the most appropriate form of analysis to undertake on a data set, the data types are very important (Hinds, Vogel, & Clarke-Steffen, 1997; Miller, 1991; Szabo & Strang, 1997). The DACS does not readily lend itself to analysis by regression techniques or multivariate analysis because all the data are nominal (Torra et al., 2006). The Chi-square or goodness-of-fit test is useful for testing the significance of an association between attributes (Nanivadekar & Kannappan, 1990). Traditional Chi-square, however, does not detect relationships between multiple variables; it only provides insight into the relationship between any two variables.

CHAID is a tool designed for the study of the relationship between a focus variable and a series of predictor variables and their interactions; it identifies those variables that best predict the dependent measure. Further, a robust predictive model results from the CHAID decision tree analysis process when a single categorical (dependent) variable is used (Magidson & Vermunt, 2005). Additionally, classification and regression trees are becoming increasingly popular for partitioning data and identifying local structure in small and large datasets (Wilkinson, 1992). Finally, CHAID provides a more efficient tool of analysis than other more traditional analytical approaches, including regression or ANOVA, when primarily categorical data is the input (Statistical Packages for the Social Sciences, 1999).

By choosing a focus variable (i.e. a variable of interest), one is able to identify the relationship of that variable to all the other variables included in the analysis. A CHAID analysis is analogous to a tree and its branches (Kass, 1980). The focus variable is the trunk, while the other variables and the contribution that each makes form the branches of the tree. Variables making a more dominant contribution are larger and closer to the trunk, and those making a lesser contribution are the smaller branches or leaves. The segments that CHAID derives do not overlap because the tree-splitting algorithm used is mutually exclusive and exhaustive. Thus, the CHAID modelling process works to reduce complexity while dealing well with uncertainty (Ehrler & Lehmann, 2001).

CHAID is the recommended exploratory technique for dealing with non-linear or complex datasets, in order to find significant patterns (Hoare, 2004). The model-building features inherent in the CHAID process include its highly visual nature and the fact that output is strikingly similar to standard organisational charting, making it easily understandable to laypersons (Statistical Packages for the Social Sciences, 1999). CHAID produces a simple yet complete explanation of complex data sets (Statistical Packages for the Social Sciences, 1999).

The CHAID analysis takes place in a series of stages or recursive cycles (Ngwane, Yadavalli, & Steffens, 2001):

*Stage 1:* The sub-classes of each predictor are cross-tabbed with the focus variable sub-classes.

*Stage 2:* Significantly different sub-parts relationships are established, in order to separate relevant data from non-relevant data. Non-relevant data is discarded and the rest is merged in hierarchical order corresponding to its significance. The type of merge depends on the type of predictor.

*Stage 3:* For each merged category consisting of three or more of the original categories, the most significant binary split (depending of the type of predictor) into which a merger may be resolved, is established. If the significance is beyond the critical value, the split is implemented, and stage 2 is returned to.

*Stage 4:* The significance of each optimally merged predictor is calculated and the most significant ones are identified. If this significance is greater than the critical value, the data are sub-divided according to the merged characteristics of the chosen predictor.

*Stage 5:* For each section of the data that has not yet been analysed, stage 1 is returned to. This phase of the analysis may be modified by excluding those aspects of the data with a small number of observations.

#### *2.4.1 Selecting the focus variable for the model*

In developing a model using a range of variables related to the cost of home-based support, a decision must be made between having either dwelling (housing) or support (care) type variables as the focus, as within the DACS CURF files these are two discrete sets. Deciding on a focus variable was driven by both a housing focus and the desire to produce a valid model. A validation process assesses how well the CHAID tree structure generalises. Thus, we applied a cross-validation technique to compare the predictive accuracy of two possible CHAID trees, one with dwelling or housing type as the dependent variable and one with home support type as the dependent variable. Measuring the predictive accuracy of CHAID outputs is based on risk estimation and the calculation of standard error values. For categorical dependent variables, the risk estimate is the proportion of cases incorrectly classified after adjustment for prior probabilities and misclassification costs.

Table 2.4 shows that using dwelling type as the focus variable ensures greater reliability with less error. Further, 'home support' type had considerably lower accuracy value. Based on these results, selecting dwelling as the focus variable was optimal.

**Table 2.4: Risk estimation of dwelling versus home support type**

<i>Possible focus variables</i>	<i>Dependent variable risk estimate</i>	<i>Standard error</i>	<i>Percentage correct</i>
Dwelling type	.075	.000	94.1
Home support against the related broad activity area	.468	.001	53.2

Source: Analysis of authors.

### 2.4.2 CHAID modelling results

While all DACS variables were used in the analysis, only those considered essential in the analysis are reported. In a CHAID analysis all variables that do not contribute to the final results are excluded. Our final model thus comprises the focus variable and all the related variables organised hierarchically (Wilkinson, 1992). The dependent and independent variables used in the first scenario analysis are listed in Table 2.5.

**Table 2.5: CHAID 1 – Dwelling structure type**

<i>Variable type</i>	<i>Variable descriptor</i>
Dependent variable	→ Dwelling type
Independent variables included	→ Tenure
	→ Single or partnered
	→ Remoteness
	→ Whether receives formal or informal assistance with broad activity area
	→ Overall cost grouped

Source: CHAID analysis.

Figure 2.6 illustrates the output of the CHAID process for dwelling type. It provides a robust model of the variable relationships. It provides a snapshot of the segments, patterns and relationships inherent in the raw data. From the top to the bottom, each branch represents the next-best predictor. Each node represents a unique segment, enabling the production of a robust model. The top node contains the entire input, with the dependent or predictor variable as the focus, while each remaining node contains a subset of the cases in the node directly above it.

In the dwelling structure scenario, tenure type was the most critical aspect of the CHAID model produced. The factors that influence the independent variables revealed as a result of the CHAID data-mining exercise are organised based on significance into two levels of independent variable branching. These are:

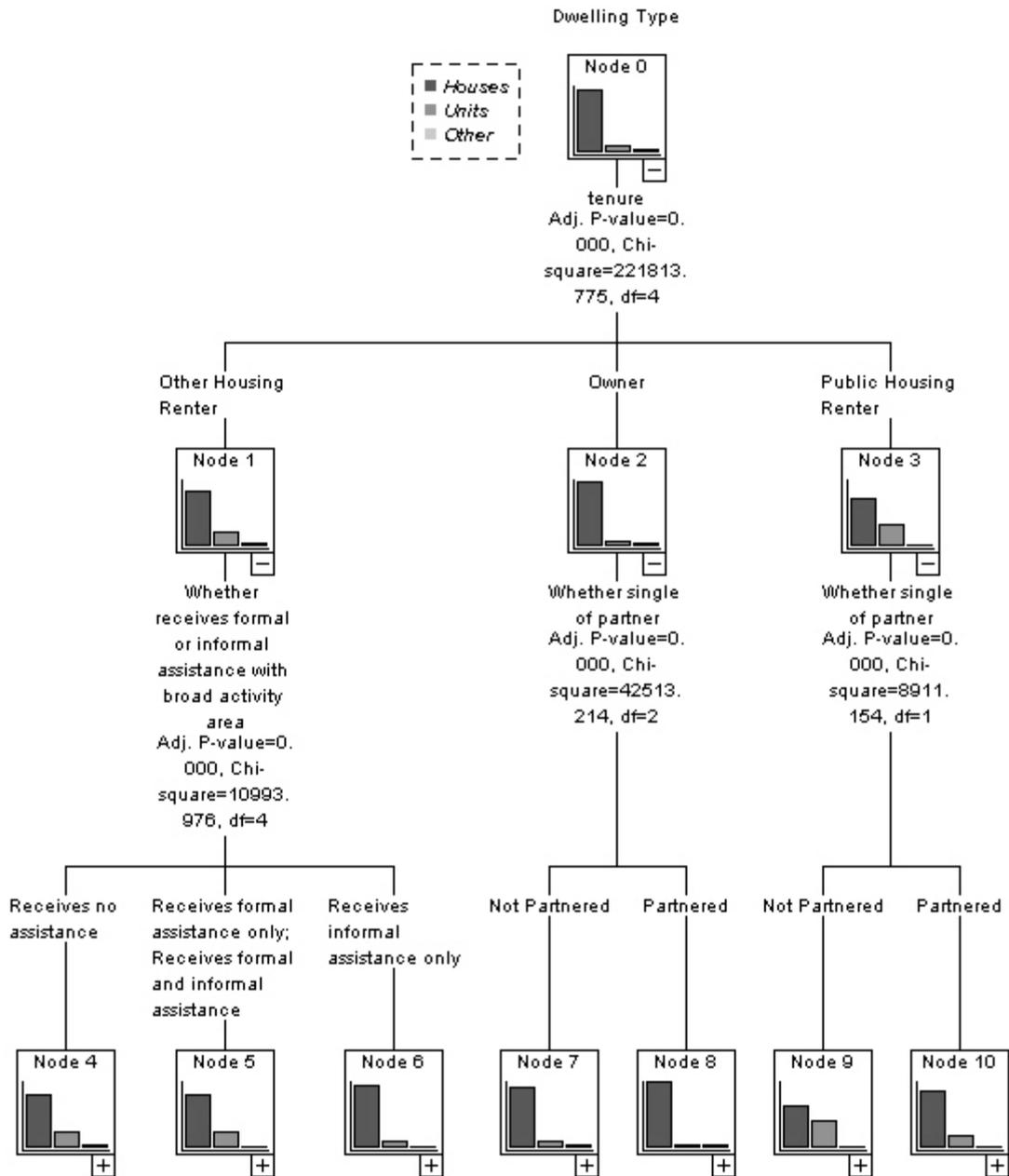
- *Level 1 branch:* The single most significant independent variable revealed was that of 'tenure type'. Tenure variables were then organised and divided into three lower branches, ranked from most statistically significant to least statistically significant as 'other housing renter', 'owner' and 'public housing renter'.
- *Level 2 branch:* At this level, support type was the most significant factor. The type of assistance versus partnership status also was important. The trigger for significance appears to be linked to relatively high numbers of older single people in units. It might be assumed that public and private unit dwellers have a greater need for care because they more typically live alone; nevertheless, living in private rental accommodation was strongly associated with receiving no support (possibly because only the most healthy can manage within this less secure tenure type).

Those who received the most informal assistance were most likely to be living in close proximity to family or significant support networks and generally appeared to be in separate housing. For home owners the variable most significantly related to care was whether they were partnered. However, for those renting in public housing, the critical variable was living alone versus those who were partnered.

## **2.5 Summary and implications**

This chapter set out to address how the financial cost of home-based care could be imputed. First, it provided an overview of how the DACS was collected, and a snapshot of some of the key geographic, age-related support and dwelling type characteristics. Second, it explained the sources, manner and phases of data handling involved in our cost imputations. Last, it examined, using the CHAID method, how the different aspects of housing such as tenure, dwelling type, location and access to support might contribute to the financial costs of home-based care for older people. The hierarchical model of statistical significance that resulted revealed that tenure type is the primary factor, with support type a secondary factor. Further research is required to explore the causal relations underlying this model. For instance, it might be fruitful to obtain primary data from older unit dwellers to better understand why units are selected and what factors within this dwelling type either effectively substitute for care or inhibit care provision.

Figure 2.6: CHAID 1 Dwelling structure as focus variable



## **3 HOUSING, SERVICES AND ENTRY TO RESIDENTIAL CARE**

### **3.1 Introduction**

This report has, so far, examined how the personal and housing circumstances of older people are related to the cost of their home care services and their accommodation in regards to the DACS CURF. However, while the DACS is a national survey, it does not provide a picture of housing transitions over an extended time period. This chapter therefore extends this understanding by reporting on some preliminary findings describing the personal and housing characteristics most associated with older Melbournians' chances of entering residential care over an 11-year period in later life (that is, it also addresses research question 1). The capacity of people to remain in the community as they grow older is crucial for themselves, their carers, and governments. As reported in our Positioning Paper, there is a dearth of information about the key factors that influence this outcome, which is so important for quality of life as well as costs to individuals and governments.

The exploratory findings<sup>8</sup> presented here were produced from the Melbourne Longitudinal Surveys of Ageing (MELSHA) study funded primarily by the NHMRC (see below). The chapter describes the MELSHA data source, summarises findings to date, and considers policy implications and future research. Appendix 2 describes the method of longitudinal data analysis. While cross-sectional data such as the DACS survey data in Chapter 2 are well suited to show factors related to current costs, longitudinal data are better suited to indicating how prior circumstances relate to later entry to residential care.

### **3.2 Data sources and methods**

The analyses were conducted on a database constructed from the Melbourne Longitudinal Studies on Healthy Ageing (MELSHA) program. Professors Colette Browning (Monash University) and Hal Kendig (University of Sydney) jointly lead the MELSHA program, which also includes a number of other collaborators from Sydney, Monash and La Trobe universities. This ongoing study has been funded by research grants from various supporting agencies, including the Victorian Health Promotion Foundation, the National Health and Medical Research Council, and the Australian Research Council.

Baseline data for the MELSHA study were collected in 1994 through a survey of people aged 65 years and over living in non-institutional settings in metropolitan Melbourne. The survey excluded people who were living in boarding houses and residential care, those who could not speak a basic level of English, and those who could not be interviewed for health reasons. Excluding these 'out of scope' categories, the response rate for the initial interview was 70 per cent, yielding a sample of 1000 respondents representative of English-speaking older people in Melbourne who were well enough to participate in interviews. More information about the survey is available in Kendig et al. (1996).

Respondents in the baseline survey were followed up biannually in telephone interviews and by mail. In 2004 another face-to face interview was conducted where possible, and in 2005 an intensive 'tracing study' was conducted to determine outcomes for those with whom we had lost contact. At each of these stages of data

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<sup>8</sup> These preliminary results are included in this AHURI report in order to bring them to the attention of policy makers as soon as possible.

collection, if respondents could not be contacted directly, we attempted to identify outcomes for them as reported by their next of kin or other key contacts given at the baseline interview. Death records were checked for individuals who were known to have died and also for those who could not otherwise be contacted. The preliminary analyses in this chapter are based on 812 participants who had had known outcomes as of January 2006; 188 had unknown final outcomes<sup>9</sup>:

- 345 were alive and were living in the community and participated in the study.
- 54 were alive and living in residential care facilities.
- 413 had died; of these, 133 were known to have died after entering residential care.
- 188 had been lost to the study sample at some point prior to the follow-up period.

The outcome variable for the analyses was whether or not respondents had ever been admitted to residential care (excluding admission to hospital or hospice) over the 12 years of the study. Three categories of response were coded:

- *Yes*: This includes both people who are known to have been alive in residential care at the final contact in 2004 and those who were known to have entered residential care prior to 2004 and who subsequently died.
- *No*: This includes people who were known not to have entered residential care at the time of the final contact in 2004.
- *Not known*: At the time of the final contact in 1994 it was not known whether this group had entered residential care.

A range of need, activity, services and housing variables as of the 1994 baseline survey were considered as indicators of possible predictors of the residential care outcome. Our major concern here is for the possible influence of housing factors: combinations of housing tenure (owner/purchaser, public tenant, or private tenant) as well as housing type (house or flat). Housing tenure serves as an indicator of housing security, cost and wealth, while housing type provides an indication of the demands of dwelling and garden upkeep.<sup>10</sup>

Multivariate analyses were conducted in order to identify the 'most important' statistical predictors of entry to residential care and their relative importance.<sup>11</sup> 'Survival analysis' (Cox regression) was used because it is a rigorous technique well suited for cases where the outcomes occur at variable points in time. It also is relatively robust in dealing with missing data (such as the people who were lost to follow-up in the survey). Appendix 2, Residential Care Admission Calculation, describes the mechanics of the application of the Cox regression technique.

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<sup>9</sup> Subsequent work to September 2007, completed after these analyses were conducted, increased the numbers with known outcomes to 884. The main changes were a reduction of those with unknown outcomes (-116) and an increase in the numbers alive and living in the community (+79 people). The improved data set could not be analysed in time for this report but a re-analysis would be unlikely to change very much the direction and strength of the statistical relationships as reported here from the preliminary analyses.

<sup>10</sup> Dwelling type can be highly variable, so can only ever be a partial indicator of upkeep costs.

<sup>11</sup> The term 'most important' refers to the strongest statistical association after taking into account all the variables included in the analyses for the sample as a whole. It is important to recognise that the most important influences on entry to residential care can vary appreciably between individuals in different circumstances.

### 3.3 Findings

Table 3.1 shows that the vast majority of respondents owned houses at the baseline survey, while small numbers were public or private tenants or lived in the homes of family or others. The small numbers of private tenants indicate the need to treat the findings with caution, but these figures provide background information before turning to the multivariate findings below. When MELSHA began in 1994, the average age of respondents in the various housing categories ranged from 73 years for homeowners to 76 years for those in private and public flats. People in rented homes and living with family were more likely to be dependent in one or more aspect of daily living. People with greater cognitive impairment and those with more medical conditions were fairly evenly distributed across the housing categories. Tenants of public flats, however, had a tendency to make greater use of community services.

**Table 3.1: Factors predicting length of survival in the community, by housing type and tenure**

<i>Factors</i>	<i>Owner</i>		<i>Public rental</i>		<i>Private rental</i>		<i>Lives with family/other (n = 31)</i>
	<i>House (n = 819)</i>	<i>Flat (n = 77)</i>	<i>House (n = 24)</i>	<i>Flat (n = 15)</i>	<i>House (n = 19)</i>	<i>Flat (n = 15)</i>	
Age (mean years)	73	76	73	76	75	76	75
More medical conditions (%) <sup>12</sup>	49	55	58	53	63	47	52
Greater cognitive impairment (%) <sup>13</sup>	22	21	29	27	26	20	26
High formal services usage (%) <sup>14</sup>	9	9	4	20	16	13	10

The chapter now turns to outcomes in terms of whether or not people had moved to residential care from the time of the baseline survey in 1994 to the end of 2005. Even though respondents averaged 74 years of age in 1994, 42 per cent of those with known outcomes were still living in the community at the end of 2005; 7 per cent were known to be alive and living in residential care. Among the 50 per cent of respondents known to have died, only 33 per cent were known to have entered residential care. Among those who were still alive in 2005, we of course do not know the proportion who will ever enter residential care. Compared to those who had already died, the eventual proportion entering care could be higher for those still alive (given that they will probably die at older ages), or it could be lower (if they will have better health until the end of their lives). Overall, these longitudinal survey findings support a growing body of evidence that the majority of older people remain in the community throughout later life and never enter residential care for very long periods.

Table 3.2 contrasts the people who had entered residential care with those who had remained in the community. As expected, those who had entered residential care were likely to be older, to have more cognitive impairment, to have more medical conditions, and to make greater use of formal services. Housing type and tenure also were different for the groups who had entered residential care as compared to those who had not. As discussed further below, the greater vulnerability of those in public

<sup>12</sup> This row shows the proportion of people in each housing category who have 'high' levels for this variable (as described later in the chapter). The survey questions that measured the variable are provided in Kendig et al., 1996. The cut-off for 'high' was set at one standard deviation above the mean.

<sup>13</sup> Ibid.

<sup>14</sup> Ibid.

flats and those living with family was shown by their over-representation among those entering residential care.

**Table 3.2: Background variables in 1994 by subsequent entry to residential care**

<i>Factor</i>	<i>Admitted to residential care (n = 187)</i>	<i>Not admitted to care (n = 564)</i>	<i>Don't know (n = 249)</i>
Age (mean years)	77	72	74
More medical conditions (%) <sup>15</sup>	20	13	14
Higher cognitive impairment (%) <sup>16</sup>	31	18	25
High formal services usage (%) <sup>17</sup>	20	6	10
Own house (%) <sup>18</sup>	70	87	78
Own flat (%)	13	7	6
Public rental flat (%)	4	1	2
Private rental flat (%)	2	1	4
Living with family/other (%)	6	2	4

Another way to consider the findings is to show the proportions of people in each housing group as of 1994, who were known to have entered residential care by the end of 2005.<sup>19</sup> The proportion of older persons entering residential care in 1994 was highest among those who were living: in public rental flats (47 per cent); in private rental houses (42 per cent); with family (35 per cent); and in owned flats (31 per cent). Much smaller proportions of people had moved to residential care among those who in 1994 were living in private rental flats (20 per cent), public rental houses (16 per cent) and (least of all) owner-occupied houses (13 per cent). The findings suggest the importance of secure, long-term home ownership in enabling 'ageing in place', as well as the generally higher levels of personal resources among older home owners. They also indicate the heightened vulnerability of older people in less secure rental housing, and the ways in which older people at risk are especially likely to live in public rental housing. These findings suggest that older people in high-risk housing settings should be targeted for better packaged accommodation and care services to enable them to remain living independently.

Our next aim in the analysis was to assess the relative importance of housing as an influence on entering residential care. The aim here was to better take account of how much each of a wide range of needs, resources and housing factors influence the chances of entering residential care. For this purpose, a multivariate model was constructed, following the procedures outlined in Appendix 2. The final model took into account a wide range of variables simultaneously and hence provides an indication of their relative importance in a statistical sense. The variables that emerged as statistically significant in the final statistical model are as follows:

→ Age – age of participants at the time of the survey in 1994

<sup>15</sup> See footnote 5.

<sup>16</sup> Ibid.

<sup>17</sup> Ibid.

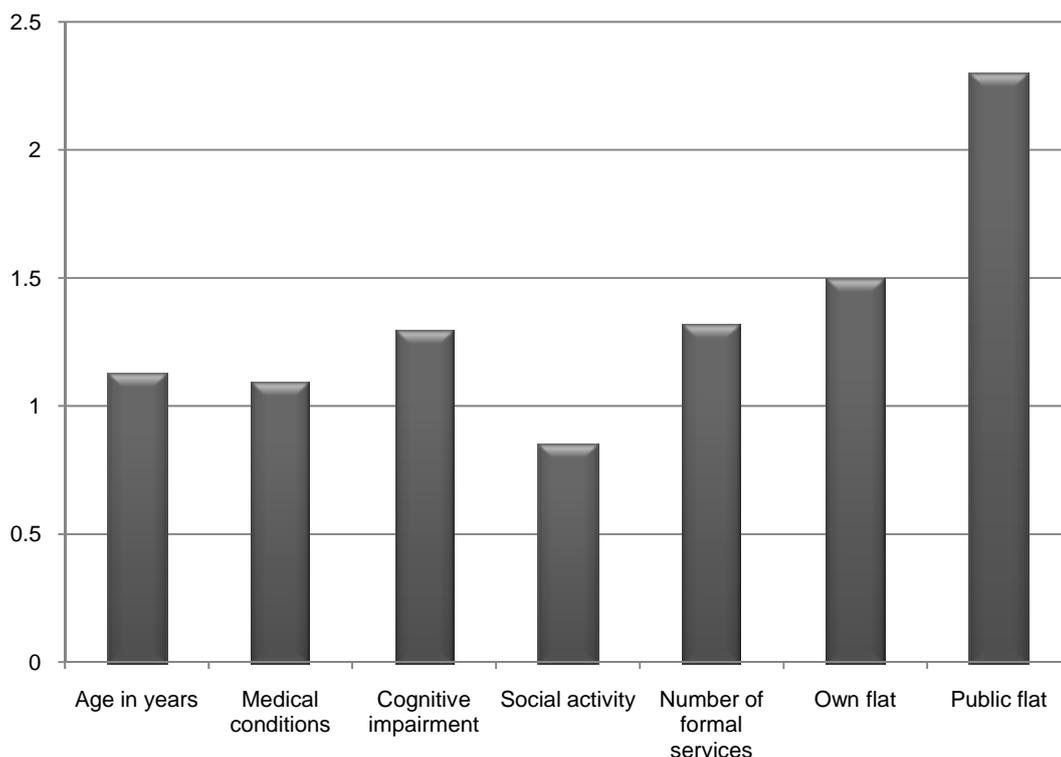
<sup>18</sup> In the multivariate analyses, 'own house' is used as the 'control' condition to which the other types of living arrangements are compared.

<sup>19</sup> The figures in this paragraph are not shown in any table in the chapter, and all the proportions exclude those for whom the outcomes were not known.

- *Medical conditions* – the number of medical conditions people reported experiencing, from a list of 33
- *Degree of cognitive impairment* – an interviewer-rated scale of cognitive impairment of participants; a higher score indicates greater impairment
- *Social activity* – the amount of social activity in the past two weeks
- *Number of formal services* – a count of the number of formal services participants reported using
- *Own flat* – a categorical variable; the 'control' group is 'own house'
- *Public rental flat* – a categorical variable; the 'control' group is 'own house'.
- *Family/other* – the participant reported living either with a family member or in one of a few other forms of accommodation. This is also a categorical variable, with the 'control' group being 'own house'.

The final statistical model (Figure 3.1) presents findings on the most important variables (after taking them all into account). These 'hazard ratios' indicate how the level of each factor relates to the risk of entry to residential care. For example, in the first column of Figure 3.1, age is shown to have a hazard ratio (HR) of approximately 1.15. This means that the risk of entry to residential care was found to increase by about 15 per cent for every additional year of age beyond 65 years old at baseline – again, all else being equal. Similarly, the chances of entering residential care increased by about 10 per cent for every additional medical condition, and by about 30 per cent for those identified as having some cognitive impairment (compared to those who did not). Conversely, those who were relatively socially active at baseline had a lower likelihood of entry to residential care (15 per cent less) compared to those with lower social activity.

**Figure 3.1: Hazard ratios for variables that significantly affected the likelihood of residential care admission, Final Statistical Model**



Use of formal community services and the type and tenure of housing were also found to be significantly associated with entry into residential care. Even after taking account of the other indicators of need noted above, every additional community service significantly increased the chance of subsequent moves into residential care. Further, the chances of entering residential care increased substantially for those living in owned flats, and (even more so) for those living in public flats, compared to those living in an owner-occupied house. The findings suggest that older people who live in a flat, whether it is owner occupied or a government tenancy, are more likely to enter residential care, after taking account of other influences. It seems that this result may be explained primarily by the tendency of more vulnerable people to live in flats rather than houses and in government housing rather than owner occupancy.

Finally, we should comment on variables that were considered in the multivariate analyses but did not emerge among the most important ones for the final statistical model on predictors of entry to residential care. These variables included income, marital status, ethnicity, educational level, self-rated health, functional capacities, and measures of psychological health and wellbeing. Residence in a house that was rented (either privately or from the government) also did not emerge as statistically important. Nonetheless, many of these factors are of course still very important for policy attention because they relate closely to the factors identified in the final model. For example, income and education of course are important influences on housing tenure, which in turn was found to relate directly to the likelihood of residential care entry. Similarly, capacities with activities of daily living are closely related to use of community services, and this service use has a relatively stronger relationship to risk of entry to residential care.

### **3.4 Directions and implications**

While these exploratory findings are subject to further refinement, they are consistent with earlier research (Mason, Liu & Braun, 2001) indicating that only a minority of older people ever enter residential care. However, the findings need to be interpreted cautiously, given: the small sample sizes (for example, the few people in government flats at baseline); the refinements now being made to the data file and the analyses; and the underlying fact that statistical associations do not necessarily reflect causal factors. Nevertheless, these preliminary findings do have important implications for program planning and service delivery. Medical conditions and social activity – two of the factors found to be independently associated with entry to residential care – potentially can be influenced by health care and health promotion efforts. Community services and housing also emerged from the statistical analyses as independent and important predictors of entry to residential care.

Older people living in their own flats or in public flats were found to have a higher risk of entry to residential care – even more than even those who live with relatives – after taking account of other influences. These findings reinforce the importance of considering housing and services when assessing and targeting older people for appropriate accommodation and care in the community. They also suggest that public housing is disproportionately available to highly vulnerable older people. Better understanding of the hows and whys behind older home owners deciding to transition to flats will be critical in learning whether flat dwelling is a response to unmet care needs and, if so, whether it is effective in delaying the final transition to residential care.

Additional analyses of the refined MELSHA data set are currently under way and will yield more conclusive findings later<sup>20</sup>. Additionally, access to a newly established, larger database on longitudinal surveys of ageing across Australia can better assist in the more accurate prediction of entry into residential care in two significant ways.<sup>21</sup> First, it will increase the sample size of people in a relatively rare but important situation (e.g. people living in public flats). Second, it will allow analyses of how the outcomes for older people are influenced by the supply factors of community services, public housing and residential care in different locations. This further research aims to draw on findings from longer-term, more fundamental research, to inform decision-making by policy makers.

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<sup>20</sup> For enquiries regarding when these definitive findings have been published (for citation), Professor Kendig, at the University of Sydney, can be contacted.

<sup>21</sup> Under the leadership of Associate Professor Kaarin Anstey at the Australian National University, the findings of major Australian longitudinal surveys are being pooled into a common database that will facilitate collaborative research among the investigators. The NHMRC/ARC Ageing Well, Ageing Productively program, funded this five-year program grant, "Learning How to Age Well From Australian Longitudinal Studies of Ageing".

## 4 COST-BENEFIT ANALYSIS

### 4.1 Introduction

This chapter addresses the research question related to determining the financial costs and benefits to individuals and governments of using private housing rather than residential care as the home base for the provision of care service for older people (i.e. research question 2). The economic valuations of benefits to individuals and to government were unable to be imputed as a result of data limitations, as explained in Chapter 2. Instead, this chapter examines the relative costs faced by older people in a range of dwelling and care types. It achieves this by comparing home-based care valuations to residential care cost estimates. The other role of this chapter is to explore how housing variables affect the cost of home-based care. Best and worst case scenarios enable estimates of home-based care costs for a range of older people with life expectancy factored in.

The average costs of services reported in the DACS were estimated using the method described in detail in Section 2.3. While this method has some limitations, it generates a reasonable approximation of the cost and level of government benefits. Because the DACS include data on housing, it is possible to investigate the impact of housing variables on the cost of home-based care – an area that has previously received little attention.

### 4.2 Estimating the costs of home-based care

Table 4.1 lists estimates of the annual average and total costs of support that were generated using the method described in Section 2.3. Estimates are provided for older people receiving:

- formal care only
- informal care only
- both formal and informal care.

**Table 4.1: Annual average cost per recipient and total cost of in-home care by care type**

<i>Care type</i>	<i>Annual cost/value</i>	
	<i>Mean (\$)</i>	<i>Sum (\$ million)</i>
Formal care only	7,520	2,200
Mixed formal and informal care	11,370	2,020
Informal care only	10,880	6,758

The average annual cost per recipient of formal care is about \$7,500, while the average value<sup>22</sup> of informal care per year for one recipient is about \$10,900. The average annual value of support for an older adult receiving both formal and informal care, however, rises to \$11,370.

The financial benefit to government of providing home-based care for older adults is best summarised by the public share of the cost of a number of alternative care packages (see Table 4.2). The provision of formal and/or informal in-home care

<sup>22</sup> Note that the value of informal care we provide sits in the middle of estimates of the value of informal care as provided by Access Economics in its 2005 report. The cost of informal care is particularly difficult to measure, because the DACS is only able to provide an estimate of the amount of informal care. It is possible that the costs of informal care are substantially higher than our estimates.

provides large savings to government compared to residential care. Given the very strong preference expressed by the aged to stay in their own homes, rather than to move into residential care, such a strategy also provides significant benefits to the aged.

Table 4.2 shows the annual cost of residential care compared to formal and/or informal in-home care. The savings that in-home care affords are based on two elements – the lower cost of recurrent and capital costs of care because of the substitution of unpaid informal care, and the absence of a recurrent accommodation charge.

**Table 4.2: Average annual cost of care per recipient, Australia 2005**

<i>Type of care</i>	<i>Average cost estimate (\$)</i>		<i>Public share</i>	
		<i>%</i>	<i>\$</i>	
In-home formal care only	7,520 <sup>23</sup>	92	6,918	
In-home formal and informal care	11,370 <sup>24</sup>	NA	NA	
In-home informal care	10,880 <sup>25</sup>	35	3,808	
Residential aged care	48,710 <sup>26</sup>	69	33,610	

Source: authors' estimates and Access Economics (2005)

The gap between the cost that residential care and in-home care are likely to have increased in recent times as a result of two factors:

1. The price of land for the cost of residential care has risen faster than the labour costs of formal care.
2. The increased regulation of residential aged care settings has generated increases in capital costs.

In interpretation of the annual cost of care estimates, it is important to acknowledge that the degree of functional dependency varies between older individuals and across care settings. For instance, residential aged care can be further sub-divided into low-care, high-care and shorter-term Innovative Care Rehabilitation Services (ICRS) based on an assessment of the degree of dependency of the person concerned. Some preliminary costing suggests that our estimate of \$48,710 as a composite residential care figure compares favourably with costs imputed by others. For instance, in the cost evaluation of the pilot for the ICRS, the authors reported the annual average costs as follows: \$23,725 for low-care aged residential services (e.g. 49 per cent of the residential care composite); \$50,005 for high-care aged residential services (e.g. 103 per cent of the residential care composite) and \$86,140 for ICRS based Residential Care (e.g. 177 per cent of the residential care composite) (Healthcare Management Advisors Pty Ltd, 2005)<sup>27</sup>.

<sup>23</sup> Based on DACS data.

<sup>24</sup> Ibid.

<sup>25</sup> Ibid.

<sup>26</sup> From Table 4.3 of Access Economics (2005) and is a weighted average of High Cost Residential Aged Care and Residential Aged Care.

<sup>27</sup> The ICRS cost/benefit table used reports nominal costs on a daily basis. It also notes that high, low and ICRS costs include patient contributions as derived from the pilot program.

### 4.3 Incremental cost analysis based on best and worst case scenarios

This section applies life table models (Liu, 1998) to our previously imputed Home and Community Care Program cost estimates in order to estimate the likelihood and cost of ageing within the community versus the cost of residential care for the best and worst case scenarios for four hypothetical older adults. In both the best and worst cases we have assumed the same survivorship period. The housing costs for non-institutionalised individuals are based on Table 4 of the 'Housing Occupancy and Costs, Australia, 2003-04' (Australian Bureau of Statistics, 2006b). The housing costs for residential care were derived from Access Economics estimates.

The cost estimates in this section are indicative only, as a myriad of factors are likely to affect the total cost. The absence of real longitudinal data sufficiently detailed in regard to housing and care costs makes more detailed and precise calculations impossible. For instance, there is no reliable way to estimate the impact of community support on the life expectancy of an individual. Despite these limitations, we have attempted to impute an indicative cost estimate for each hypothetical case in order to compare the total costs of home-based and residential care. Table 4.3 summarises age and life expectancy for each hypothetical case.

**Table 4.3: Life expectancies**

<i>Person</i>	<i>Age (years)</i>	<i>Life expectancy (years)</i>	<i>Expected age at death (years)</i>
Bob	68	15.8	84.0
Carole	80	9.9	89.9
Alice <sup>28</sup>	68	18.9	86.9
Alice <sup>29</sup>	68	2.0	70.0
Ted	78	9.3	87.3

#### 4.3.1 Bob

Bob is 67 years old and lives in a caravan park in Queensland. He was divorced 20 years ago from his wife of eight years and has not seen either of his two daughters since the divorce. Bob had earned his living as a house painter, until his arthritis and back problems got worse and forced him to retire. Currently, his only income is from an age pension of \$232 per week. While he owns his caravan, he rents a space for it in the Riverdale Caravan Park. Bob's car quit running a few years ago and there is no public transport available, so he gets rides from a neighbour or walks the 5 kilometres into town for meals at the local RSL club. He uses over-the-counter anti-inflammatory medications to control his pain and prescription medication for a circulatory problem.

#### Hypothetical 1

Last year Bob met Martha at the local RSL club. They later married and Bob was able to sell his caravan for \$3,800 and move into Martha's Housing Authority apartment. The rent on the apartment was \$161 per week. Martha's adult daughter, Mary, lives nearby with her husband and children. Mary drops by once or twice a week to help with heavy cleaning and grocery shopping. Mary's husband is an auto mechanic and was able to get Bob's old car into good running condition, so Bob and Martha now have reliable transportation. Bob had a cut on his foot that has taken a long time to

<sup>28</sup> Hypothetical 1 with support.

<sup>29</sup> Hypothetical 2 without support (i.e. estimate based on health conditions).

heal; however, because Martha is a retired nurse, Bob hasn't required any formal assistance from the home-health agency since he moved out of the caravan park.

## Hypothetical 2

Last year the owner of the caravan park announced that he had sold the park to a developer and Bob had 30 days to remove his caravan and automobile. Bob was slow in looking for a place to move to and by the time he started making calls, all of the nearby caravan parks were full. Because he had no means of moving his caravan he was forced to sell it and his car to a salvage yard. With no savings, no place to go, and a limited income, his stress level increased, his blood pressure went up, and he rapidly lost weight. Bob had a stroke and has lost the use of his right arm and leg. With no home to return to after being discharged from the hospital, Bob has moved into a long-term residential care facility.

**Table 4.4: Bob**

	<i>Housing costs (\$)</i>	<i>Support costs (\$)</i>	<i>Total (\$)</i>	<i>Life expectancy years</i>
Hypothetical 1	74,766	237,207	311,973	15.8
Hypothetical 2	242,782	521,400	764,182	15.8
Difference	168,016	284,193	452,209	0

Source: DACS and authors' estimates.

### 4.3.2 Carole

Carole is 80 years old and is single. She never had children and has lived in the same small apartment in Melbourne for over 50 years. A retired portrait photographer, she receives \$600 per week from her superannuation account and has \$5,000 in savings. She rents her second floor apartment as a protected tenant for \$60 per week. This building has no elevator and the only access to her unit is an outdoor staircase. Carole's vision has deteriorated due to macular degeneration, so she is no longer able to drive. Most of her neighbours have lived in the same building for many years, and they have become her closest friends. Isabella lives next door and takes Carole to the local supermarket on Saturday mornings and to church services every Sunday. HACC provides weekly assistance with laundry and housekeeping. HACC also transports Carole to medical appointments as needed, but Carole uses public transport for her other outings.

#### Hypothetical 1

Carole's older brother died a childless widower and left Carole his entire estate, valued at \$1.1 million. Although Carole ultimately lost her eyesight, her inheritance enabled her to purchase a fully accessible flat in a newly constructed building less than a block from her old apartment. She is able to continue to attend her local church and spend time with friends from her neighbourhood. After joining a local support group for elders with visual impairments, she has made many new friends and enjoys spending time with them at the coffee shop on the ground floor of her new building. She can also afford to pay the costs a weekly housekeeper and cab fare when she needs to go to the doctor's office or supermarket. Carole recently purchased a CD player and enjoys audio recordings of books and music, which she checks out from the public library, which is only a short walk from her new flat.

#### Hypothetical 2

Carole tripped and fell while attempting to climb the stairs to her apartment. She was rushed to the hospital with a broken hip. Because her apartment was inaccessible to her in a wheelchair, she remained in a rehabilitation facility until she found suitable

housing. The only affordable housing was a low-care hostel in a suburban area far from her old neighbourhood. All her savings were required to cover the cost of moving into the hostel. Although her new home is located in a residential neighbourhood, there are few shops or stores nearby. All her old friends are several transfers away on public transport, because her vision has deteriorated and she is now too afraid to venture far from the hostel. Carole spends most of her time alone in her room.

**Table 4.5: Carole**

	<i>Housing costs (\$)</i>	<i>Support costs (\$)</i>	<i>Total (\$)</i>	<i>Life expectancy years</i>
Hypothetical 1	10,296	123,000	133,296	9
Hypothetical 2	200,268	297,000	497,268	9
Difference	189,972	174,000	363,972	0

Source: DACS and authors' estimates.

### 4.3.3 Ted and Alice

Ted is a 78-year-old retired bank teller who has been married to Alice for 50 years. They own outright a West Sydney detached home valued at \$650,000. Of their three adult children, both daughters live interstate, and their son and his family lives nearby. Ted receives \$116 per week in age pension and \$558 per week from his superannuation account. He and Alice have a savings account of nearly \$10,000 for emergencies. Ted has hearing loss and uses a hearing aid. He also uses a wheelchair due to severe arthritis. Alice is 68 and suffers from diabetes, hypertension and obesity. Alice provides extensive care for Ted. She helps him with his personal care needs and helps steady him whenever he gets in or out of his wheelchair. They pay for a housekeeper to come in once a week, but Alice does all the cooking, laundry and shopping. Their son (Alex) helps out with yard work and many maintenance and repair jobs. He occasionally runs errands for them and recently has taken responsibility for tracking their account balances and making sure all their bills are paid.

#### **Hypothetical 1**

Ted and Alice's daughter, Linda, moved from Perth to a house in her parents' neighbourhood when her husband obtained employment in Sydney. Linda's husband is the sole source of income while their children are in school. She is happy to be able to help her parents. Her involvement with her mother in regular shopping activities and exercise programs has improved the health of her mother to the extent that Alice has lost weight and no longer requires insulin to control her diabetes. By taking her father on regular excursions on Fridays, Linda has provided Alice with time to rejoin the bridge club, which she hasn't been able to participate in since Ted's health declined. Linda arranged with the local HACC service provider to have extensive modifications done on her parents' home to make it more accessible. These modifications have improved quality of life for both Ted and Alice by increasing Ted's at-home independence and reducing the Alice's stress. Linda has also arranged for her parents to participate in some of the local day centre activities and excursions, to enhance their everyday life.

#### **Hypothetical 2**

Alice died of a heart attack after suffering several small strokes. After Alice's death, Ted's health declined to the extent that he required supervised care. After consultation with his sister, Alex arranged for Ted to be placed in a nursing home that specialised in psycho-geriatric disorders. To gain access to this facility required considerable reorganisation of Ted's financial resources and assets.

**Table 4.6: Ted and Alice**

	<i>Housing costs (\$)</i>	<i>Support costs (\$)</i>	<i>Total (\$)</i>	<i>Ted - Life expectancy years</i>	<i>Alice - Life expectancy years</i>
Hypothetical 1	32,261	385,400	417,661	9.3	18.9
Hypothetical 2 <sup>30</sup>	202,144	306,900	509,044	9.3	0
Difference	169,883	78,500	91,383	0	18.9

Source: DACS and authors' estimates.

While it is difficult to estimate the precise costs of the services required, it is clear that when Bob, Carole, Ted and Alice can remain in their homes they are able to maintain support from relatives and friends and cover their own accommodation costs. This will generate the savings described earlier in this chapter. The more optimistic picture provided by home-based care is deliberate and resonates clearly with the aged population.

#### **4.4 How do different aspects of housing contribute to the financial costs and benefits of using private housing as the home base for the provision of care services for older people?**

The benefits of ageing in place have been relatively well known for some time and have been a major force behind government policy. What is less well known is the impact of housing characteristics on the costs and benefits of ageing in place. How do the different aspects of housing, such as tenure, dwelling type and location contribute to the financial costs and benefits of using private housing as the home base for the provision of care services for older people?

The impact of age on service use is fairly well understood. Table 4.7 shows how the costs of care increase as people age. The average costs for those aged 60 to 74 years are compared with those aged 75 years and above. The table shows that there is a sharp increase in the cost of all care types in the older age category.

**Table 4.7: Average annual cost of home-based care by age group**

<i>Age (years)</i>	<i>Mean cost (\$)</i>		
	<i>Formal assistance only</i>	<i>Formal and informal assistance</i>	<i>Informal assistance only</i>
60–74	6,860	10,270	10,350
75+	9,110	15,870	13,870

Source: DACS 2003.

Table 4.8 shows the cost of care by housing tenure type. The cost of all types of care is higher for older adults in rental accommodation, with the highest costs of care for those in public housing.

<sup>30</sup> Assumes that Alice has died prematurely from health-related stress.

**Table 4.8: Cost of care by tenure type**

<i>Tenure type</i>	<i>Mean cost (\$)</i>		
	<i>Formal assistance only</i>	<i>Formal and informal assistance</i>	<i>Informal assistance only</i>
Owner-purchaser	8,090	10,150	7,450
Public housing renter	12,630	16,410	15,380
Other housing renter	11,360	12,570	13,300

Source: DACS 2003.

When examining other housing variables there was some variation in cost when comparing different dwelling types (see Table 4.9). In terms of formal care, people living in single-storey semi-detached housing received the largest dollar value of care.

**Table 4.9: Cost of care by dwelling type**

<i>Dwelling type</i>	<i>Mean cost (\$)</i>		
	<i>Formal assistance only</i>	<i>Formal and informal assistance</i>	<i>Informal assistance only</i>
<b>Separate house</b>	7,464	11,379	10,837
<b>Semi-detached, row or terrace house</b>			
1-storey	8,072	10,900	11,628
2 or more storey	5,664	11,646	10,258
<b>Flat or apartment</b>			
1- or 2-storey block	7,538	12,854	10,952
3-storey block	7,913	9,281	8,443
4 or more storey block	7,172	8,850	12,898
<b>Long-stay caravan park, caravan not in caravan park, houseboat</b>	8,540	7,110	13,000

Source: DACS 2003.

The age and health of the dwelling occupants probably affects the cost of care associated with different housing types. For example, the least-expensive dwelling type is the three-storey block flat. It is likely, however, that older people would move out of this type of dwelling and require additional care if they developed disabilities that made it difficult or impossible to climb the stairs.

When the location of the dwelling was examined (metropolitan area, regional area, and other) on a state-by-state basis, no clear pattern emerged. In some states, the cost of care was higher in regional and other areas, while in other areas the pattern was reversed (see Appendix 3).

This issue was further explored by the use of a CHAID analysis. The focus variable was the total cost of care, and seven dependent variables were examined:

1. housing tenure
2. dwelling type
3. income
4. age (60–74, 75 and over)
5. partnered/not partnered

6. location

7. type of care (formal, informal/formal, informal).

Remember that the idea of CHAID analysis is to see whether splitting the sample based on these dependent variables leads to significant cost differences based on the dependent variables. Not surprisingly, the first branch of the tree is age of the respondent – that is, we can split the sample effectively using the age of the respondent. The next dependent variable to split the sample is the type of care: formal, informal, and formal/informal. For the older cohort receiving formal care, the next branch of the tree is based on whether the receiver of care is partnered or not partnered. However, for the younger cohort, the split is based on tenure type. The significant finding of this analysis is that a housing variable – tenure type – affects the magnitude, and thus the cost, of care. While age and presence of a partner have been accepted predictors of the cost of aged care, housing characteristics must now be included in the discussion.

## **4.5 Conclusion**

Based on DACS data and reliable estimates of the costs of home-based service, the provision of care to the aged in their own homes rather than in residential care facilities promises considerable government cost savings. Although our analysis does not attempt to match the levels of care delivered in both settings and does not use a control group or a quasi-experimental design, the findings are promising. The results of the present study are consistent with the results of previous research and are underpinned by a logic that demonstrates the mechanisms that yield the benefits – the presence of a large component of informal care in a home-based setting and the large savings available in accommodation costs.

Nevertheless, it is clear that the actual size of the benefit will depend on the ability of the government to use the option of home-based care to delay the entry of the aged into residential care. Older adults' strong preference for home-based care and the growing sophistication of home-based care packages suggest that the size of the benefit is likely to increase over time.

The other important task of this chapter has been to highlight the importance of housing variables in determining the cost of home-based care. While earlier research indicated that age and the presence of a partner have a major impact on the cost of home-based care, the analysis in this chapter reveals that housing variables such as tenure and dwelling type also have an impact on costs. The nature and extent of this impact requires further investigation.

## **5 HOUSING POLICY IMPLICATIONS**

### **5.1 Introduction**

This chapter examines how different forms of housing assistance and related programs might affect the costs and benefits of using private housing as the home base for the provision of care services for older people (i.e. research question 3). The apparent cost-effectiveness of using private housing as the home-base for care of older people confirms current policy and home-care initiatives. A more novel finding, though (e.g. Chapter 2), is the notion that dwelling type and housing tenure are cost-critical variables. Nevertheless, this vital connection is overlooked all too frequently. Consequently, these findings provide another layer of understanding to a growing global awareness and an existing body of evidence that the built environment, and housing in particular, has a powerful impact on the health, mobility, independence, autonomy and wellbeing of older people (Burrige & Ormandy, 1993; Conway, 1995; Ineichen, 1993). Institutional care is primarily concerned with creating formal care efficiencies. This is untrue of private housing, which is domestic in scale and primarily concerned with facilitation of occupant autonomy and independence.

In Chapter 4 it was shown that there is a nexus between housing and the cost of in-home care for older adults and that formal or informal home-based care has the potential to provide large savings to government. It would seem, therefore, that housing issues should be an important part of the policy discussion. Home ownership appears to have significant effects on the potential to modify existing dwellings and the potential for older people to remain in the community. Dwelling condition and type, on the other hand, may impose functional limitations that increase care costs or make home-based care difficult, if not impossible. In the rest of this chapter, the policy-relevant themes of the economic value of housing to older people, growing demand for home-based care, and the appropriateness of residential housing design are further explored in relation to our cost-benefit findings. The costs of failing to address the housing needs and circumstances of older people are considerable, so housing should be centre-stage as it directly affects care provision and cost capping.

### **5.2 Economic value of housing for older persons**

Home ownership is the major financial divide among the majority of older people who rely primarily on the age pension for their income. Australia has one of the highest rates of home ownership among older people in advanced industrial countries. Among individuals and couples aged 65 years and over in private households, nearly 80 per cent are outright home owners in Australia (Kendig & Bridge, 2007). Those who own their own home outright can have a modest but adequate standard of living, while those in less secure accommodation typically face housing costs that may drive them into poverty and consequent social exclusion (Saunders, Patulny & Lee, 2005). Nearly all older owners (93 per cent) pay less than a quarter of their income on housing (Australian Institute of Health & Welfare, 2002). If the home is mortgage free, housing costs comprise only the direct costs of property taxes and maintenance, freeing income for other uses. More use of one's own assets in later life may enable ageing baby boomers to maintain higher standards of living, notwithstanding income shortfalls through long periods of retirement. Home owners are financially advantaged by the tax-free position of owner-occupied housing in terms of use value, property appreciation, and eventual inheritance (Kendig, 2000). The home is also a substantial asset that can be used to buy into aged care facilities or leave as an inheritance (Rowlingson, 2006).

Older home owners typically are 'asset rich but income poor', which means that the wealth tied up in housing is generally unavailable unless they sell their homes and move. Home Equity Conversion (HEC) provides a financial mechanism by which older people can draw down small capital sums or income streams from their mortgages (Reed & Gibler, 2003). These reverse annuity mortgages increase by the amounts of mortgage 'draw-downs' plus the accumulating interest; repayment is not required until the home is eventually sold. The potential cash-in-hand is likely to be sufficient only for one-off expenditures (such as a holiday or new consumer good) or improvements that can increase the capital value of the home (Reed, 2004).

The Commonwealth Government facilitates HEC programs by providing modest concessions on the draw-down sums in the means test for the age pension. Older people (and their children), however, are understandably reluctant to risk encumbering their homes under uncertain regulatory protections (Howe & Healy, 2005). Improved financial mechanisms and regulations might be able to facilitate the safe and more widespread take-up of these products (Tilse et al., 2005). For instance, initiatives such as the Canadian tax reforms are an attempt to tackle the funding of care and housing adaptations by allowing older people to draw-down on their superannuation for more cost-effective outcomes.

The importance of housing wealth for adequacy of aged care was underscored by the Hogan inquiry into long-term care costs (Hogan, 2004). Hogan recommended that governments could introduce a means-tested accommodation-bond in order to meet the high capital costs inherent within high-level care (nursing homes)<sup>31</sup>. The political sensitivity of this recommendation led the government to virtually rule out such change in the short term. There are, however, notable policy advantages to 'unbundling' payments for aged care into a financially means-tested accommodation component and needs based care component (Kendig & Duckett, 2001). This would provide more accommodation choice and quality for people with more resources, and free up scarce public resources to meet the capital cost of accommodation for vulnerable older people who do not have housing or other forms of wealth.

### **5.3 Growing demand for home-based care**

The ageing of the Australian population will have a significant impact on community care, particularly in terms of the potentially insufficient supply of informal carers. Of older adults who do not reside in residential care facilities, those with the greatest care needs are those who live alone, those with unsuitable accommodation, and those with dementia. Based on population projections for the period to 2031, the number and proportion of aged people with severe or profound disability will increase at a rate significantly higher than that of informal carers (NATSEM, 2004). Support for informal carers, particularly ageing carers, will therefore be critical. It is also likely that the private cost of caring for the aged will also increase, because family members either will either be forced to leave full- or part-time employment or will incur the expense of paid outside help to assist in the caring process (ACIL Consulting, 1999). Further research regarding the hidden cost of unpaid care is critical.

The shift to home-based care has already had a direct impact on formal home-based care delivery, with data from the Home and Community Care (HACC) programs clearly indicating that, currently, over three-quarters of all HACC clients nationally are aged 65 or older (Bridge & Gopalan, 2006).

For better or worse, housing and care previously have been packaged together, and entry to residential care was to satisfy either accommodation or care needs

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<sup>31</sup> This is already the case in low-level residential care facilities, e.g. hostels.

(sometimes both). Current thinking, however, concerns how best to unbundle housing and care provision in order to increase flexibility and improve outcomes for cost and quality of life. This unbundling process, in combination with the preference for 'ageing in place', means that an older person's home provides value beyond shelter. When aged care is provided in the home, the home becomes a place of work. Therefore, non-shelter housing considerations must include minimum requirements for the occupational health and safety of all those providing services to and within the home.

#### **5.4 Appropriateness of residential housing design for older persons**

Appropriate housing design innovations for older people appear to have been overlooked. Appropriateness encompasses the physical design features, but also includes siting and dwelling responsiveness (Industry Commission, 1993). Traditional Australian housing comprised two to four bedrooms and a bathroom on a quarter-acre block in the suburbs (Davison, 2006). Current housing development, however, is in the form of multi-storey dwellings; most of the new housing stock in high-density cities like Sydney, Melbourne and Brisbane is units and high-rise developments. While developments with more than three stories typically have lifts, access to the units themselves and their associated common areas remains problematic for older people with mobility and cardiovascular problems. Even if regulation similar to the United Kingdom's 1998 'Visitable Housing Act' were to be introduced, the impact would be minimal. This Act applies only to new construction, which comprises only 2–2.5 per cent of the total housing stock (Australian Bureau of Statistics, 1998a). Attention to new construction would not, by itself, be sufficient to accommodate the growing need.

Most residential housing design assumes average adult dimensions (not those of older people) and reach ranges based on full health and physical fitness (Imrie & Wells, 1993; Imrie, 1996; Scotch & Schriener, 1997). The post-war Australian dream home on the quarter-acre block has meant that the majority of homes from this period (with the exception of those in tropical zones) are on one level, making access and ageing-in-place easier. But even in one-storey homes, design features such as steps or other inaccessible building elements clearly affect mortality and morbidity and place people with disabilities and their carers at risk of injury (Buckle, 1971; Iwarsson, & Isacson, 1993; Stark, 2001). National housing policy that facilitates the adjusting of current housing stock to better accommodate functional decline associated with ageing has long been advocated.

Housing that can accommodate changes in human ability over the lifespan enables the occupants to live and remain in their homes as long as possible. Ageing with a functional impairment generally results in more time spent within the home; indeed, Baltes et al. (1999) found that 80 per cent of the activities of older persons typically take place in the home. Housing design features required by older people and people with disabilities, such as ramps and handrails, facilitate engagement in activities of daily living (such as bathing, grooming, cooking, shopping).

Moreover, maintenance and modification interventions have been shown to be effective in decreasing the incidence of accidents and injury, with a seven-fold reduction in reported morbidity (Allen, 2000; Ambrose, 2001). The importance of an accessible home for older people and people with disabilities highlights the need to plan for home maintenance and modification assistance. Home maintenance is an important part of remaining in the community and is essential for carer safety and comfort. Examples of home maintenance include minor repairs and painting. Older home owners would normally perform these activities themselves if they were fit and healthy. There is a growing body of evidence to support the practice of housing

adjustment as a cost-effective intervention for older people. Several pre- and post-intervention studies have found that housing adjustments significantly reduced the number of falls for the majority of participants (Plautz et al. 1996; Thompson 1996). The evidence accumulating from 'randomised controlled' studies suggests that appropriate home adjustments delay the onset of functional loss (Gitlin et al., 2001; Mann et al., 1999) and reduce falls among impaired older persons (Campbell et al., 2005; Close et al., 1999; Cumming et al. 1999). Unfortunately, the number of random control studies published is still very small; and existing studies all include different populations and intervention approaches.

## **5.5 Housing policy changes needed to secure the future for older people**

A major goal for older persons should be to achieve greater security of tenure (e.g. by strategies that facilitate ownership, long-term leasing, and/or entry into social housing programs) for their housing to increase their perceived control and autonomy. In Australia, most older people who reside within their local community are currently owner-occupiers, but this is unlikely to be true for future cohorts of older people. Getting older without the protection of home ownership means relying on 'mainstream' housing availability and/or income support when it is needed. Thus, housing affordability, particularly in the major capital cities, is becoming critical. Older tenants rely heavily on means-tested Rental Assistance (RA), which (as of early 2006) pays up to \$99.20 per month, subject to a stringent income and assets means test (Department of Family and Community Services, 2005). Although this assistance does not confer the security or other benefits of home ownership or public housing, it is available to nearly all who meet the eligibility requirements.

The problem of unaffordable and inaccessible private rental housing for older people is further compounded by poor physical housing conditions. People who can afford only lower-cost private rental housing often must put up with housing that is in poor condition (e.g. damp and draughty and lacking carpets, insulation and services such as heating and air conditioning). The lack of minimum housing standards in each state and territory means there is little legal support for older vulnerable people when looking for suitable and affordable housing.

Each percentage point reduction in public and community housing levels has a very significant impact on low-income, disadvantaged people who never could buy homes of their own. Public housing support increasingly has been more tightly rationed to those in highest need. Thus a particularly disadvantaged group are those older persons ageing with pre-existing disabilities. Private market forces primarily determine housing change, as the Commonwealth Government has no direct role in housing provision (Howe, 2003). Nevertheless, the Commonwealth Government and the relevant state/territory governments do share responsibility for providing two accommodation programs, neither of which is specifically targeted at older persons, but which do benefit some older persons. These are the Supported Accommodation Assistance Program (SAAP) and the Commonwealth State Housing Agreement (CSHA). SAAP provides transitional support and accommodation to homeless people and those at risk of homelessness, to help them achieve self-reliance; the CSHA provides public and community housing. Thus, most housing assistance provided for people without stable and secure housing comes under the Housing Assistance Act 1996 (Department of Family and Community Services, 1999).

The CSHA also sets out the terms for housing assistance for rental housing, home purchase and other specific housing programs. Most Commonwealth funding under the CSHA is in the form of capital grants. Approximately half of all Commonwealth

funding for public and community housing comes under the CSHA umbrella. However, the focus of housing support has shifted away from the CSHA and towards spending on rent assistance. Rent assistance has increased while base grant funding to the Commonwealth-State Housing Agreement (CSHA) has decreased. The Department of Social Security and the Department of Veterans' Affairs provide rent assistance for those in private rental accommodation who are struggling financially. Rental assistance works best for those older persons able to locate and manage their own housing needs. Unfortunately, the private rental sector cannot provide security of tenure, and access to appropriate high-quality accommodation is scarce, especially in locations close to informal support, shops, services and public transport. The lack of access to appropriate housing costs taxpayers and government, especially if institutionalisation results (Harrison & Parker, 1998).

The states and territories have a host of housing and housing-related schemes funded via the CSHA. These differ markedly and include schemes for public housing, community housing, loans for home purchase, and rental assistance. State and territory governments are also encouraged to combine CSHA home purchase assistance funds with private funds to expand their lending programs. As well as general funds for public rental housing and home purchase assistance schemes, some funds are allocated for specific programs. The role of the CSHA is important to understand because it has been under threat for some time. It is unclear exactly what the consequences might be if the CSHA was not ratified in the future and if access to public housing consequently became even more difficult.

Community care represents an important complementary system to residential aged care, and therefore of particular interest to many is the apparent trend to substitute community care in order to stem residential aged care demand. During the past twenty years, the Commonwealth has established several programs in an effort to facilitate in-home care for older people. The Assistance with Care and Housing for the Aged initiative (ACHA) was an offshoot of the HACC program and a priority initiative in some states, such as Victoria (Howe, 2003). A much more significant program, however, is the Community Aged Care Packages (CACPs), which have steadily increased in number over time. More recently, Extended Aged Care at Home (EACH) packages have been added to the mix. EACH packages, unlike the lower-level CACPs, are intended to substitute for high-level residential care.

The actual delivery of services for both residential and home-based care comes mostly from non-government service providers, most of which are from the not-for-profit sector (Australian Institute of Health & Welfare, 2004). However, HACC services and CACPs are playing an increasingly important role in aged care, and that role is likely to become even more significant in the future. Currently, most of the funding provided by the Commonwealth to the states and territories must be matched by those jurisdictions on a dollar-for-dollar basis. For example, within the HACC program this is typically a 60/40 split. As the population ages, these costs are likely to increase and policymakers will need to develop and implement a number of strategies most likely to prevent reliance on special government accommodation and care funding.

In terms of future policy implications, the key ones are those directly associated with policy and funding initiatives that will best ensure a greater supply of secure, affordable and accessible dwellings of reasonable quality to older people. This means that as well as expanding existing housing and care programs in order to meet the growing demand for housing and care services likely to result from population ageing, the following policy areas also require strategic action both nationally and regionally:

→ construction (e.g. ensuring more accessible housing features such as level entry)

- occupational health and safety (e.g. maintaining carer safety and preventing home injuries)
- taxation (e.g. offsets for retrofitting accessible features and providing longer-term home leasing options)
- banking (e.g. increasing informal care rewards and safer home equity conversion options)
- urban planning policy (e.g. supporting more affordable and diverse community-based housing options for older people)
- health policy (e.g. maintaining older people's health by preventing and postponing functional decline and associated dependency)
- housing policy (e.g. establishment of accessible and affordable property registers and examination of how density might be more flexibly interpreted to improve housing amenity and create more liveable communities).

## 5.6 Conclusions

Without policy change to increase the availability of accessible and affordable housing, the numbers of vulnerable older people who are stressed by high rents and inaccessible homes will increase. In Australia, accessible or adaptable housing is still only a miniscule percentage of the market and has traditionally been provided by public housing authorities. However, public housing authorities manage less than 5 per cent of the total housing stock; much of this stock is now at the end of its economic life, and/or does not meet the current tenants' needs. Further, the current trend in some states and territories and within the social housing sector is towards community housing cooperatives and privatisation. As a result, head leasing has become more common, with consequent issues associated with home modification and maintenance, especially regarding who is responsible for maintaining dwelling quality. Further, many new design and construction activities are being tendered out to private contractors who, as a general rule, are more concerned with marketable prices and density maximisation than with good design practice.

Secure, appropriate and affordable housing are the three critical issues that must be addressed to ensure that Australian housing policy reflects our demographic profile and is responsive to the needs of older people. Both the asset-rich older home owner and the older private renter face issues related to managing accommodation and home-based care costs while on a fixed income. Unfortunately, house prices and, as a consequence, rental prices, will increase in direct proportion to housing availability and demand. Lack of security of tenure has profound implications for capital and recurrent funding, while the lack of incentives and regulation to promote the creation of more appropriate and affordable housing for older people affects the supply of housing that will permit older adults to age in place.

To develop housing policy that accommodates the needs of older Australians, further research is needed, in order to determine the aspirations, needs, preferences, experiences, choices and decision-making of older Australians with respect to their choices regarding house and home, locality and community, and care and support. More specifically, future research needs to be commissioned to examine in greater detail:

- the value of examining the human/social costs of informal care
- the large range of external factors that could not be easily offset, such as the potential for selection bias within public housing and unit dwellers

→ the variability in costs resulting from geographical and demographic factors.

The results of such research will inform housing policy and regulation directed toward the residential construction industry, as it is the community housing choices that will better shape and sustain a productive future for older persons. How, for instance, can a greater supply of accessible and affordable dwellings be created and how will this affect housing security and tenure choices available to older people in different geographic locations in Australia?

A central theme of this chapter is that policy at all levels of government needs to take careful account of the all-embracing impact of housing on the non-shelter outcomes of older people. Of particular importance are economics and care, as these are the cornerstones of community participation and the ability of older adults to remain in the community. Many of the most important and persistent effects of the built environment reflect design, investment and regulation decisions by both the public and private sectors many decades earlier. As Australia faces unprecedented population ageing, policy makers must recognise that housing has a pivotal role in the flow of resources directly relevant to the sustainability of the economics of care.

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# APPENDICES

## Appendix 1: DACS variables used in analysis

Table A1.1: Variables and level of measurement

<i>Variable name</i>	<i>Label</i>	<i>Measurement level</i>
abshid	Household identifier	Nominal
absfid	Family identifier	Nominal
abspid	Person identifier	Nominal
pension	Main pension or benefit	Nominal
mapprec	Relationship of principal carer to main recipient	Nominal
pidcarer	Carer status	Nominal
hsglordc	Landlord type	Nominal
hsgtenuc	Housing tenure	Nominal
hsgntyc	Tenure type	Nominal
maincndc	Main condition	Nominal
mrcds1c	Disability status (1) of main recipient of care	Nominal
mrsupapc	Frequency of attendance by main recipient of care at supervised activity program	Nominal
Modifications	Number of modifications	Scale
typchgca	Type of change(s) made to dwelling because of condition(s)	Nominal
typchgcb	Type of change(s) made to dwelling because of condition(s)	Nominal
typchgcc	Type of change(s) made to dwelling because of condition(s)	Nominal
typchgcd	Type of change(s) made to dwelling because of condition(s)	Nominal
typchgce	Type of change(s) made to dwelling because of condition(s)	Nominal
typchgcf	Type of change(s) made to dwelling because of condition(s)	Nominal
typchgcg	Type of change(s) made to dwelling because of condition(s)	Nominal
respusca	Type of respite care used in last three months	Nominal
respuscb	Type of respite care used in last three months	Nominal
respuscc	Type of respite care used in last three months	Nominal
respuscd	Type of respite care used in last three months	Nominal
respusce	Type of respite care used in last three months	Nominal
pcpaycar	Whether primary carer usually pays significant proportion of living costs of main recipient of care	Nominal
pidlives	Whether primary carer lives with main recipient or care	Nominal
popestab	All persons living in establishments	Nominal
poph65	Persons aged 65 years and over living in households	Nominal
poph65ra	Persons aged 65 years or over receiving assistance living in households	Nominal

<i>Variable name</i>	<i>Label</i>	<i>Measurement level</i>
popoldie	All persons aged 65 years and over	Nominal
psnmarry	Registered marital status	Nominal
psnrvil	Whether person is in accommodation for the retired or aged (self-care)	Nominal
sfclmlim	Whether limited in climbing stairs	Nominal
sfdown	How often felt down during last four weeks	Nominal
supdaycr	Whether primary carer used a day-care centre in the last three months	Nominal
supinhom	Whether primary carer used in-home respite in the last three months	Nominal
supother	Whether primary carer used other respite service in the last three months	Nominal
suprcuse	Primary carer use of respite care	Nominal
supresid	Whether primary carer used residential respite care in the last three months	Nominal
hhdpc	Whether household contains a primary carer	Nominal
hldtypec	Household type	Nominal
incwkhd	Total weekly cash income - household	Nominal
hhdnpsv	Number of persons with a profound to moderate core activity limitation in household	Scale
hhdnorst	Number of persons with a restriction in household	Scale
ABSAID	Activity identifier	Nominal
PERS_WT	Person weight	Scale
health_care	Health care	Scale
Case_management	Case management	Scale
domestic	Domestic assistance	Scale
Home_maintenance	Home maintenance	Scale
meals	Meals	Scale
transport	Transport	Scale
absiid	Income unit identifier	Nominal
sex	Sex	Nominal
dwelling_tenure	Tenure and housing	Nominal
filter_\$	Over_grouped ~= 5 (FILTER)	Nominal
care_cost	<none>	Scale
social_cost	<none>	Scale
health_cost	<none>	Scale
case_cost	<none>	Scale
dosmestic_cost	<none>	Scale
domestic_cost	<none>	Scale
home_cost	<none>	Scale
meal_cost	<none>	Scale
transport_cost	<none>	Scale
Mod1_cost	<none>	Scale
Mod2_cost	<none>	Scale

<i>Variable name</i>	<i>Label</i>	<i>Measurement level</i>
Mod3_cost	<none>	Scale
Mod4_cost	<none>	Scale
Mod5_cost	<none>	Scale
Mod6_cost	<none>	Scale
respittea_cost	<none>	Scale
respitieb_cost	<none>	Scale
respittec_cost	<none>	Scale
respited_cost	<none>	Scale
respitc_cost	<none>	Scale
mod_cost	<none>	Scale
total_cost	<none>	Scale
cost_support	<none>	Scale
overall_cost	<none>	Scale
Mods_made	<none>	Nominal
Noverall	Overall cost grouped	Ordinal
Housing_Type	Housing type	Scale
income	<none>	Scale
BRASCODE	Broad area of activity where assistance is required or difficulty is experienced	Nominal
Personal_care	Personal care	Scale
Social_support	Social support	Scale
rastcrr	Type of core activity assistance received	Ordinal
rastncrr	Type of non-core activity assistance received	Ordinal
rastnpgr	Type of non-personal activity assistance received (cognition and emotion included)	Ordinal
rastnpnr	Type of non-personal activity assistance received (cognition and emotion excluded)	Ordinal
rastpgr	Type of personal activity assistance received (including cognitive and emotional support)	Ordinal
rastpnr	Type of personal activity assistance received (excluding cognitive and emotional support)	Ordinal
rastygui	Type of cognitive/emotional support assistance received	Ordinal
rastyhc	Type of health care assistance received	Ordinal
rastyhom	Type of housework assistance received	Ordinal
rastymea	Type of meal preparation assistance received	Ordinal
rastymob	Type of mobility assistance received	Ordinal
rastypap	Type of paperwork assistance received	Ordinal
rastypgr	Type of assistance received in broad areas of activity	Ordinal
rastyprp	Type of property maintenance assistance received	Ordinal
rastyisc	Type of self care assistance received	Ordinal
rastytra	Type of transport assistance received	Ordinal
sfalemot	Whether accomplished less than would like during last four weeks because of emotional problems	Ordinal
reclvlid	Record level identifier	Nominal

<i>Variable name</i>	<i>Label</i>	<i>Measurement level</i>
care_cost1	<none>	Scale
social_cost1	<none>	Scale
health_cost1	<none>	Scale
dosmestic_cost1	<none>	Scale
home_cost1	<none>	Scale
case_cost1	<none>	Scale
total_cost1	<none>	Scale
cost_support1	<none>	Scale
overall_cost1	<none>	Scale
Over_grouped	Overall cost	Scale
Roverall	RANK of overall_cost1	Scale
NTI001	Support cost	Ordinal
daily_care_cost	<none>	Scale
daily_social_cost	<none>	Scale
daily_health_cost	<none>	Scale
daily_Case_management	<none>	Scale
daily_domestic_cost	<none>	Scale
daily_maintenance_cost	<none>	Scale
daily_meals_cost	<none>	Scale
daily_transport_cost	<none>	Scale
total_cost_revised	<none>	Scale
new_care	<none>	Scale
cost_support4	<none>	Scale
Health_support	<none>	Scale
Home_support	<none>	Scale
Meal_support	<none>	Scale
Paper_support	<none>	Scale
Maintenance_support	<none>	Scale
Selfcare_support	<none>	Scale
Transport_support	<none>	Scale
BRFREQ	Grouped frequency of need for assistance or supervision	Nominal
P_support	Personal support	Scale
S_support	Social support	Scale
C_support	Case management	Scale
H_support	Health	Scale
D_support	Domestic	Scale
HM_support	home maintenance	Scale
M_support	Meals	Scale
T_support	Transport	Scale
care_c	<none>	Scale
social_c	<none>	Scale
health_c	<none>	Scale

<i>Variable name</i>	<i>Label</i>	<i>Measurement level</i>
domestic_c	<none>	Scale
maintenance_c	<none>	Scale
meals_c	<none>	Scale
transport_c	<none>	Scale
total_c_revised	<none>	Scale
cost_support_f	cost of support without mods	Scale
overall_f	cost of support with mods	Scale
health1	<none>	Scale
domestic1	<none>	Scale
meals1	<none>	Scale
P_support1	<none>	Scale
Case_management1	<none>	Scale
Home_maintenance1	<none>	Scale
transport1	<none>	Scale
domestic_cost1	<none>	Scale
meal_cost1	<none>	Scale
personal_cost1	<none>	Scale
transport_cost1	<none>	Scale
health_cost12	<none>	Scale
domestic_cost12	<none>	Scale
case_cost12	<none>	Scale
home_cost12	<none>	Scale
personal_cost12	<none>	Scale
transport_cost12	<none>	Scale
meal_cost12	<none>	Scale
overall_f1	Revised cost of support with mods assumption weekly	Scale
health_cost12A	<none>	Scale
domestic_cost12A	<none>	Scale
meal_cost12A	<none>	Scale
case_cost12A	<none>	Scale
home_cost12A	<none>	Scale
personal_cost12A	<none>	Scale
transport_cost12A	<none>	Scale
overall_f1A	Revised cost of support with mods assumption 4 times a week	Scale
total_overall_cost	Total overall cost	Scale
Dwelling	<none>	Nominal
tenure	<none>	Nominal
House_Units_Other	Dwelling Ttpe	Nominal
Dwelling_type	Dwelling structure	Nominal
AgeGroup	Age of persons	Nominal
Tenure_type	<none>	Nominal
state	State or Territory of usual residence	Nominal

<i>Variable name</i>	<i>Label</i>	<i>Measurement level</i>
ariac	Remoteness	Nominal
incwkpnc	Total weekly cash income – person	Nominal
agepc	Age of person	Nominal
TYPEASS	Whether receives formal or informal assistance with broad activity area	Nominal
Mstatus	Whether single or partner	Nominal
Total_non_mods_cost	Total non modifications cost	Scale
weekly	<none>	Scale
Nweekly	NTILES of weekly	Ordinal
total_c_new	Revised cost of support without mods assumption weekly	Scale
total_c_newB	<none>	Scale
overall_f1B	<none>	Scale
total_c_newA	Revised cost of support without mods assumption 4 times a week	Scale
Ntotal_c	NTILES of total_c_newA	Ordinal

## Appendix 2: Residential care admission calculation

Survival analysis techniques (Cox regression) were used to derive the final model of residential care admission. The analyses endpoints of residential care admission status and survival time were ascertained as follows. At follow-up in 2006, subjects were either (1) known to have entered residential care (with year and sometimes month of admission known; otherwise survival time was imputed as halfway between the last year of community-living data and 1 February 2006), (2) known to have not entered residential care (in which case they were censored as survivors at 1 February 2006), or (3) residential care status unknown (in which case they were censored as survivors at the last year of community-living data).

Within each block of predictors (Socio-demographic, Physical Health, Psychological Health, Social, Housing and Services), each predictor was entered singly into a Cox regression, and if the p-value was in excess of 0.10, this predictor was thereafter ignored. Categorical variables (e.g. Marital Status with 4 levels: Never Married, Divorced/Separated, Married and Widowed) were regarded as single predictors, and dummy variables were constructed after choosing one subgroup as the reference or “control” group (e.g. Married; with 3 dummy variables constructed indicating Never Married, Divorced/Separated, Widowed). The set of predictors meeting this bivariate criterion were then entered simultaneously into a multivariate model, and this model was refined by (a) omitting predictors with partial p-values in excess of 0.05, and (b) verifying with a deviance test that the predictors omitted at this stage took no significant deviance with them ( $p > 0.10$  being the criterion in these deviance tests when 2 or more DF were involved; 0.05 otherwise). In this manner, a final block model was developed for each block. The successful predictors from these final block models were then run together in a multivariate overall model, using the same (a) and (b) criteria above to refine and produce the final overall model. Missing values in the 1994 data were imputed for a given variable in its particular block by using regression-based prediction against all other predictors in that block.

## Appendix 3: Cost of support by state and region

Table A3.1: Receives formal assistance only

<i>State/territory</i>	<i>Mean (\$)</i>
<b>New South Wales</b>	
Major city	7,143.14
Inner regional	7,966.12
Other areas	9,838.51
<b>Victoria</b>	
Major city	8,516.09
Inner regional	8,102.67
Other areas	8,995.15
<b>Queensland</b>	
Major city	8,566.16
Inner regional	8,139.12
Other areas	8,804.71
<b>South Australia</b>	
Major city	9,112.07
Inner regional	7,073.80
Other areas	8,952.60
<b>Western Australia</b>	
Major city	7,057.27
Inner regional	7,279.69
Other areas	6,820.65
<b>Tasmania</b>	
Inner regional	9,008.51
Other areas	9,114.97
<b>Northern Territory</b>	
Other areas	8,058.45
<b>Australian Capital Territory</b>	
Major city	9,078.98

**Table A3.2: Receives formal and informal assistance**

<i>State/territory</i>	<i>Mean (\$)</i>
<b>New South Wales</b>	
Major city	14,348.62
Inner regional	12,602.74
Other areas	9,863.99
<b>Victoria</b>	
Major city	14,636.94
Inner regional	11,358.55
Other areas	12,058.31
<b>Queensland</b>	
Major city	13,157.56
Inner regional	13,209.60
Other areas	12,360.66
<b>South Australia</b>	
Major city	11,040.58
Inner regional	21,512.41
Other areas	9,464.93
<b>Western Australia</b>	
Major city	15,557.09
Inner regional	15,829.28
Other areas	11,604.15
<b>Tasmania</b>	
Inner regional	13,366.11
Other areas	18,505.39
<b>Australian Capital Territory</b>	
Major city	8,866.64

Note: Insufficient data to impute for the Northern Territory.

**Table A3.3: Receives informal assistance only**

<i>State/territory</i>	<i>Mean (\$)</i>
<b>New South Wales</b>	
Major city	12,216.44
Inner regional	12,702.86
Other areas	8,486.46
<b>Victoria</b>	
Major city	11,147.29
Inner regional	12,541.32
Other areas	8,136.99
<b>Queensland</b>	
Major city	12,387.56
Inner regional	12,482.77
Other areas	12,659.91
<b>South Australia</b>	
Major city	13,018.61
Inner regional	9,036.07
Other areas	10,333.12
<b>Western Australia</b>	
Major city	10,860.92
Inner regional	9,995.67
Other areas	9,848.75
<b>Tasmania</b>	
Inner regional	11,724.55
Other areas	9,622.09
<b>Northern Territory</b>	
Other areas	14,011.41
<b>Australian Capital Territory</b>	
Major city	13,349.73

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