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Home Modifications and their impact on waged care substitution

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Glossary

ACAP	Aged Care Assessment Program
AIHW	Australian Institute of Health and Welfare
CACP	Community Aged Care Package
CDC	Consumer Directed Care
CDSA	Commonwealth State Disability services Act
DACS	Disability Ageing and Carers Survey
ADHC	Ageing, Disability and Home Care, Department of Human Services NSW
DSP	Disability Services Program
EACH	Extended Aged Care at Home
EACH-D	Extended Aged Care at Home – Dementia
HACC	Home and Community Care Program
HIA	Housing Industry Association
HMMS	Home Modification and Maintenance Services
JRF	Joseph Rowntree Foundation
MDS	Minimum Data Set
NSW	New South Wales
OHS	Occupational Health and Safety
OT	Occupational therapist
OH&S	Occupational Health and Safety
PCP	Person Centred Planning
UK	United Kingdom

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Executive Summary

Introduction

This report examines and analyses the potential of home modification services to substitute for waged home care services. This is a valuable investigation for the purposes of exploring innovative and cost effective care solutions given the increasing pressure on care labour markets and care providers within the context of the demographic challenges presented by an ageing population. In addition to benefiting ageing populations, this investigation will impact upon care solutions for those with long-term disability resulting from trauma or anomalies at birth.

Exploration of how home modification impacts waged home care outcomes is important for several reasons, it:

1. Provides innovative examination of new care solutions – and establishes a new paradigm for community care
2. Acknowledges the role of housing in managing problems associated with maintaining levels of care in an ageing society
3. Instils new knowledge via the synthesis of research within the fields of housing, care and health
4. Determines whether using home modifications as a substitute for waged home care could be an innovative cost benefit (e.g. to government or insurance agencies), provide benefit to clients or achieve both.

The report reviews current literature on home modifications and care substitution followed by three case-based cost analyses in order to demonstrate cost impacts and to illustrate how the key variables affect home modification and waged home care costs. The case studies utilise data from publicly available Australian data reported by Ageing, Disability and Home Care, Department of Human Services NSW (ADHC), as well as costs obtained from actual case files (de-identified) which were supplied by Home Maintenance and Modification Service providers.

Project Aims

The research questions explored within this report aim to inform Home and Community Care policy regarding home modification provision. Thus the report specifically sets out to address the research question posed by an *Operational null hypothesis* or “no difference” form of the research question. In this sense the question asks “does a relationship exist between the number of hours of waged home care and home modification interventions?”

Further, depending on the outcome of the establishment of a relationship we also seek to determine:

> *“Is the relationship between home modifications and waged home care a positive or negative one?”*
>
> and,

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> *"If a relationship exists in what way do the two services either substitute for and/or complement each other?"*

Therefore, the research hypotheses being explored concern the specific predictions regarding the nature and direction of the relationship between home modification interventions and waged home care interventions for older people and those with known functional limitations. For example, our hypotheses include that:

- Substitution between home modifications and waged home care exists;
- The degree and direction of substitution is measurable by examination of cases where both occur; and
- Substitution is complex but that this can be determined by person-environment fit theory combined with an understanding of human function variables such as type of impairment, degree of impairment, functional prognosis etc.

Leading on from these specific understandings our general aim involves conducting a rigorous empirical evaluation of the key definitions and concepts underpinning waged home care substitution by home modifications, and then testing this by comparing outcome and process measures from cases—those with exposure to home modification and waged home care interventions.

Thus we systematically search the literature to present both current work and then use this to refine and advance a person-environment fit theory relevant to waged home care substitution, collect cases to test it, and reflect on whether the theory was confirmed or disconfirmed by the cost data emanating from the cases utilised within this research. In particular, whether the investments associated with waged home care over a period of time (i.e. 12 months) is comparable with the initial capital investment of a home modification program.

Overview of results

There is evidence to suggest that home modifications can reduce or even eliminate care in the home (Home Adaptations Consortium, 2010; Liu & Lapane, 2009; Verbrugge & Sevak, 2002) and reduce likelihood of entering residential care (Newman, Struyk, Wright, & Rice, 1990). By facilitating self-care practices, home modifications can play a role in reducing the disability threshold (Straton, et al., 2003) and improving the person-environment fit (Brandt & Pope, 1997). Both the theoretical concepts of disability threshold and person-environment fit play an important role in visualising and presenting home modifications within a community care framework.

The demands on Community Care Services are increasing (Grant Thornton, 2008) and changes to future care approaches will be required to moderate high demand for specific services including waged home care. However, it appears that the potential for home modification substitution has been under explored. For instance, in Australia home modifications are a relatively small sector of the overall home and community care program network servicing just over 3 percent of the total Home and Community Care clientele which implies that home modifications are either underutilised or do not

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offer the perceived value and benefits implied by the literature (Bridge & Gopalan, 2006). An improved understanding of the true substitutive value of home modification services will establish their place within consumer directed care networks. The three case studies reported in this paper indicate that the capital expenditure required for a comprehensive home modification program scripted by an occupational therapist is favourably comparable to the continued waged home care costs for the period of 12 months following home modifications. This comparison did not factor in other residual benefits of home modifications which include delaying nursing home admission, supporting informal care provision, reducing risk of injuries to paid and unpaid caregivers and improving well-being and sense of independence – implying that these initial values may well be conservative in further favour of home modifications.

The results imply that home modifications are cost effective, however because this is an explorative initial study our findings are based on limited data – in particular the care costs generated rely upon median published values for hourly rates and average hours provided. Therefore there is opportunity for further research in the form of a more detailed pre-post modification research design with controls. Having a control would provide greater internal validity for any effect size calculations, as effect sizes from uncontrolled designs tend to be higher than effect sizes from studies conducted with control groups

Conclusion

Home modifications appear to create substitution effects by facilitating a greater 'self-care' approach to functional limitations. The literature review that underpins this research indicates that home modifications are useful for a range of reasons:

- They facilitate ageing in place;
- Maintain sense of independence;
- Reduce hazards in the home environment; and
- Act as a substitution for assisted care services – reducing the need for care.

It is this final benefit of home modification that has been of most interest in this report, in particular the cost analysis investigations based on the theoretical framework derived from the literature. Initial values derived from the case studies suggest that Home Modifications provided through Home and Community Care program have the potential to be a cost effective and valuable component of a consumer directed community care approach.

This report has served to illustrate the possibilities of substituting waged home care with self-care supported by home-modifications. However, in order to establish stronger links between home modification and care substitution, and to understand the nature of self-care approaches over time, more comprehensive and longitudinal data comparison between particular health profiles, care costs and home modification will paint a more detailed picture and provide more comparable data sets.

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1. Introduction

Why investigate the substitution of care?

The potential for environmental change to reduce disability threshold is well documented (Straton, et al., 2003) however its relationship directly to care provision in the home is underexplored. In order to make informed decisions about the impact of environmental change on the cost of care, it is necessary to seek out scenarios that are innovative, cost effective and needs responsive. An analysis of the current literature is required both to underpin the project and to inform better decision-making in the future. Findings from the literature are further explored via some prototypical cases involving individuals with existing care need. Ultimately, a better understanding of the complexities of substituting care services is needed in order for successful care reform to be developed and implemented.

Substitution is defined as *a person or thing acting or serving in place of another* (Flexner & Hauck, 1987). In care terms, substitution involves understanding the distinctions between and the overlapping of care streams including institutional (residential) care, home-based (community) care and self-care. Researchers have long recognised that a deeper understanding of how care types can substitute for one another reveals new opportunities for cost effective and user-centric care service provision models (Fleming, Giachello, Andersen, & Andrade, 1984; Pezzin, Kemper, & Reschovsky, 1996). This research centers on the substitution that may occur between waged home-based care and self–care when home modifications are installed.

Home modifications (also known as home adaptations or residential modifications) are defined as environmental interventions aiming to support activity performance in the home (Gitlin, Miller & Boyd, 1999; Johansson, 2008) and thus relate to home-based care. The Australian Home and Community Care (HACC) Program defines Home Modifications as “structural changes to the client’s home so they can continue to live and move safely about the house. It will often include the fitting of rails, ramps, alarms or other safety and mobility aids” (Home and Community Care Program, 2007, p1).

Home modifications are an interesting alternative to waged home care services because in some circumstances they can reduce or eliminate the need for care assistance in the home (Liu & Lapane, 2009) or reduce the likelihood of entering residential care (Newman, et al., 1990). This reduction in the need for care takes place as self-care practices are enabled. Self-care refers to activities undertaken to enhance health, prevent disease, limit illness and restore health (DeFriese, Konrad, Woomert, Kincade Norburn, & Bernard, 1994). An example of a home modification that facilitates self-care practices (and reduces the need for personal care assistance) could include the installation of grabrails alongside a toilet which enable independent, safe transfers from sit–to–stand, and without which a person may require assistance every time they visited the toilet in order to transfer safely.

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The purpose of this paper is to provide a foundation for further research in the field of home modifications as a substitute for waged home care, particularly the longitudinal research and cost analyses that need to be conducted in the future. By reviewing current literature on home modifications and community care, the current position on the possibilities and limitations surrounding a case for substitution is established. This review is followed by the development of case studies that use existing data to frame client's health profiles in the context of care needs and home modification requirements and directly compare the associated costs.

Background to the research

There is both a social and economic need to address increasing pressure on existing care systems. This pressure has derived from varying needs across the whole community including those experienced by people with disabilities but has been compounded by Australia's ageing population of whom a majority are living in older, inaccessible housing. It is now widely recognised that a person's environment (e.g. home) has a part to play in either creating or eliminating disability (World Health Organisation, 2001).

An increase in the demand for community care in the past ten years has resulted in the number of elderly people receiving subsidised care in Australia rising by more than 50 percent (Grant Thornton, 2008). Research continues to play an important part in developing an understanding of how this burden of care on the community can be alleviated the role that accessible housing and home modifications can play. Age-friendly housing as a strategy to reduce demand on aged care services by enabling people to live independently and actively for as long as possible is already being actively promoted (Australian Institute of Health and Welfare, 2007).

Minimising the need for care assistance and enabling self-care practices are both linked to a sense of independence and wellbeing (Agree, 1999). Maintaining independence is recognised as an underpinning feature of successful ageing in place. The *Aged Care Industry Council Federal Budget Submission* (2010) identifies goals for a sustainable aged care sector that include the provision of greater choice and protection for consumers, while at the same time acknowledging the need for effective use of public funds. The research questions asked in this paper complement these goals by seeking a greater understanding of how care types interact.

Scope of work

This research investigates the care and home modification substitution scenarios relevant to aging and disability. Ageing, Disability and Home Care, Department of Human Services NSW (ADHC) is the primary provider of home modification funding under the Home and Community Care Program in NSW. Thus the values incorporated in the case studies utilise published HACC NSW cost data. Acknowledgment is made that there are several other agencies and departments also funding home modifications to varying degrees. For instance, Housing NSW, Veterans Affairs, Lifetime Care etc.

provide Home Modification services within NSW but their costing outcomes may differ due to different purchasing, process and guidelines framing their Home Modification operations.

This report is an examination into the substitution between waged home care and home modifications. The report's structure includes two linked stages of research – a literature review followed by case studies incorporating cost analysis. A review of existing literature on home modifications and their relationship with waged home care is conducted in the earlier sections of this report, followed by the development of a set of cost comparisons between existing HACC case studies, waged home care estimates and actual home modification costs. These cost analyses provide an understanding of relative investment required for both waged home care and home modification for a particular client case study.

In this report the term *home modification* refers to alterations carried out to an individual's place of residence as provided by the HACC funded Home Maintenance and Modification Services (HMMS) in NSW. The term *waged home care* refers to formal or paid care provided in the home by Housing and Community Care (HACC) Services. Informal care (or unpaid care) is acknowledged as impacting upon formal care needs; however its dollar value is excluded from the cost analyses in this report.

Costing in this paper is based on limited data. It includes only government expenditure in the care field, so by definition excludes informal care and respite care costs and any benefits accruing from care location. The comparison made is a targeted one, and so also a simplified one. It draws directly between community care costs to government and the corresponding home modification costs to government. Although cost-benefit analyses sometimes factor in a wider range of non-government related and non-monetary benefits including improved wellbeing, independence, and impact upon informal care-giving, it is considered that the simplified analysis explored in this paper is a better means of identifying direct costs to government, the object of this research in regards to care substitution. Consequently the home modification value results can be considered to be conservative, given the lack of incorporation of the value of additional benefits and client contributions.

Care Terminology

The word 'care' has many different meanings, associations and values. Consequently definitions and boundaries of care types are contentious and are not straightforward (Phillips, 2007). This paper seeks to better understand the nature of care as it relates to a person being able to remain living within their home despite a level of reduced functional ability. Thus some of the types of care relevant to this paper include community care, home care, self-care, and personal care. This report defines and distinguishes between these types of care based upon where the care is provided and who provides it. Thus in order to better understand and distinguish the nuances in the terminology explores their definitions.

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Table 1. Care Terminologies

Care Type	Where is this type of care provided?	Who provides this care?	Definition/Explanatory notes
Personal Care	Not restricted by location. Can be provided at home, in residential care, day care etc.	Either family or friends informally, or by paid care workers in a formal agreement.	As it relates to the HACC Program, personal care refers to care tasks that a person would normally perform for himself or herself, however due to illness, disability or frailty they are unable to perform without the assistance of another person[1]. *Personal care* often involves assistance with the tasks of daily living. For example, personal care may involve (but is not limited to) providing assistance with bathing, dressing, administering medications, eating, toileting or mobility.
Institu-tional Care	In a registered nursing home or residential care institution.	Paid care workers	*Institutional care* refers to formal care provided in a residential home or nursing home environment when a person can no longer care for himself or herself at home.
Comm-unity Care	In a community setting e.g. at home or community day care	By either family or friends (informal), or by paid care workers (formal or waged)	*Community care* is loosely defined as care based in a community setting (Khoosal & Jones, 1989) and can be provided in a variety of formats, including formal, informal and (the lesser researched) self-care. *Community Care* is the provision of care and support for people who want to stay independent and living at home for as long as possible. This includes Home and Community Care (HACC) services, Community Aged Care Packages (CACP) and respite care services for carers[2].

[1] Victorian Government Health Information

http://www.healthtranslations.vic.gov.au/bhcv2/bhcht.nsf/PresentDetail?Open&s=Definition_of_HACC_Personal_Care_and_Home_Care

[2] Australian Government Aged Care Australia website

http://www.agedcareaustralia.gov.au/internet/agedcare/publishing.nsf/Content/Glossary+Index+C

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Care Type	Where is this type of care provided?	Who provides this care?	Definition/Explanatory notes
Home Care	In a community setting e.g. at home or community day care	By either family or friends (informal), or by paid care workers (formal or waged)	*Home Care* is a broadly encompassing term, which can be understood to be the types of *Community Care* that are provided in the home. Within an Australian context, the term *Home Care* also signifies a particular care service of the NSW Government. The Home Care Service of NSW is a statutory authority of the NSW Government and is a major provider of HACC services such as domestic assistance, personal care and respite care (adhc.com.au).
Formal (waged) Care	Can be provided either in a registered nursing home or residential care institution OR In a community setting e.g. at home or community day care.	Paid care workers	Formal care includes waged care services such as those delivered by Home and Community Care: "Formal care is regulated care delivered in either residential or community settings, including the person's own home. Most formal care is funded through government programs but may also be purchased privately." (Australian Institute of Health and Welfare, 2007, p. 493).
Informal (unpaid) care	In a community setting e.g. at home or community day care	Unpaid family or friends /informal network	Informal Care refers to the unpaid services provided by family, friends and neighbours: "*An informal carer is considered to be a person, such as a family member, friend or neighbour, who provides regular and sustained care and assistance to the person requiring support, usually on an unpaid basis*." (Australian Institute of Health and Welfare, 2007, p. 493).

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Care Type	Where is this type of care provided?	Who provides this care?	Definition/Explanatory notes
Self-Care	Not limited by location	Oneself	Self-care has no universally agreed definition, however in the context of community care it often refers to the ability to provide care for oneself. The longest standing definition is as follows: *"Self-care in health refers to the activities individuals, families and communities undertake with the intention of enhancing health, preventing disease, limiting illness, and restoring health. These activities are derived from knowledge and skills from the pool of both professional and lay experience. They are undertaken by lay people on their own behalf, either separately or in participative collaboration with professionals." (World Health Organisation, 1983, p. 2)* There are four types of support for self-care: (1) assistive technology; (2) environmental changes (which include home modifications); (3) behavioural adjustments (e.g. avoid stairs) to overcome impairments (DeFriese, et al., 1994). Education and training also plays an important role in helping a carer better understand the full potential of these supports. *Assistive Technology* can be broadly defined as "*devices and techniques that can eliminate, ameliorate, or compensate for functional limitations*" (Pope and Tarlov, 1991, p. 225)

In reviewing these definitions it becomes clear that home care and self care are quite distinct, further that homecare implicitly encompasses both formal and informal provision of personal care delivered in a community setting. However, traditional definitions of homecare fail to allude to or mention self care, because by definition it is an adaptation response of the individual based on either a behavioural or environmental adaptation to a functional problem.

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2. Research Methodology

In order to illustrate the potential of the substitution of waged home care services for home modifications, this study comprises three overlapping research activities:

1. Literature Review

Reviewing a diverse range of publications, policy documents, and legislation relating to aged population, functional disablement and housing modifications.

2. Case Study

Developing three hypothetical user profiles via simulated case studies -as a benchmark to illustrate the complex nature of a person's health needs, daily activities, home modifications, care and cost.

3. Cost Analysis

A cost analysis involving establishing a system of calculating and converting home modifications and waged home care into relevant economic values and comparing these cost outcomes.

Literature Review

The literature reviewed within this report has been presented using a thematic structure similar to a standard narrative literature review as this suited a broad thematic, cross-disciplinary approach that drew on published materials from health, care and built environment databases. Our narrative presentation however draws on a systematic search methodology (see Appendix A for evidence of the search process). The systematic search methodology employed provided our meta-analysis with greater rigour. The research synthesis resulting is intended to be replicable by others and is designed to create consensus among scholars while focusing debate in a constructive fashion (Cooper, 1998). It is a form of qualitative meta-analysis and as such is intended as an integrative publication. Similar to other integrative publications such as practice guidelines, economic evaluations, and clinical decision analyses this report is based on a retrospective evaluation of the literature currently available and so is subject to both systematic and random error (Cook, Mulrow, & Haynes, 1997). Therefore the focused questions and the comprehensive and explicit search strategy employed in this research were adopted to minimise if not eliminate these known biases.

A traditional systematic review strategy involving criterion-based critical appraisal based on an established hierarchy of evidence was impracticable to implement because of the limited nature of the evidence currently available. The lack of experimental research means that illustrative case studies and the thick description of qualitative interviews become more important (Evans & Benefield, 2001). Further, reporting results using the typical systematic categories of nationality, research rigour etc. was not employed as it has the potential to distract from the key themes without adding significant new understandings. The narrative presentation approach is the best

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fit for research of an exploratory nature positioned within a sparsely researched topic area (Hammersley, 2001). Therefore a meta-analysis of the literature is deemed important despite the lack of experimental studies, because decisions based on care substitution are being made every day in the daily lives of people with functional limitations, those providing assessments and those funding the types of care provided and so a synthesis that makes clear the elements involved is critical.

Case Study Approach

The case study as a research methodology has been widely utilised in social science literature (Abramson, 1991; Stake, 1995; Yin, 1994). By selecting a single individual, group, or event to explore causation, case studies are based on an in-depth investigation in order to find underlying principles (Shepard, 2001; Yin, 2008). As a research strategy, case studies are an empirical inquiry to investigate a phenomenon within its real-life context, from which both generating and testing hypotheses become possible.

The case study method was deemed an ideal supplementary methodology for this research because of its ability to describe and illustrate a complex situation. This report seeks to better understand the substitutive relationships that can develop surrounding care in the home, where health, available care support and degree of home modifications are all highly individualised and each come into play to varying degrees.

The use of case study evaluations conducted specifically to illustrate the costs of community care has been utilised in a number of previous studies. For instance Hill PDA, Rider Hunt, & Brian Elton & Associates (1999) cite a South Australian cost-benefit conducted in 1986, and the results of research into the cost-benefits of accessible housing on community care indicated a direct cost benefit to the community. Another example is the Netten and Curtis' UK study, which investigates the unit cost of community care and utilises case studies drawn from a sample of older home care service users in 2005.

Indeed the use of case studies is not novel as they have the ability to describe escalating degrees of functional dependence, and to illustrate how home modification costs may compare with pre-modification care level costs. In this report, each case was a real de-identified community care case obtained from a range of NSW based HACC Home Maintenance and Modification Services program providers. The cases used were made available by an existing HMMS provider and were selected from their database of files based on their currency (implementation within past 3 years) and on their ability to be generalised. Each case study is presented in this report via a carefully designed template. This template, which incorporates theoretical frameworks including the enabler ideogram (Steinfeld & Danford, 1999), person-environment fit (Brandt & Pope, 1997) and a cost analysis, acts as a filter to sharpen the understanding of the complex relationships that occur between care, health and home modification. Therefore utilising case studies to explore and generate a hypothesis surrounding the

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substitution and cost benefit was deemed a practical and revealing methodology in this report.

Cost Analysis

A cost analysis was established within each case study to directly compare community care costs with home modification costs. At this early stage of the research into home modifications and care substitution, the cost analysis is representative of government cost outlay only, in line with the initial research task investigating government expenditure only. A more comprehensive and extensive Cost-Benefit-Analysis would also factor in values for improvements in wellbeing, time saving, improved safety to community members (Watkins, 2004) and reductions in careworker injuries. A brief synopsis of the methodology used in the cost analysis in this report is outlined below. A more detailed costing methodology is described in section 4 of this report.

How care costs were calculated

Care costs were determined by referencing the ADHC Report "HACC NSW Unit Cost Benchmarking Study 2005 -Service Provider Feedback" (Department of Ageing, Disability and Home Care, 2005). This report tables a full range of care service pay scales with highest/lowest unit castings. For this report, a median of these price variables was taken. Median prices were then recalculated to incorporate Consumer Price Indexation (CPI) since 2005, bringing the unit cost values up to date for 2010. CPI values were calculated using the Reserve Bank of Australia's online CPI calculator[3]. An average of these updated hourly rates was calculated and incorporates the range of hourly care service in the table.

How care hours were calculated

The cost analyses within each case study utilise an average weekly number of care hours sourced from publicly available data published by Alzheimer's Australia and developed by Access Economics (Access Economics, 2009b).

Home modification cost data

The cost values of home modifications included in the case-studies in this report are based on actual prices supplied by Home Modifications and Maintenance Services (HMMS) providers who agreed to provide de-identified file information. The provided quotes had been set up within the HMMS fee framework, incorporating the range of subsidy levels and had been designed to establish cost to the client.

HMMS fee structures are set within three levels, entrance to each level depending upon total cost values of the modifications recommended, and each level represents a different subsidised rate to the client. Because this report utilises the cost of home

[3] Reserve Bank of Australia website. http://www.rba.gov.au/calculator/

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modifications as they relate to the government provider, and not the adjusted fees charged to the public clients, appropriate calculations to remove any subsidies were conducted and final values reflect current commercial labour rates.

Given the short time frame allocated to this report, the methodology of obtaining and adjusting already costed home modifications within a case study was considered an accurate and timely approach when compared to the method of consulting a published building guide with generic building and labour values.

3. Literature Review

General Structure of the Review

Relevant literature tended to cluster around four main topic areas, which comprise the structure of the review:

1. Community Care Systems
2. Home modifications
3. Self-care
4. Care Substitution

As explained in the previous Methodology section, this review is approached in a systematic manner, however limited research in the topic area of *home modifications as a substitute for waged home care* led the review to take a more exploratory, narrative format.

Community Care

Community care, which is loosely defined as *care based in a community setting* (Khoosal & Jones, 1989) can be provided in a variety of formats, including formal, informal and (the lesser researched) self-care in an accessible home environment.

Formal care includes waged home care services such as those delivered by Home and Community Care:

> *"Formal care is regulated care delivered in either residential or community settings, including the person's own home. Most formal care is funded through government programs but may also be purchased privately." (Australian Institute of Health and Welfare, 2007, p. 493).*

Informal Care refers to the unpaid services provided by family, friends and neighbours:

> *"An informal carer is considered to be a person, such as a family member, friend or neighbour, who provides regular and sustained care and assistance to the person requiring support, usually on an unpaid basis." (Australian Institute of Health and Welfare, 2007, p. 493).*

Self-care has no universally agreed definition possibly because it is a term that can be applied in diverse medical circumstances (Levin, Katz, & Holst, 1977; Van Der Geest,

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1987), however in the context of community care it often refers to the ability to provide care for oneself. The longest standing definition is as follows:

> *"Self-care in health refers to the activities individuals, families and communities undertake with the intention of enhancing health, preventing disease, limiting illness, and restoring health. These activities are derived from knowledge and skills from the pool of both professional and lay experience. They are undertaken by lay people on their own behalf, either separately or in participative collaboration with professionals." (World Health Organisation, 1983, p. 2)*

Over the past 30 years there has been a better understanding of the blending of these community care formats (Liu, Manton, & Aragon, 2000). Along with the understanding that these care formats can blend with each other, is the theory that in some cases, care types will substitute for each other (Agree & Freedman, 2000).

The policy of developing community care systems is underpinned by the desire of elderly and people with limited functional ability to remain in the community. This desire has been established in the literature and is recognised as a key to successful ageing and achieving optimum wellbeing (Secker, Hill, Villeneau, & Parkman, 2003; Tinker, 1999). For many older people admission to long-term institutional care is a last resort and is associated with dependence on others, and with a profound loss of choice and usefulness (Bland, 1999; Salvage, Jones, & Vetter, 1989; Secker, et al., 2003). Community Care plays a role in promoting independence by enabling people to stay in their own homes, and also by facilitating models of self-care within its implementation.

Community Care Models

Since 1985 Australia has been pursuing a policy of deinstitutionalising (Gibson, 1998) and currently provides a diverse range of community care programs aimed at;

> *“Enabling the frail aged and people with a disability to live independently in their homes for as long as it is reasonably possible by ensuring they have access to appropriate services” (Commonwealth Department of Health and Ageing, 2003, p7).*

Community care has been a neglected area of academic research (Twigg, 2000). Even less research has been conducted into the relationship between community care and the home environment. To date, research has focused on the provision of care rather than the development of a housing and community care strategy (Faulkner, Findlay, Barrington, & Luszcz, 2004). This is surprising given that housing is the foundation of community care, as the place where community care is delivered (Bochel, Bochel, & Page, 1999). In addition, very little research has been conducted into the significance of home environment and design for community care provision, with health care environment research focusing on residential and high level health care facility environments (Devlin & Arneill, 2003).

One of the key differences between being cared for in an institution and cared for in your own home is that community care is practiced in a client-controlled environment - the home (McMurray, 1990). This is associated with a shift in power and represents a fundamental shift in how care is delivered – and is one of the premises of a Consumer Directed Care approach.

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Consumer Directed Care

Community care delivery is experiencing a move towards personalisation, customer-focused service delivery, empowering people through choice and control over their care decisions (Access Economics, 2009a). Dissatisfaction with care delivery, disempowerment in care provision and the environmental barriers associated with limited functional ability have all contributed to support for a more customer focused assessment and care delivery, such as *Person Centered Planning* (PCP) and *Consumer Directed Care (CDC*).

The welfare and care systems in which CDC has been developed overseas (in UK for example) are different to the Australian context (Tilly & Rees, 2007). However the influence of CDC is being extended across Australian programs and services to increase consumer choice; and indeed, one of the current goals of *The Aged Care Industry Council Federal Budget Submission* (2010) includes ensuring greater choice and responsiveness for consumers (Aged Care Industry Council, 2010).

It is now recognized that empowering people to make informed choices about their treatment and care, through discussion and time for reflection, is fundamental to the promotion of a sense of independence (Secker, et al., 2003). The objective of *Consumer Directed Care* is to give more choice and control to the cared for over their care arrangements (Tilly & Rees, 2007). Self-care is one of many care components in the spectrum of a community-based Consumer Directed Care model. It is one that deliberately sets out to foster choice, independence and empowerment for those being cared for.

Australian Community Care Services

The Home and Community Care (HACC) program is the main community care program in Australia, and is cost-shared between the Commonwealth (60 per cent) and State and Territory governments (40 per cent). The program provides funding for a range of services to prevent institutionalisation of older or disabled persons who are at risk of inappropriate admission to long-term residential care (Australian Government Department of Health and Ageing, 2010) as well as support to their carers.

The Home and Community Care (HACC) National Service Standards (Home and Community Care, 1991) set out key principles designed to ensure that services are allocated in a fair and equitable manner based on needs assessment. The New South Wales HACC program has produced additional guidelines pertaining to the HACC-funded services in New South Wales (Home and Community Care, 2007a). These guidelines include:

- Service type guidelines for some service types including HMMS
- Interagency Protocols for responding to abuse of older people
- Additional NSW HACC MDS reporting requirements.

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The Home Modification and Maintenance Services are two of many services offered by HACC. According to an analysis of the HACC minimum data set, Home Modification and Maintenance Services are accessed by at least 3.1 percent of the total HACC client base (Australian Institute of Health and Welfare, 2003). This figure is potentially higher because of the risk of underreporting HMMS services - some clients elect not to have the dates of their care reported, and not all community care services report.

Demand for community care

There is evidence of an increasing demand for HACC services in alignment with an ageing population. Between 1998 and 2007, the number of elderly people receiving subsidised care in Australia increased by more than 50 per cent, with a dramatic increase in the demand for all forms of community cares services (Grant Thornton, 2008). As further evidence of the high demand in the area of community care provision, a report by the National Ageing Research Institute (2001) outlined the administration processes required to manage the high demand on HACC and other community care services. These included the need to prioritise clients and ration services, the need for waiting lists, and the limited promotion of services.

Home Modifications and Maintenance Services (HMMS)

Home modification and home maintenance are two of the service types that the HACC Program funded nationally to support people to remain living independently at home or to prevent the premature admission into residential care. The Home Modification service assists clients who need structural changes ranging from small installations to full-scale construction projects such as wheelchair ramps, wider doorways, or bathroom modifications. The maintenance service includes minor and major repairs and maintenance to dwellings, ranging from changing light bulbs to repairing roofs (Home and Community Care Program, 2007). There is evidence to suggest that the implementation of home modifications and maintenance programs can have direct and positive impact upon safety, independence and lifestyle (Jones, et al., 2007).

Who is currently using Australian home modification services?

Given that at least 3.1 per cent of HACC clients utilise home modifications and maintenance services (Australian Institute of Health and Welfare, 2003), it is useful to review how these services are being used and by whom. The demographic profile of those utilising HACC home modification services are older and more likely to be female (Australian Institute of Health and Welfare, 2003) and must own the home being modified.

The HACC Minimum Data Set (MDS) is a collection of data about HACC clients (including age and living arrangements) and the amount and types of care being provided to them through the HACC Program. According to the analysis of the HACC MDS undertaken in 2001-2001, Home Modifications and Maintenance services availability and usage appears to be distributed unevenly across the States and Territories – NSW account for the greatest proportion of HACC-funded home

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modifications, while Victoria and Western Australia account for the greater proportion of maintenance services (Hodges & Bridge, 2007) due to differing policy settings.

The HACC MDS 2001-2002 data indicates that those who do not speak English, or who were not born in Australia are also underrepresented in the population as accessing home modifications through HACC. Indigenous clients were represented in a proportion equivalent to that of their census population numbers (Hodges & Bridge, 2007). The Aboriginal Home Care Service of NSW provides the vast majority of Aboriginal Home Care services. Based on a comparison of indigenous and non-indigenous Australians, 6.28 per cent of HACC Home Care clients are Aboriginal (Department of Human Service, 2010).

Demand for home modifications

Home Modification and Maintenance is a relatively small stream within the Community Care Sector. For instance only 3.1 per cent of HACC Clients were reported as receiving home modifications through HACC (Australian Institute of Health and Welfare, 2003). In contrast, home modifications appear to be more prevalent, with approximately 24 per cent of HACC Service Clients living in private housing having made modifications to their home because of functional limitation (based on HACC MDS data 2001/2) (Bridge & Gopalan, 2006).

It is difficult to quantify either actual demand or unmet demand for home modifications in Australia for a number of reasons. There are the challenges of conceptualising need for any community service, as people's perceived, real, expressed and comparative needs are subjective and changeable (Jones, et al., 2007). Demand for Government funding for home modifications is not an accurate indicator of actual demand, as eligibility criteria for such funding can be restrictive (Nissim, et al., 2008). The tendency for people to underreport their modification and maintenance needs as well as the likelihood of people choosing behavioural changes over environmental changes (Heaton & Bamford, 2001; Pynoos, Tabbarah, Angelelli, & Demiere, 1998; Steinfeld & Shea, 1993), or even 'make do' (Smith, Quine, Anderson, & Black, 2002) also compound the inadequacies of data quantifying unmet need. The need for further data collection in this area is further highlighted by inadequate Census data on housing in general (Gilderbloom & Markham, 1996). Thus there is no clear picture of the true unmet need for Home modifications in Australia, although some statistical signs indicate that this unmet need does exist.

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Significance of the home environment

The significance of housing design to a population's health, wellbeing and social participation has been recognised in research both locally (Bridge, 2005; Jones, De Jonge, & Phillips, 2008; Kendig & Bridge, 2007), and internationally (Imrie, 2006; Preiser & Ostroff, 2001). An overview of Australian housing stock indicates that a majority (57 per cent) of Australian homes are over 20 years old (Australian Bureau of Statistics, 1999), with many up to 100 years old; and they were designed and built at a time when consideration was not made for the needs of the elderly or those with functional impairments. Australian homes, be they free standing or unit dwellings, may incorporate such features as stairs, narrow doorways and older bathroom designs that do not allow safe and independent living for older people or people with a disability. Home modifications can play an important role in enabling the Australian population to 'age in place' independently.

Many existing homes have been designed and built to suit a young healthy adult with complete functional ability (Bakker, 1999; Bridge, 2006a; Bridge & Gopalan, 2006), and therefore exclude the ability for a growing sector of the community to live independently. Short of relocating to a more accessible home environment, home modifications are one of a number of ways people with functional limitations can adapt to or change the environment to meet their needs. The five methods of adaptation as outlined by Pynoos, Cohen, Davis, & Bernhardt (1987) include:

1. Structural changes
2. Special equipment
3. Assistive devices
4. Material adjustments
5. Behavioural changes

Home modifications constitute *structural changes* to the environment and can include adaptations such as door widening and installation of ramps, and also equipment such as grabrails, lighting and lifts. A number of other terms are often used synonymously such as *environmental intervention (EI)*, *environmental adaptation*, or *retrofitting*. These terms all refer to altering the existing structure of a home to accommodate functional limitations (Bridge & Gopalan, 2006). Other terms for environmental change include *renovation*, or *remodelling* however these alterations refer to changes driven by activities, investment maximising or lifestyle (to accommodate more children). A comprehensive definition of *home modifications*, acknowledging their relationship with care giving, has been given by Pynoos et. al. (2003):

> *"Home modifications are environmental adaptations aimed at creating a more supportive environment, enhancing participation in major life activities, preventing accidents, facilitating care-giving, and minimizing the need for more costly personal care services."* (Pynoos, Nishita, & Perelma,2003. p107)

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Home modifications and accessible environment

The literature indicates that for those living in accessible environments, there are a number of benefits;

- The rate of functional decline is reduced (particularly the frail elderly) (Mann, Ottenbacher, Fraas, Tomita, & Granger, 1999),
- Autonomy, safety and daily task efficiency is improved (Roelands, Van Oost, Buysse & Depoorter, 2002; Sonn & Grimby, 1994).

Accessible housing is one of a range of terms used to refer to designs that have developed in response to recognition of the need for high standards of housing accessibility, particularly in the context of increased disability prevalence and ageing societies. It refers to an approach to housing provision that focuses on including the widest range of ability levels of occupants. Other related terms include Barrier-free, Universal, LifeSpan, Visitable and Inclusive Design. Some of these terms have developed into building codes; others convey a general design approach. All have the common goal of providing accessible home environments on a variety of levels.

It is acknowledged that a majority of existing housing in Australia can be considered inaccessible (Bridge, 2005). Australians have inherited housing designs from the past that fail to take into account changing needs throughout a lifetime, and are often designed with inaccessible features (Bridge & Gopalan, 2006). Home modifications provide a means of retrospectively addressing a lack of accessibility.

Inaccessible features in older homes may include:

- Narrow doorways
- Stepped entrances
- High door handles
- Bathroom problems e.g. shower with hob, lack of grabrail support for transfers.

How home modifications improve accessibility

It should be acknowledged that some properties are not suitable to be modified to improve accessibility for technical or cost reasons. Examples of scenarios where home modifications may not be tenable include (but are not limited to);

- Sites where limited land area does not permit the installation of walkways, ramps or lifts.
- A home where poor layout or lack of space in bathrooms does not permit an accessible redesign.

Despite these exceptions, where able to be specified correctly, and according to individual needs, home modifications have the ability reduce the disability threshold of an environment meaning that the home environment now *fits* the user and their functional capacity (Allen, Resnik, & Roy, 2006). For many (including older people and people with a disability) inaccessible households mean that remaining in the

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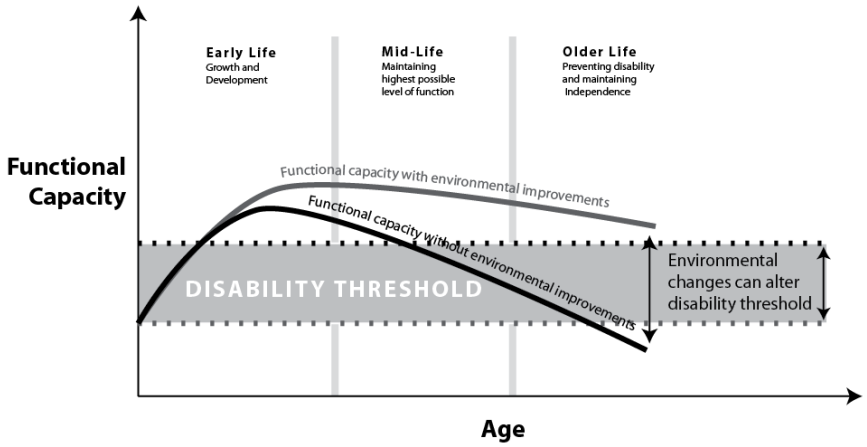
community without substantial home modifications is a difficult journey (Scotch & Schriner, 1997) and one often reliant on home care. In an inaccessible home, home modifications can symbolically act as a bridge, reconnecting those with functional disabilities with their home environments by reducing the disability threshold.

A better understanding of the concept behind the term “disability threshold” requires a clear understanding of The International Classification of Functioning Disability and Health (ICF) model of disability. The ICF, as developed by the World Health Organisation (WHO), models disability as a biosocial process, in which functioning and disability is experienced at three levels - the body, the person, and society. According to ICF classification, impairment information alone does not give a complete picture of the situation of disability, either in an individual or in a population. In addition, ICF includes a classification of environmental factors recognising the positive or negative impact of the environment on a person's functioning. It is this recognition of the importance of the environment that resonates strongly with research revealing the ability of home modifications to reduce disability (World Health Organisation & United Nations Economic & Social Commission for Asia and the Pacific, 2009).

The *disability threshold* is an arbitrary marker delineating between ability and disability. Although the disabling process lies on a continuum, there is a specific disability threshold at which a person’s functional capacity is disabling in a particular environment for a particular task.

Figure 1 has been adapted from Straton, et al., (2003) and originates from the World Health Organisation (2001). The diagram illustrates how functional capacity fluctuates with age, and how environmental changes can mitigate against a declining functional capacity by adjusting the disability threshold. With reference to functional capacity within a home environment, environmental changes could include the improvement of an existing home through home modifications, or the transfer to a new accessible home environment. Thus a supportive environment can enable people to remain independent despite reduced functional capacities.



Adapted from WHO, 2002

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Figure 1. How functional capacity relates to the disability threshold with environmental change. Adapted from Straton, et al., (2003) p20

Person Environment Fit

Brandt & Pope (1997) identified that a poorly matched environment can initiate a disability process, where daily tasks are limited, difficult and or impossible without assistance. Brandt & Pope developed an illustration that uses effective symbolism to represent the restrictive nature of the disabling process and poor person/environment fit. This diagram, through its symbols, reinforces the important role that home modifications can play in resurrecting inaccessible home environments. The original diagram has been reproduced in Figure 2 following.

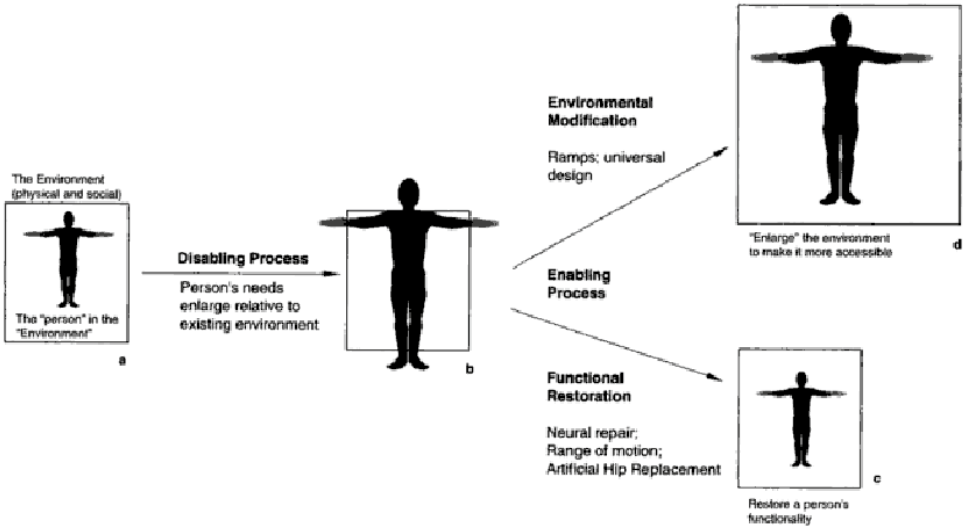

Figure 2. Enablement Disablement Process model.

Original diagram showing enabling-disabling process via the graphical representation of Person-Environment Fit (Brandt & Pope, 1997 p4.)

The symbolism used in Brandt & Pope's original work is explored in further detail in Figure 3. These symbols capture the relationship between the environment and disablement process, and versions of these symbols are incorporated into the case studies later in this report. In this symbolic adjustment of the environment, it is the environment that changes to accommodate the needs of the person. The person symbolically remains the same size – their functional ability does not change.

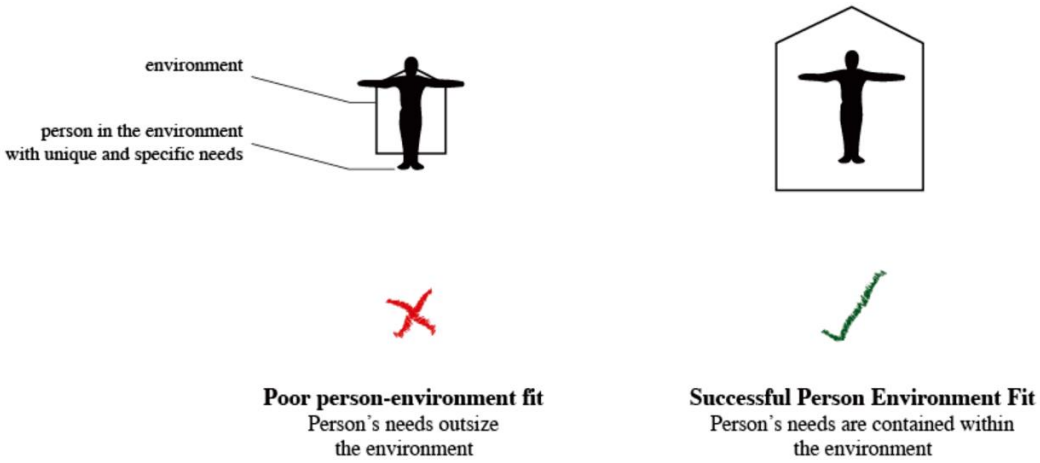

Figure 3. The symbols of Person-Environment fit adapted and remodelled by the author from original by Brandt & Pope (1997).

For a person with reduced functional capacity in an inaccessible environment, the need for personal care comes in to play. Care temporarily bridges any unmet needs by performing tasks on behalf of the person with functional limitations (e.g. bathing, toileting). Care can bridge unmet needs only when a carer is present; therefore care is in this sense a temporary and limited measure. The original Brandt & Pope diagram can be remodelled to include a representation for the temporary and limiting nature of care provision as it relates to the disabling process (see Figure 4).

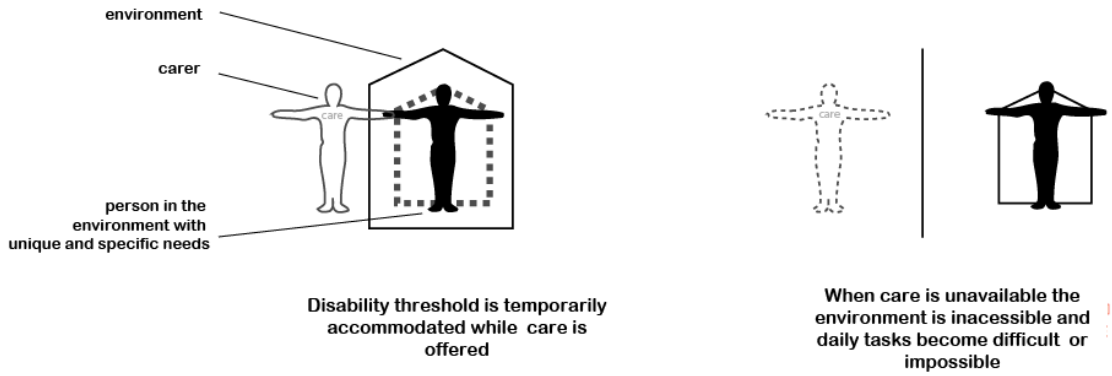

Figure 4. Authors extension of Brandt & Pope's symbolism to incorporate care model within the environment.

Home modifications when specified correctly, can replace the need for any or all care, and do so for as long as the person's functional ability does not decline (due to aging process, degenerative illness, or cognitive changes). As a final adaptation of the disablement process (Brandt & Pope, 1997), Figure 5 illustrates the enabling process as facilitated in a home environment by either care or home modifications.

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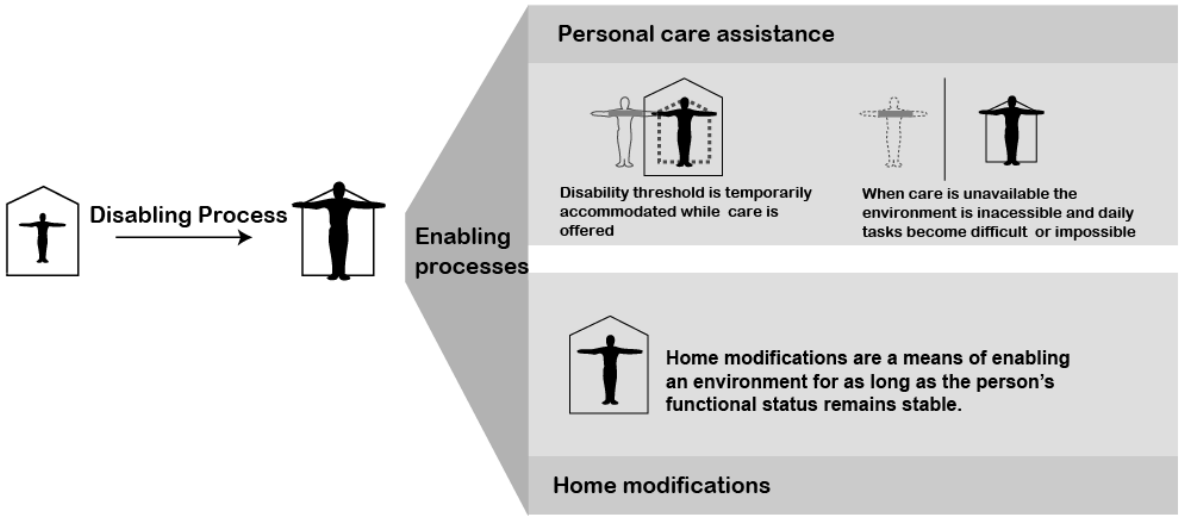

Figure 5. Disabling and enabling – the person/environment fit including personal care and home modification. This is the author's further and final extension and interpretation adapted from original model of Person Environment Fit (Brandt & Pope, 1997)

Home modifications and safety

Injuries in the home are common and account for more than one in three of all injuries (Lyons, et al., 2006). Fall related injuries lead to hospitalisation and higher risks of morbidity either directly or indirectly. Australian research has shown that people with fall related injuries spend an average of 11 days in hospital (Cripps & Carman, 2001). The ability to reduce or at least minimize the amount of injuries occurring in the home would result in considerable health cost savings, and therefore implies that research investigating the potential role of home modifications in this area is of relevance to health and community care providers.

According to a systematic review into injuries and home modification (Lyons, et al., 2006), the extent to which environmental factors cause or prevent injury in the home is inconclusive and requires further research, in particular research with larger study samples. There are some smaller studies suggesting that a significant proportion of falls are due to environmental factors (Connell, 1996; Sattin, 1992) and home modifications play a part in reducing the injuries older people experience at home (Ambrose, 2001; Chang, et al., 2004; Van Haastregt, Diederiks, Van Rossum, De Witte, & Crebolder, 2000). These smaller studies imply that reducing the risk of fall injuries by modifying home environments could result in considerable saving to health costs including hospital care.

Environmental hazards are common in homes of all older people regardless of the existence of impairments. Older people confront numerous difficulties navigating at home and encounter environmental problems that include the need for home modification and maintenance needs (Clemson, Roland, & Cumming, 1997; Gitlin,

Corcoran, Winter, Boyce,& Hauck, 2001). Home modifications can play a part in removing or at least minimising any identifiable home hazards.

In addition to helping the elderly and disabled, home modifications can assist their carers. Modifications make the home environment more conducive to caring, for instance installing ramps for a mobility impaired person, or providing grabrails to assist during the difficult task of bathing. Thus home modifications can make the home a safer place for both care givers and those being cared for (Axtell & Yasuda, 1993; Cantu, 2003; Trickey, Maltais, Gosselin, & Robitaille, 1994). These studies lend weight to the argument for the ability of home modifications to support or supplement care, if not substitute for care itself.

Home modifications can contribute to the safety of home environments by providing better support features throughout the home (grabrails), removing potential hazards (stairs), facilitating mobility (ramps) or by minimising severity of fall injury (Healey, 1994). It is vital that home modifications are installed correctly however, as poorly installed home modifications can contribute to injuries in the home and in themselves become a hazard (Bridge & Oram, 2005). The link between correctly installed home modifications and a reduction of fall injuries in the home implies that home modifications could be indirectly associated as limiting potential burden on health care networks, although this elimination of health/medical care costs is difficult to quantify.

Are there situations where home modifications do not benefit?

There will be cases where home modifications are not tenable or desirable. First, the feasibility of a home modification hinges on the ability and permission to conduct building works to premises. Home tenureship (renting or owned) and dwelling type (freestanding or unit) has a part to play in the type of care models received and whether home modifications can be made at all (Bridge, Kendig, Phibbs, Mathews, & Cooper, 2008). Secure tenure is important to minimise likelihood of institutionalisation (Bridge & Kendig, 2007).

Second, there are certain psychosocial profiles that predetermine whether a person is more or less likely to utilise home modifications. Emotional wellbeing and self-esteem are important indicators that environmental modifications will be proactively taken up by a person. The presence of depression (often linked with loss of mobility/function) can also have a cycling negative effect on a person's ability to self-help (Gitlin, Mann et. al. 2001). There may also be situations where replacing care with a non-labor substitute (such as home modification), leads to increased isolation and less personal contact – causing loneliness (Roelands, Van Oost, Depoorter, et al., 2002). Therefore successful implementation of a home modification solution needs to take into account the mental state of a person living at home.

Finally, timing is also crucial factor to the success of home modifications. Because of continually changing care needs and the potential for declining health, home modifications need to be implemented efficiently to be effective. One study revealed that each consecutive month a person waited for their home modification the difficulty

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of performing everyday life tasks increased (Petersson, Kottorp, Bergstrom, & Lilja, 2009). Thus efficient prescription and installation of home modifications is important in reducing mounting difficulties with daily tasks.

Home modifications and their impact on care needs

There is limited evidence on whether and how home modifications affect the need for care provision however a recent report sourced from the UK based charity *Care and Repair* refers to three community based case studies which directly attribute improvements in service and saving efficiencies through care reduction to home modification initiatives (Home Adaptations Consortium, 2010). Of studies that are conducted exclusively on home modifications, one reveals that home modifications can prevent disability by altering the disability threshold and facilitating self-care (Verbrugge & Sevak, 2002). Another two of the studies indicate that widespread adoption of home modifications may lead to a decrease in disability in later life (S. Liu & Lapane, 2009), and reduce functional decline (Mann, et al., 1999). The Verbrugge & Sevak (2002) study has a large sample [n=100,000] drawing from the US National Health Interview Survey Disability Supplement, while the Liu & Lappane (2002) has a smaller sample [n=9,447] and the Mann et al. (1999) has the smallest sample size [n=104]. Despite the wide variable in sample sizes between the studies, all three indicate that home modifications are attributed with positive impacts on disability and hence are a buffer against functional limitation within a home environment.

In terms of their effect on care streams other than community care, one American study shows that home modifications are linked with a decreased likelihood of entering a nursing home (Newman, et al., 1990). Another study, also American, found that the presence of home modifications decreased the use of informal care among a sample of adults who use wheelchairs (Allen, Resnik, & Roy, 2006). These studies suggest that home modifications do have a direct impact on care provision in general, which is important evidence for the effective substitution of care.

Also of interest to this study is the impact of home modifications on independence in Activities of Daily Living (ADL), which in turn determines care needs. Daily tasks are incorporated into ADL and refer to any daily activity performed for self-care, work, homemaking, and leisure. The ADL is a summary of performance in bathing, dressing, going to toilet, transferring, continence, and feeding (Sunnaas Hospital Dept. of Occupational Therapy, 2000). Two studies, one based on American National Health Interview Survey and the other the Canadian Health and Disability Survey reported that users of home modifications were more independent in ADL performance than non-users (Fox, 1995; Allen, Resnik, & Roy, 2006). Specifically relating to the ADL of bathing, research has revealed that home modifications result in a decreased need for bathing personal care assistance among older adults (Gitlin, Miller, & Boyd, 1999). Collectively, these studies imply that home modifications have the capacity to minimise individual care needs by enabling individuals to perform tasks independently in their own homes.

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Self-care

The ability of home modifications to reduce the disability threshold within the home environment (as discussed in previous section) relies upon the practise of self-care. Self-care is defined as:

> *"Self-care in health refers to the activities individuals, families and communities undertake with the intention of enhancing health, preventing disease, limiting illness, and restoring health. These activities are derived from knowledge and skills from the pool of both professional and lay experience. They are undertaken by lay people on their own behalf, either separately or in participative collaboration with professionals."* Attributed to (WHO 1983) as it appears in (DeFriese, et al., 1994 p101).

There are three types of support for self-care: (1) assistive technology; (2) environmental changes (which include home modifications); and (3) behavioural adjustments (e.g. avoiding stairs) to overcome impairments (DeFriese, et al., 1994). Assistive Technology can be broadly defined as "*devices and techniques that can eliminate, ameliorate, or compensate for functional limitations*" (Pope and Tarlov, 1991, p. 225). Training and education also plays a crucial role self care support, by encouraging the correct use of Assistive Technology and educating about the potential benefits of behavioural adjustments.

According to Agree (1999), self-care through the use of assistive technology is the most common form of long-term care. Self-care is rarely discussed as a viable alternative to formal (paid) and informal (unpaid) care streams. This report strategically investigates how self-care might be positioned within the community care sector as a viable substitution for other care types reliant on the availability of external labour sources.

For a self-care approach to succeed requires the application of a holistic approach to health, home environment and care. The provision of appropriate training and effective home-based assessments are important factors in the successful adoption of self-care (Kohn, LeBlanc, & Mortola, 1994; Sanford, Arch, & Megrew, 1995; Steinfeld & Shea, 1993). Thus self-care is not a stand-alone solution to comprehensive community care programs, and must work within the framework of a holistic home care approach.

Self-care: The added value of independence

One of the benefits of integrating a self-care approach through home modifications is the level of improved independence in those whose reliance on care within their home is minimized. Agree (1999) describes how one of the differences between self-care and formal care is that self-care, through the use of home modifications, does not require the ongoing cooperation and coordination of others and instils a sense of independence with which the elderly /disabled can meet their needs long-term.

A person's drive to achieve self-care and reduce reliance on others can be overt and self-motivated. There is evidence to suggest that the disabled elderly will actively reconstruct and modify their environment to reduce distress in carers and their own

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functional decline (Gitlin, et al., 2001; Mann, et al., 1999; Tinetti, et al., 2002). This type of active adaptation informs our understanding of how highly independence is valued.

Independence can be understood to be;

> *"A subjective state of self-determination whereby the individual, with or without the assistance of others and regardless of disability, is able to dictate the path that his or her life should take." (Fisk, 1986 p4)*

When discussing the value of independence, it is important to understand its definition in the context of aged care. The term independence is recognized as the ability to take responsibility for one's own performance and desires. A person who has some difficulties with task functions can still be independent with the use of tools (assistive technology and home modifications), training and with the management of supportive care (Mann, et al., 1999).

A finding that may be surprising to some is Secker's (2003) research showing that a sense of independence is not necessarily directly related to autonomy. Secker's model of independence illustrates (using independent axes) that reliance on others and a sense of independence are not mutually exclusive. A person can be reliant on others for the most basic of care needs, but through a sense of control over their environment and care, they can experience independence.

Also realising the importance of the home for older adults in terms of the continuity of memories and experiences the home represents (Csikszentmihalyi & Rochberg-Halton 1981) leads us at least in part, to consider the complex interdependence of care, independence and self-care within the home.

Self-care and Bathing

The ADL of bathing is particularly revealing when studied in the context of bathing disability, care substitution and self-care. Many older adults have difficulty bathing, and those unable to bathe will require assistance in the form of care (Meera George, Aanand, & Naik, 2006). Decreased function in bathing is prevalent in older people, and in itself can be an indicator of morbidity and mortality (Brody, Johnson, & Ried, 1997; Gill, Guo, & Allore, 2006; Reuben, et al., 2002).

The links between bathing difficulties and the need for care services are strong. There have been associations made between bathing difficulties and the receipt of home care services (LaPlante, Harrington, & Kang, 2009), and long-term nursing home admission (Gill, Allore, & Han, 2006). Bathing is one of the first ADL skills lost in a nursing home population (Cohen-Mansfield & Werner, 1995; Dunlop, Hughes, & Manheim, 1997) and bathing disablement is one of the earliest signs of impairment in Alzheimer's (Norman & Lancaster, 1990). In light of these connections, home modifications focused on the prevention of bathing disability alone can directly address how long-term care services are provided.

Bathing is defined as the task of washing and drying one's whole body (Meera George, et al., 2006). On a simplistic level, bathing relates to hygiene, however when reviewing

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bathing as a daily task involving the elderly or disabled, bathing brings with it with many other complexities relating to independence, emotion, safety and cultural issues. One study details the high distress experienced by some Alzheimer sufferers during care-assisted bathing, and attributes this to feelings of vulnerability and discomfort – directly associated with poor person-environment fit (Cohen-Mansfield & Parpura-Gill, 2007).

Further adding to the complexities of the bathing experience is the issue of introducing a carer into the private domain of bathing. To many bathing is relaxing, pleasurable and is a highly individualised and personal act (Cohen-Mansfield & Parpura-Gill, 2007), but it is also very private. Determining culturally appropriate care can add further complexity and symbolism and very specific bathing conditions may be required.

Understanding the symbolism attached to bathing, and what is lost when a person can no longer self-care during bathing leads to an appreciation of how preventing bathing disabilities plays a large part in maintaining independence and sense of control (Twigg, 2000). This also explains in part the link between bathing disabilities and long term care admission.

In terms of the potential for home modifications to substitute for care assistance in bathing, some studies raise the possibility that tasks for which privacy is a paramount concern may be most conducive to substitution eg. grabrails adjacent to toilet (Agree & Freedman, 2000).

When a carer is required to assist in the personal task of bathing it introduces a wide range of potential difficulties and dangers for both the cared for and the carer. The carer has a difficult task in discreetly and safely supporting and washing a person's body with the important task of maintaining comfortable and safe temperatures both in and out the shower/bath. There is a high risk of injury to the carer in this difficult OHS situation. Add to this the obvious risks of being in a wet environment or being partially submersed in water, surrounded by hard and slippery surfaces and the complexities of bathing and care begin to become apparent.

If simple modifications in the bathroom could eliminate the need for care giving – or at least make care-giving and bathing safer and more enjoyable, then the substitution of waged home care would have multiple benefits.

Is self-care always the ultimate goal?

Providing a wide-ranging care solution in the form of home modifications is a challenge given the characteristics of the majority of the target market. The elderly population exhibit traits that assist in defining their demographic (Bakker, 1999), and these characteristics have an impact on how care is best delivered. A summary of behavioural and environmental characteristics of the elderly include that as a group they;

- Display a wider range of both physical and psychological differences than any other age group
- Have changing needs and require ongoing assessment of the environment

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- Live in varying housing arrangements and structures, with unique characteristics
- Engage in learned behaviour that affects their relationship with the environment.

These characteristics influence the viability of a self-care approach. For a person to remain at home despite functional limitations, successful home modifications depend upon the following conditions (Lansley, McCreadie, Tinker, et al., 2004):

- The extent of their functional limitations (and their own perspective on their limitations)
- The presence of learned helplessness and/or depression
- The ability of home modifications to meet the needs arising from their functional limitations
- The cost of the proposed modifications and the suitability of existing home for modifications
- Whether care support is required to supplement any home modifications and whether this care is available.

The success of conditions is also dependent on the acceptance and agreement of those who will be impacted by the home modifications, and whether in fact quality of life will be improved. Although some of these conditions are measurable and can be predicted, for example costs and functional limitations, other psychological factors may be much more subtle and difficult to predict. This is one of the difficulties in predicting the success of home modifications as a substitute for assistance with personal care.

Self-care and learned helplessness

A person's mental state and outlook has a large part to play in whether a change in care from personal assistance to self-care (via home modification) is a success. Increased depression incidence is linked with increased physical impairment (Badger, 2007). In addition to this relationship, research shows that depression has an inverse relationship with involvement with others and a sense of usefulness (Stevens, 1993), implying that social contact and independence are important to maintaining a positive outlook. Taking these relationships into consideration, it follows that depression can have a negative impact on active self-care which in turn decreases functional ability, causing more depression (Tomita, Mann, Fraas, & Stanton, 2004).

The success of the introduction of self-care and home modifications can be compromised by the condition of learned helplessness. Learned helplessness is the state in which individuals believe that they have no opportunity or ability to change their lives and enter a spiral of depression (Seligman, 1975). Problems arising from learned-helplessness make self-care a non-viable model of care in some circumstances simply because of an unwillingness to engage in maintaining independence – a drive that is fundamentally central to the success of home modifications (Abramson, Seligman, & Teasdale, 1978). There is some evidence to suggest that cognitive behavioral approaches may reduce learned helplessness by promoting learned resourcefulness (Zauszniewski, 1997). Thus, learned helplessness can be an obstacle to the success of

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the introduction of self-care, however it is a condition that can be improved through therapy.

Interestingly, in the longer term, if self-care approaches can be introduced into the homes of people suffering from depression, there is also evidence to suggest that self –care can improve a person's psychosocial status. Research indicates that there is a clear relationship between psychosocial status (less depressed state and higher self-esteem) and improved self-care through assistive device usage (Roelands, Van Oost, Buysse, & Depoorter, 2002; Tomita, et al., 2004). Thus self-care practices have the potential to improve some existing psychosocial problems.

Manton, Corder, and Stallard (1993, p. 176) stated that incentives for assistive technology use among elderly people could increase their social autonomy. Similarly, use of equipment has been shown to be effective for reducing and resolving limitations, and, compared with personal assistance from others, allow elders to maintain a greater sense of self-sufficiency (Verbrugge et al., 1997).

The benefits of functional adaptations are not only realised at the individual level, but have also been shown to affect national medical expenditures. In a recent study, Stearns and colleagues (2000) found that certain lifestyle practices and functional adaptations among elderly adults were associated with reductions in Medicare expenditures (Mathieson, Kronenfeld, & Keith, 2002).

Drivers for a self-care alternative

Education, technology, rehabilitation, independent living, and deinstitutionalisation are all driving changes in care policies for older people and people with a disability. Self-advocacy in care arrangements has also been recognised as an important aspect of successful independent living as a driver of wellbeing/quality of life (Boyd, 1998). Of relevance to this report in establishing self-care as a model of care delivery via home modifications, are the following drivers for a self-care alternative:

- Lack of and cost of care facilities
- Lack of and cost of community care staff and informal carers
- Recognition of consumer-directed approach to care
- Recognition of a preference to self-care in private daily tasks.

As the population ages and chronic illnesses become more prevalent, the current levels of provision of nursing and health care staff cannot be maintained (Botsis & Hartvigsen, 2008) (Merrell & Doarn, 2006). Community care has come to the forefront of policy change because it is also likely that there will be a lack of facilities to accommodate the elderly, disabled and chronically ill. The Community-Based Aged Care Workforce report (commissioned by the Department of Health and Ageing) warns that all prospects are for a continuous shortage of nurses and personal care workers in the coming decades and continues that the expansion and training of aged care staff in general must be undertaken to a level well beyond anything contemplated in recent years (Australian Department of Health and Ageing, 2006).

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More notably, the elderly do not want to be admitted to these facilities despite chronic illness and/or disability as more elderly and disabled express the desire to remain in their own homes (Australian Housing and Urban Research Institute, 2010). A majority of long-term community care is provided in kind by informal (unpaid) carers (typically family members but also friends and neighbours), the public sector plays an important role in ensuring that these needs are met (Pezzin, et al., 1996).

Care assistance can involve personal touch that may cause embarrassment (bathing/toileting) and also raises issues surrounding the meaning of home, culture, independence, identity, status/power and relationships with others (Twigg, 2000). Home-based care involves allowing careworkers into a home environment with its own rhythms (Gitlin, 2003), encroaching into personal spaces within the home. Where assisted care is difficult to deliver sensitively, self-care is uniquely placed to substitute, and can mean the reclaiming of independence, the maintaining of long established routine and ritual, and correspondingly, the maintenance of wellbeing.

Care substitution

Why substitute care

The study of care substitution is important for a number of reasons. First, being able to offer effective care alternatives is in line with Aged Care Sector goals of providing maximum choice of care options *(Aged Care Industry Council, 2010)*. Second, there may be individual care situations where one care type is not appropriate or possible and an alternative is required (Agree, 1999). Third, there may be economic reasons why providers may want to offer an alternative care model as a substitute.

There has been a relatively small amount of research into care substitution, and the effectiveness of care outcomes, possibilities and economics. Much of the research into substitution of care has focused on the ability of home care to replace residential or hospital care and the economic consequences of this substitution (Chappell, Dlitt, Hollander, Miller, & McWilliam, 2004; J. Jones, et al., 1999; Shepperd, Harwood, Gray, Vessey, & Morgan, 1998) while other research investigates the interdependent role of informal and formal home care (Ettner, 2007; Greene, 1983; Greene, Ondrich, & Laditka, 1998; Tennstedt, Crawford, & McKinlay, 1993).

The specific substitution of interest to this study is the replacement of formal community provided care with a self-care approach made possible through home modifications. The economic benefits of substituting or supplementing waged home care hinge on the opportunity for home modifications to reduce the reliance on external paid care labour, which currently constitutes over 75 per cent of community care costs (Hogan, 2004). The current shortage of skilled home care is likely to push care wages costs up (Hogan, 2004; Iliffe & Lenihan, 2006; Wood, 2005). This demand for and relative cost of community waged-care reinforces the interest in determining equally successful and cost effective alternatives or substitutes. It is the economic value of a

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substitution between waged home care and self-care (with home modifications) that is examined in the case studies later in this report.

Research indicates that a person's living arrangements will impact on whether formal care is utilised (Houde, 1998). Informal carers provide most personal long-term care in the community with formal care supplementing the informal network as disability levels increase (Agree, 1999). Living alone indicates higher probability of formal care usage possibly due to limited informal care networks; in particular a female spouse, who often provides live-in care support. Informal care plays an important role in the provision of home-based care.

How care models substitute for one another

The relationships between care systems are complex, making research into determining the level of substitution and the reasons behind these levels equally challenging. Agree (1999) states that there are specific medical conditions whereby different combinations of care may be better suited. In addition, a person's psychosocial needs may dictate the best care options. Every care need requires a care solution tailored to individual requirements, and although a substitution process may be shown to be possible between care streams it may not always be advisable or feasible.

Agree (2000) found a stronger connection between formal care and assistive technology usage, and a weaker connection between assistive technology use and informal care. In this research, Agree uses the Pope & Tarlov (1991) definition of assistive technology that states that assistive technology is broadly defined as "*devices and techniques that can eliminate, ameliorate, or compensate for functional limitations*" (Pope and Tarlov, 1991, p. 225). According to Agree, a proportion of this relationship will be due to the link between the formal care and higher levels of disability; however the same study also found that the use of assistive devices is also consistently higher when formal services are a part of the long-term care arrangement, regardless of disability level. Agree hypothesised these results may be due to improved access to assistive technology through contact with the formal health system. (Agree & Freedman, 2000). Therefore, the supplementary role of self - care systems can be influenced by a range of external factors including access to information, existing informal and formal care arrangements and levels of functional limitation.

The viability of substituting amongst care types was succinctly reviewed by Agree & Freeman (2000), who found that early studies argued that care assistance was most likely to be provided first by the informal network (friends, family, neighbours) and that formal services were acquired only as a last resort (Cantor, 1979; Cantor & Little, 1985). Underlying this approach is the assumption that formal care can directly substitute for informal care at some point along the care-giving process. Another study however, suggests that care giving is a response to task-specific need for help and that the care solution will be dependent upon the ability to provide the task specific solution (Litwak, 1985). Litvak suggests that there will be needs that will only be fulfilled by specific types of helpers, ultimately meaning that helpers are not always substitutable.

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A more recent study found that in fact substitutability between informal and formal care is minimal (Pezzin, et al., 1996). Pezzin's results showed that formal care provision results in only small reductions in the overall amount of care provided by informal carers to unmarried persons and in no reductions for married persons.

Home modifications and care substitution

Relatively little is known about the ability of home modifications to substitute and supplement formal home care networks. Most of the work done in the field of care substitution has been conducted by a small number of authors. Agree et. al. has conducted extensive study into care substitution in American populations but covers assistive technology rather than home modifications (Agree, 1999; Agree, Cornman, & Freedman, 2005; Agree & Freedman, 2000; 2003). Of closer relevance to this report is the work conducted by Lansley, et.al (2004) that specifically investigated the cost effectiveness of home modifications within the social rented housing sector in the UK.

Agree and Freeman's (2000; 2003). research outlines the factors that will affect the substitutability of personal care with self-care (via assistive technology). Agree determined that the value of substituting formal care with self-care models needs to take into consideration not only economic value, but also the value of the sense of independence afforded to the disabled (Agree, 1999).

There is evidence to suggest that home modifications have an affect on the likelihood of institutionalisation (depending on whether care provision is formal or informal) (Newman, et al., 1990). There have however been studies that reveal evidence of a substitution process occurring following the introduction of assistive technology. de Klerk and Huijsman (de Klerk & Huijsman, 1996) reported reductions in the number of hours of home care used per week by an elderly sample (N=83) provided with technical aids by occupational therapists.

Understanding that there is an unmet demand for home modifications in the previous chapter, and with a current low supply stream of home modifications (only 3 per cent of HACC services), we can deduce that there is currently a low incidence of substitution of care (either self-care, informal or formal) benefiting from home modifications– potentially substituting care costs, offsetting the need for institutional care and facilitating independence. Community care costs are over 75 percent labour based (Hogan, 2004), and a small reduction in these labour-rich costs would result in a considerable economic benefit to care systems.

Agree's research on the substitutability of assistive devices for care assistance (Agree & Freedman, 2000) establishes important groundwork for the analysis of substitution of personal care with modified home environments. Agree's results suggest that such assistive technology have the potential to enhance quality-of-life for older persons and their carers and cost savings for government providers.

Once a person enters a residential care institution; informal care and all its benefits are reduced (Bridge, et al., 2008). Thus home modifications and the provision of a supportive home environment can play the role of maintaining the community care

network and its associated value. Given this important fact, very little attention has been given to the role of home modifications in supporting formal (Agree & Freedman, 2000) or self-care models in the home.

4. A matter of cost: Waged home care and home modifications

Economics of Care

There is an absence of economic evaluations of care at-home for older people and people with a disability in Australia. This is significant given that policy and care arrangements vary substantially from country to country and that international comparisons lose their relevance. In addition, cost-benefit studies associated with home care have used inconsistent terminology and inconsistent methodologies (Bridge, et al., 2008). They have not viewed costs and benefits from similar perspectives or considered the same dependent or independent variables. As a consequence, results have at times been contradictory.

In terms of intensity of care levels, Howe visualised the structure of Australia's aged care system as a pyramid, with the highest intensity of care being at the apex – nursing home care (Howe, 2002). The relative cost intensity of the Australian Care system can be reinterpreted using an inversion of Howe's Australian Aged Care System pyramid. This has been drawn in Figure 6. The Relative Cost of Aged Care Services, which shows the dominating costs of nursing homes (residential care) and relative care costs reducing down to the lowest point -living in the community with a carer.

Figure 6. The Relative Cost of Aged Care Services

Source: An inversion of Howe's (2002) Aged Care System Pyramid

According to a report conducted by company Grant Thornton in 2008, community care is less costly to deliver than residential for low care services (Grant Thornton, 2008). The Grant Thornton Report is an independent study into changing trends in the aged

care industry conducted by Grant Thornton, and supported by Professor Hogan, the Aged Care Association of Australia, Aged & Community Services Australia, Catholic Health Australia and Stewart Brown & Co.

Labour costs are the major cost component for all aged care services. According to the Australian government commissioned Hogan Report (Hogan, 2004), labour costs account for over three-quarters of HACC costs. Unit costs of nurses and other aged care workers is estimated to grow faster than average wages in the economy in the future 40 years. This is compounded by the fact that the aged care workforce will increase by 35 per cent over the next decade compared with an 8 per cent increase in the entire Australian workforce. This establishes the relevance of this report into home modifications and substitutability, as determining the feasibility of substitution of home care with home modifications will provide a potential solution to maintaining labour costs within the care system.

The general goal of aged care policy is summarised by Howe as moving the balance of care towards lower cost services and maintaining the broad base of the service pyramid as a means of containing the high-cost services. Decreasing the need – and the costs – of home-based care is of interest to both community and government sectors.

The Australian Department of Health and Ageing published a projection of total costs of each of the care streams up to 2042 based on current policy arrangements. This projection indicates a high level of increase in the costs of care, and that residential care streams will continue to dominate as the most cost demanding of all care types. Currently, the cost of supplying residential aged care accounts for 85.9 per cent of the cost of all formal aged care services and will increase to 88.7 over the next 40 years (Hogan, 2004).

Cost effectiveness of waged community care

There is a considerable body of academic research relating to economic evaluations of community care, however many reports on the costs and benefits of in-home care models have been unclear and contradictory. Early research indicated that home care did not improve health-outcomes nor was it cost effective (Hedrick & Inui, 1986; Weissert, 1985). Conversely, another study has indicated that home care can be made cost effective even for those who are medically-dependant to a high level, such as those who are ventilator assisted (Bach, Intintola, Alba, & Holland, 1992). These diverse research results illustrate how controversial the issues of community care, patient outcomes and costs of care have become.

A review of attitudes to community care over time has established that the consensus on the value of community care has changed with time (Bridge, et al., 2008). According to this report, 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. However in an informal care situation, relative value needs to incorporate the tax losses and missed superannuation contributions for carers as well

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as respite care costs. Bridge et. al. (2008) reported that 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. (Bridge, et al., 2008)p7

Research into home modifications suggests that they can further support (or even substitute) for waged home care scenarios by enabling individuals to care for themselves unaided at home. The impact of home modifications on home care is an unexplored research area. In particular the direct cost comparison between home modifications and home care services, taking into consideration the active level of substitution that takes place, is of interest to this study.

Cost effectiveness of home modifications

Research conducted within the field of Geriatrics has proposed that home modifications can 'pay their way' when analysed in the context of care and ageing in place (Lansley, McCreadie, & Tinker, 2004). Within housing literature, home modifications are considered a relatively costly undertaking when compared alongside homes built to an already accessible standard (Hill PDA, Rider Hunt, & Brian Elton & Associates, 1999). Installing wider doors, accessible door-ware, and wall reinforcements for future grab-rails affect initial building costs very little, however adding these features at a later date increases the cost at least 60 per cent to 90 per cent (Nolte, 1988). Although the cost of modifying an existing non-accessible home is considered costly in comparison to building an already accessible home, investment in modifications of older existing homes is unavoidable in the short to medium term (Bridge & Gopalan, 2006). Housing in general has a low percentage turnover of stock – i.e. only a small percentage of homes are pulled down and rebuilt in any year. Therefore designing for accessibility in new homes to adequately provide larger sectors of the population with accessible homes cannot be relied upon (Hill PDA, et al., 1999). This further emphasises the necessity of continuing to adapt existing homes via home modification as an important part of successfully providing accessible housing for a larger portion of the population.

The economic advantage of home modifications has remained a relatively unexplored area of research and is related to factors including housing tenure and type (Bridge, et al., 2008), and predicted longevity of an aged or disabled person (Lansley, McCreadie, & Tinker, 2004). Therefore, before a more pronounced focus on home modifications policy is undertaken, a systematic approach into feasibility and costing is necessary. This report will provide the background for developing a model to determine the feasibility and cost effectiveness of home modifications.

As previously stated, research on the economic benefits of home modifications and home care is limited. A report by Home Adaptations Consortium (2010) directly compares the costs of the installation of level entry showers and compares this with the

cost of assisted bathing care costs over 5 years. The home modifications costs compare favourably and are less than 10 percent of the care costs over five years. A cost benefit study undertaken in 1978 estimated that adapting existing homes to improve accessibility reduces the need for support services and may even yield benefits between 13 and 22 times the cost of the initial outlay of the modifications (Robinette, 1978). Studies into the feasibility and costs of home modifications and assistive technology indicate that there are considerable cost savings attributed to the implementation of home modifications (Lansley, McCreadie, & Tinker, 2004; Mann, et al., 1999). Of critical importance to the level of saving is that any modifications meet the individual's needs, suit their home environment, incorporate their individual preferences and monitor for awareness of changing needs.

Considerations of the economic benefits of individual home modifications are tempered by life expectancy and general health prognoses (Lansley, McCreadie, Tinker, et al., 2004). Home modifications are impractical in a short-term care scenario because of capital outlay and the time, materials and labour required to implement them.

There are a number of areas within the care provision process where accessible home environments can minimise cost input:

1. The cost of admitting people into residential care
2. The need for temporary accessible environment immediately following hospital discharge
3. Personal injury from falls or strains – for both the care recipient and carer
4. Waged home care costs for aged and/or disabled people. (Hill PDA, et al., 1999).

Additional economies – OH&S for carers

Accessible housing environments assist both the cared for and the carer. ADL difficulties endured by an individual can be minimised by an accessible environment, reducing the amount of care needed. Where home and nursing care is required, an accessible environment can make care tasks easier, more productive (Frisch, 1998) and lower risk.

Home modifications offer additional cost benefits in the area of Occupational, Health and Safety (OHS) associated with home care provision. Carers are put at higher risk of injury when they operate in a non-accessible housing environment. This is because a high proportion of care work is related to mobility, bathing and showering and can involve heavy, potentially injurious lifting (Nissim, et al., 2008). Research shows that Australian carers are likely to be suffering from a physical injury (Cummins, et al., 2007), further emphasising the need for safer work environments for carers. Care activities can be made easier and safer – by the inclusion of simple home modifications including grab rails, hob free showers and ramps.

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Home modifications can reduce the cost intensity of OHS issues home care by:

1. Minimising the amount of personal care required by providing a more enabling environment
2. Reducing time and effort required by carers to perform care tasks incorporated with mobility and bathing
3. Reducing risks of injury, thereby saving on health care costs
4. Making the work environment safer means less injury, and less workers compensation claims -insurance premiums are reduced.
   (Nissim, et al., 2008)

Cost Analysis: Costing Community Care for the case-studies

Accurately estimating community care costs requires local and current costing information. There are many challenges with multi-national economic evaluations because of the unique nature of nation, locality, government, economy etc. (Patel, 2006). International economic data is complex to interpret within a local framework and therefore has not been consulted in this report.

Due to the importance of local data, all care costs incorporated within this report have been derived from publicly available Australian and NSW data (ADHC reported). Likewise, home modifications costs, which are also sensitive to local economics, were sourced locally.

The following paragraphs detail how community care costs were calculated for inclusion as an average hourly rate of care, when used within the case studies in this report. The average hourly care rate was calculated from a local unit cost benchmarking study, (excluding irrelevant cost units from the average), and recalculated incorporating CPI to reflect current values. This then resulted in an average hourly rate for care provision that could be used in the case study analysis.

Hourly Care rates and Indexation

Initially, hourly care rates were referenced from the ADHC Report “HACC NSW Unit Cost Benchmarking Study 2005 -Service Provider Feedback”[4]. This report tables a full range of care service pay scales with highest/lowest unit costing (see Table 1).

[4] Department of Ageing, Disability and Home Care report “HACC NSW Unit Cost Benchmarking Study 2005, Service Provider Feedback” : Unit cost table, page 2.

http://www.dadhc.nsw.gov.au/NR/rdonlyres/39C1876A-27F6-4C70-ABAD-CAD56D4F64E1/2095/HACCUCBPServProvReport.pdf.

Exclusions from the DADCH Unit costing data.

Only hours of service units were included in the calculations. Of the hourly service types, transport and centre based day care were excluded from the calculations because they do not relate to care within the home, and are therefore not directly affected by home modifications.

Indexation -CPI Adjustments

Using the ADHC Payscale Table (Department of Ageing, Disability and Home Care, 2005 p44) the median of the lowest and highest unit hourly cost was taken. The medians were then recalculated to incorporate CPI since 2005, bringing the unit cost values up to date for 2009. CPI values were calculated using the Reserve Bank of Australia's online CPI calculator[5]. According to the Reserve Bank's calculations, there has been a total change in costs of 12.6 per cent over 4 years, at an average inflation rate of 3.0 per cent[6]. Only service types potentially affected by home modifications have been included in the average. Frequency of transport and centre based day care will not be directly affected by home modifications within the home environment.

[5] Reserve Bank of Australia website. http://www.rba.gov.au/calculator/

[6] http://www.rba.gov.au/calculator/annualDecimal.html

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Table 2. Median unit costs 2009
Recalculated using CPI index for use in case study calculations.

Source: Original data obtained from "HACC NSW Unit Cost Benchmarking Study 2005" (Department of Ageing, Disability and Home Care, 2005)

Service Type	Lowest Unit Cost (2009 CPI adjusted)	Highest Unit Cost (2009 CPI adjusted)	Unit of Service	Median Unit Cost (2009 CPI updated)
1. Domestic Assistance	$27.53	$66.88	Hours of Service	$47.21
2. Allied Health	$61.52	$92.85	Hours of Service	$77.19
3. Nursing Care	$48.76	$88.64	Hours of Service	$68.70
4. Home Maintenance	$27.80	$85.40	Hours of Service	$56.60
5. Respite	$9.58	$62.83	Hours of Service	$36.21
6. Personal Care	$27.92	$57.19	Hours of Service	$42.56
7. Centre Based Day Care	$2.02	$39.24	Hours of Service	N/A
8. Transport	$3.99	$64.81	Hours of Service	N/A
9. Social Support	$3.32	$70.98	Hours of Service	$37.15
10. Case Management	$34.78	$68.90	Hours of Service	$51.84
		average unit hour cost of home based service		**$52.18**

GST Exemptions

For the purposes of this task, it is appropriate to use a GST tax exempt costing as accountable government sectors will not be submitted to GST tax on labour or materials for home modification services.

The average hourly cost of Australian Community Care Services has been calculated to be $52.18.

This is the value that will be used across all three case studies in this report.

Care Hour calculation

The cost analysis within the case studies utilises an average weekly number of care hours sourced from publicly available Australian data (Access Economics, 2009b). The annual care values in the Access Economics sourced report were regenerated as average weekly number of care hours at each community care level in the following table.

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Table 3. Generating average weekly hours of community care for use in calculating average community care costs. (Access-Economics, 2009) p12.

Care Level	Annual Average Hours per Person with Disability (PWD)	Converted to weekly average care hours per PWD
Community Care with HACC	39	0.75
Community Care with CACP	685	13.1
Community Care with EACH, EACHD	1,023	19.67

Source: *Excludes a large number of HACC, CACP, EACH and EACH-D services provided to people living in the community such as meals, linen deliveries and transport trips, as these are not measured in hours. Averages have been calculated only for people receiving formal care.

Each case study was assigned a number of care hours for calculations. The number of hours assigned was proportional with the level of functional capacity. The direct relationship between hours of care needed and functional capacity has been established by Disler, Roy, & Smith, (1993).

It is recognised that the number of home care hours required will be directly linked to:

- Living Status – living alone means informal care support is less likely and is linked to higher reliance upon formal care.
- Level of Impairment – level of impairment is proportional to level of care needs; e.g. high level of impairment leads to higher care needs
- Likelihood of transfer to nursing home. High level of home care hours implies a higher likelihood of residential care admission.

Each of the three case-studies in this report was assessed according to the existence of live-at-home informal care support and level of functional limitations to assign an appropriate level of community care support as listed in Table 3 above.

Costs associated with Home Modifications in NSW

Home modification provision in NSW

In NSW home modification services are prescribed, costed and project managed by Home Modification and Maintenance Services (HMMS) teams, and are part of the Home and Community Care program which is jointly funded by the State and Federal Governments. Home Maintenance and Modification Services provide environmental modifications in the home (as well as some garden and home maintenance) to people who are frail aged, those with disabilities and their carers.

Home Modification Fee Structure - Who pays?

Under the current fee structure, cost liability for home modifications does not lie solely with ADHC. The fee structure in place states the following:

> *"For all major modifications over the value of $5000, clients will be asked to contribute the first $5000 of the cost of the job and 20 per cent of the remaining costs. Clients who have difficulty paying their account may negotiate their payment in instalments. Capacity to pay is not a determinant for eligibility or priority for Home and Community Care (HACC) nor can inability to contribute to cost be the basis for refusal of services as per guidelines" (Home and Community Care Program: Commonwealth of Australia, 2007, p25).*

HMMS fee structures are set within three levels, entrance to each level depending upon total cost values of the modifications recommended, and each level represents a different subsidised rate:

Level 1 -Minor modification up to the value of $7,500.00

Cost to client and subsidisation -all materials charged for in full plus a percentage of labour base upon available funding and in-house policies. Labour is subsidised at a rate of between 45 per cent and 50 per cent depending on whether it is in-house or contract.

Level 2 -Major modifications between the values of $5,000 and $25, 000

Cost to client and subsidisation

Full hourly labour cost is quoted for (including GST). Because of cost savings of utilising in house contractors and bulk materials, final labour costs are up to 70 per cent LESS than externally contracted work (particularly in rural areas where external contractors charge a premium for travel).

For Level 2 Projects, ADHC requires that HMMS providers charge for the first $5,000 then 20 per cent thereafter.

Level 3 – Combination of major modifications valued at $20,000+

Full hourly labour cost is quoted for (including GST). However because of cost savings of utilising in house contractors and bulk materials, final labour costs are up to 70 per cent LESS than externally contracted work (particularly in rural areas where external contractors charge a premium for travel).

For Level 3 Projects, ADHC requires that HMMS providers charge for the first $5,000 then 20 per cent thereafter.

It should be noted that in line with Home and Community Care policy, all clients have the right to negotiate a further reduced client contribution based on genuine hardship.

Home Modification quotation process

The process of quoting, subsidising and reclaiming modification costs is complex, and in a simplified format can be understood to comprise the following:

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- Home maintenance and modification service providers assess a client's home and put forward home modification recommendation.
- This recommendation, once approved by the client, is then costed. The costing process involves the calculation of a total price for the modification project, according to which the project is then assigned a Level (1, 2 or 3). These three levels correspond to different subsidisation rates for clients.

Home modification costs used in this study

The values of home modifications included in the case-studies in this report are based on actual costing supplied by Home Modifications and Maintenance Services (HMMS) providers who agreed to supply de-identified files for this study.

There are two comments to be made about the provided cost data with implications on the final values. First that the costs incorporate in-house builders and bulk material rates meaning that the values will be lower than externally sourced building quotes. This implies that the capital costs used for the home modification values will be conservative. The nature of the building industry is that external quotations are not regulated and the range of possible quotations for a single job can be high, particularly when travel is involved as in rural cases.

Second, the quotes were set up within the HMMS fee structure framework and were thus designed to establish total cost to *the client* (and not to the government). Therefore where the provided costing reflects subsidised rates, appropriate calculations to remove any subsidies were conducted to better reflect current commercial labour rates. The final cost analysis incorporates the home modification cost as the cost to the *government provide*r, and not the subsidised fees that are charged to the public clients.

This methodology of obtaining already costed modification case-studies (and performing calculations to remove subsidy rates) was considered a more accurate approach than consulting a published building guide with generic building and labour values. The values represented in this report reflect unsubsidised labour and materials costing in real situations.

5. Case-Studies

The results of collected data on home modifications and health status have been collated and illustrated within three Case-Studies. Home Modification and Maintenance Service Providers (HMMS) supplied three de-identified case profiles, which included information on health status, living arrangements, functional prognosis, home modification specifications and home modification costs. Each case study was selected on the basis of it having been conducted between 2009-10 and also in order to provide varying levels of case complexity. In conjunction with care hour and cost data, this health information has been incorporated into a set of comparative profiles, based upon the culmination of the theoretical frameworks of (Steinfeld, et al., 1979) and (Brandt &

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Pope, 1997). These theoretical frameworks, the enabler and person-environment fit, support and inform the Cost Analysis element.

These case-studies are intended to provide a foundation for further research investigating the relationship between clients, home modifications and care. The case-studies in this report estimate care costs accumulated over a period of 12 months with one off home modification costs. Longitudinal data over 24 months and more, although desirable, was not possible due to a lack of available data on client health decline over time, care adjustments over time and home modification additions in following years.

The three case-studies in this report introduce the possibilities of cost analyses and comparisons horizontally across the care stream networks. The task of equitably determining the resultant cost impact of home modifications on care needs will benefit from further data collection and a longitudinal meta-analysis of real-time care provision costs and home modifications costs.

Data used in these case-studies

Due to the short-term nature of this report, the three case-studies have been constructed from two separate information/data sources:

- Actual de-identified client reports (provided by HMMS Providers) including health status, inadequacies of home environment, home modification specifications and costs.
- Existing, published statistical data on average care costs and average community care hours.

Data required to project the impact of home modifications on the provision of care include:

- A clear understanding of a person's functional status, diagnosis and prognosis over time. For this paper, this data was made available by HMMS services in a de-identified format.
- Real time care needs and costs prior to home modification installation.
- Data unavailable due to lack of care stream meta-analysis.
- Home modification specifications and detailed non-subsidised costing data. For this report, this data was made available by HMMS services in a de-identified format.
- Follow-up data on adjustments to care requirements following installation of home modifications. Data unavailable due to lack of care stream meta-analysis.
- Repeat follow-up data on home mods and care requirements 24 months following home modification installation.
- Data unavailable due to lack of any longitudinal study.

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Availability of Raw Dataset

The raw dataset that comprises the original three case studies (Scope Access, 2010) is not published within this report to ensure privacy of both client and service provider is maintained.

The dataset can be made available in a de-identified format for research methodology verification purposes.

Building Costs

It is acknowledged that the building cost data supplied in the raw dataset is regionally specific and being based on private commercial building quotations is impacted upon by many changeable factors including economic climate, individual quotation method, and contractor's lack of or excess of current work. Therefore there will be a lack of uniformity in quotations for home modification work nationally.

Future Data Collection

In order to set up a more accurate comparative framework between home modifications and waged home care, longitudinal data which tracks a range of care and home modification changes is beneficial. It is anticipated that future research will enable a meta-analysis across community care and home modifications and will include a longitudinal study of care changes over time, as they relate to home modifications and changing functional status.

Case study – Analysis of Template Design

The case study template has been designed to evaluate and compare the potential impact of home modifications on individual care cases. Because there are a number of interdependent information sets, the template was required to include a comprehensive health overview, as well as care details/estimates and home modifications specifications/costs.

The template links a number of theoretical frameworks in its layout.

- Steinfeld & Danford's "Enabler" diagram to illustrate functional limitation of each case (Steinfeld & Danford, 1999).
- Brandt & Pope's Person-Environment Fit model and symbolism to describe care, environment and home modification relationships (Brandt & Pope, 1997).
- Cost Analysis – a direct comparative cost analysis between care and home modification scenarios informed by both the enabler and person-environment fit frameworks.

The case study templates consist of two main parts: Personal Profile (1) and Environmental and care cost comparison (2) with an additional third area allocated for Notes and References (3).

The *Personal Profile* informs the *Environmental and care cost comparison* by giving information upon which to qualify average care hours. Severity of functional limitations,

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health prognosis and evidence of informal care were all instrumental in deciding whether the case study was estimated at a higher or lower intensity care level.

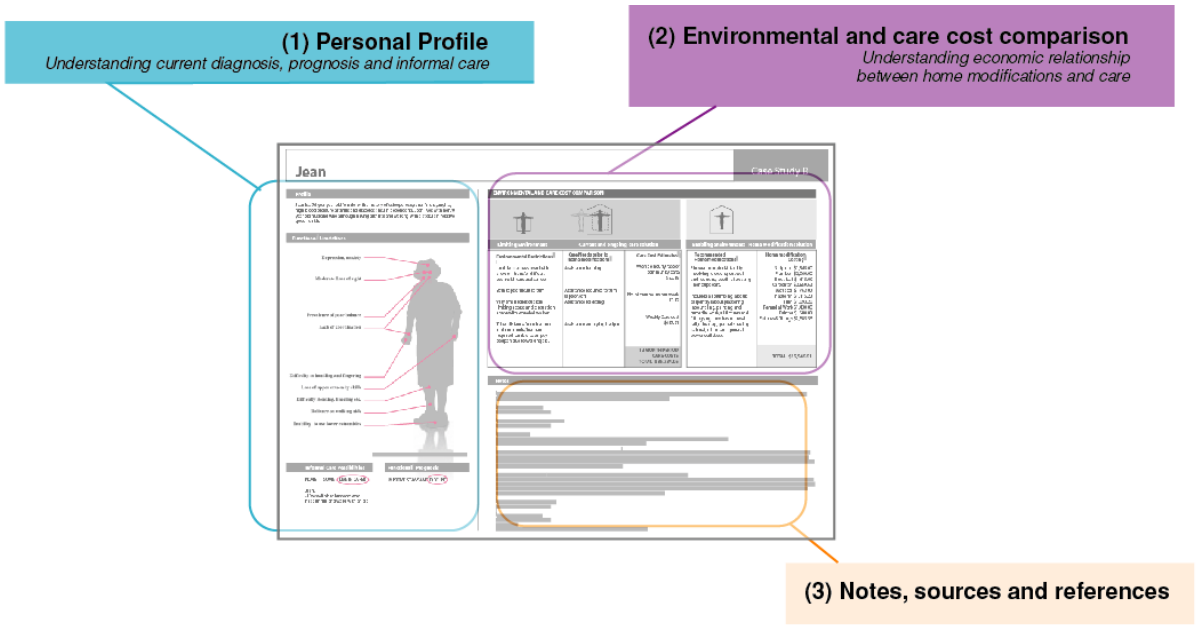

Figure 7. Main sections of the Case study Template.

Case study Section (1) -Personal Profile

In this system the Personal Profile is comprised of four smaller sections (mapped in Figure 8), each performing a particular task.

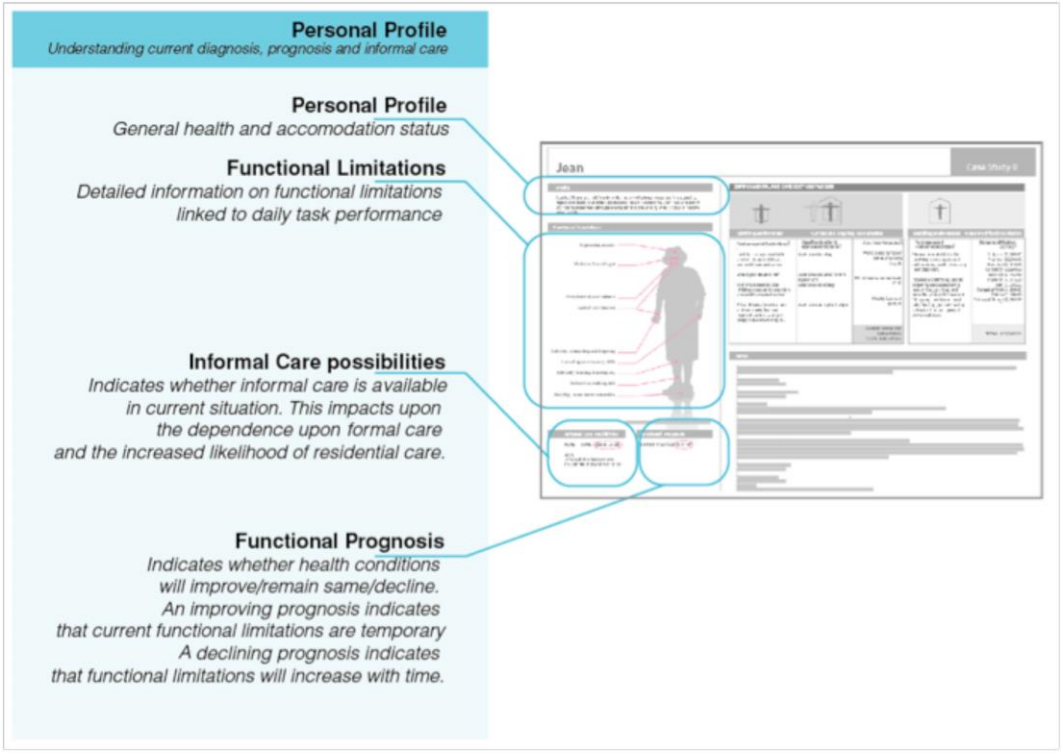

Figure 8: Mapping of Personal Profile Information within Case study format

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a) Profile descriptor

The Profile descriptor establishes the age, gender and general health condition of the client, with an overall descriptor of any diagnoses. Current living status is also included, describing the type of accommodation and the presence of any live in carers.

b) Functional Limitations

This diagram of a human form with annotations to various parts of the body is adapted from the original Enabler Ideogram (Steinfeld, et al., 1979) shown in Figure 9. The newly adapted ideogram utilises a figurative diagram to illustrate complexity of physical limitations (see Figure 10). It is an effective means of illustrating functional capacity, as evidenced by its inclusion and reinvention in research since its original publication (Bridge, 2006; Iwarsson & Slaug, 2001; Kidd & Clark, 1988).

c) Informal care possibilities

This section indicates the availability of informal care, and informs the level of average care hours assigned to the care estimation. Lack of informal care is directly related to the likelihood of increased reliance on formal home care and admission to residential care.

d) Functional Prognosis

This is also an important indicator when estimating care hours and future care needs. An improving prognosis indicates that current functional limitations are temporary and that care needs may decrease with time.

A declining prognosis indicates that functional limitations will become more severe with time and care needs will increase to accommodate these changes.

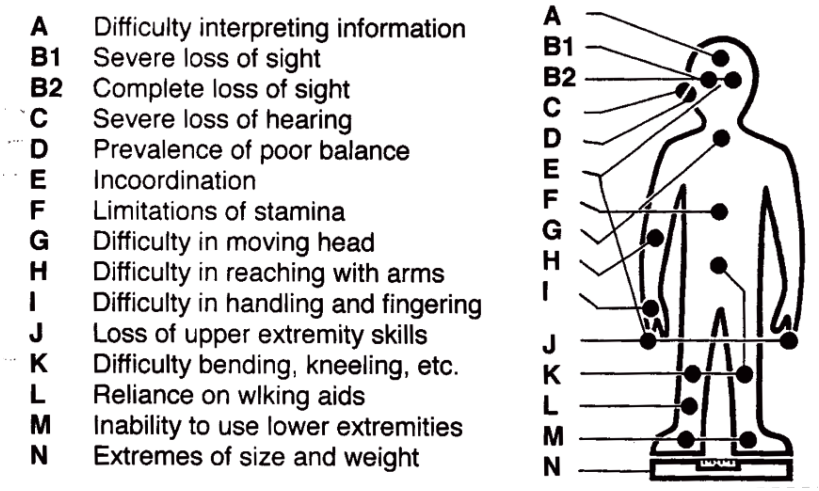

Figure 9. The original Enabler Ideogram detailing the range of functional limitation dependence.

Source: Published in Enabling Environments (Steinfeld, et al., 1979) p75

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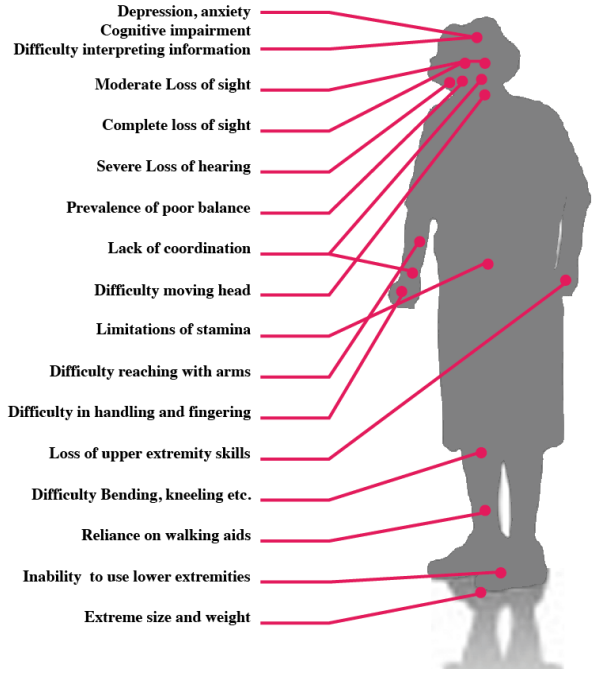

Figure 10. The modified Ideogram incorporated into Case study Template. (shows female version silhouette) from original Ideogram by Steinfeld et al. (1979).

Case study Section (2) Environmental & Care Cost comparison section

The *Environmental and care cost comparison* matrix has been designed to enable easy comparison between costing of care and home modifications as well as an understanding of the scope of home modification and care needs. The matrix incorporates descriptive and cost information about the restrictive environments requiring care input, and enabling environments with home modifications.

In this case study template the *Environmental and care cost comparison* is comprised of six key sections, each performing the following tasks:

a) Person-Environment Fit Icons

The top of the matrix incorporates symbolism adapted from the original Brandt & Pope (1997) diagram illustrating person-environment fit. See the Literature Review earlier in this report (p 21) for further explanation of these icons. Figure 11 is an excerpt from a final case study showing how the icons have been used to illustrate person-environment fit before, and after home modifications have been installed.

Figure 11: Case study Template excerpt showing use of Person-Environment Fit Symbols

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b) Limiting Environment. Provides a description of any environmental restrictions with the home identified by an Occupational Therapist during consultations.

c) Current and ongoing care solution. Details the care needs prior to home modifications as they pertain to the listed environmental restrictions.

d) Care Cost Estimate. Outlines the calculated estimate of care costs based upon average hourly care cost and average care hours for a person of similar functional limitations and informal care availability.

e) Recommended Home Modifications. Details the home modifications as recommended and costed by HMMS Provider.

f) Home modification costing. Outlines the total cost of provided home modifications as provided by HMMS provider.

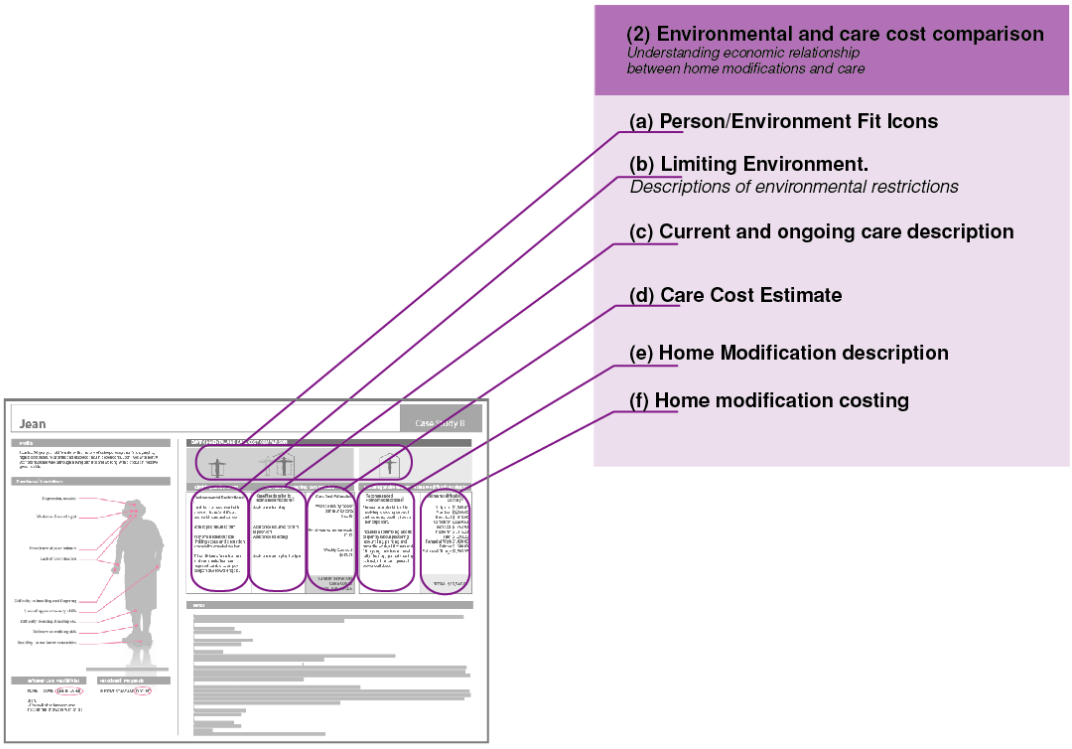

Figure 12. Mapping of Environmental & Cost Matrix information features within Case study format

Final Case-Studies

The following three Figures form the basis of the cost comparison establishing a cost comparison between community care costs, and equivalent levels of home modifications to supplement or substitute those care arrangements.

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The case-studies outline the following:

- The health profiles of actual HMMS clients
- Average care costs estimates for the period of 12 months
- Actual home modification costs for the clients

The purpose of the case-studies is to reveal the evidence and nature of relationships between functional limitations, the costs of existing care support and the costs of equivalent level of HMMS specified home modifications. Given that research indicates that home modifications can both benefit and reduce the existing care support, these case-studies can reveal the potential of home modifications to generate savings in the provision of community care.

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Elizabeth

Case Study A

Personal Profile

Elizabeth is a 65 year year old female who has been diagnosed with Cerebella Spinal Ataxia (CSA). Elizabeth is widowed and has recently moved away from the larger family home into a smaller freestanding cottage.

Functional[1] Limitations

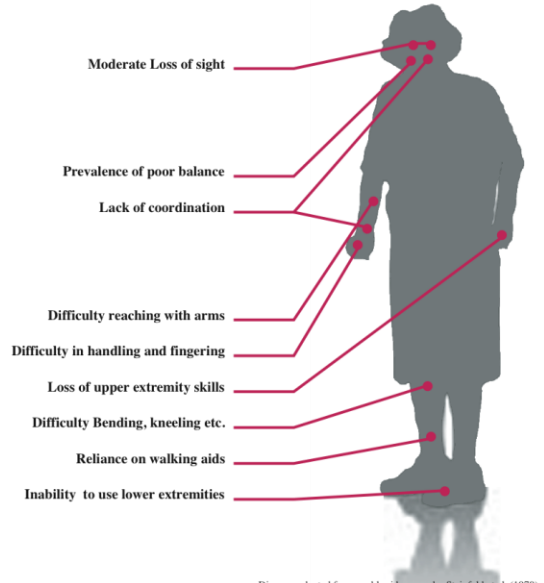

Diagram adapted from enabler ideogram by Steinfeld et al. (1979)

Informal Care Possibilities

NONE SOME LIVE-IN CARER

Elizabeth;
- Lives alone
- Has 3 Adult children who live a long distance away and who also have health problems, & therefore cannot visit regularly.

Functional[1] Prognosis

IMPROVE STAY-SAME DECLINE

ENVIRONMENTAL AND CARE COST COMPARISON

Limiting Environment	Current and ongoing care solution		Enabling environment: Home Modification solution	
Environmental Restrictions[2]	**Care Needs prior to home modifications[3]**	**Care Cost Estimates[4]**	**Recommended Home modifications[5]**	**Home modification Costing[6]**
Unable to access/exit front entrance safely with wheeled walker.	Assistance entering and exiting home	Average hourly rate of community care: $52.18	Entrance platform and ramp	Stripout/tip $15.00 Plumber N/A Electrical N/A Carpenter $1026.00 Wet seal $ 759.00 Plasterer N/A Tiler N/A Remedial Work $260.00 Painter N/A Fixtures & fittings $412.00
Unable to move safely from kitchen to laundry	Assistance with laundering	No. of care hours per week 19.7	Remove sliding door between kitchen/laundry and install Tyrex ramp. Remove and make good existing towel rail	
Lack of support during toilet transfers	Difficulty toiletting	Weekly Care cost $1027.95	Installation of 2 x 600mm long grabrails in toilet/ ensuite	
Lack of support when standing under shower and when negotiating hob in/out	Difficulty showering	**12 MONTH PERIOD CARE COSTS TOTAL $53,453.19 with likelihood of transition to nursing home within following 12 months[7]**	Installation of corner grab rail	**TOTAL $2472.00**

Notes

[1] ***Function*** describes the person's functional status, including communication, mobility, interpersonal interactions, self-care, learning, applying knowledge, etc. International Classification of Functioning, Disability, and Health (ICF) World Health Organisation (WHO) website http://www.who.int/classifications/icf/en/

[2] **Environmental restrictions**
As documented by HMMS provider

[3] **Care needs prior to Home Modifications**
As documented by HMMS provider

[4] **Care cost estimates**
Includes Formal Care costs estimate over 12 month period based on average community care hourly rates and quantities Excludes informal care costs
Lack of available data means that longitudinal results beyond 12 months cannot be extrapolated.

Cost hourly Rate: The hourly rate of $52.18 was calculated from "HACC NSW Unit Cost Benchmarking Study 2005 - Service Provider Feedback" (Department of Ageing, 2005) which tables a full range of care service pay scales with highest/lowest unit costings. For this research, a median of these price variables was taken. These prices were then recalculated to incorporate CPI since 2005, bringing the unit cost values up to date for 2009. Excludes a large number of HACC, CACP, EACH and EACH-D services provided to people with living in the community such as meals, linen deliveries and transport trips, as these are not measured in hours. Averages calculated only for people receiving formal care.

Number of hours of care estimated: Generated as an average weekly no. of hours at the highest community care level.
The highest community care level was selected for calculations in this case study because of the severity of functional limitations and lack of any informal care support in this case.
Highest level of community care (Community with EACH, EACHD) is represented by the average weekly amount of (19.73hrs). Excludes a large number of HACC, CACP, EACH and EACH-D services provided to people living in the community such as meals, linen deliveries and transport trips, as these are not measured in hours. Averages calculated only for people receiving formal care.
Source: Access Economics Powerpoint Presentation by Penny Taylor (2008) web; www.alzheimers.org.au/upload/PennyTaylorPreso.ppt

[5] **Recommended Home modifications**
As documented by HMMS provider

[6] **Home modification costing**
As documented by HMMS provider
Excludes GST. Labour at market value - non-subsidised rates based on market value provided by HMMS

[7] **Residential Care Costs.** Average residential care costs estimated at $48,710 p.a. as at 2005, of which 69% is Commonwealth funded. Source: Bridge et al (2007) AHURI Report No. 115: "The costs and benefits of using private housing as the 'home base' for care for older people: secondary data analysis."

Figure 13: Case study A: Elizabeth

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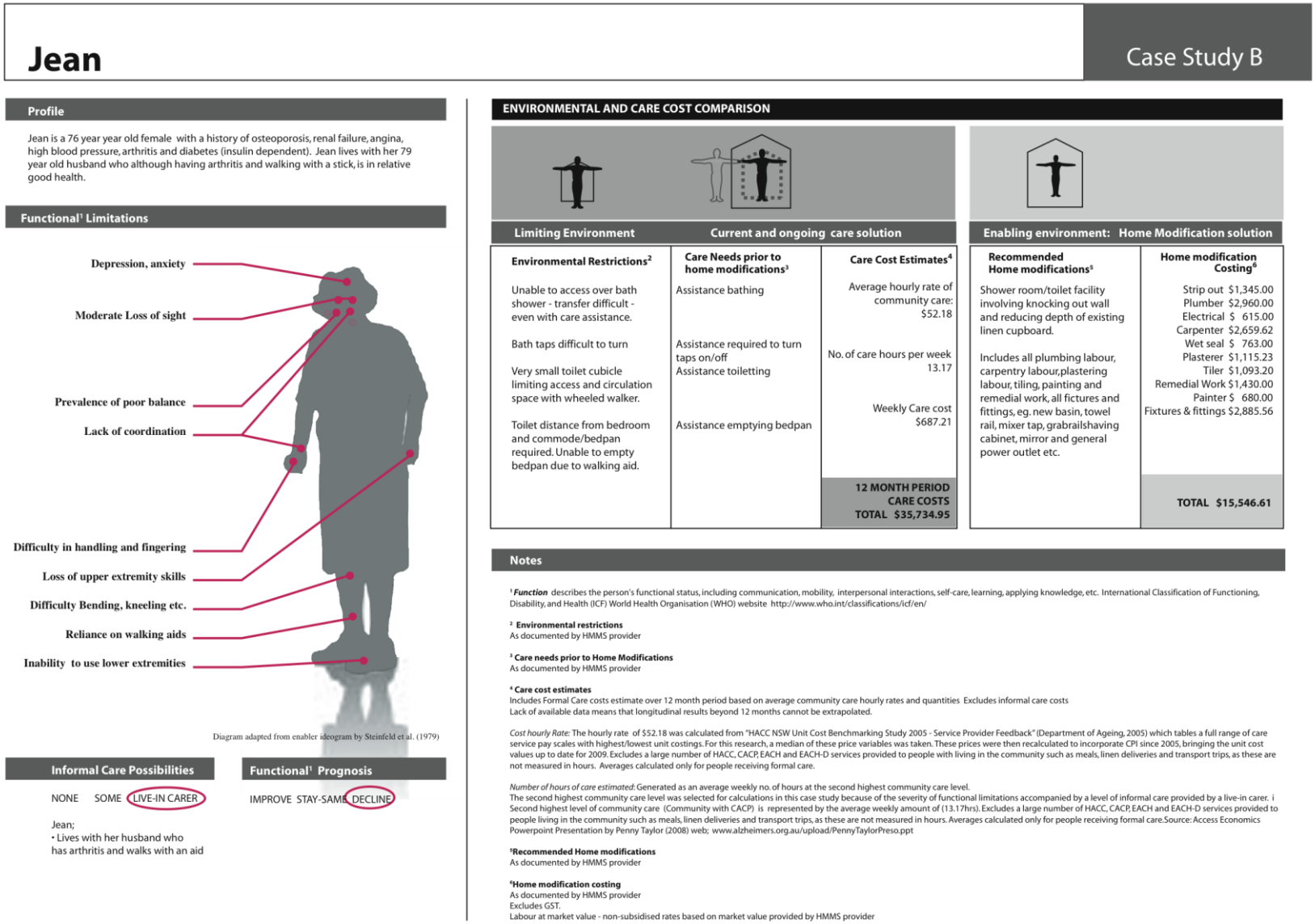

Figure 14. Case study B: Jean

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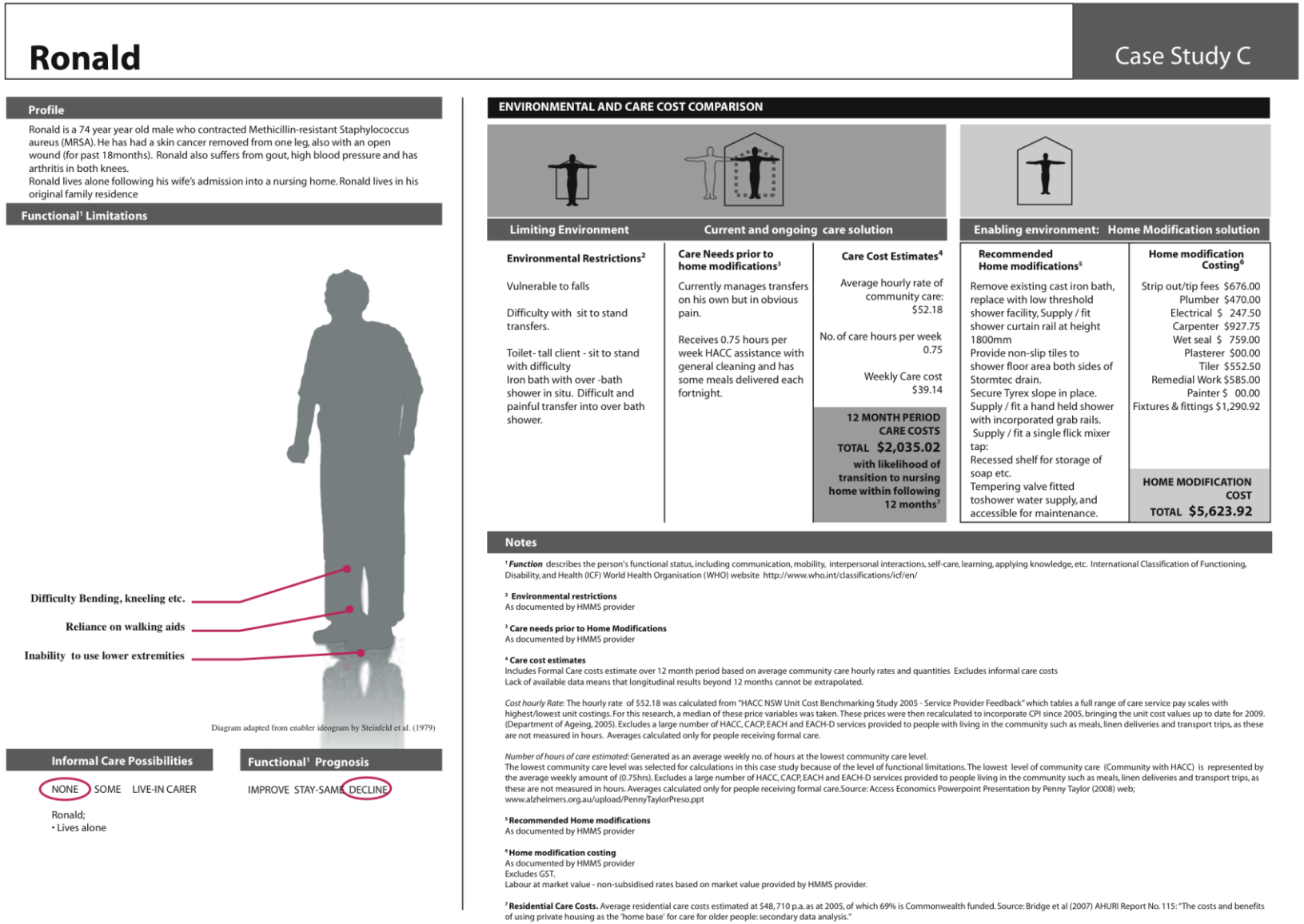

Figure 15. Case study C: Ronald

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Results

The case study template is a synthesis of theoretical frameworks that underpin the concept of waged home care substitution by home modifications – the enabler ideogram, person-environment fit and cost analysis. The case health profile provides information about the existing functional limitations, and also an indication of future prognoses – which research indicates is crucial to providing timely and feasible home modification solutions (Lansley, McCreadie, & Tinker, 2004). Each case study then details the costs of both ongoing waged home care (each case assigned an average care amount based on increasing scale of need) and actual home modification costs in light of health prognoses.

Figure 16 graphs the care costs alongside the home modification costs for each of the three case-studies. Two out of the three cases resulted in a lower home modification investment compared to care costs for 12 months, suggesting a cost effective comparison between care wages and home modifications. These case-studies were Elizabeth (A) and Jean (B). In contrast, the single case study where the home modification costs were greater than care costs was Ronald (C).

Ronald's higher home modification than care costs can be explained by both the use of a generic low care hour average and a lack of longitudinal information about his declining health and care needs. Based on the current care received by Ronald, his current care needs were estimated to be the lowest of all three cases, however his health profile indicated he had a declining prognosis and without informal support there is a likelihood of Ronald entering residential care as his health deteriorates. This snap shot of his care needs occurs at a time when he has unmet needs and does not reflect his potential changing health status and corresponding changing care needs. Therefore a longitudinal study would provide more accurate details of his changing care costs over time.

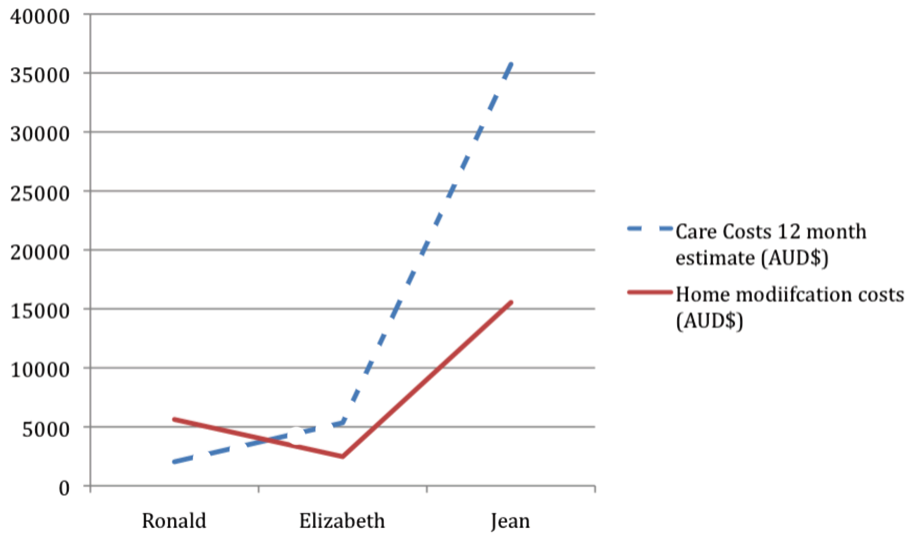

Figure 16. Graph of home modifications costs compared to care costs for each of the three case-studies

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The case study templates do not indicate actual costs savings that could be made using the cost values. Therefore a review of the potential saving in each case study is provided below.

Potential cost savings

Case study A – Elizabeth

Elizabeth currently relies upon formal support care only and is at high risk of entering residential care within the coming 24 months as a result.

Without home modifications, Elizabeth's annual care costs are estimated to be $53,453.19 in the next 12 months, with the likelihood of transition to residential care within 24 months because of her declining functional capacity.

Elizabeth's home modifications were priced at $2,472.00.

Substitution potential

Over the period of one year, 100 per cent substitution of her care would result in a saving of $50,981.19.

If a partial substitution of care takes place, and the home modifications reduced her waged home care needs by 50 per cent, there would be a saving of $24,254.59 in care costs over the period of one year.

Comment

From the information provided HMMS providers it can be understood that Elizabeth's home modification costs are low because of the existence of a privately installed ramp.

Case study B – Jean

Jean benefits from live-in informal care provided by her husband.

Without home modifications, Jean's annual care costs are estimated to be $35,734.95 in the next 12 months.

Jean's home modifications were priced at $15,546.61

Substitution potential

Over the period of one year, 100 per cent substitution of her care would result in a saving of $20,188.34

If a partial substitution of care takes place, and the home modifications reduced her waged home care needs by 50 per cent, there would be a saving of $2320.87 in care costs over the period of one year, with greater savings expected in the following 24 months.

Case study C – Ronald

Ronald currently lives alone and relies upon formal support care only and is at risk of entering residential care within the coming 24 months as a result.

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Without home modifications, Ronald's annual care costs are estimated to be $2,035.02 in the next 12 months.

Ronald's home modifications were priced at $5,623.92

Substitution potential

Over the period of one year, 100 per cent substitution of his care would result in a cost of $3,588.90 (no saving).

If a partial substitution of care takes place, and the home modifications reduced his waged home care needs by 50 per cent, there would be a cost of $4606.41 (no saving) in care costs over the period of one year; however savings would be expected in the following 24 months.

The potential savings shown above indicate that in two of the three cases home modifications could provide a cost saving if substitution for waged home care was achieved (Elizabeth and Jean).

Given the short lead time for this positioning paper and the need to use published data estimates of care to correlate with the home modification and health profile, these care costs are a snapshot of a care week that has been extended over a 12 month period. Therefore this study does not take into account the changing dynamics of a health prognosis and the reflected change in care requirements. A longitudinal study would further reveal the cost relationships between home modifications and waged home care, in particular a meta-analysis of care data with home modification data over an extended time period.

6. Discussion

The evidence sourced via the review and the data analysed in the three case studies provides the basis for refuting the null hypothesis; *There is no relationship between the number of hours of waged home care and home modification interventions*. It is clear from the literature review that a relationship between home modifications and care does exist. For instance a study conducted in 2004 concludes that home modifications can both substitute and supplement waged home care services (Lansley, McCreadie, & Tinker, 2004), and a separate study establishes a link between home modifications and delaying residential care (Newman, et al., 1990). The research reviewed also indicates that home modifications can achieve this substitution of care by reducing the disability threshold and improving the accessibility of the home environment, thereby reducing the need for care and enabling the independence in the daily life of people with functional limitations (Scotch & Shriner, 1997; Allen, Resnik & Roy, 2006).

One of the main outcomes of the literature review has been recognition of the need to review the way in which we view home modifications in terms of care. The lesser consideration given to a home modifications and self-care model has been evident in the small amount of research conducted in the field, despite continued calls for further research within the literature (Gitlin, 2003; Heywood, Allen, Moore, & Longden, 2007;

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Jones, et al., 2007). Home modifications have been undervalued in terms of their contribution to care provision, and are seen as impacting on a relatively small segment of the community care service sector (see Figure 17).

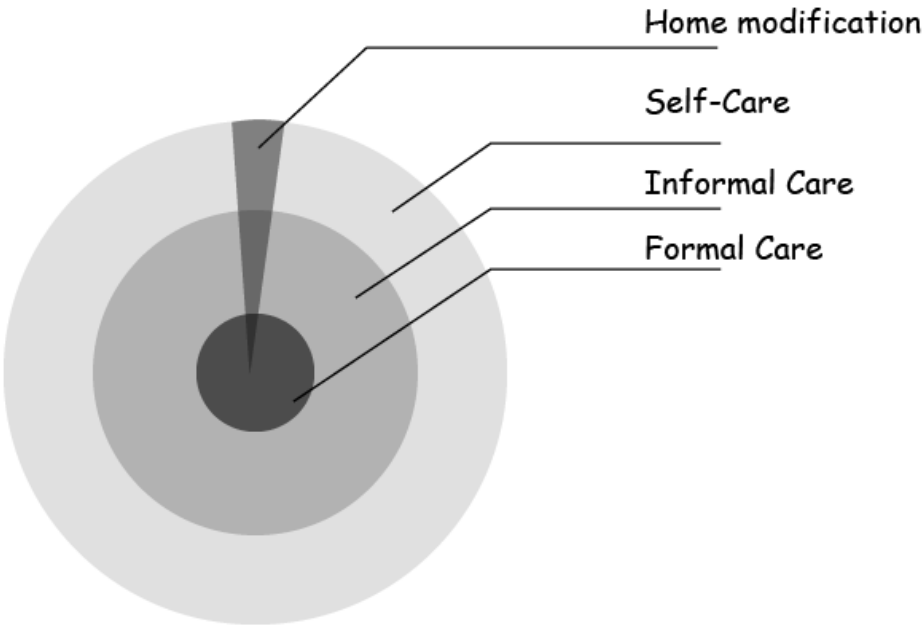

Figure 17. Under-usage of home modifications within the context of community care provision.

The diagram shows concentric and overlapping community care types with small segment of each impacted by home modifications.

In contrast to this view, the literature review has gathered wide-ranging evidence indicating that home modifications act as the facilitators of a self-care model, which can play a more significant part in community care provision. Figure 18 illustrates how this imbalanced view of home modification can be corrected in the context of community care provision as a component of self-care, formal and informal care services in the context of community care provision.

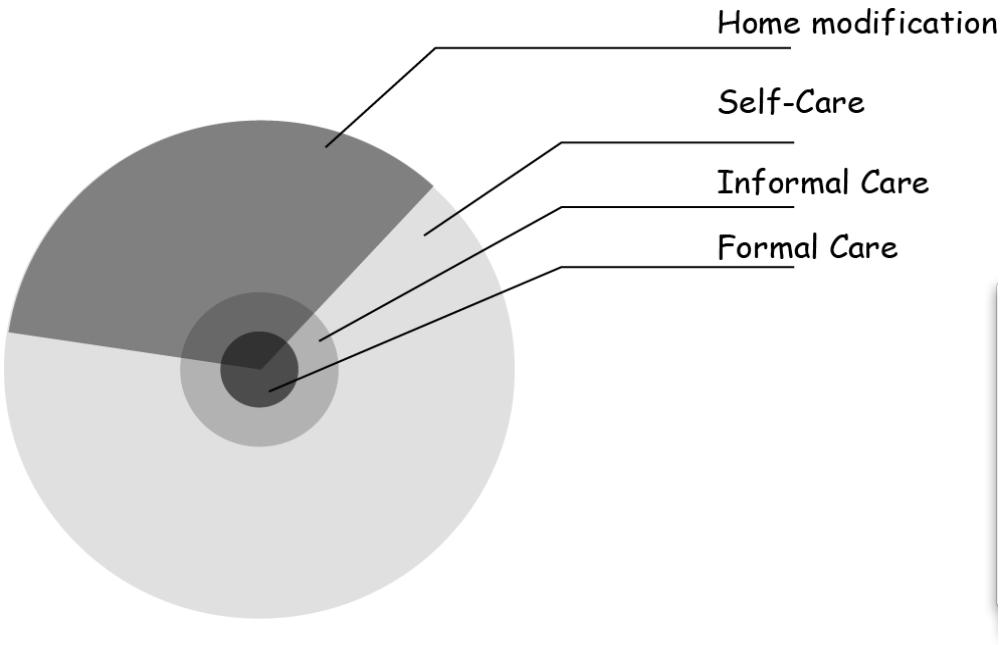

Figure 18. Projection of corrected utilisation of home modifications within the care sectors.

Diagram shows reduction in formal and informal care requirements compared to Figure 17, as well as an increase in the proportion of self-care incorporated into the community care. A larger proportion of care in particular self-care is impacted by home modifications.

It should not be underestimated that the home is the foundation of care delivery for the spectrum of community care services and that home modifications are central to making our standardised homes accessible (Bochel, et al., 1999). Of significance to a home modification is its relationship to home, disability threshold and care. The Home and Community Care definition of home modifications intrinsically links home modifications to disability threshold, accessibility and maintaining independence in the home environment (Home and Community Care Program, 2007, p. 1).

One way of viewing the existence of the relationship between home modifications and self-care is thus: *Self-care can exist without home modifications, but a home modification does not exist without self-care*. A home modification ceases to be a home modification without the element of care (be it self-care, informal care or formal care and is instead simply a renovation. A change in understanding of the building blocks of community care is warranted, and with it the stepping up of self-care to the ranks of formal and informal care which will bring home modifications and its benefits to the forefront of community care service provision. Home modifications and self-care can contribute, be judged, analysed, costed and are substitutable alongside the established care formats of *formal* and *informal* care.

This report also precipitates the need for further consideration of the relationships between care, disability threshold and the environment. In the context of this report,

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disability threshold is the cut-off point whereby someone with a functional limitation cannot perform a daily task. Disability threshold can be minimised, via a range of interventions:

- Medical
- Rehabilitation
- Environmental

Where these three interventions cannot step in, care must fill the gap to enable the task to be completed. An example of the significance of the interaction between care, disability threshold and the environment can be illustrated with the following simple case (see Figure 19 on following page).

Disability Threshold Interventions – Hypothetical Case Example

Client Persona: Bill

Health profile: Painful hip condition

Difficulty with task of: Bathing

Bill's bad hip condition currently prevents him from stepping into and sitting in his over-bath shower to bathe without considerable pain. In order to reduce the disability threshold and enable Bill to bathe himself a range of interventions are possible:

1. Medical: Bill could have a hip replacement operation thereby removing Bill's functional limitation, reducing the disability threshold and enabling him to use his bathe as usual once again.

2. Rehabilitation: Bill could learn a different way to wash. Either a sponge bath at his sink, or he could still use his bath but minimise hip flexion by sitting on the edge of the bath and swinging legs over and around.

3. Environmental (home modification): A hob-free shower can be installed which will allow easy standing access to shower for washing. And reduce the need for any hip flexion in order to wash.

Finally, if the preceding three interventions are not made **care** will be required to assist Bill to perform the task of bathing until such time as the **medical, rehab** or **environmental** interventions can be implemented. The optimum intervention requires case-by-case assessment. Factors such as age, health prognosis and life expectancy play a part in determining which intervention is most appropriate.

Figure 19: Disability Threshold Interventions-Hypothetical Case Example of variable interventions to reduce disability threshold – and the role of care.

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Evidence from the review has revealed that the relationship between home modifications and waged home care is likely to continue to be a positive one in a significant number of cases. The review has generated some new considerations regarding the disability threshold, home modifications, self-care and waged home care. In particular, new consideration should be given to the future roles of self-care and home modifications within the realms community care.

The second aspect to our hypotheses was that the substitution between home modifications and waged home care does exist, and that the degree of substitution is measurable by examining cases where both occur. The development of the case study template reveals that the degree of substitution will be measurable with a more detailed longitudinal study. It is anticipated that this further study would incorporate a meta-analysis of care data over time and be correlated with home modification data.

One of the main objectives of the case-studies is to begin to quantify the value of the benefit home modification might have on care needs by factoring in annual wages and capital outlay on modifications. Using the available data, the case-studies suggest the possibility of a twofold relationship between costing home modifications and waged home care;

- There is a general proportionality between care costs and home modification costs, meaning that lower care costs relate to lower home modification costs. Based on the common relationship of functional limitations, and the fact that less functional limitations would correspond to less care requirement, and less environmental intervention this would not be a surprising result.
- That home modifications over time will be a cost effective alternative to continued use of only waged home care assistance

The results of case-studies suggest that the investment associated with home modifications compare favourably with a waged home care equivalent over a fixed period of time (12 months) in two of the three cases. The case study where home modifications are more costly than the care equivalent (Case study C) can be attributed to the use of low care estimates, and short a study frame that does not capture declining health status or risk of falls.

The potential for home modifications to substitute for waged home care has been supported in two ways; First, the literature review on home modifications reveals the opportunity for multi-factorial benefits of home modifications in addition to pure cost. These could include improved independence, wellbeing, and safety in the home (Axtell & Yasuda, 1993;Cantu, 2003). Second, the case-studies demonstrated the interdependent relationship between health status, care needs and environmental change and how the costs of waged home care compare with home modifications if direct substitution takes place.

An important aspect of this research is that home modifications are recognised for their ability to minimise community waged home care needs while improving the accessibility of homes and increasing independence. The case study findings in this

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research are supported by the literature review and establish home modifications as a cost effective substitute for waged home care with the potential to play a larger role within community care. Further data collection will better determine the levels of substitution that can be achieved by home modifications. How care needs are changed by home modifications will depend on a detailed cost analysis to be developed by further investigating this hypotheses.

7. Conclusion

This report comprises a review of current literature on home modifications, care substitution and self-care that was conducted with the intention of informing policy of the potential of home modifications as a substitution for waged home care. The evidence presented by the literature review indicates that the null hypothesis proposed in this report can be refuted. This hypothesis stated there was no relationship between the number of hours of waged home care and home modifications interventions. Despite the existence of only a small amount of research in this specialised area, there was evidence of a relationship between waged home care and home modifications.

The review revealed new insights into the way we can view home modifications in terms of self-care and community care service in general. Recognising the strong interrelationships across environment (home modifications), waged home care, self care and disability threshold holds the key to further analysis of this new understanding of home modifications. Of most significance is the understanding that a home modification ceases to be a home modification when without a related care element – it is then relegated to being only a renovation.

The results of the literature review also inspired the development of a case study format collating data on home modifications, health status and care needs. One of the main objectives of the case-studies is to begin to quantify the value that home modification might have on care needs by factoring in annual wages and capital outlay on modifications.

The ability to measure the values of substitution that take place was investigated via the development of a template that incorporates the theoretical frameworks of functional limitations, disability threshold and person-environment fit. This template was then applied to three selected cases that had been exposed to both home modifications and waged home care. We found that despite the use of limited care data two key relationships emerge from the cases; First, that home modification costs may be to some extent proportional with waged home care costs, and; Second, that home modifications may emerge as a cost effective substitute for ongoing care costs.

In summary, the findings of the literature review and the preliminary cost analysis confirm the existence of a relationship between waged community care and home modifications. The review exposes limitations in the current vision of home modifications and leads to a new paradigm of community care where home modifications and self-care play a much more prominent role. In order to measure the

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degree of substitution that can take place between home modifications and waged home care, further data collection and research is needed. The research that is available on home modifications reveals that they are beneficial for care provision on many levels; they decrease functional limitations, improve independence, improve safety and reduce falls within the home. These benefits all have an impact on care needs, both directly and indirectly. These case study evaluations are explorative in nature, and their development has led to the recognition of the need for further data collection, in order to create more meaningful and accurate long-term study within this field.

Recommendations

This research highlights the need for a longitudinal, meta-analysis of data across the variety of care streams – in particular levels of formal care preceding and following home modifications. Research covered in the review indicates that care substitution is likely to take place, however there is currently no data available to measure the amount of care that is substituted when a home modification is installed. In order to do this accurately, monitoring of care requirements over time are needed along with the relevant health profiles and home modification specifications and costs.

This lack of research also means there is limited understanding of how home modifications will impact upon care needs in a real time, longitudinal manner. This further emphasises the need for data that establishes pre-home modification care hours, home modification recommendation costing, and compares with post-home modification care hours over a period of time.

This report focuses on home modifications in relation to existing care scenarios however further research is warranted which investigates home modifications as a preventative care strategy (and risk management approach). Research into home modifications as a preventative strategy to offset future care needs is particularly appropriate given the increasing pressure on care networks as the Australian population ages (Grant Thornton, 2008).

Policy Implications

Predicting if and when home modifications will enable a person to perform at a level that formal care services are no longer required will be instrumental in formulating effective public health policy. Home modification policy is a complex field due to the fact that it encompasses three broad policy and service fields: health, community care and housing (Habibis, et al., 2007). Home maintenance and modification services (HMMS), as a level of community care, has tended to be addressed both in the research literature and in policies and programs as a minor component part of each of these wider systems – this is reflected in HMMS small representation (3.1 per cent) nationally alongside other community care services (Australian Institute of Health and Welfare, 2003).

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One of the key financial benefits to Government with respect to the provision of community care is that the responsibility of accommodation remains with the client. Further supporting this home care environment and reducing formal care requirements with the home is an extension of the move towards community care practises. The preliminary results of this research indicate that home modifications are a cost effective alternative when compared to waged home care costs for 12 months. Further research will reveal the potential of home modifications to support and substitute for formal waged home care affording a reduction in the reliance on care labour in the community care provision.

Home modifications are valuable as a complement to existing care services, as an alternative to formal care provision to facilitate self-care where appropriate and as a means of extending the period of time that people can remain independently living in their homes.

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ISBN: 978-0-7334-2893-7 **www.homemods.info**

References

Abramson, L., Seligman, M., & Teasdale, J. (1978). Learned helplessness in humans: Critique and reformulation. *Journal of abnormal psychology, 87*(1), 49-74.

Abramson, P. (1991). *A case for case studies: An immigrant's journal*: Thousand Oaks CA US. Sage Publications.

Access Economics. (2009a). *Economic evaluation of capital financing of high care*: Access Economics. Retrieved from: www.cha.org.au/site.php?id=92

Access Economics. (2009b). *Making Choices -Future Dementia Care: Projections, Problems & Preferences*: Access Economics for Alzheimer's Australia. Project report for Alzheimer's Australia. Retrieved from: http//:www.alzheimers.org.au

Aged Care Industry Council. (2010). *2010-2011 Federal Budget Submission*. Aged and Community Services Australia. Retrieved from: http://www.agedcare.org.au/what-we-do/policies-and-position/acsa-submissions-pdfs/ACIC-Federal-Budget-Submission-2010.pdf/view

Agree, E. (1999). The influence of personal care and assistive devices on the measurement of disability. *Social Science & Medicine, 48*(4), 427-443.

Agree, E., Cornman, J., & Freedman, V. (2005). Measurement of assistive device use: Implications for estimates of device use and disability in late life. *The Gerontologist, 45*(3), 347-358

Agree, E., & Freedman, V. (2000). Incorporating assistive devices into community-based long-term care: An analysis of the potential for substitution and supplementation. *Journal of Aging and Health, 12*(3), 426-450

Agree, E., & Freedman, V. (2003). A comparison of assistive technology and personal care in alleviating disability and unmet need. *The Gerontologist, 43*(3), 335-344

Allen, S., Resnik, L., & Roy, J. (2006) Promoting Independence for Wheelchair

Users: The Role of Home Accommodations. *The Gerontologist, 46*(1), 115-123

Ambrose, P. (2001). Living conditions and health promotion strategies. *Journal of the Royal Society of Health, 121*(1), 9-15.

Australian Bureau of Statistics. (1999). *4182.0 Australian Housing Survey; Housing Characteristics, Costs and Conditions*. Retrieved from: http://www.abs.gov.au/ausstats/abs@.nsf/productsbytopic/53AF1D370FC826FECA256988007BF6A9?OpenDocument

Australian Department of Health and Ageing (2010). *Home and Community care- Help Staying at Home*. Retrieved from: http://www.agedcareaustralia.gov.au/internet/agedcare/publishing.nsf/content/Home and Community Care. Accessed: Jan 2010

Australian Department of Health and Ageing (2006). *The Community-Based Aged Care Workforce -A desktop Review of the Literature*. Department of Health and Ageing. Retrieved from: *www.health.gov.au/internet/main/.../CBW%20pt1%20synopsis.pdf*

Australian Housing and Urban Research Institute (AHURI) (2010) How well do older Australians utilise their homes? *AHURI Research Bulletin Issue 126 May 2010*. Retrieved from: www.ahuri.edu.au/publications/download/rap_issue_126

Australian Institute of Health and Welfare (AIHW), (2003). *Australias Welfare 2003 Canberra:.* Canberra: AIHW

Australian Institute of Health and Welfare (AIHW), (2007). *Australia's Welfare (No. 8) Canberra.* Canberra*:* AIHW.

Axtell, L., & Yasuda, Y. (1993). Assistive devices and home modifications in geriatric rehabilitation. *Clinics in Geriatric Medicine, 9*(4), 803-821

Bach, J., Intintola, P., Alba, A., & Holland, I. (1992). The ventilator-assisted individual. Cost analysis of institutionalization vs rehabilitation and in-home management. *Chest, 101*(1), 26-30

April 2011; 2nd printing July 2014

ISBN: 978-0-7334-2893-7 **www.homemods.info**

Badger, T. (2007). Physical health impairment and depression among older adults. *Journal of Nursing Scholarship, 25*(4), 325-330.

Bakker, R. (1999). Elderdesign: home modifications for enhanced safety and self-care. *Care management journal 1*(1), 47-54

Bland, R. (1999). Independence, privacy and risk: two contrasting approaches to residential care for older people. *Ageing and Society, 19*(05), 539-560.

Bochel, C., Bochel, H., & Page, D. (1999). Housing: the foundation of community care? *Health and Social Care in the Community, 7*(6), 492-501.

Botsis, T., & Hartvigsen, G. (2008). QCurrent status and future perspectives in telecare for elderly people suffering from chronic diseases. *Journal of Telemedicine and Telecare, 14*(4), 195-203.

Boyd, S. (1998). Shifting Paradigms in Disability Services: Implications for the 21st Century. In Natale, S., Hoffman, R., Hayward, G. (Eds.) *Business Education and Training: A Value-Laden Process, Corporate Structures, Business and the Management of Values*. Chapter 17, 277.

Brandt, E.N. & Pope, A.M. (Eds.)(1997). *Enabling America: Assessing the role of rehabilitation science and engineering*. Washington D.C: National Academy Press

Bridge, C. (2005). *Accessible Housing in Australia. HMMinfo Consultation Paper Response: Home Modification Information Clearinghouse Project.* University of Sydney. Australia. Retrieved from: www.homemods.info/files/HMinfoAccessibleHousingResponse.pdf

Bridge, C. (2006). *Computational case-based redesign for people with ability impairment: Rethinking, reuse and redesign learning for home modification practice*. (Doctoral dissertation) University of Sydney. School of Architecture, Design Science and Planning: Sydney, Australia.

Bridge, C. and Gopalan, P. (2006). *Retrofitting, a response to lack of diversity: An analysis of the Home Modification and Maintenance services funded under the Home and Community Care Program*. In S. Darby, P. Flatau & I. Hafekost (Eds.). Building for diversity, proceedings of the National Housing Conference 26-27th Oct 2005, Perth, Western Australia. 349-366.

Bridge, C., Kendig, H., Phibbs, P., Mathews, M., & Cooper, B. (2008). The costs and benefits of using private housing as the 'home base' for care for older people: secondary data analysis. *AHURI Final Report Series, Final Report No. 115*. Sydney: Australian Housing and Urban Research Institute (AHURI)

Bridge, C., & Oram, L. (2005). *A better grip on handrails*. Proceedings from The Festival of International Conferences on Caregiving Disability Aging and technology (FICCDAT) Toronto, Canada. June 16-19, 2007. Retrieved from: www.homemods.info

Brody, K., Johnson, R., & Ried, L. (1997). Evaluation of a self-report screening instrument to predict frailty outcomes in aging populations. *The Gerontologist, 37*(2), 182-191

Cantor, M. (1979). Neighbors and friends: An overlooked resource in the informal support system. *Research on Aging, 1*(4), 434-463

Cantor, M., & Little, V. (1985). Aging and social care. *Handbook of aging and the social sciences*, 745-781.

Cantu, C. (2003). Home modification for independence and success. *Exceptional Parent, 33*(4), 38-45.

Chang, J., Morton, S., Rubenstein, L., Mojica, W., Maglione, M., Suttorp, M., et al. (2004). Interventions for the prevention of falls in older adults: systematic review and meta-analysis of randomised clinical trials. *British medical journal, 328*(7441), 680-687

Chappell, N., Dlitt, B., Hollander, M., Miller, J., & McWilliam, C. (2004). Comparative costs of home care and residential care. *The Gerontologist, 44*(3), 389-400

Clemson, L., Roland, M., & Cumming, R. (1997). Types of hazards in the homes of elderly people. *Occupational Therapy Journal of Research, 17*, 200-213.

April 2011; 2nd printing July 2014
ISBN: 978-0-7334-2893-7 **www.homemods.info**

Cohen-Mansfield, J., & Parpura-Gill, A. (2007). Bathing: A framework for intervention focusing on psychosocial, architectural and human factors considerations. *Archives of gerontology and geriatrics, 45*(2), 121-135.

Cohen-Mansfield, J., & Werner, P. (1995). Environmental influences on agitation: An integrative summary of an observational study. *American Journal of Alzheimer's Disease and Other Dementias, 10*(1), 32-39

Commonwealth Department of Health and Ageing. (2003). *A New Strategy for Community Care: The way forward.* Canberra: Commonwealth of Australia. Retrieved from: www.ageing.health.gov.au

Connell, B. (1996). Role of the environment in falls prevention. *Clinics in Geriatric Medicine, 12*(4), 859-80

Cook, D. Mulrow, C. & Haynes, B. (1997). "Systematic reviews: synthesis of best evidence for clinical decisions." Annals of Internal Medicine 126(5): 376-80.

Cooper, H. (1998) *Synthesizing Research: a guide for literature reviews*, 3rd Ed, London: Sage.

Cripps, R. & Carman, J. (2001). *Falls by the elderly in Australia: Trends and data for 1998*: Australian Institute for Health and Welfare (AIHW). Canberra: AIHW. Retrieved from: www.nisu.flinders.edu.au/pubs/reports/2001/eldfalls_injcat35.pdf

Csikszentmihalyi, M. & Rochberg-Halton, E. (1981). *The meaning of things: Domestic symbols and self*. UK: Cambridge University Press.

Cummins, R., Hughes, J., Tomyn, A., Gibson, A., Woerner, J., & Lai, L. (2007*). Wellbeing of Australians: carer health and wellbeing.* Geelong, Vic.: Deakin University

DeFriese, G., Konrad, T., Woomert, A., Kincade Norburn, J., & Bernard, S. (1994). Self-care and quality of life in old age. In Abeles, R., Gift, H., Ory, M., (Eds.) *Aging and quality of life: Volume 2 of Springer Series on life styles and issues in aging.* New York: Springer Publishing Company.

de Klerk, M., & Huijsman, R. (1996). Effects of technical aids on the utilization of professional care. A study among single 75-year olds. *Tijdschrift voor gerontologie en geriatrie, 27*(3), 105-114

Department of Ageing, Disability and Home Care (2005). *HACC NSW Unit Cost Benchmarking Study 2005 -Service Provider Feedback*. NSW Government Family & Community Services. Retrieved from http://www.dadhc.nsw.gov.au/NR/rdonlyres/39C1876A-27F6-4C70-ABAD-CAD56D4F64E1/2095/HACCUCBPServProvReport.pdf.

Department of Human Services (2010) *Department of Humans Services Victoria Annual report 2010-11.* Retrieved from: http://www.dhs.vic.gov.au/about-the-department/our-organisation/annual-reports. Accessed: Nov 2010

Devlin, A. & Arneill, A. (2003) Health Care Environments and Patient Outcomes. *Environment and Behaviour*. September 35 (5), 665-694

Disler, P., Roy, C., & Smith, B. (1993). Predicting hours of care needed. *Archives of Physical Medicine and Rehabilitation, 74*(2), 139-143

Dunlop, D., Hughes, S., & Manheim, L. (1997). Disability in activities of daily living: patterns of change and a hierarchy of disability. *American journal of public health, 87*(3), 378-383

Ettner, S. (2007). The effect of the Medicaid home care benefit on long-term care choices of the elderly *Economic Inquiry, 32*(1), 103-127.

Evans, G.W., Kantrowitz,E. & Eshelman, P. (2002). Housing quality and psychological well being among the elderley population. *Journal of Gerontology*, 57B (4), 381-383

Evans, J. & Benefield, P. (2001). "Systematic Reviews of Educational Research: does the medical model fit?" British educational research journal 27(5): 527-541.

Faulkner, D., Findlay, M., Barrington, R., & Luszcz, M. (2004). *Factors That Make Housing More Suitable For Older People*: *Australian Housing and Urban Research Institute (AHURI).* Melbourne: AHURI

Fleming, G., Giachello, A., Andersen, R., & Andrade, P. (1984). Self-care: Substitute, Supplement, or Stimulus for Formal Medical Care Services? *Medical Care, 22*(10), 950-966.

April 2011; 2nd printing July 2014
ISBN: 978-0-7334-2893-7 **www.homemods.info**

Flexner, S., & Hauck, L. (1987). *The Random House dictionary of the English language*: New York: Random House

Fox, P (1995). Rehabilitation in practice: Environmental modifications in the homes of elderly Canadians with disabilities. *Disability & Rehabilitation* 17(1), 43-49

Frisch, J. (1998). *The benefits of accessible buildings and transport.* Physical Disability Council of NSW, Sydney, NSW. Retrieved from: http://www. pdcnsw. org. au/Access. pdf] and http://www. members.optushome.com.au/jackfrisch.

Gibson, D. (1998). *Aged care: old policies, new problems*. UK: The Press Syndicate of the University of Cambridge

Gilderbloom, J., & Markham, J. (1996). Housing modification needs of the disabled elderly: What really matters? *Environment and Behavior, 28*(4), 512-535

Gill, T., Allore, H., & Han, L. (2006). Bathing disability and the risk of long-term admission to a nursing home. *Journals of Gerontology Series A: Biological and Medical Sciences, 61*(8), 821-825

Gill, T., Guo, Z., & Allore, H. (2006). The epidemiology of bathing disability in older persons. *Journal of the American Geriatrics Society, 54*(10), 1524-1530.

Gitlin, L. (2003). Conducting research on home environments: Lessons learned and new directions. *The Gerontologist, 43*(5), 628-637

Gitlin, L., Corcoran, M., Winter, L., Boyce, A., & Hauck, W. (2001). A randomized, controlled trial of a home environmental intervention: effect on efficacy and upset in caregivers and on daily function of persons with dementia. *The Gerontologist, 41*(1), 4-14

Gitlin, L., Mann, W., Tomit, M., Sue, M., & Marcus, L. (2001). Factors associated with home environmental problems among community-living older people. *Disability & Rehabilitation, 23*(17), 777-787.

Gitlin, L., Miller, K., & Boyd, A. (1999). Bathroom modifications for frail elderly renters: Outcomes of a community-based program. *Technology and Disability, 10*(3), 141-149.

Grant Thornton. (2008). *Aged Care Survey -Summary Findings*: Grant Thornton, October 2008. Retrieved from : www.grantthornton.com.au/files/aged_care_survey_2008-final.pdf

Greene, V. (1983). Substitution between formally and informally provided care for the impaired elderly in the community. *Medical Care*, 609-619.

Greene, V., Ondrich, J., & Laditka, S. (1998). Can home care services achieve cost savings in long-term care for older people? *The Journals of Gerontology: Series B, 53*(4), S228 – S238

Habibis, D., Atkinson, R., Dunbar, T., Goss, D., Easthope, H., & Maginn, P. (2007). *Final Report 103. A sustaining tenancies approach to managing demanding behaviour in public housing: a good practice guide*: *Australian Housing and Urban Research Centre* (AHURI), Melbourne: AHURI

Hammersley, M. (2001) On 'Systematic' Reviews of Research Literatures: A 'Narrative' Response to Evans & Benefield, *British Educational Research Journal,* 27, No(5) Dec., 543-554.

Harden, A. (2004). "Applying systematic review methods to studies of people's views: an example from public health research." *Journal of epidemiology and community health* 58(9): 794-800.

Healey, F. (1994). Does flooring type affect risk of injury in older in-patients? *Nursing times, 90*(27), 40-41

Heaton, J., & Bamford, C. (2001). Assessing the outcomes of equipment and adaptations: issues and approaches. *The British Journal of Occupational Therapy, 64*(7), 346-356.

Hedrick, S., & Inui, T. (1986). The effectiveness and cost of home care: an information synthesis. *Health Services Research, 20*(6 Pt 2), 851-880

Heywood, F., Allen, T., Moore, P., & Longden, C. (2007). *An integrated methodology for establishing the health-related cost benefits of housing adaptations and other housing interventions for older people (The Aimwell project)*. Paper presented at the International Conference of Sustainable Urban Areas. Rotterdam, Netherlands: 2007.

April 2011; 2nd printing July 2014
ISBN: 978-0-7334-2893-7 **www.homemods.info**

Hill PDA, Rider Hunt, & Brian Elton & Associates. (1999). *Adaptable housing study: a cost benefit analysis of adaptable homes*: New South Wales Government Department of Urban Affairs and Planning, May 1999.

Hodges, L., & Bridge, C. (2007). *Evaluation of the national and NSW HACC-funded home modification and home maintenance service usage as reported by the 2001/2002 – 2005/2006 HACC MDS*. Home Modification Information Clearinghouse, University of NSW. Retrieved from : http://www.homemods.info/resource/occasional/evaluation_of_the_national_and_nsw_haccfunded_home_modification_and_home_maintenance_service_usage_as_report

Hogan, W. (2004). *Review of Pricing Arrangements in Residential Aged Care*. Australian Government Department of Health and Aging. Retrieved from www.health.gov.au/internet/wcms/publishing.nsf/content/health-investinginagedcare-report-index.htm.

Home Adaptations Consortium. (2010). *Home Adaptations for Disabled People.Equality and Excellence in Future Provision*. Addressing the Nine Key Comprehensive Spending Review Questions posed by HM Treasury. Care and Repair England. Available: www.cotss-housing.co.uk. Accessed: March 2010.

Home and Community Care Program (1991). *Home and Community Care National Service Standards.* Retreved from: http://www.health.gov.au/internet/main/publishing.nsf/content/hacc-pub_isd_nssi.htm

Home and Community Care Program. (2007a). *NSW service type guidelines for Home and Community Care (HACC): Home modification*. Commonwealth of Australia. Retrieved from: www.adhc.nsw.gov.au. Accessed: Dec 2009.

Home and Community Care Program (2007b). *National Program Guidelines for the Home and Community Care Program*. ACT: Commonwealth of Australia. Available: www.health.gov.au. Retrieved from: Jan 2010.

Houde, S. (1998). Predictors of elders' and family caregivers' use of formal home services. *Research in Nursing and Health, 21*(6), 533-544.

Howe, A. (2002). Recent developments in aged care policy in Australia. *Journal of Aging & Social Policy, 13*(2), 101-116.

Iliffe, S., & Lenihan, P. (2006). Promoting innovative primary care for older people in general practice using a community-oriented approach. *Primary Health Care Research and Development, 2*(02), 71-79.

Imrie, R. (2006). *Accessible housing: quality, disability and design*. Oxon, UK: Routledge.

Iwarsson, S., & Slaug, B. (2001). *Housing Enabler: An instrument for assessing and analysing accessibility problems in housing*: Navlinge,Sweden: Veten & Skapen HB & Slaug Data Management.

Jones, A., de Jonge, D., & Phillips, R. (2007). *The impact of home maintenance and modification services on health, community care and housing outcomes in later life: Australian Housing and Urban Research Centre (AHURI).*Queensland Research Centre: AHURI

Jones, A., De Jonge, D., & Phillips, R. (2008). *The role of home maintenance and modification services in achieving health, community care and housing outcomes in later life*: Australian Housing and Urban Research Institute (AHURI). Melbourne Australia: AHURI

Jones, J., Wilson, A., Parker, H., Wynn, A., Jagger, C., Spiers, N., et al. (1999). Economic evaluation of hospital at home versus hospital care: cost minimisation analysis of data from randomised controlled trial. *British Medical Journal, 319*(7224), 1547.

Kendig, H., & Bridge, C. (2007). Housing Policy for Long-Lived Society. In Borowski, A., Encel, S., Ozanne, E. (Eds.) *Longevity and social change in Australia*. Sydney: University of NSW (UNSW) Press.

Khoosal, D., & Jones, P. (1989). Community care again: a need for definition. *Journal of the Royal Society of Medicine, 82*(8), 451-452

April 2011; 2nd printing July 2014
ISBN: 978-0-7334-2893-7 **www.homemods.info**

Kidd, B., & Clark, R. (1988). *Outdoor Access For All: a guide to designing accessible outdoor recreation facilities.* Melbourne, VIC: Department of Youth, Sport and Recreation.

Kohn, J., LeBlanc, M., & Mortola, P. (1994). Measuring quality and performance of assistive technology: results of a prospective monitoring program. *Assistive technology: the Official Journal of RESNA, 6*(2), 120-125

Lansley, P., McCreadie, C., & Tinker, A. (2004). Can adapting the homes of older people and providing assistive technology pay its way? *Age and Ageing, 33*(6), 571-576.

Lansley, P., McCreadie, C., Tinker, A., Flanagan, S., Goodacre, K., & Turner-Smith, A. (2004). Adapting the homes of older people: a case study of costs and savings. *Building Research & Information, 32*(6), 468-483.

LaPlante, M., Harrington, C., & Kang, T. (2009). Estimating paid and unpaid hours of personal assistance services in activities of daily living provided to adults living at home. *Health Services Research, 37*(2), 397-415.

Levin, L., Katz, A., & Holst, E. (1977). *Self-care: Lay initiatives in health*: London: Taylor & Francis.

Litwak, E. (1985). *Helping the elderly: The complementary roles of informal networks and formal systems*: New York: Guilford Press

Liu, K., Manton, K., & Aragon, C. (2000). Changes in home care use by disabled elderly persons: 1982-1994. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 55*(4), 245-253

Liu, S., & Lapane, K. (2009). Residential Modifications and Decline in Physical Function Among Community-Dwelling Older Adults. *The Gerontologist, 49*(3), 344-354.

Lyons, R., John, A., Brophy, S., Jones, S., Johansen, A., Kemp, A., et al. (2006). Modification of the home environment for the reduction of injuries. *Cochrane database of systematic reviews (Online)*(Issue 4). John Wiley and Sons. Retrieved from: www.aubmc.org.lb. Accessed: Dec 2009

Mann, W., Ottenbacher, K., Fraas, L., Tomita, M., & Granger, C. (1999). Effectiveness of assistive technology and environmental interventions in maintaining independence and reducing home care costs for the frail elderly: A randomized controlled trial. *Archives of Family Medicine, 8*(3), 210-217

Manton, K., Corder, L., and Stallard, E. 1993. "Changes in the Use of Personal Assistance and Special Equipment from 1982 to 1989: Results from the 1982 and 1989 NLTCS." *The Gerontologist* 33:168-176.

Mathieson, K., Kronenfeld, J., & Keith, V. (2002). Maintaining functional independence in elderly adults: The roles of health status and financial resources in predicting home modifications and use of mobility equipment. *The Gerontologist, 42*(1), 24-31

McMurray, A. (1990). *Community health nursing: primary health care in practice*. Melbourne: Churchill Livingstone.

Meera George, J., Aanand, D., & Naik, A. (2006). Clinician's Role in the Treatment of Bathing Disability. *Geriatrics and Aging, 9*(9), 642-645.

Merrell, R., & Doarn, C. (2006). Telehomecare: Where Are We? *Telemedicine Journal & e-Health, 12*(2), 79-80.

Naik, A., & Gill, T. (2005). Underutilization of environmental adaptations for bathing in community-living older persons. *Journal of the American Geriatrics Society, 53*(9), 1497-1503.

National Ageing Research Institute. (2001). *Analysis of Demand for Local Government 'In-Home' HACC Services in the Western Metropolitan Region*. Retrieved from: www.mednwh.unimelb.edu/au. Accessed: Jan 2010

Newman, S., Struyk, R., Wright, P., & Rice, M. (1990). Overwhelming odds: Caregiving and the risk of institutionalization. *The Journal of Gerontology, 45*(5), 173-183

Nissim, R., (2008*). Universal housing, universal benefits.* Victorian Council of Social Service (VCOSS). Melbourne: VCOSS

Nolte, E. (1988). *Building Adaptable Housing*: National Housing Council of The Netherlands,.

Norman, L., & Lancaster, M. (1990). Hygiene and the patient with Alzheimer's disease. *Alzheimer's disease: a handbook for caregivers*, p62.

Patel, A. (2006). *Issues in multi-national health economic evaluation*: University of London.

Petersson, I., Kottorp, A., Bergstrom, J., & Lilja, M. (2009). Longitudinal changes in everyday life after home modifications for people aging with disabilities. *Scandinavian Journal of Occupational Therapy, 16*(2), 78-87.

Pezzin, L., Kemper, P., & Reschovsky, J. (1996). Does publicly provided home care substitute for family care? Experimental evidence with endogenous living arrangements. *Journal of Human Resources, 31*(3), 650-676.

Phillips, J. (2007). *Care: Key Concepts* UK: Polity Press

Pope, A. & Tarlov, A. (1991) *Disability in America: Toward a national agenda for prevention.* Washinton, DC: National Academy Press.

Preiser, W., & Ostroff, E. (2001). *Universal design handbook*: New York: McGraw-Hill Professional.

Pynoos, J., Cohen, E., Davis, L., & Bernhardt, S. (1987). Home modifications: Improvements that extend independence. *Housing the aged: Design directives and policy considerations*, 277-303.

Pynoos, J., Nishita, C., & Perelma, L. (2003). Advancements in the Home Modification Field. *Journal of Housing for the Elderly, 17*(1), 105-116.

Pynoos, J., Tabbarah, M., Angelelli, J., & Demiere, M. (1998). Improving the delivery of home modifications. *Technology and Disability, 8*(1), 3-14.

Reuben, D., Keeler, E., Seeman, T., Sewall, A., Hirsch, S., & Guralnik, J. (2002). Development of a method to identify seniors at high risk for high hospital utilization. *Medical Care, 40*(9), 782-793.

Robinette, G. (1978). *Access to the Environment*. Washington: Department of Housing and Urban Development.

Roelands, M., Van Oost, P., Buysse, A., & Depoorter, A. (2002). Awareness among community-dwelling elderly of assistive devices for mobility and self-care and attitudes towards their use. *Social Science & Medicine, 54*(9), 1441-1451.

Roelands, M., Van Oost, P., Depoorter, A., & Buysse, A. (2002). A social-cognitive model to predict the use of assistive devices for mobility and self-care in elderly people. *The Gerontologist, 42*(1), 39-50

Salvage, A., Jones, D., & Vetter, N. (1989). Opinions of people aged over 75 years on private and local authority residential care. *Age and Ageing, 18*(6), 380-386

Sanford, J., Arch, M., & Megrew, M. (1995). An evaluation of grab bars to meet the needs of elderly people. *Assistive technology: the official journal of RESNA, 7*(1), 36-47

Sattin, R. (1992). Falls among older persons: a public health perspective. *Annual Review of Public Health, 13*(1), 489-508.

Scope Access (2010). *Home Modification Services Case Study Records*. Unpublished raw data.

Scotch, R., & Schriner, K. (1997). Disability as human variation: Implications for policy. *The Annals of the American Academy of Political and Social Science, 549*, 148-159.

Scotts, M., Saville-Smith, K., & James, B. (2007). *International Trends in Accessible Housing for people with disabilities.* Centre for Housing Research Aotearoa New Zealand (CHRANZ). Retrieved from: www.chranz.co.nz. Accessed Dec 2009.

Secker, J., Hill, R., Villeneau, L., & Parkman, S. (2003). Promoting independence: but promoting what and how? *Ageing and Society, 23*(03), 375-391.

Seligman, M. (1975). *Helplessness: On depression, development, and death*: WH Freeman San Francisco.

Shepard, J. (2001). *Sociology and You*: McGraw-Hill/Glencoe.

April 2011; 2nd printing July 2014
ISBN: 978-0-7334-2893-7 **www.homemods.info**

Shepperd, S., Harwood, D., Gray, A., Vessey, M., & Morgan, P. (1998). Randomised controlled trial comparing hospital at home care with inpatient hospital care. II: cost minimisation analysis. *British medical journal, 316:* 1791.

Smith, R., Quine, S., Anderson, J., & Black, K. (2002). Assistive devices: self-reported use by older people in Victoria. *Australian Health Review, 25*(4), 169-177.

Sonn, U., & Grimby, G. (1994). Assistive devices in an elderly population studied at 70 and 76 years of age. *Disability & Rehabilitation, 16*(2), 85-92.

Stake, R. (1995). *The art of case study research*: Thousand Oaks, CA:Sage Publications

Steinfeld, E., & Danford, G. (1999). *Enabling environments: measuring the impact of environment on disability and rehabilation*: US: Springer.

Steinfeld, E., Schroeder, S., Duncan, J., Faste, R., Chollet, D., & Bishop, M. (1979). Access to the built environment. *A review of the literature.* Government Printing Office, Washington DC, US.

Steinfeld, E., & Shea, S. (1993). Enabling home environments. Identifying barriers to independence. *Technology and Disability, 2*(4), 69-79.

Steinfeld, E., & Scott, M. (2003). *Enabling home environments: Strategies for aging in place*. Rehabilitations Research Centre on Ageing. State University of New York, US. Retrieved from: www.ap.buffalo.edu.

Stevens, E. (1993). Making sense of usefulness: an avenue toward satisfaction in later life. *International journal of aging & human development, 37*(4), 313-323

Straton, J., Saunders, N., Broe, T., Brown, W., Earle, L., & Gregory, B. (2003). *Promoting Healthy Ageing in Australia*: Prime Minister's Science, Engineering and Innovation Council.

Sunnaas Hospital Dept. of Occupational Therapy. (2000). *Sunnaas ADL Index. English 2nd Edition*.

Tennstedt, S., Crawford, S., & McKinlay, J. (1993). Is family care on the decline? A longitudinal investigation of the substitution of formal long-term care services for informal care. *The Milbank Quarterly, 71*(4), 601-624.

Tilly, J., & Rees, G. (2007). Consumer directed Care: a way to empower consumers. *Alzheimer's Australia*.

Tinetti, M., Baker, D., Gallo, W., Nanda, A., Charpentier, P., & O'Leary, J. (2002). Evaluation of Restorative Care vs Usual Care for Older Adults Receiving an Acute Episode of Home Care. *Journal of the American Medical Association, 287*, 2098-2105.

Tinker, A. (1999). Ageing in Place: What can we learn from each other. *The 6th F. Oswald Barnett Oration, Melbourne,: Ecumenical housing*.

Tomita, M., Mann, W., Fraas, L., & Stanton, K. (2004). Predictors of the use of assistive devices that address physical impairments among community-based frail elders. *Journal of Applied Gerontology, 23*(2), 141-155

Trickey, F., Maltais, D., Gosselin, C., & Robitaille, Y. (1994). Adapting older persons' homes to promote independence. *Physical & Occupational Therapy in Geriatrics, 12*(1), 1-14.

Twigg, J. (2000). *Bathing--the body and community care*: London: Routledge.

Van Der Geest, S. (1987). Self-care and the informal sale of drugs in South Cameroon. *Social Science & Medicine, 25*(3), 293-305.

Van Haastregt, J., Diederiks, J., Van Rossum, E., De Witte, L., & Crebolder, H. (2000). Effects of preventive home visits to elderly people living in the community: systematic review. *British Medical Journal, 320* (March) 754-758.

Verbrugge, L., & Sevak, P. (2002). Use, type, and efficacy of assistance for disability. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 57*(6), 366-379

Watkins, T. (2004). Introduction to Cost Benefit Analysis. *San Jose State University Economics Department*.

Weissert, W. (1985). Seven reasons why it is so difficult to make community-based long-term care cost-effective. *Health Services Research, 20*(4), 423 - 433

April 2011; 2nd printing July 2014
ISBN: 978-0-7334-2893-7 **www.homemods.info**

Wiener, J., Hanley, R., Clark, R., & Van Nostrand, J. (1990). Measuring the activities of daily living: Comparisons across national surveys. *The Journal of Gerontology, 45*(6), 229 - 237

Wood, M. (Producer). (2005) Aged Care Costs and Funding Options. *Presentation to the National Aged Care Alliance Forum : Ageing:Who will pay?* Available: www.naca.asn.au. Accessed January 2010.

World Health Organization (1983). *Health Education in Self-care: Possibilities and Limitations.* Geneva: Report of a scientific consultation. Geneva: November 21-25, 1983

World Health Organisation. (2001). *International classification of functioning, disability and health (ICF)*. Retrieved from: http://www.who.int/classifications/icf/en/. Accessed March 2010

World Health Organisation and United Nations Economic & Social Commission for Asia and the Pacific. (2009). *Training Manual on Disability Statistics*. Retrieved from: http://www.unescap.org/stat/disability/manual/index.asp

Yin, R. (1994). Case Study Research: Design and Methods, Third Edition,Applied Social Research Methods Series, Vol. 5. Thousand Oaks, CA: Sage

Yin, R. (2008). *Case study research: Design and methods*:. Third Edition,Applied Social Research Methods Series, Vol. 5. Thousand Oaks, CA: Sage.

Zauszniewski, J. (1997). Evaluation of a measure of learned resourcefulness for elders. *Journal of Nursing Measurement, 5*(1), 71-86.

April 2011; 2nd printing July 2014
ISBN: 978-0-7334-2893-7 **www.homemods.info**

Appendix: Literature Search Strategy

Question component breakdown

Problem	Intervention	Outcome	Comparison	Target population
Cost of care	Home modifications	Substitution – ageing in place	Waged Home Care	Disability/ Aged

A selection of databases (1980–February 2010) for all relevant publications search terms from the following table:

Problem	Intervention	Outcome	Comparison	Target population
• Housing • Houses • Bathrooms • Home/Homes • Housing for the elderly • Public housing • Community housing • Domestic housing	• Home modification • Adaptations • Architectural • Accessibility • Housing modification • Housing adaptations • Home adaptations • Environmental modifications • Environmental interventions • Housing intervention • Housing improvements • Universal design • Elder design • Assistive devices • Assistive equipment • Adaptive equipment • Self help devices • Assistive technology	• Cost effectiveness • Cost benefit • Cost analysis • Economics • Costs • Investment • Substitute/ Substitutive/ Substitution • Replacement • Supplement/ • Supplementation/ • Supplementary • Benefits • Case study • Appropriateness • Suitability • Choice • Options • Feasibility • Comparison/ • comparative • Independent living • Ageing in place/Aging in place	• Waged home care • Paid care • Paid labor/labour • Paid assistance • Waged assistance • Home care services • Home care • Home health care • Domiciliary care • Cost of care • Formal home care • Formal care • Formal helping services • Home care provider • Burden of illness • Cost of illness	• Aged/Ageing/Aging • Disability/Disabled • Seniors • Older • Geriatric • Mobility impaired • Mobility limitation • Impairment

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A typical search string appears as follows:

"home mod*" or "home adapt*" or "assistive device" and "self-care" or "integrated care" or "formal care" or "co-produc*" or "care model" or "care system" or "personali*" and aged or disabled or impair*

(Cost* or Economic* or Investment*) and (Aged or Ageing or Aging or Disabilit* or Disabled or Elderly or Seniors or Older people or Geriatric* or Impair* or Mobility limitation* or wheelchair*) and (Home* or Hous* or Bathroom*)

Databases searched include: Medline, CINAHL, Ageline , APAIS – Health , ICONDA , Web of Science , Scopus , Avery , BUILD, Applied Social Sciences Index and Abstracts , International Bibliography of the Social Sciences.

Inclusion Criteria

In order for material to be eligible for inclusion into this review they had to correspond to all of the following criteria. All material to be eligible for inclusion had to be:

- Written in English.
- Attainable through the UNSW or via the World Wide Web (i.e. Google/Google scholar).
- Searched, obtained via and related to specified keywords (outlined above).
- Written post 1.

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