

Occasional Paper Home Modifications in Aboriginal Housing

Authored by

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Acknowledgement of Country

In the spirit of respect, we acknowledge the traditional owners of Country, this gesture acknowledging Aboriginal and Torres Strait Islander custodianship for millennia. As our mark of respect, we acknowledge the Elders and the peoples who are talked about in this publication. We acknowledge the Land on which this work was done. Australia is the only place in the world where Aboriginal and Torres Strait Islander Australians belong, and there is no place in Australia where this is not true.

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Language use

On the advice of a Gathering group of Aboriginal and Torres Strait Islander people, the word 'Aboriginal', rather than Indigenous, has been used within this document, in order to refer to people of Aboriginal and Torres Strait Islander descent, as this term could be used to refer to people indigenous to other nations. This document uses the term 'Aboriginal' to cover both groups for readability purposes, unless expressly specified.

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1 Introduction

1.1 Background

Housing in rural remote Australia has always posed a number of management challenges due to the challenging geography and climate in many regions of the continent. These housing challenges tend to be augmented when applied to the Aboriginal population. Evidence suggests that current housing provision for Aboriginal people in remote/rural Australia is inappropriate due to its lack of cultural relevance, incompatibility with the geographic landscape, poor design and state of disrepair, and its inability to cater to the functional impairment of Aboriginal older people and people with disabilities (Fien et al., 2008a; Pholeros, 2002; Taylor, 2002; Torzillo et al., 2008).

Inadequate housing supply, inappropriate home environments and a high incidence of disability and long-term health issues has led to compounded disadvantage for Aboriginal Australians living in remote areas (Bailie, Stevens, McDonald, Brewster, & Guthridge, 2010). The Australian Bureau of Statistics (ABS) reports that at June 2006, most Aboriginal and Torres Strait Islander people lived in non-remote areas, with 32% of people living in major cities and 43% in regional areas. However, 25% of Aboriginal Australians were living in remote areas, a significant proportion (ABS, 2012). People living in remote areas face a number of challenges in accessing vital health and housing services. The availability of and accessibility of health and disability services is extremely limited in remote communities (Productivity Commission, 2011), which means that many Aboriginal people with disabilities may face heightened difficulties with regards to mobility around the home and neighbourhood and daily living activities. People can also be isolated from services by lack of transport and limited mobility due to disability. Language, gender issues and lack of information about or understanding of treatment or modification options may be further limiting factors in seeking assistance (Horton, 1994)

Aboriginal health and well-being has been a key government and health service priority for many years, however outcomes remain well below those of non-Aboriginal Australians. Half of all Aboriginal and Torres Strait Islander people aged 15 years and over had a disability or long-term health condition in 2008, and around one in twelve (8%) had a profound or severe core activity limitation (ABS, 2012). The complexity of housing needs within Aboriginal communities is compounded by a higher than average spread of disability and disease, especially in remote areas (ABS, 2006; O'Dea, 2005). There are increased incidences of diseases such as diabetes, Machado Joseph Disease, dementia, and hypertension. Aboriginal Australians also have a lower life expectancy than non-Aboriginal Australians: at the national level for 2005–2007, the gap between Aboriginal and Torres Strait Islander and non-Aboriginal life expectancy was 11.5 years for men and 9.7 years for women (ABS, 2012). Despite the high incidence of long-term illness and disability in Aboriginal populations, data shows that Aboriginal people access programs such as the Home Modification and Maintenance Service significantly less than the national and state average (Jung & Millikan, 2009).

An undersupply of appropriate, accessible housing in remote Aboriginal communities limits the ability of Aboriginal people with a disability or long-term illness to participate in activities of daily life and in their community. Houses tend to be publically owned, and poorly maintained, with dysfunctional hardware such as taps, sinks and doors (Bailie et al., 2010). As Fien et al state, housing policy for Indigenous Australians has been shadowed by “a history of misunderstanding and chronic under-funding [that] has led to inappropriately designed, under-specified and poorly maintained houses that have a significant negative effect on the health and well-being of residents, including

overcrowding resulting from inadequate numbers and inappropriate styles of houses” (2008a, p. 6). Badly designed housing or badly implemented home modifications can cause injuries such as falls, and have a degenerative health outcome for the resident, including loss of muscle tone, weight gain, circulation problems, depression and other health disorders (Pighills, Torgerson, Sheldon, Drummond, & Bland, 2011). Further attention to the particular cultural, social, environmental and medical/rehabilitative needs and preferences of Aboriginal Australians is crucial in order to design home environments that support older people, people with a disability and people with long-term illness live fulfilling lives.

1.2 Aims and methods

The purpose of this research was to develop a checklist of key issues and design elements to consider when designing effective home environments for Aboriginal people who are ageing or who have a disability, particularly in remote areas. This Checklist, presented in Section 4, will be of use to designers, planners, and home modifications professionals within the Aboriginal housing sector. The Checklist was developed based upon the research undertaken in this report as well as the six dimensions of sustainability identified by Fien et al in “A new design framework for remote Indigenous housing” (2008b). The Checklist was developed after an in-depth review of the literature on best practice in design, construction, and home modifications in Aboriginal housing was conducted, and this literature review is presented in Sections 2 and 3. In order to cover a wide range of factors involved in designing effective home environments in Aboriginal housing, the materials reviewed encompass building codes, articles and reports on architectural and construction practice, home modifications, health and social welfare, and current related statistical data where available.

The provision of housing and other services in remote Australia is a complex matter, and both the literature review and Checklist components of this research suggest various problem-solving strategies and solutions to aid service providers in tackling this complexity. The checklist and literature review recommend a range of functional improvements to housing that are realistic for use in remote environments and present distinct benefits for service providers and tenants alike. This paper also indicates areas in which further research is most vital to further develop our understanding of these challenges and how to address them. Increased understanding of the key issues and challenges in providing housing in remote Aboriginal communities will lead to better design, construction and home modification services in these areas.

1.3 Structure of this report

Section 2 looks at the links between housing environment and health/disability outcomes. It firstly considers the general impacts of poor housing on the health outcomes of Aboriginal residents, and the need for effective home environments that promote healthy living and participation in daily life. It then examines the particular health conditions that have a high incidence in Aboriginal communities and the specific ways in which problems with the home environment can exacerbate and even cause these conditions, and ways in which modifications of the environment can promote better health outcomes and increased functionality within the home.

Section 3 discusses some more general considerations that must be addressed in design, construction and modification Aboriginal housing, including the appropriateness of the home environment given particular beliefs and practices in Aboriginal culture, the facilitation of healthy living practices and employment opportunities, and the ways in

which housing must take into account of the specific environmental conditions and their challenges in remote areas of Australia.

Sections 2 and 3 should be read in conjunction with the Checklist presented in Section 4, as they provide an in-depth discussion of the areas of specificity for Aboriginal communities listed in the Checklist that must be considered in creating effective housing environments, and the design elements that address these issues from a disability/ageing perspective.

2 Home environments and health in Aboriginal communities

The World Health Organisation defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, 2013). A review of the literature made clear that there is a strong link between home design and health, and highlighted in particular the importance of home modifications that promote mobility, participation, and health-related personal care activities (Bridge & Gopalan, 2005; A. Jones, de Jonge, & Phillips, 2008; Kendig & Bridge, 2007). There is considerable crossover between the functional outcomes of the built environment and the welfare of Aboriginal housing occupants (Bailie et al., 2010; Pholeros, 2002). The design and construction of an appropriately accessible home can impact greatly on both the functional and mobility outcomes of those living in it, and their overall physical, mental and social well-being.

Conversely, inadequate housing has wide-reaching negative impacts on health (Trewin & Madden, 2005). Inadequate and insecure housing leads to a range of economic, social and psychological disadvantages for all people, including difficulty in engaging in paid work or study, lack of feelings of safety and social connectedness, anxiety disorders, depression and low self-esteem (Hulse & Saugeres, 2008). Obstacles within the home can lead to physical and emotional health problems, exacerbating existing functional difficulties and impeding recovery. This suggests a strong need for a housing design framework that has health benefits as a core principle.

2.1 The home environment, home modifications, and well-being

Effective home environments are even more crucial for older people and people with a disability, and often require home modifications to modify the environment for the particular functional needs of the resident (Carnemolla & Bridge, 2011). Home modifications have been defined in the literature as environmental interventions that aim to support activity performance in the home, particularly for people with some form of functional impairment (Gitlin, Miller, & Boyd, 1999). The NSW Home Modification and Maintenance State Council states that minor modifications include the supply and installation of lever taps, grab rails, handrails and hand held showers as well as access modifications including the widening of doorways and building ramps, step wedges, easy steps and paths to suit individual needs, while major structural changes include bathroom, kitchen and safety modifications (NSW HMMS, 2013).

Supporting people with disability to live as independently as possible in their own home and older people to age in place benefits their physical, social and psychological well-being in many ways. For example, without appropriate home modifications, it may not be possible for a resident to independently engage with vital activities in their own bathroom, thus necessitating informal or waged care support, which reduces privacy in personal care routines (Carnemolla & Bridge, 2011). This reduces the opportunity to be independent and diminishes the resident's overall quality of life. Without appropriate home modifications, occupants may feel the need to initiate makeshift solutions to their environmental problems so as to attempt to maintain independent living. This may create a risk to wellbeing for users and their carers, and could also be perceived by housing or service providers as damage to the property. Home modifications improve the safety of the home (Ambrose, 2001; Van Haastregt, Diederiks, Van Rossum, De Witte, & Crebolder, 2000), for example by reducing the risk of falls (Chang et al., 2004).

Home modifications also decrease disability in later life (Liu & Lapane, 2009) and decrease the likelihood of older people entering residential aged care institutions due to disability (Newman, Struyk, Wright, & Rice, 1990). Home modifications also have the potential to minimise individual care needs (Gitlin et al., 1999; Straton et al., 2003), reducing the reliance of the person with impairment upon others in order to perform daily activities and increasing independence and autonomy.

However, undertaking home modifications for Aboriginal clients in remote areas encounters a number of structural, cultural, environmental and functional challenges. This paper addresses many of the health, cultural and environmental specificities of designing effective housing for Aboriginal people with functional impairments; however structural challenges remain a major issue that requires policy response. Much of the housing stock for Aboriginal communities in remote areas is state-owned and managed (Fien et al., 2008a). The long waiting list for community and government housing is an additional challenge to implementing home modifications, particularly in remote areas where there are major housing shortages. Additionally, some people with a disability in need of home modifications to make their home environment safe and enabling may be living with extended family or friends as a temporary visitor, or be in a state of secondary homelessness (Von Behrens, 2007) and therefore not listed as a tenant, which means the household may not be eligible for home modification services to cater for that person's needs.

One of the most difficult barriers to overcome in implementing home modifications solutions in Aboriginal communities is the high incidence of sub-standard, deprecated housing. The ABS reports that 26% of all Aboriginal and Torres Strait Islander households were living in dwellings with major structural problems in 2008, and this rate rises to 34% in remote areas (ABS, 2012). Crowding is also a major issue in Aboriginal housing, and it is not uncommon for up to 30 people to occupy a house at one time (Neutze, 2000). Recent ABS statistics state that one-quarter (25%) of all Aboriginal and Torres Strait Islander adults lived in overcrowded housing in 2008 (ABS, 2012). The increased traffic and use of the home in many Aboriginal households, coupled with insufficient design, inappropriate materials and poor building practices, is a recipe for disaster:

Many permanent indigenous dwellings are in need of major repair or replacement; are overcrowded; and lack sufficient water supplies, washing facilities, or sewage infrastructure...endemic overcrowding (or high-use load) contributes to rapid wear and tear, and since much Aboriginal housing is cheaply constructed, repair and maintenance issues quickly become a problem. This has a series of material effects. On the one hand, intermittent maintenance exacerbates degradation of housing stock. On the other, it swiftly creates a visual image of mess and decrepitude that...invokes an interpretive automaticity for the remediating viewer (Lea & Pholeros, 2010, p. 189).

Many remote Aboriginal communities have inherited inappropriate dwellings, provided under previous policy regimes. This has led to problems of overcrowding in some communities, with adverse impacts on health, amenity and dwelling quality. In addition, many of the dwellings inherited may be of poor quality, in need of major repair and upgrading (Hall & Berry, 2005). The issues of inappropriate housing design and construction for people with functional impairment are intensified by deterioration of their home environment, and this can perpetuate a negative cycle for people unable to maintain inappropriate dwellings due to ageing or disability and because of their social and financial situation. The ability to implement retrofitting and home modifications services are heavily influenced by and dependent on the existing structure in place, and in instances where that structure is dilapidated, it may not be safe to undertake modifications. Where no home modifications are possible due to the conditions of the

home premises, the client's ability to live at home is severely jeopardized, and in the worst cases, it is not possible for the client to receive home-based health and care services at all.

2.2 The home environment, home modifications, and specific health conditions

The complexity of housing needs within Aboriginal communities are compounded by a higher than average spread of disability and disease, especially in remote areas. The ABS National Aboriginal and Torres Strait Islander Health Survey (ABS, 2006) reported that the rate at which Aboriginal people in rural and remote Australia develop certain diseases such as diabetes, hypertension, and bronchitis and other impairments is significantly higher than the general population of Australia as well as higher than urban and regional Australian Aboriginal cohorts. Treatable issues such as glue ear, eye infections, pest infestations and related skin infections can also lead to long-term illness and functional impairment (O'Dea, 2005). Medical conditions related to lifestyle are also an important contributor to poor health outcomes in remote communities. Issues such as obesity, malnutrition, and alcohol/drug abuse affect long-term wellbeing and may result in functional impairments.

Designing effective home environments for Aboriginal clients in remote areas involves designing and constructing appropriate housing that will prevent environmental disability and health conditions from occurring, and implementing home modification solutions that facilitate participation in daily living for people who have functional impairments or severe health conditions. The second part of this section looks at the main health conditions that are experienced in high incidences in Aboriginal communities, and suggests ways in which the home environment can be designed, constructed and/or modified in order to mitigate the barriers to participation and quality of life experienced by people who have these health conditions/disabilities.

Endocrine, nutritional and metabolic diseases

Aboriginal populations have an increased incidence of diabetes and high blood sugar levels when compared to the non-Aboriginal population of Australia. Aboriginal Australians are 3 times more likely to have type 2 diabetes compared to non-Aboriginal Australians, a number that is even higher for Aboriginal Australians living in remote locations (Shaw & Tanamas, 2012).

Diabetes can result in functional impairment due to reduced circulation, poor insulin control resulting in conditions that affect mobility. It also presents an increased risk of falls and related injuries (Soro-Paavonen et al., 2008). The development of impairments may be linked to dyslipidemia, which manifests most acutely where high insulin levels are left unregulated. Dyslipidemia refers to abnormalities in the lipid composition of blood plasma, and can be related to lipid levels as well as individual lipid cell structure (Haffner, 1998). Lipid cell structural abnormalities can specifically lead to extra deposits of lipid materials in tissues such as the liver, tendons and retina. Other circulatory issues can manifest as high cholesterol, angina, and myocardial infarction (heart attack), all of which pose risks for loss of function. It is important to note that dyslipidemia can also be caused by a range of inherited chromosomal defects in lipid production, from poor diet, and from abuse of drugs or alcohol (Weissglas-Volkov, 2010), which is prevalent in this cohort (Daniel, Lekkas, Cargo, Stankov, & Brown, 2011).

The primary contributing conditions that result in functional impairments impacting on mobility are:

- Diabetic Retinopathy – reduced vision due to retinal damage (Barber, 2003). Prevalent in diabetes mellitus, reduced vision can require special equipment and environmental changes that assist the occupant in understanding their surroundings. Colour and/or texture on surfaces may assist in negotiating space around the home (Gohar, 2009; Whitfield, Bridge, & Mathews, 2005). Uneven flooring will present a strong risk of falls in people with vision problems, and should be addressed in home modifications (Decullier et al., 2010).
- Atherosclerosis, Thrombosis, and Artherothromogenesis – reduced circulation resultant from diabetes can contribute to a wide range of detrimental medical health outcomes. These include:
- Macular oedema – an effect of diabetic retinopathy, a progressive disease that impacts functioning of the retina (Williams et al., 2004). This can lead to visual impairment and blindness, and thus may require home modifications to assist with navigation and effective interaction with the home environment.
- Peripheral arterial disease (PAD) – a painful atherosclerotic disease of the lower extremities that discourages walking and exacerbates poor circulation (American Diabetes Association, 2003). This can be related to neuropathy (see below) and lower extremity sores in people with diabetes. Other effects are gangrene and tissue loss leading to limb loss, and extreme cardiovascular risk (American Diabetes Association, 2003).
- Necrosis or gangrene, which can lead to amputation due to tissue death (Lipsky et al., 2004). Amputation can reduce mobility, affect balance, and reduce a person's ability to manage personal care routines in a safe and effective manner. Limb amputation (particularly lower limb or hind quarter) often requires environmental modifications that facilitate function in relation to these issues. Examples include grab rails in the home to assist with transfers, equipment to assist with mobility and personal care, and ablution facilities that can admit a carer if required.
- Dizziness and proprioceptive dysfunction – reduced sensitivity related to poor circulation, peripheral arterial disease, necrotic tissues, visual and/or cognitive impairment may induce sensations of imbalance and poor sensory feedback from the limbs (Van Sloten et al., 2011). This is also linked to reduced muscular tonicity and can promote reduced activity, which in turn exacerbates poor circulation and increase in BMI (Nwose, Richards, Kerr, Tinley, & Jelinek, 2008).
- Cataract and Glaucoma – both cataract and glaucoma can result from diabetes and other metabolic disorders (Negi & Vernon, 2003). Glaucoma is also a prevailing and independent risk factor for cataracts, and with cataract being a serious complication of diabetes, these two linked visual impairments need to be taken into consideration in home modifications for people with diabetes.
- Obesity – a factor that can both lead to diabetes and be an outcome of diabetes (Huang, Li, & Xu, 2011). Complications related to reduced mobility and diet may be linked to other symptoms and outcomes of diabetes/dyslipidemia such as peripheral arterial disease or limb loss.
- Dementia and other cognitive impairments – studies have shown that people with diabetes mellitus can experience reduced cognitive ability as well as impaired proprioception, increasing the risk of falls (Alvarenga, Pireira, & Anjos,

2010; Brismara et al., 2007; Morrison, Colberg, Mariano, Parson, & Vinik, 2010). This is related to both general deterioration of executive function and impaired sensory feedback due to peripheral neuropathy. Dementia can also be an outcome of diabetes mellitus, related to inappropriate depositing of fatty tissues in the brain as a result of a form of dyslipidemia called hyperlipidaemia (Alzheimers Australia, 2008). People with dementia often require assistance with a range of personal care and daily living activities, and may require home modifications to support their changing skill set and to provide carers with a safe environment to provide support. Consideration for changes in physical needs as dementia progresses should be taken into account, and planned for as part of long-term support strategies.

Diseases of the circulatory system

Hypertensive disease (high blood pressure) and other diseases of the heart and circulatory system are further medical conditions that impact more on Aboriginal populations than non-Aboriginal populations. Hypertensive disease affected 22% of Aboriginal Australians aged 35 and over (ABS, 2006). Hypertension affects Aboriginal Australians at much earlier ages than non-Aboriginal Australians, with prevalence levels for Aboriginal people similar to those experienced by non-Aboriginal Australians who are 10 years older among people aged 25 years or over (ABS, 2005). Long term health conditions related to the circulatory system are also more likely in remote areas (14%) than non-remote areas (11%) (ABS, 2006). Cerebrovascular disease (CVD) and coronary heart disease are diseases that are commonly linked with hypertension, and can result in symptoms such as shortness of breath, angina, chest pain, and in more severe cases, stroke; all of which can have significant limitations on mobility (AIHW, 2007). Home modifications to accommodate reduced mobility, such as grab rails throughout the home, ablution facilities that allow access for a user and their carer, as well as accessibility modifications for mobility equipment such as wheelchairs, are all potential requirements for people with CVD.

When designing effective home environments for functionally independent people with hypertensive disease or other disease of the circulatory system, it should be anticipated that they may require carers and mobility aids in the future. In instances where hypertension results in stroke, there is risk of acquired brain injury affecting neurological, psychiatric and cognitive functions (Van Velzen, Van Bennekom, Edelaar, Sluiter, & Frings-Dresen, 2009). Functional impairment resultant from neurological damage is a common outcome with wide-reaching consequences: *“A full 50% of patients with stroke have lasting disabilities. Of these, approximately 30% are institutionalized in nursing homes or assisted-living environments, and 20% depend on assistance for daily activities. The functional impairments due to stroke include disturbances in motor activity, speech, sensation, vision, and cognition”* (Dihné, Hartung, & Seitz, 2011, p. 2342).

Space for a carer and for lifting equipment should be considered in design and retrofitting for clients with impaired mobility. Adequate circulation space for turning and manoeuvring are essential and particular attention must be paid to issues such as lifting and wet area transfers, where shower chairs/commodes, hoists and bathing trolleys are required. This may mean widening hallways or doorways. A larger wet area is generally required to manage lifting equipment and the presence of at least one carer, as it is ill-advised for a single carer or care worker to undertake lifting activities. Impairment to sensation can result in poor balance and this creates a risk of falls (Decullier et al., 2010). In this instance, reducing the impact of flooring is important, as well as the need for grab rails throughout the home. Surface transitions are more likely to create trip areas, and so where possible these should be eliminated. It may be wise

to consider stability aids in wet areas, especially in relation to bathing. Items such as shower chairs (appropriate to client's weight and height) may allow a person to maintain independence in personal care whilst reducing the risk of injury due to falls.

Otitis media and glue ear

Otitis media is a common inflammation and infection of the middle ear characterized by the presence of liquid behind the tympanic membrane (Binks et al., 2011). Repeated episodes of untreated otitis media may lead to a condition called glue ear, where the middle ear does not drain, and is one of the most common causes of childhood deafness worldwide. Aboriginal children are 3 times as likely to report ear or hearing problems compared with other Australian children, and rates are higher in remote area as opposed to non-remote areas (AHMAC, 2011). Within Australian Aboriginal populations, otitis media and progression to tympanic membrane perforation (TMP) occurs in 30% of children by 6 months of age and 40% by 18 months of age (Binks et al., 2011). Due to the risk factors involved, adult populations may also become involved in recurrent infection. The high prevalence in this cohort is attributed to a combination of factors including overcrowding, poor hygiene, poor health intervention and poor education (J. N. Jones, Henderson, Poroch, Anderson, & Taylor, 2011). Poorly designed and constructed housing that does not take into account factors such as the possibility of crowding and the need to facilitate healthy living practices can therefore be one of the causes of conditions such as otitis media and glue ear, and exacerbate these conditions once present. Common outcomes of glue ear include reduced hearing, which affects academic performance and can lead to behavioural problems, and in a small percentage of cases balance is affected. Modification of the home environment may be required in order to alleviate these outcomes and facilitate daily living activities in the home. Because of the potential for hearing loss related to these conditions, background noise and echoing in the home may need to be controlled to allow the affected individual to hear other key sounds (Lee, Bridge, & Mathews, 2006). There is also a range of visual signalling devices and vibrating pagers that can replace auditory doorbells and alarm systems, including fire detection systems (Lee et al., 2006). Because of the potential impacts of otitis media on balance, all care must be taken to make sure the home environment is easily navigable for people with this condition, with even and slip resistant surfaces, and good quality lighting.

Blindness and ocular impairments

Apart from the influence of metabolic disorders, visual impairment can be caused by a lack of intervention in infective diseases of the eye. Australia is the only developed country where trachoma is endemic, persisting mainly in rural and remote Aboriginal communities. Trachoma is a major cause of visual impairment in Aboriginal communities in Australia, and is the leading infectious cause of preventable blindness, occurring where people live in overcrowded conditions with limited access to water and health care (J. N. Jones et al., 2011).

As well as being addressed through preventative housing and social planning, visual impairments need to be accommodated in home modification interventions. Attention needs to focus on both the current and projected levels of impairment. A number of different strategies may be employed, including:

- High-contrast surfaces or textured surfaces can be used to demarcate space for people with low vision (Gohar, 2009) and a lighting system that creates a high contrast with the background can assist with wayfinding (Bridge & Pitch, 2006)
- Surfaces should be even and provide stability

- Surfaces that employ visual aids should be implemented consistently and with consideration to the activities of the user
- Wet areas must be slip resistant, and give consideration to the needs of people with reduced vision and their carers (Whitfield et al., 2005)
- Good quality lighting in the home is a priority in ensuring safe and independent mobility for the individual with visual impairment (Bridge & Pitch, 2006)

People with visual impairments may also require a range of equipment to assist in daily living tasks. As hearing and touch become much more valuable discriminators in navigation for those who have a visual impairment, it is important to consider the auditory qualities of the home environment, such as echo, noisy flooring and tactile surface areas. Using textured surface markers for flooring and other surfaces of the home may assist the user to remain in control of their understanding of the space they live in (Whitfield et al., 2005). This is particularly important in relation to potential fluctuation in numbers of residents and visitors in Aboriginal households. Families may need to accommodate a range of relations/kin with little notice, and this may alter sleeping and living arrangements in a way that impacts on the predictability of the home space.

Infestation and infection

While many parasitic infestations can be easily remedied, within Aboriginal communities eradication of these health issues seems to remain a significant challenge. Infants and young children account for the majority of those affected with parasitic infestations (McDonald, Bailie, Brewster, & Morris, 2008). People with autoimmune dysfunctions due to other illnesses are also more susceptible to infestation, and infestation and infection can have further adverse health impacts upon those with functional impairments. In instances where functional impairment involves faecal incontinence, parasitic diseases such as *Cryptosporidium hominis*, *Giardia duodenalis*, and a range of common helminthes (parasitic worms) present an increased risk of infection for carers and family members (Holt, McCarthy, & Carapetis, 2010).

Infestations common in preschool aged children such as scabies, helminthes and head lice have a much higher incidence across the Aboriginal population (La Vincente et al., 2009). This high rate of infection in children living in remote Aboriginal communities is due to overcrowding, poor housing conditions, and poor hygiene (Bailie et al., 2010). The difficulties that arise from infestation may involve malnourishment, anaemia, leukocytosis and eosinophilia (elevated white blood cell counts), pruritus, and ongoing re-infestation/transmission (La Vincente et al., 2009; Pilger et al., 2011). Scabies and head lice follow similar infestation/transmission routes, and can be easily spread through close contact (exacerbated by overcrowding), and the sharing of towels, clothing, and bed linen. Helminthes transmission is more likely due to faecal-oral transmission. These skin-aggravating infestations can lead to pyoderma – a bacterial infection of the skin (Carapetis, Connors, Yarmirr, Krause, & Currie, 1997) and in some instances this can be serious in nature, especially where frail, elderly, or infant residents are involved.

The ability to control and minimise incidences of pest and parasite infestation is strongly linked to both sanitation and hygiene standards. Designing effective home environments for people with functional impairments requires ensuring that health hardware is in place that allows people to effectively wash themselves, wash clothes and bed clothes, remove human and food waste, separate animals from people, reduce discomfort from the environment and climate, improve nutrition, and reduce crowding (Fien et al., 2008a; Pholeros, Torzillo, & Rainow, 2000). When combined with

overcrowding issues, disease and infestation become very difficult to manage in deprecated housing situations, as crowded housing conditions facilitates the spread of numerous infectious and parasitic diseases (Baillie & Wayte, 2006). Further details on home modification and design strategies to minimise the chance of infestation and re-infection are provided in Section 3.2 on housing and healthy living practices.

Machado Joseph Disease

Machado Joseph Disease (MJD) is a rare condition that is not present throughout the whole of Aboriginal Australian populations, but has a high presence in some island communities and in certain remote areas. MJD, also known as spinocerebellar ataxia type 3 (SCA3) is a neuro-degenerative disease affecting motor function (Perlman, 2011). Like most spinocerebellar ataxias, it is progressive, usually manifesting later in life, and is usually fatal (Bettencourt & Lima, 2011). As MJD may develop later in life, people who carry the gene may not know they are likely to pass on the disease until after they have had children. When both parents contribute affected alleles for the expression of MJD there will likely be an earlier-onset, more severe manifestation of the disease (Bettencourt & Lima, 2011). In real terms this means that while one generation may experience symptom onset in their forties, their children may experience it in their twenties or thirties, and the resulting offspring affected from the following generation may experience initial symptoms in their teens. This anticipation effect could be due to either homozygous allele presence (both parents are carriers) or further expansion/mutation of the allele responsible for MJD (Perlman, 2011).

The reason this anticipation effect is so important is that often family members in a care-giving role for their elders are in early stages of MJD themselves. Very frequently it is a small number of unaffected family members that care for a number of their siblings and elders. This being the case, assistive environments are highly desirable where families present with MJD, as there is a strong chance that more than one member of the family will experience this disease over time (Perlman, 2011). Equipment such as hoists and bathing trolleys need to be accommodated in the layout of the home. All access, bathing and food preparation areas need to be able to accommodate carers and specialized wheelchairs. People with MJD often use customised wheelchairs, the size and specifications of which vary significantly from the standard measurements for the A80 and A90 wheelchairs used in the development of the relevant Australian Standards in AS1428 (Standards Australia, 2001). These customised wheelchairs are often bariatric or all-terrain fitted with special (and quite large) all-terrain wheels that will function on unpaved surfaces such as wet soil and sand during monsoon seasons. These wheelchairs require wider clearance for doorframes, and as these clients may also require full bath trolleys, the difference in specifications will also need to be considered should a switchback ramp be employed. Bathing trolleys, hoists, ramps and lifts are very important for this user group, as all affected individuals will eventually experience a complete loss of motor functioning, beginning with fine motor skills and degrading to involve even smooth muscle (such as intestinal muscles used for passing waste). For those in different stages of the disease, rails along all walls may assist in navigation of the home environment. Electrical outlets and appliances should be fitted in a way that allows independent use from a seated position/chair height. Food storage areas should also be designed so that there is an increased functionality and availability at a height that is manageable for a person with reduced mobility. For example, this may involve a 'lazy Susan' type installation for frequently used items in the kitchen.

Cognitive impairments

Cognitive impairment that is the result of particular health conditions has already been discussed; it is also important however to note the direct impact of drug and alcohol use on cognitive function. The literature reviewed highlighted the high incidence of substance abuse in Aboriginal communities and the impact this has on long-term cognitive abilities (Mildford, MacLean, Catto, Thomson, & Debuyst, 2010; Nagel, Robinson, Condon, & Trauer, 2009). A common example of substance abuse practice that is strongly associated with cognitive impairment is volatile substance use (VSU), which is reported to cause a wide range of impairments, from diminishing problem solving skills to severe dementia (Mildford et al., 2010). Cairney, Clough, Jaragba and Maruff (2007) suggest that in the case of chronic alcohol abuse that progressive cognitive decline may precede more serious and irreversible neurological syndromes. The early detection of cognitive impairment may therefore aid in the prevention of permanent brain damage. Despite the devastating consequences of alcohol abuse among Aboriginal Australians, the effects on brain function have never been studied in this population and a lack of appropriate assessment tools has prevented the development of such research (Cairney et al., 2007).

There are a number of ways in which well-designed home environments and home modifications can assist people with cognitive disabilities in activities of daily living and maintain safety. For example, 9 design guidelines were formulated by Hodges, Bridge, Donnelly, and Chaudhary (2007) to manage the behaviours of people with cognitive impairments: 1) the home environment should be kept simple in design and layout; 2) the presence of known stressors to the individual with cognitive impairment should be reduced; 3) providing balance between over-stimulation and under-stimulation in the home; 4) facilitating the use of preventive and reactive support strategies; 5) being flexible and affording opportunities for choice and control; 6) making sure the environment is physically safe; 7) removing or making more durable any home environment features with a history of being damaged; 8) accommodating formal and informal care support; and 9) ensuring that the external design of the home blends in with the local community. It is also important that ageing in place is enabled through a home environment sensitive to the needs of people with dementia. Hodges, Bridge, and Chaudhary (2006) developed 9 conceptual design guidelines for creating an effective day centre environment for people with dementia, which can also be applied in general form to home environments: 1) facilitate independence, autonomy and control by making the environment adaptable to the user; 2) create spaces that afford meaningful and culturally appropriate activity; 3) include interior and exterior detailing that is familiar & non-threatening; 4) ensure that spaces, access points and pathways use appropriate modes (light, colour, pictorial, verbal, tactile) for presentation of essential information; 5) ensure that spaces, access points, and pathways in the home eliminate unnecessary complexity and reduce extraneous sensory stimuli; 6) design environments that will reduce agitation and opportunities for meaningless wandering; 7) ensure all areas of the home afford approach, reach, manipulation, and use regardless of the user's limitations; 8) ensure all spaces, access points, pathways are safe and secure; and 9) ensure that the environment also meets the needs of other users of the home.

3 General considerations in designing effective home environments for Aboriginal clients

3.1 Culturally appropriate housing

Effective home environments for Aboriginal Australians with functional impairments need to be designed in ways that are responsive to Aboriginal cultural beliefs and customs, domestic living arrangements and household compositions. Aboriginal Australians, like other groups, want their housing to provide a “shelter around which to conduct the business of living” (Fien et al., 2011, p. 346) Providing a dwelling that delivers suitable, adequate shelter within a culturally appropriate framework is a crucial goal, however identifying and appropriately addressing this framework is an area fraught with difficulties. Aboriginal Australians are far from a homogeneous population, and cultural practices, behaviours, languages and belief systems are diverse, varying from group to group. As different Aboriginal peoples have varying practices and beliefs, as well as unique environmental situations and functional requirements, a one-size-fits-all approach is not appropriate. There have been backlashes against the notion of ‘culturally appropriate’ housing within Aboriginal sectors of the housing market, with commentators arguing that in differentiation lies discrimination:

“Although clients may well retain their culturally unique norms of behaviour when they move into their new conventional houses, many display a strong architectural conservatism which results in requests for conventional-looking houses. Any deviation from the local white standards of rural or urban housing may be resented. Behind such reaction often lies an understandable desire to achieve equality, to be accepted, to have some modest but recognised status and not to be ridiculed. The provision of anything but a conventional house may often be regarded as an insult” (Memmott, 2004, p. 46).

Good design needs to be socially inclusive as well as meeting the cultural and functional needs of the client. Memmott’s observation highlights the need for strong consultation with Aboriginal communities in relation to the creation of desirable, liveable dwellings. Consultation should involve engagement and negotiation with the local community, building relationships and acting on contributions in order to be effective (Barker, 2008). It is paramount that respect for the client is one of the central concerns when designing safe, healthy, serviceable home environments.

Home-like environment

A sense of place, space and belonging are important to foster in creating a home-like environment, and need to be promoted through vigorous consultation with all residents and other relevant stakeholders. The home environment can take on an industrial and alienating feel if care is not taken to preserve the sense of ‘home’ in applying appropriate hardware for healthy living (Steinfeld & White, 2010). Creating a liveable dwelling that does not alienate the client from other householders is important. It is an important aspect of creating a liveable environment that in prescribing modifications, the environment does not lose its liveability in other more personal ways. In instances where extensive modifications are required, it is important to attempt to preserve or create an outcome that fits the needs of the user without de-identifying the environment. There are a wide range of product finishes available to clients, and various options for most standard health hardware and mobility equipment. The accessibility hardware market is widening to include a range of stylish aids that not only serve to provide important health outcomes, but can be sympathetic additions to the

home environment. Grab rails come in a wide range of colours that can be matched to the interior design and bright bevels on counter edges and rails can provide strong visual aids and attractive design. The same can be said for flooring, wall padding, doorway finishes, etc. A combination of usability and individual aesthetic is important in finding a product that will both perform well and allow the client to feel comfortable and content with the result.

Importance of country

Aboriginal people have a strong connection to the land of their birthplace, and to tribal members of that land (Horton, 1994). Ageing in place and the provision of in-home care require a housing environment that supports both self-care and carers. Accessible and supportive home environments can promote quality of life for older Aboriginal Australians in a familiar environment, as well as the ability to age in place. Within Aboriginal communities, especially remote communities, being admitted to a formal care setting such as residential aged care or hospital can mean being removed from country and kin (McGrath, 2007). Kin and place relationships have high importance in Aboriginal cultures, so institutional care options must be considered in balance with the weight of disruption to the normal relationship with family and land that is at the centre of Aboriginal life. Aboriginal people may have a specific 'death country' – a place they need and want to go to die (McGrath, 2007). Removal from their normal kin and migration system for care reasons can interfere with this cultural practice. Furthermore, the significant role of elders in preservation and dissemination of culture, as well as the strength and social capital they provide to their communities, is eroded where aging in place is not possible. Mechanisms to delay or avoid these transitions to institutional care, such as home modifications, are of great benefit in Aboriginal communities, making it possible to accommodate a person with significant barriers to functional living in their own home, without resorting to relocation. This is particularly important in remote communities where relocation to a regional centre can mean a significant distance must be travelled for both the resident and visiting family.

Outdoor living

The importance of outdoor activities in the life and cultures of many remote Aboriginal communities should be taken into account when planning home modifications and new constructions (Von Behrens, 2007). Aboriginal people tend to spend much time outside their houses (Memmott, 1988). In order to create well-designed outdoor living environments, external space near the dwelling needs to be assessed for the safety of the client as if it were another room in the home. For some, it may even be the most important room in the home. Culturally sensitive housing design and construction will support a direct relationship with the physical environment and may facilitate sleeping, sitting, and resting outdoors and on the ground (Keys, 2000).

There are significant safety and security issues related to outdoor spaces in remote areas that must be considered. Fencing provides additional security for residents and a bounded area in which to perform outdoor activities, as well as protecting from wild animals and unwanted visitors and keeping children safe in backyards (Fien et al., 2008a). Security hardware and gates should be considered in conjunction with any graded surface intended to permit ramp-free access, so as to protect against dangerous vermin (Fien et al., 2008a). Due to wet seasons and seasonal flooding, this would need to be of a material that is able to endure a wide range of conditions while affording shade and protection from insects.

Including the external living space in assessment both facilitates the culturally desirable use of outdoor space and has a number of other advantages for home modifications

and healthy living outcomes. An effective outdoor living space can give relief and comfort to all the residents in the home. In instances of overcrowding, a well-designed external space can spread use-load over a wider area, creating feasible options for managing avoidance relationships and addressing some of the problems related to internal crowding. Sealed and covered verandas that are wide enough to be a temporary living space for eating, sleeping and entertaining, should be considered by planners and designers, as it can alleviate the stress on the dwelling caused by visitors and temporary residents (Fien et al., 2008a; Memmott, Long, & Thomson, 2006). If external spaces are modified to allow sufficient 'sleeping out' areas, it is possible that some of the typical infestation pathways for issues such as scabies can also be reduced.

External cooking areas should also be provided, such as a BBQ or patio cooking area, as many Aboriginal people prefer to cook outdoors (Fien et al., 2008a). As cooking is a bonding family activity, it is also important to create safe and constructive ways to allow people with disability and older people to participate. This is especially of concern for people with mobility impairment, as they may not be able to get out of the way of dangerous cooking practices quickly. Adaptable external spaces that provide additional wet areas for showering, toileting and personal care can also be considered (Fien et al., 2008a). This is an asset in situations of overcrowding, and may also reduce distress in situations in which a resident has particular needs around toileting and bathing that require specific or dedicated access. The inclusion of additional wet areas, accessible living spaces and appropriate ablution facilities can address both residents' needs both culturally and in terms of environmental health (Memmott et al., 2006).

It is also important to remember that a person with mobility impairments does not just need to be able to move around their own home; without appropriate support to engage with the community they may become housebound. This can lead to health problems related to inactivity, such as loss of muscle tone, weight gain, and depression. There are also a wide range of communal activities that require mobility between domestic spaces. It may be wise to consider not only the need for changes to the home, but assessing the activities that the person engages in or is excluded from, to see if there is a way to integrate mobile technologies for in and out of home use that generates a wider sense of inclusion in community.

Family and kin groups

Within Aboriginal people, there are family relationships of skin, kin, and country, and these relationships are governed by a wide variety of cultural practices that can have a dramatic impact on how people interact with their housing (Memmott et al., 2006). Approaches to Aboriginal housing provision have historically represented a 'lack of fit' between housing type and traditional Aboriginal domiciliary arrangements, defined by dwellings designed for the nuclear family model, which fail to meet the housing needs of many Aboriginal groups (Keys, 2000). It is important to be able to facilitate the appropriate adherence to custom within an enabling housing design framework that supports users with impairments to lead functional lives. A person's position in the kinship system may impact the way they interact with others in the community (Bishop, Colquhoun, & Johnson, 2006). Some people in the community may be unable to interact with one another due to 'avoidance' relationships (Horton, 1994), which may impact the therapeutic relationship and other relationships with professional service providers (Bennett & Zubrzycki, 2003). Aboriginal clients may be required to avoid contact with persons outside their skin/kin system as well as members of the opposite gender. It is essential to understand kin relationship systems in the community in which the assessment is taking place, as they can have influence on the functional needs of clients when avoidance relationships may dictate that a client needs to quickly leave a

room or dwelling, regardless of their level of impairment. The integration of traditional practices into a modern adaptive environment that is designed to support wellbeing is essential.

Cultural practices associated with kin relationships also have a significant impact on how residents and their wider families interact with housing (Morphy, 2007). Aboriginal people are under a cultural obligation to accommodate family, including extended family, should they have nowhere else to go (McGlade & Purdy, 1998). It is common within some Aboriginal groups for relations to visit a home in which they can claim kinship ties to the household, staying at the residence for an indefinite period (Morphy, 2007). Kin migration can occur within a wide region, and results in the temporary or semi-permanent residence in a dwelling of people outside the original household that the dwelling was designed for. These relational obligations are called upon often without warning or prior notice (Fien et al., 2008a) and can involve both the use of kin's home, and the use and removal of property within the home, increasing daily wear and tear of facilities (Memmott et al., 2006). Migration behaviour illustrates how critical it is to understand a client's culture of living in order to design effective home environments.

Within certain Aboriginal cultures the concept of property ownership within a household can be somewhat ambiguous. Family and kin can demand their right to enter, use and remove property from the house (Taylor, 2002). Kin are able to use and remove items from the household without consultation, an issue which needs to be considered in advance by home modification professionals when deciding upon assistive technology within the home. Therefore equipment required for specific family members should be provided in such a way as to prevent removal or misuse if practical. Additional locked storage spaces within the dwelling to secure belongings may be necessary (Fien et al., 2008a) This is not purely for the sake of the client, but also for the safety of other people who may believe the equipment may be of benefit to other users, but these potential users have not been appropriately assessed for assistive equipment. For example, if a hoist is needed for transfers, establish whether a ceiling hoist is suitable for the members of a household and if so, it may be better to install one instead of arranging a mobile hoist. The benefit of this item is that it is permanent, relatively unobtrusive, requires less space and is considered to have better safety outcomes for carers (Jung & Bridge, 2009).

3.2 Housing and healthy living practices

As discussed in Section 2, many of the health conditions experienced in high numbers in Aboriginal communities relate to issues of sanitation, crowding, and pest infestation, and home environments that do not facilitate healthy living practices can both cause and exacerbate functional disability. Kin migration and visitation customs mean that a house designed for a household of four occupants may be occupied by many more over some periods of the year, increasing wear and tear on the dwelling and stretching the capacity of everyday amenities such as water and power supply, cooking areas, and bathrooms. Crowded living conditions creates strain on household facilities (Baillie & Wayte, 2006) Some of the disrepair associated with Aboriginal housing results from the additional strain placed on housing infrastructure that is not designed for such heavy use (Neutze, 2000). This can have a negative impact on even well-designed and well-serviced dwellings, however dwellings in regional and remote communities where infrastructure for reliable access to water, sewerage output, electricity or gas are not consistent, reliable, or even present in some cases can become the sites for significant health and safety hazards.

Sanitation

Torzillo et al. (2008) audited over 4000 houses and their domestic infrastructure with regard to basic sanitation and found Aboriginal housing to be dramatically underperforming when compared to non-Aboriginal housing stock. This is a serious health concern particularly for residents of sub-standard housing who are ageing or have a disability. This survey also revealed a number of dwellings were not connected to a water supply, sewerage, or any form of power (Torzillo et al., 2008). Where these facilities do exist, they were noted as having inadequate infrastructure and subject to frequent failure and breakdown. State and local planning authorities need to be consulted when designing home environments in remote Aboriginal communities to ensure that there is adequate sewage, water, and power infrastructure in place to support existing dwellings and future modifications. Due to the overcrowding prevalent in many Aboriginal households, there is a pronounced lack of adequate toileting, showering, and cooking facilities for the number of residents within dwellings (Memmott et al., 2006). An extra toilet or en-suite bathroom can also be important in facilitating avoidance relationships, so bathrooms can be segregated for male and female exclusive use (Fien et al., 2008a).

There is the additional challenge that current guidelines for design and construction of Aboriginal housing stock in remote areas do not always sufficiently address the needs of people with functional impairment. For example, the *Environmental Health Standards for Remote Communities in the Northern Territory* stipulates that wet areas such as bathrooms and laundries should be constructed with concrete, and recommends construction details such as shower hobs: "Bathrooms and laundries are seen to be very high-risk corrosion areas. Concrete should be used wherever possible for bathroom and laundry flooring, and concrete hobs provided to avoid water contact with steel framing. Laundries are best placed adjacent to the house so as to avoid the need for steel framing" (Northern Territory Government, 2001, p. B10). However, for residents with functional impairment, concrete flooring poses a significant risk of falls, and shower hobs restrict access for less mobile residents. Residents with mobility impairments who use wheelchairs or walking aids are unable to navigate bathroom features such as standard shower enclosures and concrete hobs without impediment. A graded floor that is designed to contain greywater and direct it to a drainage area can be sloped to allow access for less mobile users, and in instances where a resident may require seated bathing or assisted bathing, an open shower room with no screens or concrete partition walls is a much better option than an enclosed shower cubicle with a hob. The Northern Territory represents the greatest concentration of remote Aboriginal housing tenants - and includes the least healthy cohort of Aboriginal Australians according to ABS statistics (ABS, 2012). Given that the document targets remote community Aboriginal housing, and that it is precisely this sector of the Aboriginal population experiencing higher incidence of impairment and illness, it is of concern that the provisions contained in the NT Environmental Health Standards do not accommodate the needs of those with serious impairments.

Another document, the 2005 Guidelines for Design and Construction of Housing issued by the NSW Aboriginal Housing Office, stipulates that bathing and toileting areas should be kept separate for one bedroom homes (2005, p. 3.13). This poses significant inconvenience to those people in need of both toileting and bathing with assistance, or within a special environment. Separating the two in instances where accessibility is an issue poses a greater risk of accident for people who have difficulty navigating the home. Transport between the two rooms requires the client to be undressed, dressed, and undressed again. This is a process that can take a long time, requires adequate space, and may also require special equipment in both locations. It adds to the burden of duties for carers, and does not aid a resident with care needs to feel comfortable in

their own home. A second bathroom or toilet area can also be provided for possible other members of the household, which would reduce the hygiene and sanitation issues associated with overcrowding and bathroom use, and is also a feature requested by many Aboriginal public housing residents (Fien et al., 2008a).

Hygiene and cleanliness

As mentioned in Section 2, the high incidence of many diseases such as otitis media and glue ear in Aboriginal communities is associated with overcrowding and poor hygiene. The creation of clean and health-promoting environments with adequate storage, ablution and laundry facilities would reduce the possibility for re-infective cases of conjunctivitis and transmission to other family members, potentially lowering the number of permanently visually impaired people in Aboriginal communities. Studies have suggested that residents in homes with functional sewage/waste removal, functional utilities and tiled floors experienced far less infestation than residents of homes where these factors were not present (Holt et al., 2010).

There are a number of ways in which an effective home environment can facilitate hygiene and cleanliness in a household that includes someone with a functional disability. Antimicrobial materials and surfaces in kitchens and bathrooms should be considered where possible and appropriate, particularly when residents have a health condition or disability associated with faecal incontinence. Faecal hand to mouth transferred diseases can be more widespread if appropriate areas for treatment and cleaning are not provided. The safe containment and disposal of contaminated waste is needed in all circumstances for the health and safety of the client, their family, friends, carers and visiting healthcare workers. Separate areas to manage treatment of equipment such as stoma bags, catheters and other re-usable care items must be provided. This is for the safety and hygiene of all household members as well as for the protection of expensive medical equipment from daily routine use of sinks, laundry and shower areas, etc.

Training programs also need to be provided to residents in how to properly maintain a safe and clean household. These could include understanding of environmental health issues, the care of whitegoods, and the use, maintenance and repair of electrical and plumbing fittings (Fien et al., 2008a) Cleaning and maintenance kits should also be provided to residents, or available somewhere in the community for borrowing.

Pest and parasite management

In an investigation of parasitic diseases in remote Aboriginal communities in Australia, Holt et al. (2010) state that “the overcrowded living conditions and sanitation and hygiene problems currently present in many remote communities” are a major contributor to the spread of parasitic disease. The prevalence of such endemic infestations increases the likelihood for longer term health complications. The risk of infection and infestation of parasites is much higher in dwellings where appropriate ablution, laundry, sewerage and contaminated waste disposal facilities are not present or are in poor repair. Sanitation and hygiene were identified as problematic issues across remote Aboriginal populations in a report on endemic scabies in Aboriginal communities (La Vincente et al., 2009). The materials examined in the literature review suggested that many sanitation and hygiene issues in remote areas of Australia resulted from failure of utility infrastructure and home facilities for utility supply and waste/sewage removal (Daniel et al., 2011; Lea & Pholeros, 2010).

The numbers of helminthes (parasitic worms such as tapeworms, roundworms, and hookworms) are disproportionately high in remote Australia (Engwerda & Meeusen, 2010). Acquisition may be through soil or water supply; however transmission from

person to person is often associated with poor hygiene in relation to toileting and inappropriate disposal of blackwater and faecal materials. The common routes of transmission are either self-retransmission by lifecycle, or hand to mouth transmission. If the water table is contaminated this can also lead to outbreaks of helminthes and other gastroenteric illnesses (Häfliger, Hübner, & Lüthy, 2000). These types of infestations are best controlled by the avoidance of overcrowding, and the provision of appropriate laundry, ablution, and waste facilities.

Overcrowding, poor sanitation and hygiene problems are also related to diarrhoeal disease in remote communities, and these diseases particularly affect children (McDonald et al., 2008). *Escheria coli*, *Strongyloides* and *Cryptosporidium* are the most commonly isolated parasites in this cohort, and their presence is “responsible for significant morbidity in the Australian Indigenous population” (Holt et al., 2010, p. 1124). Similar to other infective and infestive organisms, gastrointestinal diseases can be reduced by providing appropriate environments with functional utility infrastructure. Furthermore, Holt et al. (2010) suggest that residents in homes with functional sewage/waste removal, functional utilities and tiled floors experienced far less infestation than residents of homes where these factors were not present. Tiled floors may be a better option than concrete, which is currently a common floor surface in Aboriginal housing construction, as concrete is porous and can act as a surface of transfer and culture for infection and infestation. In addressing pest management, it is important to ensure preventative strategies exist in the form of simple, accessible laundry and ablution facilities, adequate sleeping space, and storage areas for linen and clothes. Separate storage areas for all family members’ personal clothing and linen may assist in reducing cross-infestation. By facilitating a clean environment it is more likely that treatment of pest infestation will be successful. There should be adequate kitchen storage areas in place for both food and kitchen implements, with doors to prevent vermin from getting to food and prevent young children from accessing kitchen equipment without adult assistance (Fien et al., 2008a).

For residents already suffering with more permanent functional impairments, the possibility of infestation and re-infestation should be reduced as much as possible. Pests such as scabies and head lice can cause distress both emotionally and physically, and may be difficult to eradicate once established. Risk of infection as a result of infestation may be higher in groups with cognitive impairments, users of incontinence products, people restricted to bed and vulnerable to ulcers, infants and those with fragile skin. Eradicating infestation may be more complicated in situations where special equipment is used on an ongoing basis, or where people are restricted to bed or a wheelchair.

3.3 Housing and the environment

Landscape fit

One of the major contributors to poor housing outcomes in Aboriginal communities is the unsuitability of techniques and materials used for their environment. Inadequate ventilation and climate control within a dwelling subject to high climatic variation can pose a threat to the wellbeing of its occupants. Prevailing local weather conditions need to be taken into consideration before design and construction of housing (Barker, 2008). Extreme temperatures and humidity effect wet areas and food storage as well as the general wellbeing of occupants. Health priorities that concern housing and its fit with the landscape and climate include dust control, controlling the extremes of temperatures in living environments, and reducing the potential for trauma and physical injuries (Pholeros et al., 2000).

Climatic variation in rural and remote Australia also has a deteriorative effect on the built environment, exacerbating problems with stock maintenance. Without adequate climate management, the elements will hasten disrepair and dilapidation: “climatic variations impact on the quality and rate of depreciation of dwelling stock, particularly in the Far-North and North-West of the country” (Hall & Berry, 2005, p. 297). Eco-efficient design in remote Aboriginal housing needs to involve building styles, siting and orientation that respond to the local climate and use building materials and water, energy and waste management systems that are environmentally appropriate (Fien et al., 2008a). Housing should be designed for sustainability, both in terms of environmental sustainability such as energy, water use, and minimising waste, and life-cycle cost (Barker, 2008). This is particularly important when implementing modifications solutions in the homes of people with functional impairments, as materials and building styles that suit the environment will reduce the costs of maintenance and replacement due to environmental stress and damage. It is also important in order to minimise the negative impacts of crowding: visitors can place extra stress on energy and water supplies, so it is important to consider alternative, sustainable sources (Memmott et al., 2006)

Outdoor living and social activities need to be assessed in conjunction with the condition of the ground surrounding the home, across all seasons. If the grounds are not accessible for residents with a disability or older people due to either soil drainage problems or weather conditions, it may be appropriate to consider landscape solutions. For instance, tropical regions may experience seasonal monsoons, and there can be ongoing issues related to drainage that reduce mobility, especially for those reliant on wheelchairs and other types of mobility aids. It is common for homes to be elevated off the ground for these climatic reasons, but the external living area may be at ground level. Landscape solutions could be used to create raised external spaces with appropriate drainage. For residences in areas that experience monsoonal weather or are otherwise subject to flooding, ground preparation and drainage can ease the use of wheelchairs outside the home. Good siting and installation of landscape solutions such as French drains can provide a cheap and effective solution to keep ground from flooding, which can also cause damage to the property.

An understanding of traditional Aboriginal techniques of building and orientating dwellings and sourcing materials may lead to better design and construction of housing in remote environments to suit local climates. In rural and remote areas access to infrastructure and dependable supplies of water, sewerage and power can be limited (Baillie & Wayte, 2006), so innovative methods should be investigated as much as possible. However, this is an area where there is limited information available and targeted research is needed. The logistics of transporting materials and constructing in remote locations also needs to be adequately considered (Barker, 2008).

Building and construction materials

Modified standards of practice in construction for remote or tropical zone areas such as in the Torres Straits, Far North Queensland, Western Australia and the Northern Territory have been developed to take into account the extremes of heat experienced in that state. The Northern Territory has separate guidelines for building in coastal and inland remote areas to address the different environmental stressors in these regions. These building guidelines consider issues of damp, ventilation, and insulation, as well as detail materials that will withstand extreme environmental impact of events such as bushfires and floods. State-based Aboriginal housing authorities create standards for service provision, construction and maintenance to public housing stock that sometimes deviate from the Building Code of Australia (BCA), and that are geared towards delivering robust housing solutions and homes that survive the environment.

However, these deviations may impede the provision of appropriate home modifications. For example, the *Environmental Health Standards for Remote Communities in the Northern Territory* (Northern Territory Government, 2001, p. 3.12), recommends the use of concrete in the construction of housing in remote areas due to its durability, as mentioned in the previous section.

However, the use of concrete as a floor surface can result in a serious injury due to falls, especially to elderly clients. Falls on hard surfaces can lead to a range of debilitating injuries such as broken hips, fractured skulls and concussion. An elderly client may not recover completely from such a fall. In the general population, fall injuries in elderly people represent a typical first step away from independent living into full-time residential care (Kannus, Sievänen, Palvanen, Järvinen, & Parkkari, 2005). Therefore before home modifications interventions a household should be assessed not only on the basis of the age of tenants, but the propensity for the tenants to fall. This can be gauged by assessing for a) a fall in the previous year (self-reported); (b) taking four or more medications per day; (c) a history of stroke or Parkinson's disease; (d) self-reported problems with balance; and (e) inability to get out of chair at knee height, without using arms (Northern Territory Government, 2001) as well as by assessing the environment for risk due to uneven surfaces, especially where mobility apparatus are in use.

Covering concrete flooring with foam underlay and hospital-grade vinyl could present an improvement in safety, as it allows for some insulation and shock absorption to reduce the impact of plain concrete. If a slip resistant surface is needed, this can be achieved with the type of vinyl used, or with agglomerates such as Sliptech, which can be employed throughout the house. Insulated floor covering reduces the risk posed by a damaged or contaminated substrate by reducing impact. It is also much easier to clean, as brushed concrete collects dirt very easily, and this is highly problematic for homes situated in arid remote areas. Difficult to clean surfaces that allow dust to gather could pose problems for asthmatic residents, and brushed concrete is also a difficult surface for cleaning faecal contaminants, which can be an issue with certain types of impairments. A more easily manageable surface is therefore recommended. For homes where there is a strong risk of faecal contaminants due to incontinence or other ongoing care needs such as stoma management, care should be taken to ensure the product chosen would be easy to clean and preferably have antimicrobial properties. Concrete flooring throughout a home can also cause drainage problems. Severe weather events and lack of appropriate house site planning can lead to internal flooding. For this reason, a graded floor surface with appropriate drainage as per wet areas should be adopted where climactic factors pose a risk of flooding (Whitfield et al., 2005). This is also of distinct benefit where the household composition includes people suffering incontinence, as cleaning regimes may vary from those of the average household, and adequate drainage is a crucial component of maintaining adequate hygiene.

In terms of home modifications hardware and equipment, adequate consideration of the climate and conditions of remote areas in tandem with the accessibility of the home for the client is equally important. Functional aids and home modifications equipment designed to be employed in urban areas are often prescribed for use in rural and remote areas without taking into account the climactic differences in these environments and the effects of increased humidity and salinity. In her review of health hardware in rural and remote Aboriginal communities, Taylor (2002) notes that: "Housing to cater for this population needs to take into account the rigors of these isolated communities. However, in much of indigenous housing, standard building hardware has been used that was more appropriate for urban communities. This has resulted in continuing failure of certain building elements and components. Window

systems, plumbing systems and fixtures, electrical fittings and appliances, door hardware and door systems are the components that frequently fail and these failures occur in all communities”.

Given the cost of equipment, it is very important when implementing home modifications to ensure that the solution is one that will have a long life-span despite the environmental conditions. Barker (2008) recommends that industry professionals design with a view to future management and maintenance. In remote areas, where servicing of special equipment is more difficult to arrange, choosing simple, functional design is highly important. Consideration of the environment, materials, and whether there is a tendency towards corrosion, mould, or other damaging conditions, is crucial. For example, carpet is considered a good floor surface to reduce echo and to absorb noise however this floor covering is not suitable in areas of high humidity, high foot traffic or for people who use electric wheelchairs. A semi-commercial grade of vinyl with a high quality underlay may be a better and more functionally suitable option. When designing homes or modifications in remote areas, double-check that the materials chosen are appropriate for the environment they will be used in, and consult with the local industry to get a clearer idea of what types of construction practices and materials are encouraged or discouraged for environmental reasons.

4 The Checklist

Area of specificity for Aboriginal communities	Conceptual ideas	Operational design attributes ¹	Design element. ²	Function from an ageing / disability perspective
1. Cultural appropriateness	<i>A “shelter, around which to conduct the business of living”</i> (Fien et al., 2011, p. 346)	<ul style="list-style-type: none"> • Air circulation • Adequate shade at all times of the day • Accessible • Visually pleasing 	<ul style="list-style-type: none"> <input type="checkbox"/> Passive solar design <input type="checkbox"/> Takes consideration of prevailing winds and thermal currents <input type="checkbox"/> Able to access by all members of the family unit (including kinship groups) 	Allows all members of the family unit to access and participate in daily life regardless of ability set Supports carers in their role
	Orientation toward ‘country’ and relationship with land	<ul style="list-style-type: none"> • Dwelling is situated in a culturally appropriate position • Ensure doors and windows provide 	<ul style="list-style-type: none"> <input type="checkbox"/> Consult with local elders and /or relevant peak bodies <input type="checkbox"/> Consider louvered 	Maintains the link with ‘country’ for all

¹ Attribute – property or characteristic of a physical object of any kind, including construction products, work sections, elements and whole facilities (Leslie & Potter, 2004).

² Element (cost planning) – portion of a project that fulfils a particular physical purpose irrespective of construction and/or specification (Leslie & Potter, 2004).

Area of specificity for Aboriginal communities	Conceptual ideas	Operational design attributes ¹	Design element. ²	Function from an ageing / disability perspective
		effective visual and auditory contact with the environment wherever possible	windows with different materials such as opaque safety glass, plexiglass, and anodised aluminium	
Cultural appropriateness (cont.)	Outdoor living	<ul style="list-style-type: none"> • Enable meal preparation and consumption in culturally appropriate way (cooking fires vs. stoves or oven) 	<ul style="list-style-type: none"> <input type="checkbox"/> Outdoor cooking space <input type="checkbox"/> Outdoor sink with running water and waste pipe <input type="checkbox"/> Storage space for kindling 	<p>Access for users with mobility or sensory impairment</p> <p>Allows all members of the family unit to access and participate in daily life regardless of ability set</p> <p>Supports carers in their role</p>
	Outdoor living	<ul style="list-style-type: none"> • A place for people to wash that maintains privacy • A place to wash laundry with suitable water collection and disposal 	<ul style="list-style-type: none"> <input type="checkbox"/> External sanitation spaces <input type="checkbox"/> Sanitation spaces designed for heavy usage <input type="checkbox"/> Sanitation spaces that are accessible to those with 	<p>Allows all members of the family unit to access and participate in daily life regardless of ability set</p> <p>Supports carers in their role</p>

Area of specificity for Aboriginal communities	Conceptual ideas	Operational design attributes ¹	Design element. ²	Function from an ageing / disability perspective
			mobility impairment <input type="checkbox"/> Opportunity for grey water collection and appropriate re-use	
Cultural appropriateness (cont.)	Semi – outdoor living	<ul style="list-style-type: none"> • Personal safety considerations • Privacy and dignity is considered 	<input type="checkbox"/> Screened in veranda <input type="checkbox"/> built off the ground <input type="checkbox"/> Louvres of suitable materials e.g. one way vision security mesh	
	Additional shelter for people and animals	<ul style="list-style-type: none"> • A detached shade structure 	<input type="checkbox"/> Open, accessible <input type="checkbox"/> Suitable pathway to the structure for all users	Able to be accessed by those with mobility impairment, those who use mobility aids, carers who push mobility aids and/or prams and strollers

Area of specificity for Aboriginal communities	Conceptual ideas	Operational design attributes ¹	Design element. ²	Function from an ageing / disability perspective
Cultural appropriateness (cont.)	Location of family and kinship groups when designing settlements & townships	<ul style="list-style-type: none"> • Keep family and kinship groups together 	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure availability of homes or additional rooms for family/kin members, particularly carers 	<p>Visitability is possible for elders and family/kin relations regardless of ability set</p> <p>Family and kin can be contactable and close by for support and assistance</p> <p>Family and kin can visit each other's homes without physical barrier to the home (e.g. no stairs)</p>
2. Eco efficiency	Reduce green mileage in construction	<ul style="list-style-type: none"> • Local materials used where suitable 	<ul style="list-style-type: none"> <input type="checkbox"/> Consider traditional orientation of dwellings and siting <input type="checkbox"/> Investigate viability of traditional building materials and techniques 	

Area of specificity for Aboriginal communities	Conceptual ideas	Operational design attributes ¹	Design element. ²	Function from an ageing / disability perspective
Eco efficiency (con't)	Follows 'Green' building guidelines where possible	<ul style="list-style-type: none"> • Utilise appropriate 'green' technology to reduce reliance on high cost (and intermittent) electricity resources • Bioclimatic design principles 	<ul style="list-style-type: none"> <input type="checkbox"/> Use of solar hot water heaters where appropriate <input type="checkbox"/> Use of solar panels where appropriate <input type="checkbox"/> Passive solar design <input type="checkbox"/> Built off the ground to enable air currents beneath the house. <input type="checkbox"/> Position windows / louvers to take advantage of prevailing winds / sun position 	<p>Optimal energy resources are made available to those on limited incomes (e.g. Aged Pension, Disability Support Pension)</p> <p>Reduced need for additional appliances such as air conditioners and heaters – costly to purchase and to run</p>
Eco efficiency (cont.)	Landscape fit	<ul style="list-style-type: none"> • Consider landscaping options that enhance the function of the dwelling and provide shelter and shade 	<ul style="list-style-type: none"> <input type="checkbox"/> Use local flora to support the dwellings aesthetic fit with natural environment and 	<p>Careful use of trees and shrubs that will not result in roots disrupting path of travel or cause falls and injury</p>

Area of specificity for Aboriginal communities	Conceptual ideas	Operational design attributes ¹	Design element. ²	Function from an ageing / disability perspective
3. Healthy living practices	Sanitation spaces designed for heavy use; have multiple sanitation spaces	The toilet works and is easily accessible for repair	Consideration of a flushing toilet and a dry toilet system as backup (such as a self-composting toilet)	
	Suitable access in and out for all users and visitors to the dwelling	Residents are able to manage avoidance relationships, and determine personal safety Inclusive design principles are used to ensure egress is unhindered	<input type="checkbox"/> Approach is visible from the dwelling <input type="checkbox"/> Second door / exit from main living space and back access/exit available	Cultural practices are maintained and the personal safety of the resident with a disability or age related impairment is confident
	Protection from local fauna	A space that allows outdoor living and reduced risk of being attacked by insects / vermin	<input type="checkbox"/> Screened in veranda (mosquito, vermin /& snake management)	People with vulnerable immune systems / skin / respiratory problems are protected from injury and illness via insects / vermin

Area of specificity for Aboriginal communities	Conceptual ideas	Operational design attributes ¹	Design element. ²	Function from an ageing / disability perspective
	Meteorological factors are considered	<ul style="list-style-type: none"> • Thermal performance is factored into design • Flooding risks are considered 	<ul style="list-style-type: none"> <input type="checkbox"/> Suitable eaves / overhang / veranda position and roof pitch <input type="checkbox"/> Height to veranda is congruent with past flood data <input type="checkbox"/> Ground care is considered – for example use of French drains³ to manage moisture 	Those most vulnerable to thermal stress or moisture related pathogens such as mould and mildew (the elderly, young children and those with mobility impairment) are protected and able to continue their ADLs in an optimal thermal environment
	Access to clean water	<ul style="list-style-type: none"> • All dwellings should have the capacity to receive and manage clean, potable water supplies 	<ul style="list-style-type: none"> <input type="checkbox"/> Linked to town water systems wherever possible <input type="checkbox"/> Water tanks with appropriate runoff systems in place 	Opportunity for regular personal hygiene activities, washing of linen, clothing and cleaning living spaces to support those most vulnerable to infection, skin breakdown and other

³ A French drain (also known as a blind drain, rubble drain, rock drain, drain tile, perimeter drain or land drain) is a trench covered with gravel or rock that redirects surface and groundwater away from an area.

Area of specificity for Aboriginal communities	Conceptual ideas	Operational design attributes ¹	Design element. ²	Function from an ageing / disability perspective
			where rainwater collection is viable	health problems in high humidity, or very hot environments
	Effective management of human effluent	<ul style="list-style-type: none"> • Acceptable distance from sewage treatment / septic tanks / evaporative pools 	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure any groundwater / seepage is considered when locating a dwelling. <input type="checkbox"/> Establish routes of prevailing winds and air currents 	People with vulnerable immune systems / respiratory problems are protected from waterborne and airborne pathogens
	Management of infestations and pest control from domestic animals	<ul style="list-style-type: none"> • Separation of dogs and other livestock from children 	<ul style="list-style-type: none"> <input type="checkbox"/> Screened in veranda 	People with vulnerable immune systems / skin / respiratory problems are protected from contagions
	Management of infestations and pest control from mismanaged waste	<ul style="list-style-type: none"> • Adequate waste removal (water and rubbish) 	<ul style="list-style-type: none"> <input type="checkbox"/> Allocated secure space for rubbish bins <input type="checkbox"/> Suitable waste water management systems / water recycling systems 	All users protected from vermin, contagions and other problems related to poorly managed waste products

Area of specificity for Aboriginal communities	Conceptual ideas	Operational design attributes ¹	Design element. ²	Function from an ageing / disability perspective
	Management of dust / sand storms.	<ul style="list-style-type: none"> • Dust control mechanisms in place • Identification of dust risks in area (from both landscape and industry) 	<ul style="list-style-type: none"> <input type="checkbox"/> Installation of air-conditioning systems with adequate filtration <input type="checkbox"/> Ensure housing envelope is able to withstand dust penetration if required 	People with vulnerable immune systems / skin / respiratory problems are protected from dust borne pathogens, dust related respiratory problems such as asthma etc.
4. Employment opportunities	Local resources used	<ul style="list-style-type: none"> • Local materials used where appropriate • Housing projects are within reasonable commute to centres of employment and training / support 	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that gazetted and non-gazetted residential precincts are identified prior to new builds 	That, wherever possible, the aged and those with disabilities are not placed in locations where support services and caring relationships are untenable, and maintenance and modification is unmanageable

Area of specificity for Aboriginal communities	Conceptual ideas	Operational design attributes ¹	Design element. ²	Function from an ageing / disability perspective
<p>5. Lifecycle costing</p>	<p>House is easy to maintain – materials are common / durable / available if need to be replaced</p>	<ul style="list-style-type: none"> • Sanitation spaces designed for heavy use 	<ul style="list-style-type: none"> <input type="checkbox"/> Electrical fittings designed for heavy use and are humidity / temperature appropriate. <input type="checkbox"/> Plumbing fixtures are designed for heavy use and are humidity / temperature 	<p>Resident is not reliant on external contractors for basic maintenance procedures</p>
	<p>A reasonable timeframe for dwelling endurance is determined taking into consideration the environmental press of the geography</p>	<ul style="list-style-type: none"> • The <i>design working life</i> (Leslie & Potter, 2004) is congruent with other materials in the construction 	<ul style="list-style-type: none"> <input type="checkbox"/> Use of materials that are suitable for the climactic variation of the local area 	<p>Resident is not expected to relocate unnecessarily or to live in substandard housing as result of poor material choices</p>

Area of specificity for Aboriginal communities	Conceptual ideas	Operational design attributes ¹	Design element. ²	Function from an ageing / disability perspective
<p>6. Innovation in procurement, ownership and construction systems</p>	<p>Dwellings are procured by management agencies that will support the residents with tenancy and / or ownership in a culturally relevant way</p> <p>Dwellings are built from easy to assemble materials</p>	<ul style="list-style-type: none"> • Dwelling design considers the limited availability of ongoing technical expertise and the transient/FIFO nature of modification and maintenance personnel 	<p><input type="checkbox"/> Provide opportunity for local employment and or training for maintenance and servicing</p>	<p>Increased likelihood of timely build, repair and modification</p> <p>Decreased likelihood of resident needing to seek interim (accessible) housing while awaiting repairs</p>

5 Conclusion

This paper has explored many of the key issues that need to be considered when designing effective home environments for Aboriginal people with a functional impairment in remote areas. While many of these issues must be considered when implementing any home modifications solutions, undertaking appropriate new build projects and completing therapist scripted home modifications in housing that is managed for Aboriginal people in remote Australia encounters specific and unique structural, cultural, medical, and environmental challenges. To approach Aboriginal Housing in the same way as mainstream housing is to run the risk of over simplifying issues such as overcrowding, the prevalence of certain diseases and disabilities, the importance of cultural beliefs on how people interact with their homes, and the challenges of extreme climates and temperatures in remote Australia, and then failing to adequately address these issues through the built environment. As discussed in this paper, inappropriate, inaccessible, and deprecated housing has dramatic impacts on the wellbeing of functionally impaired people.

As discussed earlier, housing shortages in remote areas, long waiting lists for public housing, and the failure of existing dwellings to cater for the cultural practices and needs of Aboriginal groups are key contributors to overcrowding. One spare bedroom per dwelling is unlikely to be enough in situations where a household experiences groups of extended family visitors staying with them. Standard 3 bedroom dwellings may not be appropriate for diverse household types, yet “public housing ...has been, and is still being, designed for nuclear families. Innovative design should consider Indigenous culture and extended families – for example, positioning homes in relationship to each other with covered walkways and/or breezeways between them” (Fien et al., 2008a, p. 47). Housing design in remote areas of Australia also needs to take into account the siting and orientation of dwellings to take advantage of views, visibility, light, and proximity to family and friends, in order to appreciate the importance of matching the built environment to the natural landscape, and the importance of meeting cultural needs and preferences.

There is a distinct challenge in determining the real costs of providing culturally appropriate housing across jurisdictions and in a sustainable way (McGlade & Purdy, 1998, p. 149). In many instances, inappropriate housing has simply been inherited from previous housing regimes, and deprecated housing can be difficult and costly to repair and maintain. The high cost of transporting materials and labourers to remote areas to construct new housing is a further barrier. However, from a costing perspective, it may well be substantially less expensive to provide accessible, culturally-appropriate housing from the outset than it is to allow conditions to deteriorate, particularly to the point at which people with a disability or who are ageing are no longer able to live at home. Effective home modifications can reduce or even eliminate the need for formal and informal care services at home for some people with disability (Liu & Lapane, 2009; Verbrugge & Sevak, 2002) and ageing in place rather than transitioning to residential aged care is generally found in the literature to be a better outcome for both personal well-being and financial outcomes (Newman et al., 1990). Home modifications also reduce the hazards in the home environment that put people with a functional impairment most at risk, and maintain a sense of independence and dignity that most people who have a disability or are ageing desire (Carnemolla & Bridge, 2011).

This paper brings to the fore some key strategies in designing home environments through home modifications that can benefit Aboriginal people with disabilities or who are ageing. Yet despite these benefits, use of home modifications services is extremely

low amongst remote populations in Australia, and even lower amongst remote Aboriginal populations (Jung & Millikan, 2009). Remote home modification service users face challenges in sourcing occupational therapists to assess their needs, and modifications take longer and require more funds due to the availability of builders and materials and costs of transportation, yet are often those who need these services most.

To fully consider and act upon the issues raised in this paper will require innovation from both industry and policy makers in investing in creative strategies for the provision of housing and home modifications to Aboriginal groups and to undertake true community and stakeholder consultation to ensure this provision is executed in a meaningful and successful manner. In particular, policies to identify and manage the specific and unique difficulties faced by Aboriginal Australians with a disability and who are ageing (or both) will be critical to a meaningful and ongoing dialogue with service providers and tenants with the ultimate goal of effective and appropriate housing for Aboriginal people regardless of their location in Australia. The complex relationship between inadequate housing supply, poor housing conditions, overcrowding, and health and disability needs to be explored further in order to design the most effective home environments in remote Aboriginal communities.

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