Heart Foundation

Healthy Active by Design™

Designing for density

Delivering healthy, higher-density neighbourhoods in Australia

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Evidence review, August 2025

Proudly supported by

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First published August 2025.

Suggested Citation: Sarah Foster, Alexandra Kleeman, Melanie Lowe, Lucy Gunn, Chris De Gruyter, Manoj Chandrabose, Amanda Alderton, Karen Villanueva, Nicole Edwards, Joelie Mandzufas, Jerome N Rachele, Rebecca A Reid, Thomas Astell-Burt, Xiaoqi Feng, Neville Owen, Billie Giles-Corti, 2025. Designing for Density - Delivering healthy, higher-density neighbourhoods in Australia. Evidence review prepared for the National Heart Foundation of Australia, Australia, August 2025.

Edited by Anna Gurnhill, Elizabeth Calleja, Elaine Ho and Sheree Hughes; Heart Foundation.

The Heart Foundation gratefully acknowledges the following individuals and organisations who have prepared this paper: Dr Sarah Foster, Dr Alexander Kleeman, Dr Melanie Lowe, Dr Lucy Gunn, Dr Chris de Gruyter, Dr Manoj Chandrabose, Dr Amanda Alderton, Dr Karen Villanueva, Distinguished Professor Neville Owen, Emerita Professor Billie Giles-Corti. Dr Nicole Edwards; University of Western Australia, Australian Urban Design Research Centre. Dr Joelie Mandzufas; University of Western Australia. Dr Jerome Rachele, Dr Rebecca Reid; Victoria University. Professor Thomas Astell-Burt; Sydney University. Professor Xiaoqi Feng; University of New South Wales.

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Executive Summary

Australia is in the midst of a housing shortage with governments at every level seeking solutions to increase housing supply. In contrast to the low density, car-dependent urban developments that have previously characterised most Australian cities and towns, urban planners and others are increasingly advocating for greater housing density, particularly in proximity to transportation hubs and activity centres. This call not only responds to housing supply issues, but seizes the opportunity to address a range of other mounting challenges such as traffic congestion, climate change and housing affordability .

The Heart Foundation recognises that the national focus on building new residential developments presents an opportunity to improve the health and wellbeing of residents and communities. If well-planned and carefully implemented, new residential areas with higher density, particularly medium-density housing, can encourage healthier behaviours that reduce risk of cardiovascular disease and other chronic diseases.

This evidence paper outlines the research on how to maximise the benefits of higher-density development and avoid the risks of poorly planned densification.

Summary of recommendations

1. Develop vibrant and mixed-use neighbourhoods with access to daily living destinations within a walkable distance
2. Locate higher-density housing in established areas of mixed-use developments and minimise air and noise pollution
3. Provide safe and inclusive access to public transport and active transport infrastructure, such as footpaths and cycleways
4. Create leafy, cool neighbourhoods by planting trees and providing public green space that caters to multiple user groups
5. Design and construct health-promoting higher-density housing that caters to all populations
6. Foster engagement between local communities and stakeholders, including vulnerable groups

Definitions/glossary:

Active travel/active transport: Travel (or transport) using physical exertion by a person. This includes walking, wheeling and bike riding. Active travel and active transport also include e-mobility devices such as e-bikes. Active travel is primarily used as a verb (action word) and active transport as a noun.

Active travel infrastructure: Infrastructure for people walking, wheeling and bike riding. This can include footpaths, cycle paths, kerb ramps, raised pedestrian crossings and other measures that support active forms of transport.

Car dependency: A situation in which urban design, infrastructure, and cultural norms prioritise car use, making alternative modes of travel such as walking, wheeling, bike riding or public transport less viable or attractive.

Child-friendly neighbourhood design: Design which considers and prioritises opportunities for children to play, socialise, learn, explore, grow and develop.

Complete neighbourhoods: A complete neighbourhood is one which provides a complete range of destinations, services and amenities to meet a person's daily needs within their local area.

Crime Prevention through Environmental Design (CPTED): An approach that uses features of the built and natural environment, including urban and architectural design, to enhance personal safety and minimise crime.

Cycling: Travel using a bike, including traditional, recumbent and an e-bike, as well as any form of trike (a three-wheeled bike). Although e-bike requires less physical effort to operate it is typically considered as a form of physically active travel. The term 'cycling' can be used interchangeably with bike riding.

Density: Density measures the number of units within an area of land. Two key measures of density used by planners are population density and dwelling/residential density. Neighbourhoods are often described as being low-, medium- or high-density. See page 2 for more information.

Greenfield areas: Undeveloped land, usually on the urban fringe, that has not previously been used for residential, commercial or industrial purposes. These areas are often used for new housing developments and are typically located in outer suburbs or rural settings.

Infill housing: Redevelopment of vacant or under-utilised land that is located between existing structures and is centrally located. Redevelopment is often for residential, commercial or retail use.

Land Use Mix: Diversity or variety of land uses (e.g. residential, commercial, industrial).

Missing Middle Housing: A range of multi-unit housing types – such as duplexes, townhouses, and low- or medium-rise apartments – that fall between detached housing and high-rise apartments in terms of scale and density. Missing middle housing offers a more diverse and affordable housing choice within walkable neighbourhoods but is often underrepresented due to zoning and planning barriers.

Passive surveillance: Greater visibility and observation across both public and private spaces. This can be achieved through the presence of people, window placement in architectural design, active street fronts and clear lines of sight, which enhance safety and discourage antisocial behaviour.

Physical activity: Any bodily movement produced by skeletal muscles that require energy expenditure including activities such as walking, wheeling, bike riding and recreational exercise. Physical activity can be categorised into different domains: transport, leisure, occupational and household.

Transport-oriented development: A compact mixed-use residential and commercial development positioned with good access to public transport (such as a centrally located train station or bus stop).

Walkability: The extent to which an area supports and encourages walking (as well as wheeling and bike riding). It typically consists of three urban design factors: residential density, street connectivity and land use mix which combine to create an environment that makes active travel to destinations easier and more convenient.

Wheeling: The action of moving as a pedestrian, using manual or self-assisted modes of transport including the use of wheelchairs, mobility aids, scooters and others.

Contents

1. Introduction

1.1 The importance of density for creating vibrant health-promoting neighbourhoods

Australia is a highly urbanised nation, with nearly 90% of people living in 21 cities.[1,2] Melbourne and Sydney are fast becoming 'mega-cities', and in all Australian cities there is growing congestion, and pressure on infrastructure and housing affordability. Decisions about how cities grow, and how they house and mobilise urban dwellers, profoundly affect human, eco-system and environmental health.[3] Population health concerns must be central to urban planning to ensure urban development promotes health and community wellbeing.[4]

Increasing the density of housing in Australia's urban areas is an important step to accommodate growing urban populations and create a more sustainable future. Historically, Australian towns and cities have been characterised by low-density, car-dependent urban sprawl.

However, the adverse health, environmental and economic impacts of urban sprawl have prompted a pivot towards urban planning strategies that ensure more people live close to shops, services and public transport.[5] This shift is welcome because, if done well, it will encourage more walking, wheeling, bike riding and public transport use, and reduce car dependency with multiple health, environmental, economic and community benefits.

Increasing density in urban areas across Australia is an important step to accommodate growing urban populations. image credit: iStock.com, fotografixx

Increased urban density must be carefully considered, as poorly planned high-density living with limited access to essential amenities, green space and recreation opportunities can expose residents to environmental stressors, such as noise and air pollution, congestion and overcrowding.

This evidence review provides the latest research on how density can be increased to maximise health benefits and minimise any harms from poorly planned high-density developments.

1.2 Definition of density in the context of urban planning

Density measures the number of units (e.g. people, dwellings, employees) within an area of land. Two key measures of density used by planners are:

- **Population density:** number of people divided by the size of a given area; and
- **Dwelling/residential density:** number of dwellings divided by the size of a given area.

Dwellings per hectare is the most used Australian density unit (one hectare =10,000 square metres, or approximately 2.47 acres of land).

This report focuses primarily on the role of population and dwelling density in creating compact, vibrant, healthy neighbourhoods.

Neighbourhoods are often described as being low, medium or high density. From an Australian perspective, the following definitions of dwelling density are generally accepted:[6]

- *Low density*: less than 25 dwellings per hectare
- *Medium density*: 25 to 60 dwellings per hectare
- *High density*: over 60 dwellings per hectare.

2. The health case for increasing residential densities

There are two fundamental approaches to accommodating growing urban populations:

1. The densification of new and established neighbourhoods; or
2. Continued low-density development on the urban fringe.[7]

Densification of established areas involves accommodating more people within the existing urban footprint through infill housing, resulting in more medium- and high-density housing. In contrast, low-density development on the urban fringe of towns and cities involves expanding urban boundaries into previously undeveloped greenfield areas, including agricultural land, predominantly through single-use residential developments.

2.1 Is there an optimal level of density for health?

There is substantial evidence that living in low-density urban sprawl located far from city centres, with limited access to essential services, retail, job opportunities and infrequent public transport, adversely affects cardiovascular health.[8,9]

Australian evidence demonstrates that residents living in low-density urban sprawl are more car-dependent and engage in less active travel,[10,11] which increases their risk of obesity[12,13] and cardiometabolic diseases.[14,15] Car dependency contributes to climate change by generating greenhouse gas emissions[16] and exacerbating air and noise pollution, both of which increase the risk of cardiovascular disease.

In contrast, well-implemented urban densification has the potential to improve residents' health.

Australia-wide longitudinal studies have found that densifying established neighbourhoods is associated with increased walking and physical activity[17] and a reduced risk of obesity.[18] This is because higher-density development supports the presence and viability of local shops, services and public transport. The presence of destinations in close proximity to one another, and to residential areas, encourages active travel,[3] reduces car dependency[11] and sedentary time,[19] and promotes social engagement and mental health.[20]

While 25 dwellings per hectare is often cited in policy and academic literature as the minimum density needed to support walking,[21,22] few empirical studies have investigated the minimum density thresholds required to achieve health benefits. A recent international study found that population densities of at least 5,700–6,500 people per km^2 (~25 dwellings per hectare, assuming 2.5 people per household),[23] are needed to optimise walking for transport outcomes. This will meet the World Health Organization's target of a 15% relative reduction in insufficient physical activity through walking.[24] However, Jafari et al.[25] found that this level of density may be insufficient in the Australian context to support access to all the destination types required for daily living – those that make neighbourhoods 'liveable' – within an 800-metre walkable catchment. Their findings suggest that at least 30–35 dwellings per hectare may be required.

Higher-density development supports the economic viability of local destinations, including cafes.
Image credit: iStock.com, Patricia Mado

Research has also identified potential adverse health effects of densification and proximate shops and services, such as an increased risk of hypertension among residents in areas with growing population density[18] and depression in older men living in neighbourhoods with more land use mix and retail.[26] There is emerging evidence that there may be a tipping point above which higher densities could have detrimental impacts.[24] Further research is required to confirm these findings, particularly longitudinal studies. However, an international comparative analysis by Cerin et al.[24] found that when densities exceeded the upper threshold of what is generally considered medium density – 14,000–14,500 people per km^2 (or 58 dwellings per hectare assuming 2.5 people per dwelling) – the likelihood of achieving recommended levels of walking began to decline.

It is plausible that at particular high density thresholds, walking distances reduce due to the close proximity of local destinations and frequent public transport.[24] If not well-designed and located, very high-density housing can also be associated with overcrowding, increased pollution exposure and poor access to green space, all of which have detrimental impacts on cardiovascular, mental and physical health.[27-29] Hence, there is a need to consider how to maximise the benefits of density and minimise any of these potential harms.

3. Benchmarking the densities of Australian neighbourhoods

In Australian cities, many neighbourhoods (e.g. in Adelaide, Canberra, Melbourne and Sydney) have densities that are too low to support walking, suggesting that they would benefit from densification.[30,31] Only 51% of Sydney's population, 18% of Melbourne's and none of Canberra's or Adelaide's live in neighbourhoods that meet the minimum 5,700 people per km^2 population density (i.e. 25 dwellings per hectare) threshold recommended to achieve World Health Organization physical activity guidelines.[30,32] Given most Australian neighbourhoods fail to meet minimum health-promoting thresholds for walking, there are opportunities to address density shortfalls in ways that lead to increased physical activity.

The building blocks of a healthy, liveable neighbourhood are its structure and connectivity, the mix of destinations and activities it offers, and the quality of its design features.[33] Density is the cornerstone of a healthy liveable neighbourhood, because without adequate densities, there are insufficient people to support nearby local destinations (e.g. shops, public transport, healthcare).[33,34]

There is research to suggest a threshold of 35 dwellings per hectare is needed to ensure access to the full range of destinations that create liveable neighbourhoods within a walkable catchment.[25] Yet, national liveability studies have found that across Australia's state capital cities, only 17–44% of dwellings are within 1 km of a supermarket, with the average distance to an activity centre with a supermarket ranging from 1.3–2.0 km.[31] Moreover, on average, only 48% of dwellings in Australia's state capital cities have access to a public transport stop within 400 m that is serviced every 30 minutes, and only 51% have a large park within 400 m.[35]

Despite the evidence and importance of designing for heart health, low-density greenfield suburbs continue to pervade across Australia. image credit: iStock.com, Phillip Wittke

Despite the importance of density for creating healthy neighbourhoods, 'business as usual' low-density greenfield suburbs continue to be developed in efforts to improve housing supply and affordability.[36] These newly developed areas often start without essential amenities such as parks, healthcare facilities and public transport.[37] In many cases, developer contributions intended to fund these amenities fall short, leaving local governments struggling to bridge the gap.[38,39] This disproportionately impacts disadvantaged groups who move to these areas in search of affordable housing but find themselves in housing developments that lack necessary health-supporting infrastructure and public transport.[40,41]

Low-density suburbs effectively force households to own and maintain (sometimes multiple) private vehicles, increasing transport costs and negating the 'true' affordability of outer suburbs.[42] These conditions can exacerbate socioeconomic inequalities and undermine the wellbeing of residents.[43,44]

To prevent this cycle, there is a need to ensure that new developments include sufficient densities to support the provision of local amenities and public transport that promote healthy living. This requires enforceable evidence-based design guidelines, adequate funding through robust developer contributions and long-term strategic planning.

4. Existing policy responses to create healthy higher-density neighbourhoods

Different models of urban development are being proposed in Australia and globally to help meet density thresholds, while maintaining the liveability of rapidly growing and congested urban areas.

During the COVID-19 pandemic, the C40 global network of city mayors committed to 'building back better' by creating *15-minute cities*, where all urban dwellers live in 'complete neighbourhoods'. Complete neighbourhoods provide access to core services and local opportunities for urban dwellers to meet their basic needs including local education and healthcare, grocery stores and pharmacies, recreational parks and working spaces.[45] C40 is a global network of mayors from leading cities across the world who are united in taking action to address climate change.

In Australia, the NSW state government has similarly proposed creating 15-minute neighbourhoods in Sydney where local shops, services, transport, and quality public space are easily accessible by active transport on leafy-green, well-designed and safe roads and pathways.[46] These neighbourhoods would be embedded within a *30-minute city* where jobs, healthcare and social connections are accessible by high-quality public transport.[47]

Higher-density neighbourhoods provide access to local services and amenities, including public libraries. Image credit: iStock,com, Nils Versemann

The Victorian state government has proposed the development of '*20-minute neighbourhoods*' in Melbourne, where residents have access to daily living amenities within a 20-minute return trip from home by walking.[22] These amenities include shops and services (shopping centres and healthcare services), educational opportunities (schools and lifelong learning), public open space (playgrounds and parks; sport and recreational facilities), green public realm (green streets and spaces), multi-modal transport infrastructure and services (public transport, safe cycling and walking networks, public transport to regional jobs and services) and diverse housing. In Victoria, this concept is underpinned by an 800-metre walkable catchment and a minimum density target of 25 dwellings per hectare.[22]

The Western Australian state government has similarly recommended 26 dwellings per hectare for Perth.[48]

Queensland has proposed higher-density thresholds for urban areas, aligning with Australian recommendations of 30–35 dwellings per hectare to support access to essential daily destinations;[25] however, these density targets do not extend to suburban areas.[49]

Despite different models of urban development, most Australian cities are now proposing urban policies designed to encourage active and public transport use by creating walkable,[50] liveable[48] and vibrant village precincts,[51] or transit-oriented developments with higher-density housing and amenities around public transport hubs.

These urban policy directions are consistent with the Heart Foundation's Healthy Active by Design priorities. Healthy Active by Design is the Heart Foundation's digital toolkit translating public health evidence into practical urban design outcomes. There is also a substantial body of longitudinal evidence emphasising that greater accessibility (e.g. number of destinations, land use mix, public transit availability) and access to infrastructure for walking, wheeling, bike riding and public transportation, are determinants of both overall and transportation-related physical activity.[52]

To support health and wellbeing, higher-density development needs to be carefully undertaken with consideration of building design, the diversity of the local population, the nearby landscape and infrastructure and the broader geographic location. The following sections consider evidence on how to design density well, the potential risks, and how these can be avoided.

5. The provision of quality high-density housing

5.1 Well-designed and constructed apartment developments

Larger scale developments, including higher-density apartment complexes, are needed to achieve the population thresholds that underpin walkable neighbourhoods. However, in urban areas across Australia, density increases in established areas have mostly been achieved through the opportunistic subdivision of suburban lots, which produces density gains that are too small to improve local amenity and services.[53] This feeds into the problem of the "missing middle" – an absence of medium-density housing types such as duplexes, townhouses, and low- or medium-rise apartments. This type of urban infill has the potential to sensitively increase density and provide diverse housing options for different life-stages within established neighbourhoods, but is frequently constrained by restrictive zoning, community opposition, and outdated planning frameworks.[54,55]

It is vital that high-density housing is designed, constructed, and managed to meet residents needs and expectations and support their health and wellbeing.

The High Life Study, a multi-city comparison of apartments built between 2006 and 2016 across Sydney, Melbourne and Perth, identified that apartment design factors were higher priorities for apartment residents than neighbourhood factors when choosing an apartment.[56] Findings from this study underscore the importance of well-designed and constructed apartments – with sufficient space, natural light, ventilation, thermal comfort, privacy and private/communal outdoor space[57] which support housing satisfaction[56] and contribute to mental wellbeing.[58,59]

Strong design policy guidance with minimum standards is key for ensuring that new apartments deliver base levels of healthy design quality. However, different apartment design policies apply across Australia, and some state policies provide more extensive design guidance than others.[60]

The High Life study also found that developers implemented more health-promoting requirements when buildings were developed under a comprehensive operational policy. This was the case in Sydney, where buildings were developed under State Environmental Planning Policy[65] and its detailed Apartment Design Guide.[51] There was a direct link between 'high performing' buildings (i.e. where policy requirements were implemented more holistically) and better resident wellbeing.[62] Yet, in Melbourne, where buildings were developed under the most lenient policy settings, just 9% of the sample buildings were classified as 'high performing', compared to 86% of Sydney buildings.[63] These findings reinforce the need for comprehensive apartment design policies and approval processes to ensure buildings adhere to the minimum requirements that help protect residents' health and wellbeing, and in turn, foster vibrant, liveable, high-density communities with lasting benefits.

Designed well, apartments provide density gains to support health and wellbeing.
Image credit: iStock.com, Elias Bitar

5.2 Diverse affordable housing with resilient and adaptable design

People living in Australia need towns and cities with diverse housing choices to maximise health and wellbeing.

More people in Australia are facing housing affordability stress in the private rental market. At the same time, social housing supply is not keeping up with demand. Addressing this challenge requires not only a significant boost in social and affordable housing supply, but also diverse housing stock that caters to all ages, life stages and abilities.

For example, accessibility and universal design standards in apartments are essential to cater for people in Australia who live with disability or frailty, with specific design considerations including wider doorways, levelled entries that are wheelchair-accessible and lever-style door handles.[66] Equally important are accessible building-level features such as lifts, ramps and barrier-free access to communal areas. Many newer apartment buildings include gyms, swimming pools, or rooftop gardens. However, if these facilities are only accessible by stairs, residents with mobility impairments may be unable to use them, despite their financial contribution to the maintenance and upkeep of these spaces via strata fees. Designing adaptable living spaces and features that can

accommodate changing needs and abilities promotes greater independence for people living with disabilities and supports older adults to age in place.

Affordability pressures are also driving a shift towards apartment living for families, but apartments are rarely designed with children in mind. Apartments are typically designed to appeal to investors, and families are faced with small, inflexible, standardised apartment layouts that do not adequately support a diverse range of needs relating to privacy, supervision and shared spaces. To better support families, apartments should offer larger floorplans with adaptable spatial configurations (e.g. moveable internal walls or modular furniture) that can respond to children's developmental stages, support multi-generational living and evolve with changing household needs over time.[67]

The recent COVID-19 pandemic and lockdown restrictions further reinforced the importance of dwelling designs that are resilient and adaptable to a range of uses/users to enable healthy and sustainable lifestyles. In the event of future global health emergencies, apartments must provide sufficient space to facilitate social distancing within the home, accommodate working and schooling from home (including flexible furniture arrangements to create dedicated workspaces), offer adequate sound insulation between apartments to reduce noise annoyance, and incorporate health-promoting design elements (e.g. enhanced natural light/ventilation, private open space amenity and views of nature).[68,69]

Dwelling design for apartment living must be resilient and adaptable for a range of uses and users. Image credit: iStock.com, piranka

6. Considerations for supportive higher-density neighbourhoods

In addition to building design, 'good' density depends on social and geographic factors. Well-designed and constructed higher-density housing that meets the needs of different population groups must be located within supportive neighbourhoods. These are neighbourhoods that maximise the health and social benefits of higher densities, while mitigating the risks inherent in a shift to more populous settings.

Density without local amenity is simply higher-density sprawl. Hence, the success of density in achieving desired outcomes is predicated on the timely provision of local shops, social infrastructure, amenities and public transport.

6.1 Mixed land use and access to destinations

Mixed land use developments co-locate commercial and social infrastructure within residential zones, enabling the mixing of residential housing with retail, office, healthcare and entertainment amenities. This allows people to live close to shops, services, employment and transport, enabling greater access to activities that support daily living across the life course, in line with the concepts of 15- or 20-minute neighbourhoods.

Higher-density, compact, mixed land use and well-connected neighbourhoods are more walkable,[70] sustainable,[24] and healthy.[71-73] Research provides a link between walkable areas with a greater mix of land uses and active behaviours including walking, bike riding and public transport use, and less driving.[11,74,75]

Research also highlights the importance of different types of land uses for physical activity, with evidence that mixed land use increases walking for transport, whilst recreational walking is more likely to occur in the presence of public open space and sporting infrastructure.[76]

In a longitudinal study of people moving into new housing developments, Giles-Corti and colleagues (2013) found that after adjustment, for each additional daily living destination gained, residents undertook six additional minutes of transport-related walking. While for each additional recreational destination gained, they did 20 minutes additional recreational walking.[77]

Other research has focused on the presence of specific types of destinations.[78] Activity centres,[75] which have a greater mix of destinations due to commercial zoning, have been strongly associated with increased walking. Walkable areas with mixed land use and commercial activity attract people walking, wheeling and bike riding, who are more likely to linger and shop, leading to greater economic activity.[79]

6.2 Fresh, healthy food options

The type of retail destinations available in high-density neighbourhoods also has implications for what people eat. Where neighbourhoods have increased exposure to fast-food (more outlets or closer proximity to homes), children[80] and adults[81,82] are more likely to be overweight or obese. Conversely, with better access to fresh food, residents are more likely to have healthier food intake,[83] contributing to lower rates of obesity-related disease, including cardiovascular disease.

It is critical that supermarkets, restaurants and cafes with healthy, safe and affordable food options are located within a distance accessible by active and public transport. However, access

to different types of food outlets and dietary patterns in high-density neighbourhoods can vary by socioeconomic context. For instance, an Australian study found that residents in high-density, walkable but socioeconomically disadvantaged neighbourhoods had unhealthy dietary patterns, while those in similarly dense but more affluent neighbourhoods had healthier dietary patterns.[84] A key factor contributing to this disparity is the relative cost of healthy versus unhealthy food.

Evidence indicates that healthy diets are often unaffordable for low-income households and in disadvantaged areas, where they can consume 30–60% of household income.[85] Moreover, fast-food outlets tend to be disproportionately concentrated in socioeconomically disadvantaged areas, including near schools, which can limit access to healthier alternatives and shape food choices.[86,87]

Proximity to fast-food outlets has also been associated with increased obesity risk, prompting calls for zoning regulations to limit their density near homes, schools, and community spaces.[88] These findings underscore the importance of considering both the availability and affordability of healthy food options in broader socioeconomic contexts when planning equitable food environments in high-density neighbourhoods.

Higher-density neighbourhoods can provide better access to fresh healthy food. Image credit: National Heart Foundation of Australia

For those living in smaller higher-density dwellings, kitchen designs require sufficient space for the preparation and storage of food and appliances.[89,90] It is also important to consider how groceries will be transported via public or active transport (e.g. baskets or carts on bicycles), and whether there are appropriate storage options for deliveries of groceries, meal kits or meals prepared out of the home. Some high-density developments provide further opportunities for residents to access fresh food by growing their own produce, either in private outdoor spaces or within shared communal gardens.

6.3 Good amenity and sense of place

Neighbourhood destinations contribute to local amenity, helping cultivate a strong sense of place, where individuals experience a high quality of life,[91] feel connected to their environment, and to one another.[92] If a neighbourhood has a good sense of place, more people will choose to walk through and within it.[93] Various types of amenities – including natural, recreational, commercial, retail and cultural – enhance a neighbourhood's sense of place.[94-96]

In denser environments, access to amenities such as public space, parks, water bodies, walking, cycling and public transport infrastructure, activity centres, educational facilities, community centres and shops, supports community activities.[96] These amenities also contribute to a vibrant public realm, enhance neighbourhood wellbeing[97] and foster a sense of place.[94,98-100]

Additionally, the provision of good urban design and amenity can mitigate the potential drawbacks of higher-density living.[101] For example, greening and traffic calming interventions can alleviate perceptions of crowding,[102] while well-designed housing contributes to a greater sense of community.[103,104] Ultimately, achieving a balance between density and good amenity is essential for creating liveable, dynamic urban spaces that resonate with residents and foster a shared community identity.

Good amenity, including greenery, is important to support higher-density living.
Image credit: iStock.com, fotografixx

6.4 Safe, inclusive streets with active and public transport infrastructure

As we densify our suburbs for improved heart health, and to avoid traffic congestion, there is an urgent need to ensure that more people walk, wheel, bike ride and use public transport rather than use a car to travel to local shops, services, and places of work and education.

Appropriate walking, cycling and public transport infrastructure must be provided to enable and encourage this transport mode shift.

To reduce inequalities, infrastructure for people walking must cater to the needs of diverse and vulnerable populations, including children, parents with prams and older adults. For example, footpaths are essential to promote walking and should be high quality,[105,106] of adequate width[107] and free from obstacles[108] such as parked cars and e-scooters.[109] Streets should include trees that provide shade,[110] seating[105] and adequate lighting.[111,112] They should also feature low-rise gradients to road level to increase accessibility for older adults, parents of children in prams and people using mobility aids.[105] Additionally, there must be a clear delineation of space for the various road and shared space users to avoid conflicts and traffic accidents,[109,113] including separate pedestrian and cycle paths.[114] Combined with lower traffic speeds, these elements can support the role of streets as destinations, rather than just thoroughfares.

Cycling networks should enable safe access to everyday destinations within cycling distance, such as public transport hubs, activity centres, schools and other educational facilities. The safety of cycling infrastructure is predicated on road space availability, traffic flows and speed limits. While cycling infrastructure can be improved with the presence of painted lanes and markings,[115,116] concrete barriers and separated bike lanes,[117] encouraging bike riding requires safer cycling environments more generally. Traffic calming measures are needed, including reduced speed limits,[118,119] fewer vehicle lanes, speed humps and raised sections[120] and intersections with dedicated spaces for people riding bikes at traffic lights.[121] The creation of green wave traffic signals that prioritise people riding bikes can improve travel times and cycling uptake,[122] whilst end-of-trip facilities and secure bike parking also encourage bike riding.[123]

Reliable, frequent and direct public transport service provision is critical to support public transport use.[124-126] On average, less than half of residents in Australia's state capital cities have access to frequently serviced public transport within 400 m of their homes.[35] Access may be worsening, with longitudinal evidence from Melbourne showing the number of apartments increased by 88% between 2004–2022, while public transport services within walking distance of apartments only increased by 5%. This mismatch highlights the need for public transport provision to keep pace with housing development.[127]

However, access to public transport alone is not enough. Factors such as service frequency, reliability, cleanliness, crowding, personal safety and overall comfort are important determinants of whether people choose to use public transport. Poor-quality services can disproportionately affect those who rely on public transport, contributing to stress, reduced mobility and poorer mental health outcomes.[128] Integrating high-quality, well-serviced and equitable public transport into the planning process is essential to ensure it functions as a viable alternative to private vehicle use.

Provision of public transport becomes more viable with higher-density residential areas. Image credit: iStock.com, Jade Craven

6.5 Street space allocation and parking management

Plans for higher densities often spark community concerns over increased traffic and car parking problems.[129] Street space allocation and parking management are key to addressing these issues. Research undertaken in Melbourne found that wider footpaths, high frequency public transport services and car-sharing services are associated with less car use and on-street parking in shopping strips.[130] Other research has found that on-street car parking represents the least efficient use of street space, and that opportunities exist to reallocate some of that space for more productive uses such as outdoor dining, wider footpaths and bicycle lanes.[131]

Better management of off-street car-parking also presents significant opportunities to use space more efficiently through unbundling car parking from the purchase price or rental cost of housing, adopting maximum car parking requirements (i.e. limits on the number of spaces allowed) for developments in areas of high public transport accessibility, and providing adequate parking facilities for bicycles and other forms of micromobility (e.g. scooters, shared bikes).

Research in Melbourne has found that an additional off-street car parking space increases the odds of an apartment household having two or more cars, compared with zero cars, by around 10 times.[132] Conversely, the availability of bicycle parking has been found to increase the odds of an apartment household owning one bicycle, compared with none, by more than two times.[133] This highlights the significant role that off-street parking can play in influencing car and bicycle ownership, but also the opportunities to reduce car use and increase levels of bike riding in the community.

6.6 Child-friendly neighbourhood design

To support the wellbeing of children and families, higher-density neighbourhoods must be designed to allow children to safely walk, wheel or bike ride to a range of destinations, including their school, childcare and places to play outdoors.[134,135]

Protecting children from exposure to high traffic volumes and speeds is critical in all neighbourhoods,[136] but especially those of higher density, to reduce both their actual and perceived risk of traffic injury. For example, one study[137] found that the construction and maintenance of footpaths, along with the installation of traffic lights on routes leading to schools, was associated with increases in children's active commuting.

In addition to safe walking and cycling infrastructure, higher-density neighbourhoods should include key child-friendly destinations that support play, learning, socialising and connecting with nature. For example, a recent study found that access to high quality preschools led to improved mental health outcomes for children.[138]

It's important that children living in higher-density areas have access to outdoor spaces.
Image credit: iStock.com, SbytovaMN

Evidence generated during the COVID-19 pandemic lockdowns – when children and families were restricted from using public spaces – found that children living in higher-density housing without outdoor space showed greater declines in physical activity, larger increases in sedentary behaviour and poorer mental health outcomes, compared with their peers with access to private gardens or backyards.[139] Others have found that a larger amount of private yard space[140] and garden access[141] was associated with reduced vulnerability in children's emotional development.

Access to natural open spaces may also reduce social, emotional and behavioural difficulties in young children,[141] whilst access to public open spaces can be protective of child mental health outcomes,[142] with children living within 800m (about a 10-minute walk) from high-quality parks being more likely to have positive mental health.[143] These findings highlight the importance of ensuring that children living in higher-density neighbourhoods have access to outdoor spaces to play, ideally both private (e.g. backyards, or communal spaces shared within an apartment block) and public open spaces.[6]

6.7 Public open green space and tree canopy thresholds

As urban areas densify, access to public green spaces and nature becomes increasingly important for residents of higher-density housing to compensate for the loss of private open space.[144] Evidence indicates that conserving, restoring and increasing green spaces in urban areas, and especially urban forests, are key for sustaining and enhancing mental, physical and social health within the context of densification.[145,146] Recognised pathways through which green spaces and tree canopy promote health include restoring psychological wellbeing (e.g. reducing stress), strengthening psychological and physiological functioning (e.g. promoting physical activity, sleep and social connection), and protecting against harms (e.g. cooling air temperatures and buffering air pollution).[145,147]

Analysis of people living in Sydney, Newcastle and Wollongong highlighted that achieving a 30% tree canopy cover target within 1.6 km of home reduced the odds of the onset of psychological distress over six years by 31%,[148] diabetes by 31%, cardiovascular diseases by 22%, and hypertension by 17%,[149] as well as dementia risk over 11 years by 16%.[150] Furthermore, research links a local target of 30% tree canopy within 1.6 km with 22% reduced odds of insufficient sleep over six years.[151]

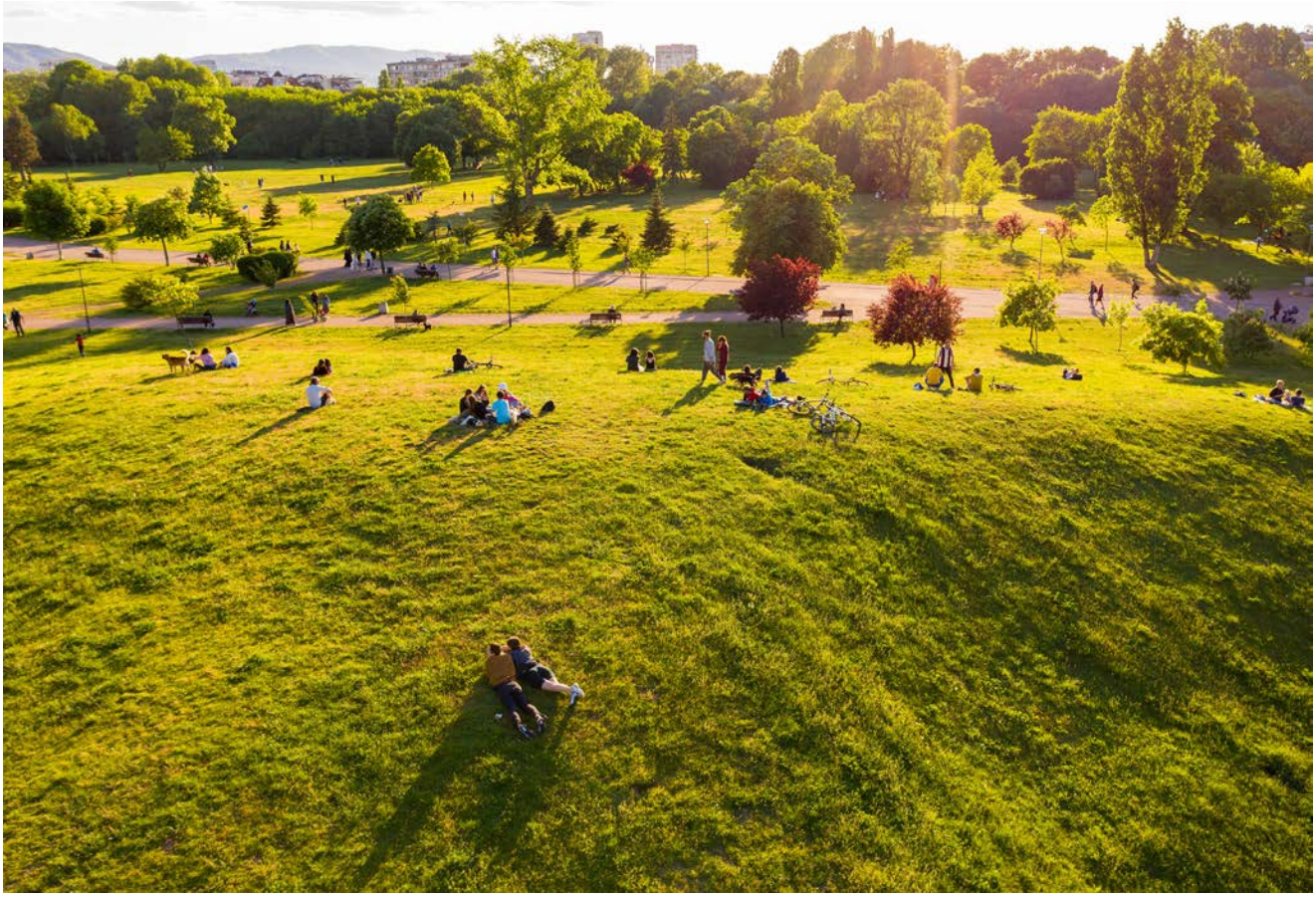
Over four years, the odds of becoming lonely were halved in adults who lived alone and where 30% or more of the area within 1.6 km of their home was parkland.[152] These benefits accrue significant reductions in healthcare burden and expenditure. For example, 30% tree canopy versus less than 10% is associated with significantly fewer hospital admissions for major cardiovascular events per year,[153] translating into healthcare cost savings of approximately $20 million per 100,000 people annually.[154] This is a conservative estimate as it ignores other health conditions and demands on the healthcare system (e.g. medication), meaning the overall cost-benefit of urban greening is likely to be substantially higher.

However, emerging evidence indicates that the many health benefits of tree canopy are diminished for residents of apartments relative to occupants of houses, particularly in terms of physical activity[155] and cardiovascular health,[153] though not mental health.[156] This suggests that aspects of urban design may be limiting opportunities for physical activity, thereby constraining the cardiovascular health benefits of having nearby tree canopy.

Several factors may contribute to this disparity, including the location of apartment blocks – which are commonly built along major transit corridors – where noise and air pollution can negate the attractiveness of nearby green spaces. Additionally, densification may not be matched by adequate increases in park provision, resulting in lower overall quantities of green space per person, and

poorer green space quality and upkeep because of increased use.

Beyond the amount of green space available, its quality has been shown to be important to a range of health issues, including mental health in both children[142,157] and adults.[158-160] This underscores the need to sensitively locate higher-density housing and balance apartment provision with initiatives that increase tree canopy cover and improve green space quality.



Access to quality green space in higher-density areas is critical to support health outcomes.
Image credit: iStock.com, VichoT

6.8 Noise and air quality

Housing located near busy roads or major public transport hubs exposes residents to traffic-related air pollution and noise.[4,161-164] Vehicle emissions, containing a complex mix of pollutants such as particulate matter and nitrogen dioxide[161,163] have been associated with cardiovascular disease, adverse respiratory health, lung cancer mortality[165,166] and poor mental health.[167] Road traffic noise is linked to increased stress, disturbed sleep, cardiovascular disease and cognitive impairment in children.[168] Furthermore, noise from neighbours such as loud voices, barking dogs, or music and television is a common source of annoyance which may trigger a negative emotional response.[162,168]

To mitigate these negative effects, strategies to manage and minimise the unintended consequences of increased density must be factored into apartment building and neighbourhood design. This includes careful planning to increase urban greening in ways that reduce air pollution, locating higher-density housing away from congested roads[4,6] and designing buildings to reduce exposure to air and noise pollution (e.g. use of natural sound barriers, wall insulation, double glazing, acoustic seals, and positioning of windows, balconies, bedrooms and mechanical ventilation air intake).[161,164,169,170]

6.9 Strategies to limit crime & antisocial behaviour

Density brings people closer together and attracts more people into neighbourhoods, with conflicting impacts on real and perceived crime-related safety. While denser, more connected neighbourhoods support walking and active transport, they are also often associated with increased levels of crime and antisocial behaviour.[171,172] For example, non-residential land uses, such as shops, services and transport hubs have been linked to higher rates of property crime and physical disorder. Additionally, venues that sell or serve alcohol, including bars, nightclubs and takeaway alcohol outlets are sometimes associated with increased rates of violent crime.[173,174] These patterns are largely due to the greater number of people circulating in an area, which increases opportunities for crime.

However, denser, more walkable neighbourhoods also result in more 'eyes on the street' or 'passive surveillance' which can enhance people's sense of safety, even in areas with more crime,[175] and help deter some forms of crime.[174]

Neighbourhoods and buildings designed in accordance with Crime Prevention Through Environmental Design (CPTED) principles can help promote real and perceived safety by increasing opportunities for passive surveillance, and using design and maintenance to distinguish private from public space, thereby fostering a sense of ownership.[176] While some level of crime and disorder is inevitable in vibrant, walkable urban neighbourhoods,[177] effective design strategies, combined with community initiatives, can help create safer, welcoming communities.

Higher-density areas can provide opportunity for passive surveillance, or 'eyes on the street'. Image credit: iStock.com, NoSystem images

6.10 Creating environments that address inequalities

Not all environmental characteristics of a local neighbourhood will affect everyone in the same way. Understanding how density affects health requires considering how individual characteristics and circumstances align or interact with urban environment features. For example, the presence of raised crossings, curb ramps at both sides of a road, and well-maintained paths to and through parks can benefit many people, but are vital for people using wheelchairs or mobility aids.[178-180] Neglect of these design details may disproportionately affect people who are already at risk of poorer health, making them feel 'out of place' in their own neighbourhood[181] and denying opportunities to reap the various health, social and economic benefits of density that others may take for granted.

The compatibility between person and place also relates to personality traits, preferences and emotions. For example, evidence indicates that the subjective quality of a green space, rather than its quantity alone, may disproportionately benefit the mental health of adolescents with introverted personalities and those prone to persistent rumination.[182] Similarly, off-leash dog areas in parks attract dog owners, but can simultaneously discourage visits by those who worry about aggressive dogs and associated incivilities.[183,184]

Other examples include shared cycle and pedestrian paths, which helps people riding bikes to avoid vehicles and thus reduce the risk of serious injury, but can discourage people walking who fear the speed at which some people riding bikes travel and the potential for collisions.[185]

In each of these examples, the physical environment interacts with a person's experiences, needs, and preferences to impact the benefits and harms they derive from density. Engagement and co-design with a wide range of groups who are sensitive to these design details will help ensure that increasing density not only improves health but also helps to promote health equity.

6.11 Balancing density and amenity in established neighbourhoods

Despite the benefits of urban densification, community resistance can obstruct the approval of infill developments or result in density concessions.[186,187] 'Not In My Backyard' (or NIMBYism) is the sentiment sometimes ascribed to residents who oppose or resist new development in their communities, such as dense housing, infrastructure or commercial projects.[188] This resistance is often motivated by perceived negative impacts on lifestyle, property values and local character, and can be underpinned by fears of increased congestion, overburdened public services and environmental degradation.[189,190] However, a longitudinal study of Brisbane adults found that as densities increased, neighbourhoods generally changed for the better, becoming more walkable, socially connected and pleasing environments to live in.[191]

Recently, scholars have begun to frame NIMBY sentiments as more complex than its characterisation as close-minded or prejudiced resistance,[192,193] instead recognising the value of NIMBY perspectives[194,195] to facilitate engagement between private and public interests and ultimately, urban democracy.[189] Evidence suggests effectively managing community resistance requires industry groups and policymakers to engage in constructive conversations with community groups with different perspectives (i.e. including 'Yes in My Backyard' (YIMBYs) as well as NIMBYs)[189,194,196,197] via participatory processes.[198]

Transparent communication about the benefits of density, such as enhanced public services, access to everyday needs, sense of community, sustainable resource use, improved housing affordability and health, can help mitigate opposition. Additionally, strategies to preserve existing character, such as implementing design features for housing and public amenities that complement the area, can help address community resistance to densification.[194,198-200] By encouraging healthy debate and dialogue between community groups and stakeholders, and addressing drivers of resistance, urban designers and planners can better manage community concerns and foster acceptance of densification.

Transparent communication can help overcome concerns about increased density.
Image credit: iStock.com, jack10289

7. Conclusions and recommendations

Creating higher-density neighbourhoods that promote good health is contingent on well-designed and constructed dwellings, located in supportive neighbourhoods. A supportive neighbourhood has good amenity and services, high-quality public green space, well-designed walking and cycling infrastructure, frequent public transport, and minimises exposure to air and noise pollution. As urban areas densify, it is paramount that improvements to neighbourhood amenity and public transport services, as well as urban greening initiatives, keep pace with the needs of growing local populations.

This evidence review has emphasised the need for strategies to maximise the benefits of higher-density development, while mitigating any unintended harms that can come with increased densification. Here we summarise our recommendations for delivering healthy higher densities in Australia.

7.1 Develop vibrant mixed-use neighbourhoods with access to daily living destinations within a walkable distance

- Increase minimum suburban density policy targets to 30–35 dwellings per hectare to support access to daily living destinations, enable frequent and accessible public transport services, and encourage physical activity.
- Provide a high-quality public realm with parks, walking, cycling and public transport infrastructure, educational facilities, community centres and shops to support community interaction and activities.
- Ensure higher-density neighbourhoods cater to the needs of children by providing child-friendly destinations for play, learning, socialising and connecting with nature.
- Incorporate Crime Prevention through Environmental Design (CPTED) measures, which promote real and perceived safety of neighbourhoods by promoting eyes on the street and enhancing residents' sense of ownership of the residential space and its surrounds.

7.2 Carefully locate higher-density housing

- Locate higher-density housing in mixed-use developments, optimally within 800 metres of amenities and services required for daily living, including public transport and healthy, safe and affordable food options.
- Ensure higher-density housing is located away from congested roads to reduce exposure to air and noise pollution. Where this is not possible, design buildings to reduce exposure to air and noise pollution sources and enhance energy efficiency via the use of natural sound barriers, wall insulation, double glazing, acoustic seals, and positioning of windows, balconies, bedrooms and mechanical ventilation air intake.
- For high-density development built in established areas, provide additional amenities and services to take pressure off existing infrastructure and offset community concerns.

7.3 Provide safe and inclusive active and public transport infrastructure

- Encourage people to switch from using private cars to public transport by providing frequent, direct and accessible public transport services.
- Integrate land use and transport planning, particularly in higher-density developments, to reduce traffic congestion.
- Invest in safe walking infrastructure within 1 km and cycling infrastructure within 5 km of major destinations such as public transport hubs, activity centres, schools and other educational facilities.
- Ensure walking and cycling infrastructure meets the needs of diverse populations, including children, parents with prams, people with disabilities and older adults.
- Reallocate street space to walking and cycling infrastructure and reduce speed limits on local roads to 30 km/hour.
- Incorporate shade trees, seating, adequate lighting and low-rise gradients to road level to increase accessibility for older adults, parents with prams and people using mobility aids.
- Limit on-street car parking and reallocate some of that space for alternative uses such as outdoor dining, wider footpaths and bicycle lanes.
- Locate schools in low-traffic, well-connected neighbourhoods and provide well-maintained footpaths and traffic lights on routes to schools to protect children from traffic hazards and increase active commuting.

7.4 Create leafy, cool neighbourhoods by planting trees and providing public green space that caters to multiple user groups

- Implement urban greening initiatives to meet the 30% tree canopy cover target associated with improved health and wellbeing and to mitigate urban heat.
- Provide high-quality public green space to meet the needs of growing populations in densifying urban areas.
- Ensure parks in dense areas are continuously maintained and adapted with community input through co-design processes to encourage sustained benefit.

7.5 Design and construct health-promoting higher-density housing that caters to all populations

- Ensure diverse housing stock exists in all localities, catering to different life stages, abilities and income-levels.
- Increase the availability of social and affordable housing.
- Increase the proportion of larger apartments with flexible designs that cater to the needs of families and different household compositions.
- Provide child-friendly communal areas in apartment complexes.
- Incorporate universal design principles and accessibility in the design and location of higher-density housing to enable independent living for older people and people living with a disability.
- Ensure apartment layouts are functional, and kitchens have sufficient space for the preparation and storage of food and appliances.
- Unbundle car parking from the purchase price or rental cost of housing.
- Adopt maximum car parking requirements (i.e. limits on the number of spaces allowed) for developments in areas of high public transport accessibility.
- Provide adequate parking facilities for bicycles and other forms of micromobility (e.g. scooters, shared bikes).
- Encourage on-site or nearby community gardens to enable high-density development residents to grow their own food.
- Provide consistent, comprehensive, evidence-based design guidance for apartments across Australia to encourage the construction of dwellings that provide residents with adequate private indoor and outdoor space, natural ventilation, daylight access, thermal comfort, acoustic and visual privacy, communal outdoor space and views of, or contact with greenery. These features will also help residents to withstand future pandemics by providing sufficient space to facilitate social distancing and working and schooling from home.
- Advocate for the inclusion (or retention) of apartment design policy requirements that promote health and wellbeing in future policy reviews.

7.6 Foster engagement between local communities and stakeholders, including vulnerable groups

- Communicate the many benefits of density to residents and stakeholders and directly address the drivers of opposition to help assuage community resistance to new infill developments in established neighbourhoods.
- Include initiatives that preserve affordable housing, improve public amenities and apply design strategies that are compatible with the character of the local area.
- Engage and co-design new developments and neighbourhood amenities with a wide range of community groups.

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First published August 2025.

ISBN 978-1-74345-141-0

HH-PAL-055.1.0225

This work was supported by grant funding from the Australian Commonwealth Government Department of Health, Disability and Ageing

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