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Neighbourhood Environment and the effect on Well-being, Physical Activity, and Social Connectedness

A thesis presented in partial fulfilment of the requirements for the degree of
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Abstract

The world's population is ageing. Efforts are being made to improve health outcomes for these ageing populations. There has been a shift from the medical model of health (personal responsibility) to an Active Ageing model, which can be defined as holistic, enlisting organisational, societal, and individual action to support better health and well-being outcomes. Governments are well-placed to play a more significant role in improving public health by contributing to the social and environmental determinants of health.

The Capabilities Approach is a useful framework with which to consider the environmental impact on health, with well-being as the defining subjective measure of an individual's health. According to the Capabilities Approach, well-being is positively affected via achieved functionings. The Capabilities Approach recognises the role of external support in achieving positive health outcomes. The residential neighbourhood environment is one external factor associated with health and well-being. It is also amenable to positive interventions to support improved health and well-being outcomes for individuals.

There are many ways to conceptualise and measure external, residential neighbourhood environments. This study included objective, subjective and socio-economic measures of the local neighbourhood environment. Objective measures of the environment capture natural and built elements. Subjective measures of the environment capture residents' feelings towards their local neighbourhood, such as safety and trust. Socio-economic measures (SES) of the environment provide demographic information about the population's income, education and household composition.

This study examined the relationship between these environmental measurements and well-being. It was hypothesised that people who live in neighbourhoods which scored higher on environmental measures would have higher self-reported well-being levels. Environmental data was collected using self-reported environment measures, objective environmental measures (OPERAT) and socio-economic measures from Australian Bureau of Statistics census data (SES). Two pathways which may explain this relationship between the residential neighbourhood environment and well-being were examined: physical activity (a physical health construct) and social connectedness (a mental health construct).

Participants were selected from three, social disparate SES groups (high, medium and low) and survey data was collected by questionnaire related to their perceptions of the local neighbourhood environment, self-reported physical activity, social connectedness and well-being. Objective environmental measures were taken by the researcher utilising OPERAT for each area.

The environment was found to be significantly related to self-reported well-being across all measures (self-reported, objective and SES). The relationship between environment and well-being was more significant for older people. Physical activity was found to mediate the relationship between the perceived quality of the neighbourhood environment and well-being. SES was found to be more strongly related to well-being and subjective perceptions of the local neighbourhood environment at lower levels of SES. Objective measures of the neighbourhood identified a significant relationship with measures of Subjective Environment and Well-being for older people. Overall, the research findings suggested the use of multiple measures of the local neighbourhood environment to measure effects on well-being. Future research could be undertaken to understand further the relative contribution each type of environment makes, especially for older people, towards well-being, and the pathways by which this is achieved. Such research would be invaluable in regard to efficient decision making associated with the effective allocation of resources to improve health outcomes.

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1. Introduction

1.1 Ageing Populations

Globally, life expectancy has surpassed 60 for the first time and by 2050, 20% of the world's population will be aged 60 years or older (World Health Organization, 2017). This ageing population trend is expected to continue and by 2050, it is predicted that the proportion of the world's population over 60 years will nearly double from 12% to 22%. In 2020, the number of people aged 60 years and older outnumbered children younger than five years. In 2050, 80% of older people will be living in low- and middle-income countries. The rate at which this change is occurring is also much faster than in the past, putting additional strain on resources and affecting intervention planning and strategies. The World Health Organization has clearly stated that the challenges associated with these changes are going to affect all countries, and that it is incumbent upon them to prepare their health and social systems to accommodate this demographic shift (World Health Organization, 2019).

The forecast for Australia's ageing population follows a similar trend. Between 2017 and 2057, the proportion of Australia's population over 65 years will increase from 15% (3,794,062) to 22% (8,799,475). This is the result of sustained below replacement levels of fertility combined with increasing life expectancy at birth over several decades. This trend is mirrored in New Zealand where the median age increased from 25.6 years in 1970 to 37.1 years in 2016. By the early 2030s, the median age in New Zealand is expected to be 40 years. By 2068, half the population of New Zealand could be older than 46 years (Stats NZ, 2019).

Although relatively high, taking 2020 as a sample year, it is apparent that the proportion of people aged 65 and over in Australia (16.1%) and New Zealand (16.3%) is consistent with other developed countries, such as The United States of America (16.6%), Canada (18.3%) and the United Kingdom (19%). Notably, for a developed country, Japan has a considerably higher forecast proportion of people aged 65 and over in 2020, at 28.2% (Australian Institute of Health and Welfare, 2018).

65 years has traditionally been the official retirement age in Australia and the age at which one qualifies for the pension, although this has changed in recent years and for those born after 1 January 1957, the official retirement age is now 67 years. It should be noted that the actual average retirement age for people aged 45 years and over in Australia is 55.3 years. However, this is increasing and for people who retired after 2014, the average is 62.9 years (Australian Bureau of Statistics, 2017). Notably, retirement is not necessarily a

one-time event, and more than 25% of Australians between the ages of 45 and 59 return to employment each year (Melbourne Institute, 2017).

In academic literature '65 years' is often taken as a cutoff age for defining an older population. A further distinction is often made between the 'young' or 'early' elderly (aged 65 to 75 years) and the 'old' or 'late' elderly (over 75 years) (Orimo, Ito, Suzuki, Araki, Hosoi, & Sawabe, 2006). It should be noted, that in Australia, for Indigenous Australians, the age range '50 and over' is used to define an older population for health reporting purposes. This reflects the life expectancy gap between Indigenous and non Indigenous Australians and the lower proportion of Indigenous people aged 65 and over (Australian Institute of Health and Welfare, 2018). Indigenous Australians face numerous disadvantages, and social determinants such as education, income, employment, and housing, are widely accepted as having a significant impact on their mental and physical health. Although Indigenous mortality rates have declined by 16% since 1998, Australia is not on track to close the gap in life expectancy by 2031, as per its target (Department of the Prime Minister and Cabinet, 2016).

In the face of ageing populations in many countries, at a government and health organisation level, there has been a steady shift in emphasis to preventative health research and practices, as well as a move to re-define ageing in terms of functioning, rather than the traditional deficit model, to address the health issues associated with ageing.

1.2 Ageing Population Policies and Frameworks

For many years The World Health Organization has had an ageing policy framework which has been intended to inform discussion and assist with the formulation of action plans that promote healthy and more active ageing (World Health Organization, 1994; World Health Organization, 2002). Most recently, the World Health Organization's *Global Strategy on Aging and Health 2016 - 2020* has specified a goal of maximising older people's functional ability (World Health Organization, 2017). This is in contrast to the prior dominant model of ageing that was a deficit model of older age (Rowe & Kahn, 1997; Strawbridge, Wallhagen, & Cohen, 2002), focusing on loss and decline associated with the ageing process. This framework recognises the need to facilitate 'ageing in place' with regard to issues such as health, land use, housing, transportation and internet access.

More recently European policy models have shifted focus, moving from a 'successful ageing' model, which became popular in the United States, to an 'active ageing' model, which can be defined as holistic, enlisting organisational and societal contributions as well as individual participation (Foster & Walker, 2015). In the United States context, the federal

government appears to play a limited role in developing ageing policy and promoting ageing-friendly communities (Scharlach, 2012).

New Zealand's ageing strategy has been developed over recent decades, albeit with significant gaps between policy and strategy document releases. The *New Zealand Positive Ageing Strategy* was developed in 2001 around the principles of positive ageing, including empowerment, opportunities and recognition of capabilities, especially for Māori and Pacific people (Ministry of Social Development, 2001). It comprised ten priority goals, the achievement of which required work items to be undertaken by government departments with contributions also required from other sectors of society. A key health initiative in the *New Zealand Positive Ageing Strategy* action plan was the development of the *Health of Older People Strategy* (Ministry of Health, 2002).

The 2016 *Healthy Ageing Strategy* (Ministry of Health, 2016) updated and superseded the *Health of Older People Strategy* released in 2002, and is aligned with the new *New Zealand Health Strategy 2016*. Its vision is for older people to live well, age well, and have a respectful end of life in age-friendly communities. It takes a life-course approach, recognising that people age in a variety of ways, their needs differ across their lifespan, and that people's health is affected by their environment. The policy includes reference to 'ageing in place', highlighting the importance of developing and supporting age-friendly communities. The strategy seeks to maximise health and well-being for all older people. It should be noted that there are marked differences in life expectancy at birth between Māori and non-Māori, and despite this gap narrowing, a distinction is often still not made between these populations when defining 'older people' in New Zealand (Ministry of Social Development, 2019).

In Australia health is not a commonwealth responsibility due to Australia's federal system so there is a lack of national policy on ageing, similar to policy shortcomings in the United States. However, multiple examples of ageing policies exist at both the state and local council level. Examples include New South Wales' *Ageing Strategy 2016 - 2020* (NSW Government. Family and Community Services, 2016), which includes follow up research for different older age groups: 60 - 79 years old and 80+ years old (NSW Government. Family and Community Services, 2018a & 2018b).

Victoria's ageing policy, *Well for life. A Healthy Approach to Ageing* (Victoria State Government. Health and Human Services, 2015) includes provision for the employment of Healthy Ageing Advisers across the state to promote, build and support the health and well-being of older people. The City of Hobart in the state of Tasmania began developing a positive ageing strategy in 2002, with an emphasis on the three pillars associated with

positive ageing: 1) valuing and empowering older people, 2) acknowledging diversity and 3) building social connectedness (City of Hobart, 2014). Practical application of the document by council has focused on improving physical access to the built environment and safety and security within Hobart. The latest version of the strategy, the 2014 - 2019 document, involved extensive consultations with older people and was further developed to maximise independence and control older people have over their lives. Participation in the community is highlighted in the document as of significant importance.

Despite the lack of recent contributions to ageing policy, the Government of Australia announced a Royal Commission into Aged Care in October 2018 (Australian Government Royal Commission, 2018) which asked what should be done to make aged care services better for people who need them now and in the future.

An example of ageing planning at a local level would be the *Central Coast Council's Positive Ageing Strategy*, first developed and published in 2013 - 2014 and reviewed in 2019 - 2020 (Wyong Shire Council and Gosford City Council, 2014). The positive ageing strategy seeks to make the Central Coast a place where older people feel valued, safe and fulfilled, so they can actively participate in their community and public life, and where people have a sense of belonging and connection. From a global to a local level, there is a clear trend in policy development towards acknowledging the role of government in improving the public and social determinants of health.

1.3 Definitions of Successful/Healthy Ageing

By the mid-2000s, there were many academic definitions of healthy ageing, a term often used interchangeably with other terms such as 'active ageing' (World Health Organization 2002, Bowling 2008), 'successful ageing' (Bowling & Dieppe, 2005; Bowling & Iliffe, 2006; Rowe & Khan, 1997), 'positive ageing' (Kendig & Browning 1997), 'productive ageing' (Kerschner and Pegues, 1998) and 'life satisfaction' (Ferring et al., 2004). Collectively, these became referred to as the 'new gerontology'. Although there is no universal definition of healthy ageing, there is a general acceptance that it involves more than just physical or functional health (Victoria State Government. Health and Human Services, 2016). Self-reported definitions of successful ageing, and the reasons given for respondents' self-ratings, illustrate clearly the multi-dimensionality of health as a concept and suggest uni-dimensional perspectives would lack applicability (Bowling, 2006)

Lacking emphasis in the above definitions and models of healthy ageing is the role external, social and environmental factors can have on a person's health and well-being, especially if the associated effects are recognised over a person's life-course (Ben-Shlomo

& Kuh, 2002; Lynch, Smith, Kaplan, & House, 2000). These models typically attributed primary responsibility with individuals to achieve this normatively desirable state. (Holstein & Minkler, 2003). Within these models, reference was often only made in passing to external social and environmental factors that may affect overall health and well-being. For example, Life satisfaction, which includes a subjective assessment of life circumstances, includes only two external domains, 'neighbourhood' and 'health care system', which can be assumed to be outside of the respondents' locus of control (Delhey, 2004). However, data does not exist to explain the extent to which each of these domains influences life satisfaction relative to the other domains (health, health care system, financial situation, employment situation, family life, social life, home, personal safety). Specifically, no differentiation is made between the external objective domains which could be measured and those that are subjective.

In terms of social and environmental factors, we find reference to such factors in The World Health Organization's *Aging-Friendly Cities Guide* (2007), which identified the following factors related to an active ageing strategy which could be applied at the city level: 1) Outdoor spaces and buildings, 2) Transportation, 3) Housing, 4) Social participation 5) Respect and social inclusion, 6) Civic participation and employment, 7) Communication and information, 8) Community support and health services. By the mid- to late-2010s, recognition of the role of the external environment in affecting health had become more prominent. A key objective of the World Health Organization's *Global Strategy on Ageing and Health 2016 - 2020* was to develop age-friendly environments that would support a person's functional ability. Functional ability is understood as the interaction between a person's intrinsic capacity and relevant environmental factors, and is theoretically based on Sen's (1987) Capability Approach.

1.4 The Capability Approach: A Framework for Shared Responsibility

A shift from emphasising individual responsibility for health, where 'health' is defined generically, to acknowledging the role of the environment, society and government in supporting person-centred health outcomes requires a new theoretical framework. The Capability Approach is a theoretical framework for exploring well-being, development and justice. From it, practical approaches to guide actions and decisions can be derived (Wells, 2019). With well-being as it's metric for measuring quality of life, the Capability Approach has developed around two main claims. The first claim relates to the importance of a person's freedom to achieve well-being. The second claim is that this freedom should be understood in terms of people's capabilities and the possibilities available to them to realise the behaviours that they value (Robeyns, 2005).

The Capability Approach signals a shift away from predefined attributes of success, to self-assessed freedom to achieve valued functionings (Sen, 2010). It is useful to conceptualise this as a shift from externally developed and applied objective definitions of well-being to internally developed and lived subjective measures of well-being. It focuses on what people are effectively able to do and to be; that is, on their capabilities (Robeyns, 2005). Capability does not constitute the presence of a physical or mental ability; rather, it is understood as a practical self-realised opportunity (Mitra, 2006) and capabilities can change over time as people age, resulting in different means to achieve the same end. Importantly, as defined by the Capability Approach, well-being can be maintained over a life-course despite a decline in intrinsic capacity.

Nussbaum's (2003) list of 10 Central Human Capabilities is based on the concept of the dignity of the human being, and of a life that is worthy of that dignity. Importantly, Nussbaum holds society responsible for ensuring all of these capabilities are available to its citizens and that a "society that neglects one of them to promote the others has short-changed its citizens, and there is a failure of justice in the shortchanging" (Nussbaum, 2003, p. 40). The following seven items, taken from Nussbaum's list of 10 Central Human Capabilities, relate specifically to the factors that this research seeks to examine: a) well-being, b) contributors to well-being, namely physical activity and social connectedness, and c) the environment as an enabler of physical activity and social connectedness.

- To have a full life, not ended prematurely or affected to the extent that it is considered not worth living. (Well-being)
- To have good health, including sufficient food and shelter. (Well-being)
- To have independence and autonomy, including the ability to move freely, be and feel safe. (The Environment, Well-being)
- To have a natural range of emotional attachments to things and people, and not have these attachments significantly affected by fear and anxiety. (Social Connection)
- To live in and interact with society. (Social Connection)
- To live with and in relation to the natural world, including the environment, animals and animals, plants. (The Environment)
- To play and engage in recreational activity. (Physical Activity)

(Nussbaum, 2003; Nussbaum, 2011)

The term 'functioning' relates to an individual's actual achievements, what a person actually achieves through being or doing (Mitra, 2006). The opportunity or freedom, that is

their capability, to achieve functioning is the individual realisation of their being and doing (Robeyns, 2016). A functioning is described as an achievement, or something a person succeeds in being or doing (Sen, 1995). The functionings are a reflection of the 'best' options available to the person, based on their evaluation of their capabilities. We can distinguish between functioning and capability using the example of the person who is starving due to lack of food, due to poverty, compared with the person for whom food is freely available, but who chooses to fast, due to religious observation. Both result in the same functioning/state of being, i.e. malnourishment, but they relate to different capabilities. This example highlights why capability instead of functioning might be an important focus of evaluation (Nussbaum & Sen, 1993).

A conversion factor is the amount of functioning able to be derived from a good or service. There are three groups of conversion factors: personal (internal), social (external), environmental (external) (Nussbaum, 2011; Robeyns, 2016). Importantly, external conversion factors can be acted upon by governments to complement capabilities and bring about positive achieved functionings. Sen, however, cautions against directly trying to affect the achieved functioning (Nussbaum, 2011). Rather, individuals should retain the choice and freedom to initiate their own achieved functionings. In this sense, government intervention in resources to promote conversion factors should refrain from promoting specific, predefined achieved functionings and associated measures of successful achieved functionings. For example, investment in footpaths and street lighting should not be directly tied to a community campaign to increase fitness via walking, as measured by, for example, 30 minutes per day of walking for fitness.

The Capability Approach involves an interaction between capabilities and conversion factors leading to achieved functioning and well-being, as illustrated in Figure 1, adapted from Ryan, Wretstrand, & Schmidt (2015) and Hatakka & Lagsten (2012).

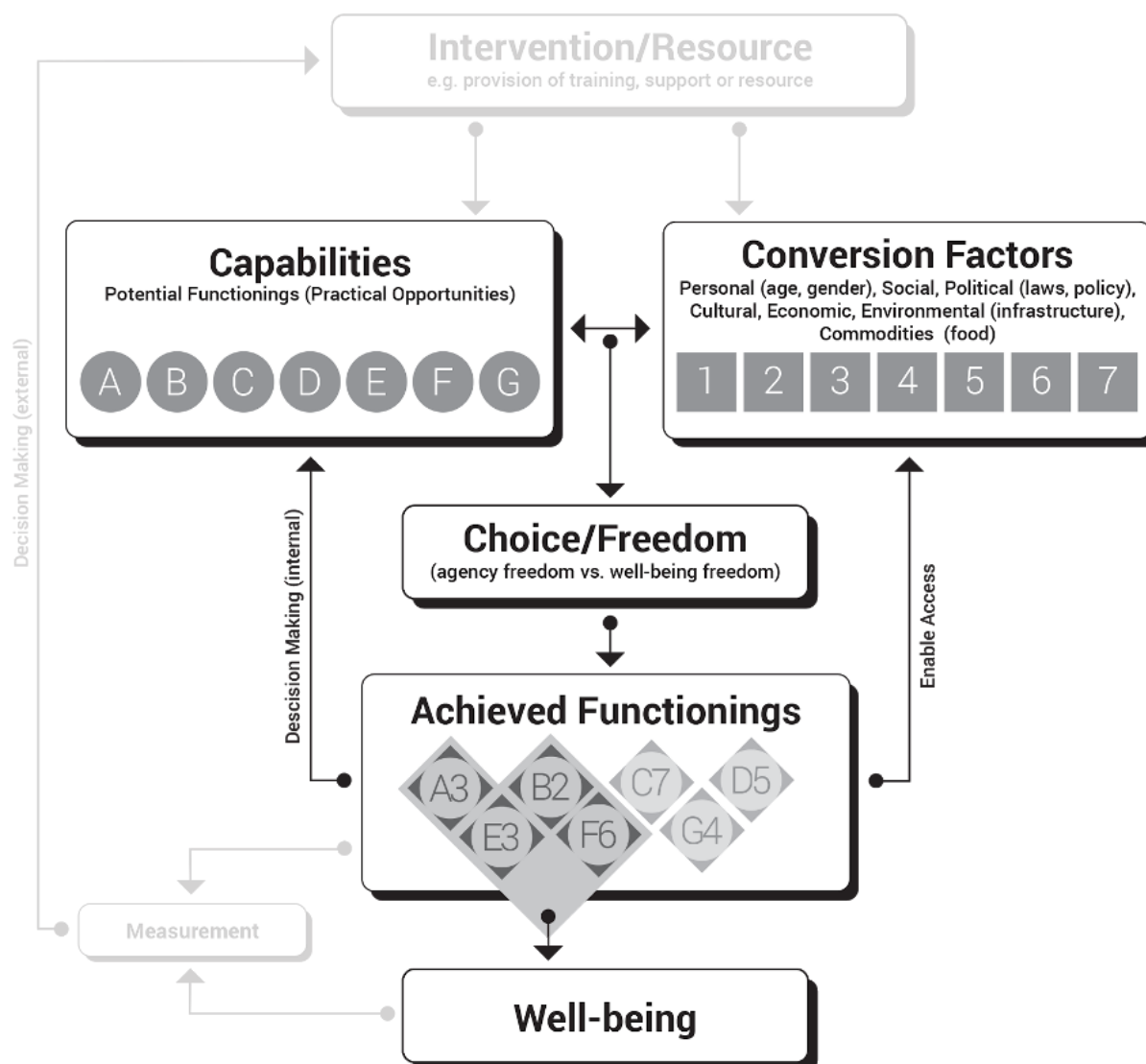


Figure 1

The Capability Approach: the interaction between capabilities and conversion factors leading to achieved functioning and well-being, adapted from Ryan, Wretstrand, & Schmidt (2015) and Hatakka & Lagsten (2012)

A more detailed understanding of the Capabilities Approach includes provision for interpersonal differences and their effect on the conversion of resources to a capability, known as ‘conversion factors’. A person’s command over their resources produces capability (Sen, 1995), where command equates to a type of freedom. The size of the scope for action, related to freedom, is also considered to contribute to the individual’s well-being (Sen, 1995). Sen differentiates between agency freedoms and well-being freedoms, the former related to actions that are undertaken with moral judgment or due to commitments. Not all activities

undertaken by individuals aim to maximise well-being, nor do their actions contribute to it (Sen, 1985a; Sen, 1985b).

Given the Capability Approach is rooted in social justice, it is implied that there is a political responsibility to support capabilities. This equates to an acknowledgement that environmental change rather than individual change should be the emphasis for societal and government interventions. Achievement of functioning then is a result of the capability of the individual interacting with the facilities/resources socially offered. For example, those with physical disabilities may need specific items to achieve mobility, and pregnant women have specific nutritional requirements to achieve good health. Government responsiveness to these conversion factors is reflected in a community's social and environmental resources. This includes a) how society and government invests in social and environmental factors relative to other investments and b) how successfully individuals interact with social and environmental factors. Overall, an understanding of the Capability Approach, its philosophical underpinnings and emphasis on shared responsibility, can assist in directing attention to the role of government and its allocation of resources to neglected dimensions of human well-being, especially in older and vulnerable populations, and thereby supporting the achievement of functioning.

1.5 Capabilities in an Older Population

A Capability Approach to healthy ageing in an older population asks what do older people themselves value in regard to healthy ageing. For older people, the capability to achieve valued functionings is of high importance regardless of physical health status. The role of individual agency remains, as capability, but the idea of a 'global' definition of healthy or successful ageing is discarded. Importantly, capability is increasingly moderated by the social resources and physical, environmental resources that are available to achieve functioning (Gopinath, 2018) and capability can become negatively affected by these resources and a person's material circumstances (Stephens, 2017; Stephens, Breheny, & Mansvelt, 2015), whereas previously the same resources may have supported or had a neutral effect. As people age then, and their physical and cognitive abilities naturally decline, the context provided by the physical and social environment plays an increasingly critical role in supporting the achievement of valued functionings (Gopinath, 2018).

A number of functionings valued by older people have been identified by research. A New Zealand study of older people, aged 63 - 93, found six valued 'functionings': 1) physical comfort, 2) social integration, 3) contribution, 4) security, 5) autonomy, and 6) enjoyment. The capability to achieve these functionings was seen to be impacted by social and material

factors (Stephens, Breheny, & Mansvelt, 2015). These functionings overlap with Scharlach's (2012) five core concepts of optimum ageing, derived from lifespan developmental psychology: 1) continuity (maintenance of preferences), 2) compensation (physical environment support), 3) connection (social connectedness), 4) contribution (positive influence on the physical and social environment, and 5) challenge (stimulation). With Sen's Capability Approach as a framework, Grewal, Lewis, Flynn, Brown, Bond, & Coast's (2006) developed five functionings that contributed to quality of life for older people: 1) attachment, 2) role, 3) enjoyment, 4) security, and 5) control. Grewal et al. found that the quality of people's lives was limited by the loss of ability to pursue these attributes. So, for example, it is not poor health itself which reduces quality of life but the combination of that poor health and the lack of relevant supporting external resources affecting each person's ability to be independent, that is important.

Additional theoretical support for the role of these external environmental and social factors and their contribution to valued functioning comes from a life course approach to ageing. Ageing trajectories highlight the need to study long term changes in functional capability. This approach has the potential to identify when and how to offer support, rather than intervention, at different life stages to maximise the chance of healthy ageing. For example, there is growing evidence that the early social environment is associated with physical and cognitive capability in later life (Kuh, 2007). Kuh suggests that healthy ageing may require interventions for vulnerable subgroups, to minimise variations present in gender and socio-economic groups.

The findings outlined above support a shift in emphasis as people age, from individual responsibility for physical health to supporting the achievement of a cluster of valued, connected functionings. This capability to be healthy is "a person's ability to achieve or exercise a cluster of basic capabilities and functionings, and each at a level that constitutes a life worthy of equal human dignity in the modern world" (Venkatapuram, 2011, p. 72). Or, put another way, health is the possibility of mobilising Nussbaum's ten central human capabilities via freedom of choice. However, given the range of capabilities, and the interconnectedness between capabilities and their effect on health, it is questionable whether it is useful to define and prescribe a set of 'health capabilities'. Rather, the provision of a more general form of support for capabilities, via social and environmental resources, will enable both direct and indirect positive effects on overall well-being. In this sense, 'well-being' can be considered a better measure of overall health than the term 'health' which carries a residual 'physical' emphasis and so does not readily capture aspects of mental health, and also has objectively measurable connotations. This argument is particularly

pertinent to an older population, in which physical health, as defined by a medical model, will naturally have ebbed.

1.6 Functional Achievement: Well-being

The Capability Approach considers subjective well-being – feeling happy – as a valuable functioning in its own right, where human well-being is acknowledged as having many dimensions. When evaluating well-being, Sen argues, the most important thing is to consider what people are actually able to be and do (Wells, 2019) and that the correct focus for evaluating how well off people are is their capability to live a life they value (Wells, 2019).

In keeping with the Capability Approach's understanding of well-being, Dodge, Daly, Huyton, & Sanders (2012) conceptualise well-being as the instances “when individuals have the psychological, social and physical resources they need to meet a particular psychological, social and physical challenge”. They further refine this definition of well-being as the balance point between an individual's resource pool and the challenges faced. See Figure 2.



Figure 2

Well-being achieved by balancing an individual's resource pool and the challenges faced (Dodge, Daly, Huyton, & Sanders, 2012)

In this sense, the ability to achieve well-being - ‘well-being freedom’ - contributes to a person's health. In other words, the capability to select and achieve functionings is a part of health. This is consistent with the Capabilities Approach definition of well-being, whereby well-being is achieved through opportunities to select and achieve functionings. The Capabilities Approach equates well-being with a “person's capability to achieve various alternative combinations of functionings” (Sen, 1995, pp.81) and these capabilities should be secured by the political order to ensure a dignified and minimally flourishing life (Nussbaum, 2011).

The model of well-being developed by Dodge et al. is useful in that it again highlights and supports the notion embedded within the Capabilities Approach that the provision of resources, by society and governments, can assist individuals to meet life challenges and achieve valued functionings. And, as previously described above, as people age, an increasing contribution to well-being can come from the social and environmental context. Social and environmental factors play an important role then in helping older people to achieve functionings via interaction with their capabilities (Stephens, 2017). These environments, by their nature and scale, are typically beyond the control of individuals but can be directly affected by the government and public organisations, to deliver positive health and well-being results. Given the role of the social and physical environment, the responsibility to achieve such functionings should be viewed as a shared responsibility, which includes society and public organisations. A Capability Approach based concept of health and well-being would include the influence of the social and physical environment, allowing for macro-economic, political and social factors, and acknowledging the role and responsibility of the public sector in supporting the achievement of capabilities.

1.7 Major Contributors to Well-being: The Environment

The environment, in and of itself, can directly affect well-being in numerous ways. The attachment older adults' have to their home and neighbourhood is well established (Choi & Matz-Costa, 2018). Many older adults have a preference to 'age in place' (Vasunilashorn, Steinman, Liebig, & Pynoos, 2012) and accordingly, the surrounding neighbourhood and environment must be supportive and responsive to the needs and wants of residents. 'Ageing in place' is already a consideration in many ageing strategies, policies and frameworks (World Health Organization, 2017). Further, housing and neighbourhood environments have the potential to facilitate older people's independence and well-being. Lui, Everingham, Warburton, Cuthill, & Bartlett (2009), found that well-being in later life is closely related to the physical environment, which is an important mediator of ageing experiences and opportunities.

Burholt, Roberts, & Musselwhite (2016), outline three main factors which have been theorised to explain the role of the external environment in supporting health and well-being: 1) environmental aesthetics (the beauty of the natural elements of the environment), 2) environmental stress (neighbourhood design, housing diversity, population density, mixed land use, and open space) and 3) neighbourhood disorder (litter, graffiti, land use, lighting, housing quality). There is growing research evidence to support the health promoting qualities of these factors. Neighbourhood factors, such as safety and accessibility, have

been shown to be positively associated with quality of life and well-being (Stephens, Szabó, Allen, & Alpass, 2019a, Stephens, Szabó, Allen, & Alpass, 2019b). Wen, Browning, and Cagney (2003) found that perceived neighbourhood quality (physical environment) or the level of physical disorder in the neighbourhood, significantly affects self-rated health, after controlling for demographic factors and socio-economic status.

Choi & Matz-Costa (2018) found that perceived neighbourhood safety affected the psychological health of older adults, with those who perceived their neighbourhood to be unsafe having significantly lower levels of psychological health than those who perceived their neighbourhoods to be safe. The physical environment can contribute to the spatial independence of older adults, and is particularly relevant to those with physical or cognitive impairments (Burholt, Roberts, & Musselwhite, 2016).

A literature review by Yen, Michael & Perdue (2009) found the neighbourhood environment to be a primary influence on older adults' health and functioning. Neighbourhood problems were significantly associated with self-rated health and symptoms. The review found a positive association between physical environment, perceived or objective, and physical activity behaviour, whereby accessible neighbourhood design consistently supported greater levels of walking. The social environment of the neighbourhood was significantly associated with mortality and incidence of heart disease.

Notably, neighbourhood-level socio-economic status (SES), which is yet another way of conceptualising the quality of the neighbourhood environment, and which is typically measured by census data, has been found to provide a strong and reliable relationship with health and well-being outcomes (Yen, Michael & Perdue, 2009) across a wide variety of populations (Pickett & Pearl, 2001). Adler, Boyce, Chesney, Cohen, Folkman, Kahn, & Syme (1994) found SES to be consistently related to health status at all levels of SES, but they noted that the pathways that may explain this relationship are not well understood.

The factors which contribute to environmental stress and neighbourhood disorder can be objectively measured and a number of assessment tools have been developed (OPERAT - see Section 2.2.1a, RESIDE, HABITAT, REAT, NeDeCC - see Section 4.2) that have allowed for further categorisation and assessment of the neighbourhood environment. These tools typically group items into neighbourhood factors such as defensible space, natural environment, territorial functioning, physical incivilities, land use, and accessibility and safety from traffic. Importantly, the weighting of each item and composite factor varies in terms of importance, with respect to age. Burholt, Roberts, & Musselwhite (2016) developed a four factor model (OPERAT) as a result of older people's assessment of item importance,

these factors being: 1) navigation and mobility (identified as most important), 2) natural elements, 3) incivilities and nuisance, and 4) territorial functioning.

Objective neighbourhood structural characteristics can also be characterised in terms of deprivation. The Townsend Index (Townsend, 1987), which measures four variables of deprivation: 1) unemployment, 2) non-car ownership, 3) non-home ownership, and 4) household overcrowding, is one of the most often cited, and is referenced by the authors of OPERAT. In the Australian context, Norman, Berrie & Exeter (2019) found a strong link between the Townsend Index, and the socio-economic measures used by the Australian Bureau of Statistics, specifically Socio-Economic Indexes for Areas (SEIFA), which includes the Index of Relative Socio-economic Disadvantage (IRSD).

1.8 Contributors to Well-being: Physical Activity

Performing sufficient physical activity is a significant determinant of health and is known to have mental and physical health benefits (Paterson & Warburton, 2010). Physical activity is a significant factor contributing to general health and well-being for older people (Oja, Bull, Fogelholm, & Martin, 2010). Biddell, Mutrie, & Gorely (2015) found that physical activity participation is consistently associated with positive mood and affect. Fox, Stathi, McKenna & Davis (2007) found older people who move more often and spend less time sitting down experience higher levels of self-rated mental health and well-being than those who are less active. Physical activity reduces the risk of all-cause mortality, prevents various chronic diseases, and in older adults especially, it reduces the risk of falls and helps maintain physical and cognitive function. Physical activity may also be an important factor for preventing the development of non-communicable diseases (Reiner, Niermann, Jekauc, & Woll, 2013). Conversely, the concept can be considered from the perspective of physical inactivity, which is strongly associated with the risk of major diseases. In this context, it is useful to consider why people may be physically inactive, so as to develop and promote effective interventions to reduce the risk of these major diseases. Beenackers, Kamphuis, Mackenbach, Burdorf, & van Lenthe (2013) identify walking as the most readily accessible type of physical activity which can address these risks. Physical activity has nominal financial barriers to participation and it is generally one of the most accessible forms of exercise across one's lifespan.

Walking is the most common form of physical activity for older people in Australia (Garrard, 2013), where the walking can be for leisure or transport (utility). In addition, walking provides an opportunity for social connection and can have psychological benefits and a positive effect on well-being (Kaczynski & Glover, 2012). National guidelines state that

older Australians should aim for 30 minutes of moderate exercise (for example, brisk walking, sports, gardening or swimming) on most, if not all, days of the week (Department of Health, 2013). In 2014 - 2015, 35% of people aged 65 and over surveyed as part of the Australian Bureau of Statistics (ABS) *National Health Survey* reported being sufficiently active (doing more than 150 minutes of exercise over 5 or more sessions) during the preceding week (Australian Bureau of Statistics, 2015b). So walking, in addition to the physical and mental health benefits, can be thought of as having functional utility in terms of leisure, transport and/or social connection.

1.9 Contributors to Well-being: Social Connectedness

Social connection is essential to nearly every aspect of health and well-being (Lieberman, 2013). Social connectedness is defined by Bel, Smolders, IJsselsteijn, & de Kort (2009) as a short-term experience of belonging and relatedness and is a significant psychological factor contributing to well-being and quality of life (Gallagher, 2012). With roots in Durkheim's late 19th century Social Integration Theory (Durkheim, 1951), Maslow's Hierarchy of Needs (Maslow, 1943) and Bowlby's Attachment Theory (Bowlby, 1967; Bowlby, 1973; Bowlby, 1980), social connectedness is increasingly viewed as a core human need. The desire to connect is fundamental to development (Baumeister & Leary, 1995). It has also been shown to confer a survival advantage. Maier & Klumb (2005) found that persons aged 70 and older with higher levels of social activity and with more time spent in the presence of others, specifically 'with friends', had a significantly reduced risk of death. Kawachi and colleagues identified strong pathways linking social cohesion to high levels of health and lower mortality in communities and neighbourhoods (Kawachi, Kennedy, & Glass, 1998; Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997).

Social connectedness can be inversely conceptualised as social exclusion. Without connection, people and other social animals experience distress and face severe developmental consequences. Lack of connection, or loneliness, has been linked to psychological and physiological illness, including inflammation, accelerated ageing and cardiovascular health risk, suicide, and all-cause mortality (Holt-Lunstad, Smith, & Layton, 2010). If social connectedness captures the feeling of belonging at an individual level, social cohesion can be thought of as the amount of connectedness among groups. Social cohesion has been most recently defined as "The ongoing process of developing well-being, sense of belonging, and voluntary social participation of the members of society, while developing communities that tolerate and promote a multiplicity of values and cultures, and granting at the same time equal rights and opportunities in society" (Fonseca, Lukosch, & Brazier, 2018,

p. 246). Stafford (2003) identifies and differentiates between the structural aspects of social cohesion (family ties, friendship ties, participation in organised associations, integration into the wider community) and the cognitive aspects of social cohesion (trust, attachment to neighbourhood, practical help, tolerance or respect). Notably, when individual structural or cognitive aspects of social cohesion are considered it is possible to identify scenarios when higher levels of overall social cohesion within a neighbourhood can result in negative, detrimental health effects for individuals and the wider community. For example, if friendship ties are strong within a neighbourhood, and an individual is not part of that clique, well-being could be negatively affected. Older Australians tend to have regular social engagement. In 2014, 63% of people aged 65 and over had contact with people outside their household at least once a week, including 19% who had daily contact (Australian Bureau of Statistics, 2015a).

1.10 Physical Activity and Social Connectedness

There are strong links between physical activity and social connectedness. A circular relationship, in terms of causality, seems to exist between social connectedness and physical activity. Evidence suggests physical activity can increase social connectedness (weak causality) and social connectedness can increase physical activity (strong causality). (Kaczynski & Glover, 2012). Maier & Klumb (2005) note the relationship between social activity and physical health is reciprocal: social activity benefits health outcomes, and in turn, good health improves participation in social activity. Social factors can significantly impact health behaviours and outcomes (Kaczynski & Glover, 2012) and social support is a predictor of physical activity (Smith, Banting, Eime, O'Sullivan, & van Uffelen, 2017). Greater levels of social capital, community satisfaction and community participation are related to increased levels of physical activity (Greiner, Li, Kawachi, Hunt, & Ahluwalia, 2004).

Giles-Corti & Donovan (2002) found that the social environment, specifically exercising with a significant other and membership of a physical activity related organisation, was a stronger predictor of physical activity than the quality of the physical environment. When examining environmental influences on physical activity, Haughton McNeill, Wyrwich, Brownson, Clark, & Kreuter (2006) found that the social environment had an indirect effect on physical activity through motivation and self-efficacy, and social support influenced physical activity indirectly through intrinsic and extrinsic motivation. It should be noted that in both of the previous examples, individual factors were found to play a significant mediating role in predicting the amount of physical activity undertaken by participants.

1.11 The Environment and Physical Activity

Older people are significantly influenced by the physical features of an environment (Cunningham, Michael, Lapidus, & Farquhar, 2005), and there is a positive association between the environment and physical activity (Mytton, Townsend, Rutter, & Foster, 2012). Physical dimensions of neighbourhoods and communities can significantly impact health behaviours (Chaudhury, Campo, Michael, & Mahmood, 2016). The Neighbourhood Environment Walkability Scale (NEWS) identifies a number of factors associated with neighbourhood walkability: 1) residential density, 2) land use diversity, 3) land use access, 3) street connectivity, 4) infrastructure and safety for walking/cycling, 5) aesthetics, 6) traffic hazards, and 7) crime (Frank, Sallis, Saelens, & Cerin, 2006). The physical environment (e.g., traffic, sidewalks, facilities) can encourage or limit physical activity (Humpel, Owen, & Leslie, 2002; Huston, Evenson, Bors, & Gizlice, 2003; Saelens, Sallis, Black, & Chen, 2003). Fisher, Li, Michael, & Cleveland (2004) found that neighbourhood-level variables accounted for a substantial variation in neighbourhood physical activity when controlling for individual-level variables. Built environment characteristics influence the amount of walking people undertake in local areas (Bentley et al., 2018). For example, the physical attributes of residential neighbourhoods, particularly the connectedness of streets and the proximity of destinations, can influence walking behaviours (Owen et al., 2007). Individuals are more likely to walk in physical environments that are aesthetically attractive and well-maintained, accessible, contain footpaths and that are perceived as safe (Ball, Bauman, Leslie, & Owen, 2001; Kaczynski & Henderson, 2007; Owen, Humpel, Leslie, Bauman, & Sallis, 2004).

Local recreational walking is influenced by objectively measured access to a medium-/large-size park, beach access, and higher street connectivity. Positive neighbourhood perceptions of access to a park and beach, higher street connectivity, neighbourhood esthetics, and safety from crime are independent determinants of increased neighbourhood recreational walking. Local recreational walking increases for each additional perceived neighbourhood attribute present (Christian et al., 2017). Ease of access to natural environments associated with recreation was related to perceived neighbourhood satisfaction and the amount of time spent by residents on physical activity (Björk et al., 2008).

1.12 The Environment and Social Connectedness

Numerous studies have found an association between the social environment and older adults' well-being (e.g., Elliott, Gale, Parsons, & Kuh, 2014; Kim, 2008; Toma, Hamer,

& Shankar, 2015). Characteristics of the place in which one lives, such as social cohesion and social capital, and factors like neighbourhood socio-economic position are core social environmental factors that influence a myriad of health related behaviours (Roux, 2001). Gale, Dennison, Cooper, & Sayer (2011) found that older people with a clear sense of neighbourhood cohesion and lower reported levels of neighbourhood disorder had relatively higher levels of mental well-being, regardless of their social class, income, health status, mobility issues, or their perception of socially available support. They argue the local residential neighbourhood may be more important for the mental well-being of older people because they have fewer reasons to leave the area, such as for work reasons, and there is an additional risk of mobility limitations. Perceptions of neighbourhood accessibility and safety are positively related to reports of social cohesion in neighbourhoods (Stephens, Szabó, Allen, & Alpass, 2019a). Conversely, environmental stress and neighbourhood disorders (e.g. crime, graffiti, litter) negatively affect social cohesion.

Environment (macrosystem) and community (exo-system) have a significant effect on social relations for older people (Burholt et al., 2019) and the physical environment (e.g. neighbourhood design, open space) can influence social exclusion, particularly for older people (Burholt et al., 2019). Choi & Matz-Costa (2018) found that community-level interventions promoting social cohesion may enhance psychological health of older adults with functional limitations (Choi & Matz-Costa, 2018). Place attachments, place identity, sense of community, and social capital are all critical parts of person-environment transactions that inspire action because people are motivated to seek, stay in, protect, and improve places that are meaningful to them (Manzo & Perkins, 2006).

NSW Health have designated the following as key to improving the relationship between the urban environment and social connectedness: 1) designing walkable neighbourhoods, 2) providing accessible community facilities and attractive public spaces, 3) allowing proximity to employment, 4) providing connectivity to nearby developments, such as retail and institutions, and 5) avoiding dissecting communities with busy arterial roads, railway lines or other substantial barriers (NSW Health, 2016).

1.13 The Environment, Well-being, Physical Activity and Social Connectedness

Conceptually then, neighbourhood environmental factors can be considered to have both a direct effect on well-being and an indirect effect on well-being via physical activity and social connectedness. See Figure 3. A supportive neighbourhood physical environment is likely to facilitate opportunities to be not only physically active but also socially engaged. This social-ecological perspective of neighbourhood-physical activity relations in older adults has

been recognised as a useful conceptualisation of the phenomenon because it acknowledges the complexity and multi-faceted nature of physical activity for older adults (Chaudhury, Campo, Michael, & Mahmood, 2016). Accordingly, physical activity promotion efforts should take into account both the built (e.g. land-use planning) and social (e.g. walking group, neighbourhood interactions) environments (Kaczynski & Glover, 2012). Both physical and social aspects of neighbourhoods affect health behaviours and therefore, well-being. Physical Activity promotion efforts should take into account both the physical (e.g. land-use planning) and social (e.g. walking group) environments (Kaczynski & Glover, 2012).

Neighbourhood physical and social environmental factors are significantly associated with walking at recommended levels (Wen, Kandula, & Lauderdale, 2007). The findings of Humpel, Owen, & Leslie (2002) suggested that exercise behaviour is affected by social and physical environments. McNeill, Kreuter, & Subramanian (2006) argue that the physical and social environment must be considered when modification of levels of physical activity is expected of individuals. Existing social norms associated with activity, including the resources and opportunities people have for participating in physical activity, as well as additional environmental constraints, such as crime, traffic and the unpleasantness of surroundings, all affect the likelihood of successful behaviour change.

Social connectedness is also related to neighbourhood walkability (Leyden, 2003). People living in walkable neighbourhoods which are perceived as mixed-use have higher reported levels of social capital in comparison to people who live in suburbs where cars are the primary mode of transportation. The environment, including neighbourhood design, housing diversity, population density, mixed land use and open space can affect intentional and spontaneous social contact (Burholt, Roberts, & Musselwhite, 2016). Areas perceived as being less neighbourly (having fewer people respondents knew and trusted) are associated with greater likelihood of low social activities (Bowling & Stafford, 2007).

1.14 The Environment and COVID-19

During the COVID-19 lockdown period (from March 2020), residents in NSW were permitted to exercise locally, in their neighbourhoods. Accordingly, residential neighbourhoods had the potential to be a supportive factor during the COVID-19 lockdown period, when extended travel was prohibited, and local exercise and outings were encouraged.

1.15 Objective

The objective of this research is to examine the relationship between environmental factor scores and self-reported well-being, defined by the Capability Approach, for older people via physical activity, and social connectedness within the neighbourhood.

1.16 Hypotheses

This research suggests the following hypotheses (See Figure 3):

- H1. Objective measures of residential neighbourhood quality are related to well-being.
- H2. Subjective measures of residential neighbourhood quality are related to well-being.
- H3. Socio-economic advantage of neighbourhood is related to well-being.
- H4. Physical activity is related to well-being.
- H5. Physical activity mediates the relationship between residential neighbourhood quality and well-being.
- H6. Social connectedness is related to well-being.
- H7. Social connectedness mediates the relationship between residential neighbourhood quality and well-being.
- H8. Physical activity and social connectedness are related to each other.

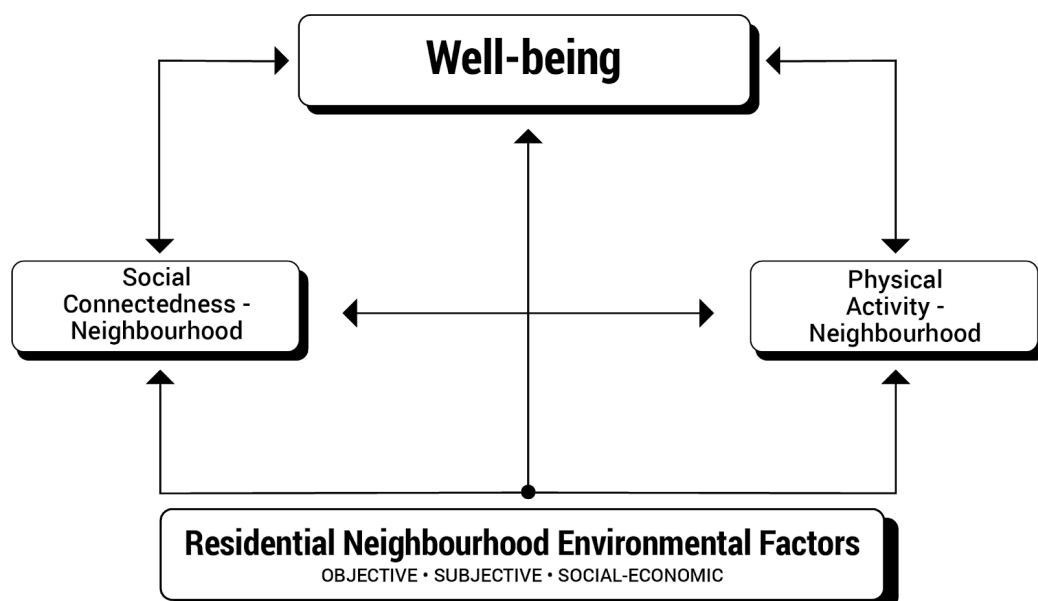


Figure 3

Residential Neighbourhood Environmental Factors affect well-being directly and via physical activity and social connectedness

2. Method

Participants were surveyed via letterbox drop questionnaire. Participants were selected from 3 socially disparate populations (low, medium, high) socio-economic status (SES) to test for SES differences.

2.1 Participants

2.1.1 Sample Selection

Australian Bureau of Statistics SEIFA indexes were used to identify disparate SES sample populations at Statistical Area Level 1. Statistical Areas Level 1 (SA1) are geographical areas built from whole Mesh Blocks. Whole SA1s aggregate to form Statistical Areas Level 2 (SA2) in the Australian Statistical Geography Standard (ASGS) Main Structure. The SA1s have generally been designed as the smallest unit for the release of census data. SA1s have a population of between 200 and 800 people with an average population size of approximately 400 people. The selected SA1s were all on the Central Coast within the Central Coast Local Government Area (LGA), a regional area approximately 100km north of Sydney, Australia. The general details of each selected SA1 are as follows:

- High SES - All SEIFA indexes at decile 10: One SA1 area met this criterion within the Central Coast LGA - Point Fredrick (356 residents/144 households)
- Medium SES - All SEIFA indexes at decile 5: Three SA1 areas met this criterion within the Central Coast LGA - Springfield (401 residents/144 households), Umina (326 residents/136 households), and Narara (201 residents/86 households)
- Low SES - All SEIFA indexes at decile 1: Eighteen SA1 areas met this criterion and three areas were randomly selected from this group - Umina Beach (512 residents/157 households), Killarney Vale (393 residents/181 households), and Lake Haven (396 residents/204 households)

The SA1 boundaries were obtained from the Australian Bureau of Statistics website and used to coordinate the addresses targeted, as well as to estimate the number of surveys (households) required for each area. See Appendix 3 for SA1 maps of each area and general SES data.

2.1.2 Participant Responses

A total of 87 responses were received from the initial letterbox drop of 1043, a response rate of 8.34%. 82 surveys were mailed in and 5 online responses were received.

The response rate differed according to the SES: High 16.20%, Medium 10.03%, and Low 5.17%. Gender response was relatively evenly distributed with 40 Males and 44 Female, with one response recording Other. No respondents identified as Aboriginal or Torres Strait Islander.

2.2 Measures

A survey questionnaire captured the following constructs: 1) psychological perceptions of residential environment, 2) well-being, 3) physical activity, and 4) social connectedness. The questionnaire (see Appendix 1) contained 23 questions, including psychological perceptions of the environment (5 items), well-being (3 items), physical activity (3 items), and social connectedness (6 items). In addition to the questionnaire measures of subjective assessment, an observational assessment of each SA1 was gathered by the author using OPERAT. The socio-economic environment of each SA1 was measured using the SEIFA SES indexes, classified as 1 (low), 5 (medium) or 10 (high).

2.2.1 Quality of the Residential Environment

The independent variable, quality of the residential neighbourhood environment, was measured using three variables, each capturing a different aspect of the residential neighbourhood environment.

2.2.1a Physical Environment (OPERAT), observed

OPERAT was originally developed to assess the suitability of external residential environments for older people in Wales, United Kingdom and to identify potential environmental interventions to improve the health and well-being for older people (Burholt, Roberts, & Musselwhite, 2016). It was developed with the understanding that the physical environment supports the independence of older people. The authors of OPERAT highlighted the increasing influence the residential environment can have on older people's health, to either support or negatively affect, via exclusion, health outcomes and functioning. OPERAT captures observable, external residential items and has been designed to be deployed for use by non-technical users, who, after completing a nominal amount of training are able to administer the test and submit results. Following its deployment in the UK, OPERAT has been utilised in a public study in Napier, New Zealand. OPERAT was used by Napier City Council to assist with achieving its objective of becoming an age-friendly city, as part of the national *Positive Ageing Strategy*. Deficits in the residential environment, identified by the study, became action items for the council to follow up.

OPERAT comprises 4 factors/16 items, derived from an original list of 84 items, and measures the quality of the environment. The 4 factors and 16 items identified as of importance by older people were as follows:

- Natural Elements - (Public grass or verges, Sounds of nature, # private trees)
- Incivilities and Nuisance - Traffic, industrial or other noise, Litter, dog fouling, broken glass, number of cars passing
- Navigation and Mobility - Legible road signs, Street and alleys lit, Pavement maintenance & width, Road maintenance, Pavement/road gradient
- Territorial Functioning - External beautification, Nature of parking, Garden maintenance, Property maintenance, Industrial/commercial outlook

The total OPERAT score is a composite of these four domains with 2x weighting given to the domain Navigation and Mobility. A higher OPERAT score indicates lower residential neighbourhood quality. The items included in the OPERAT model were derived using a participatory approach, wherein older people were asked to rank environmental items by importance to them. The participants were not asked 'why' items were important to them, nor was any data collected regarding the effect of these items on their general well-being, mental health, physical activity or social connectedness. In this study, OPERAT was used by the author to measure the external residential environment for each of the areas sampled.

OPERAT is the objective measure of the physical quality of the residential neighbourhood environment. It is a continuous variable calculated by the researcher using the OPERAT measurement instrument. OPERAT observational measures were scored according to the OPERAT Manual (Burholt & Roberts, 2017, pp. 24-27). Given the areas sampled included up to 150 properties, questions 14 - 17 were modified and scored at the neighbourhood level on a 5-point Likert scale, rather than the original which recorded yes/no for each property and then summed the 'yes' scores. Final scores for items 14 -17 were transformed to match OPERAT scoring. The four domains recorded the following range of scores: Natural Elements (0 - 3.33); Incivilities and Nuisance (0 - 20); Navigation and Mobility (16.92 – 27.69); and Territorial Functioning (2.86 – 9.29). Total OPERAT scores, derived from the sum of the four domain scores, ranged from 19.78 (higher quality neighbourhood) to 56.98 (lower quality neighbourhood).

2.2.1b Perceptions of the Environment (Subjective Environment), self-reported

The environment score OPERAT is based on observable measures of the environment. However, it has been recognised that the perceived quality of neighbourhoods is typically grounded in both observable conditions and unobservable conditions. Therefore, it is possible for “incongruities between perceived neighbourhood environment and objective reality” (Martin et al., 2010, p. 2) to exist. Furthermore, perceptions of the environment, potentially more so than objective features in and of themselves, “can elicit psychosocial or psychological processes or even a physiologic stress response that can affect mental and physical health” (Martin et al., 2010, p. 2). As a result, collecting data associated with the subjective neighbourhood environment can provide important information that must be considered when understanding the effects of neighbourhoods on health outcomes (Choi & Matz-Costa, 2018).

During development of the original OPERAT measurement tool (Burholt, Roberts, 2017), a series of questions were developed to assess the convergent validity of the observational measures. In the present study the same four questions from the original OPERAT study were employed: i) Do you enjoy living in your neighbourhood?, ii) Do you think your neighbourhood is a desirable place to live?, iii) Do you feel safe in your neighbourhood during the day?, and iv) Do you feel safe in your neighbourhood at night? An additional item was included to measure the effect of COVID-19 on perceptions of their neighbourhood: v) During the recent COVID-19 lockdown, did you enjoy living in your neighbourhood? The Responses were coded on a 5-point scale from ‘Strongly Disagree’ to ‘Strongly Agree’. Subjective Environment assessed the perceived quality of residential neighbourhood environment, measured with multiple items using a 5-point Likert scale, scored 0 (low quality) to 4 (high quality). The scores from the 5 items were averaged. Scores ranged from 0 to 4 with a higher score meaning a better environment. Internal reliability was good ($\alpha = .81$).

2.2.1c Socio-Economic Environment (SEIFA indexes), census

In Australia, SEIFA is a tool that compares an area with other areas. SEIFA is a product developed by the ABS that ranks areas in Australia according to relative socio-economic advantage and disadvantage. The indexes are based on information from the five-yearly Census (ABS). Some common uses of SEIFA include determining areas that require funding and services, identifying new business opportunities and research into the relationship between socio-economic disadvantage and various health and educational

outcomes. OPERAT was originally tested for convergent validity with the Townsend Index, a measure of material deprivation within a population incorporating four variables:

Unemployment, Non-car ownership, Non-home ownership and Household overcrowding.

The Townsend Index is referenced by the ABS in its technical document which details the development and application of the SEIFA indexes (Australian Bureau of Statistics, 2008).

Three SEIFA indexes were used in this study. The Index of Relative Socio-economic Disadvantage (IRSD) index is a general socio-economic index that summarises a wide range of information about the economic and social resources of people and households within an area. Because this index focuses on disadvantage, only measures of relative disadvantage are included. The Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD), like IRSD above, provides measures of socio-economic conditions by geographic area but differs in that it also contains measures of relative advantage. The Index of Economic Resources (IER) measures the economic resources of households within an area and includes variables such as: household income, housing expenditures (e.g., rental payments) and wealth (e.g., house ownership). The IER does not include education or occupation measures. See Appendix 2 for a detailed list of included variables in the SEIFA Indexes.

Socio-Economic Status (SES), as defined by the Australian Bureau of Statistics, is a categorical variable, with three possible values in this research: 1 (lowest SES), 5 (middle) and 10 (highest). This measure referenced the economic qualities of the neighbourhood. SES data at level SA1 was retrieved from the Australian Bureau of Statistics. These geographic boundaries were used to define the questionnaire drop areas. SES group comparisons were then made between the three groups: 1 - Low, 5 - Medium, and 10 - High.

2.2.2 Dependent Variables

The three dependent variables were Physical Activity, Social Connection and Well-being.

2.2.2a Physical Activity

The Physical Activity scale included 3 items capturing the level of neighbourhood physical activity. Physical Activity Items were from Fisher, Li, Michael, & Cleveland (2004). These measures of self-reported physical activity coded responses on a 5-point scale from 'Never' to 'Always'. One of the original questions was modified to account for residents who use a wheelchair or mobility aid. The three items asked, "Over the past 12 months, how much have you done the following:

- walked or done any physical activity in your neighbourhood?
- walked or done any other physical activity with neighbours?
- gone to a neighbourhood park for walks or other physical activities?

The scores from these 3 items were averaged to create a Physical Activity scale and internal reliability was acceptable ($\alpha = .694$). Scores ranged from 0 to 4 with a higher score meaning higher levels of neighbourhood physical activity.

2.2.2b Social Connection

A combination of social connectedness and social cohesion measures were used to calculate a measure of self-reported social connectedness at the neighbourhood level. The ICS Scale is a measure of social connectedness (Mashek, Cannaday, & Tangney, 2007; Mashek, Stuewig, Furukawa, & Tangney, 2006) and comprises a single-item picture comprising six pairs of overlapping circles. The original item asks, "Circle the picture that best describes your relationship with the community at large" (S = Self, C = Community). This item was modified to reference neighbourhood rather than community at large. "Circle the picture below that best describes your relationship with the people in your neighbourhood" (S = Self, PN = People in your Neighbourhood). The score on this item was transformed to match the 5-point Likert scale items below. Social Cohesion items were also taken from Sampson, Raudenbush, & Earls (1997). Sampson et al. developed a five-item measure of social cohesion and responses were coded on a 5-point Likert scale from 'Strongly Disagree' to 'Strongly Agree'. Participants were presented with the following 5 statements:

- People around here are willing to help their neighbours.
- This is a close-knit neighbourhood.
- People in this neighbourhood can be trusted.
- People in this neighbourhood generally do not get along with each other. (reverse coded)
- People in my neighbourhood do not share the same values. (reverse coded)

The scores from the 6 items were averaged to create a Social Connection scale. Scores ranged from 0 to 4 with a higher score meaning higher social connection. Internal reliability was good ($\alpha = .84$).

2.2.2c Well-being

The Well-being scale consisted of 3 items, measuring happiness and general self-rated health (mental and physical). The single item measure of happiness (Do you feel happy in general?) from Abdel-Khalek (2006) is answered on an 11-point Likert scale (0-10) and has a temporal stability of 0.86. It has highly significant and positive correlations with both the Oxford Happiness Inventory (OHI; Argyle, Martin, & Lu, 1995; Hills & Argyle, 1998) and the Satisfaction with Life Scale (Diener, Emmons, Larsen & Griffin, 1985; Pavot & Diener, 1993) indicating good concurrent validity. Moreover, it has been found to be positively correlated with optimism, hope, self-esteem, positive affect, extraversion, in addition to self-rated physical and mental health.

The General Self-Rated Health (GSRH) scale (DeSalvo, Fisher, Tran, Bloser, Merrill, & Peabody, 2006) contains one question, "In general, would you say your health is...?" and has demonstrated reproducibility, reliability, and concurrent and discriminant scale performance against established measures of general health, including the SF-12V. Responses are coded on a 5-point scale from 'Strongly Disagree' to 'Strongly Agree'. The 'standard' version of the GSRH was modified from "In general, would you say your health is...?" to create two measures of general health, one physical and one mental. The wording used for each was: "In general, would you say your physical health is...?" and "In general, would you say your mental health is...?". 5 category response options of: Excellent, Very Good, Good, Fair, or Poor were utilised, as in the original form of the scale. The scores from the 3 items were averaged to create a Well-being scale. Scores ranged from 0 to 10 with a higher score meaning higher well-being. Internal reliability was acceptable ($\alpha = .72$).

2.2.3 Demographic Data

2.2.3a Age

Of particular interest in this research was the effect of the environment on older people, aged 65+. Age data was requested in the form of 'age-range', with 18-19 being the youngest age range, and subsequent age ranges of a 5-year span (e.g., 20-24, 25-29). 85+ was the upper age range.

2.2.3b Gender

Gender data was collected in the form of Male, Female and Other options. Only one response was received which indicated 'Other'. The data associated with this response was excluded from the analysis.

2.2.3c Cultural Background

Respondents were asked if they identified as Aboriginal or Torres Strait Islander. Given the adverse health outcomes experienced by this cohort, the age cut off for inclusion in the older age group (65+) would be 55+ for those identifying as Aboriginal or Torres Strait Islander. No respondents identified as Aboriginal or Torres Strait Islander.

2.2.3d Mobility

Respondents were asked if they used a wheelchair or mobility aid (e.g., scooter). It was hypothesised that the environment would be of significant importance to such respondents, irrespective of age, and possibly correlate closely with the older age group (65+). No respondents reported using a wheelchair or mobility aid.

2.3 Procedure

Survey questionnaires were distributed to a total of 10 population areas over a one-week period. Household members aged 18+ were invited to participate in this research.

2.3.1 Questionnaire Delivery

Questionnaire letterbox drops occurred across these 10 socially disparate areas on the Central Coast LGA over the period of one week. Surveys were coded for each SA1. A total of 1043 surveys were distributed. Only one questionnaire was distributed to each household. Each questionnaire also contained a link to an online version of the questionnaire for participants who preferred this option and/or to allow multiple participants to complete the questionnaire. See <http://centralcoastsurvey.com.au/>. A cover letter was included explaining the aims of the research and contact details. See Appendix 1. A prepaid reply envelope was included.

2.3.2 Observational Neighbourhood Assessments

OPERAT observational measurements were recorded by the researcher at the same time as the surveys were distributed using the OPERAT assessment tool. All surveys were distributed during the week (Monday to Friday) between 10:00am and 3:30pm. The main purpose of this was to ensure OPERAT (specifically the amount of vehicle activity) and observed physical activity measures were consistent. It was noted by the researcher that one of the OPERAT assessments occurred during the end of school time period and this contributed to an increase in the amount of traffic, thereby affecting the OPERAT score.

Completed questionnaires were stored securely and only accessed by the researcher during the data collation period. Participant data and personal details from the posted questionnaires were entered and stored in secure SPSS and password protected Google Sheets files respectively and were only available to the researcher and research supervisor. The survey data that was submitted electronically via the online form version of the questionnaire was automatically injected into the master Google Sheet. The survey and associated procedures were approved by the Massey University Human Ethics Committee.

2.3.3 Data Analysis

All analyses were conducted using SPSS software version 26. During the data collation stage, a small number of responses (change in $N < 3$) were found to be incomplete. Where responses were missing for a significant number of items that comprised a whole scale, they were removed from the data set. Responses that did not include an age range were omitted from the data. Given only 1 response indicated gender 'Other', it was decided to omit this response. Firstly, correlation between key variables for the entire sample was tested with Pearson's r , and then at the age group level for the Under 65 and 65+ groups. Secondly, mean differences by environment (SES) were tested using one-way ANOVA. Where differences existed, post-hoc testing with Tukey HSD was used to examine where these differences occurred. Mean differences by environment (OPERAT) were examined by binning the OPERAT scores into two categories (Low and Medium). This decision followed frequency analysis. Where differences existed, further analysis was undertaken by age group (Under 65 and 65+). Thirdly, hypothesis testing to examine the mediating effects of physical activity, social connection, and subjective environment (where applicable) between the environment and well-being utilised PROCESS (Hayes, 2017) with Model 4. Where mediating effects were found to exist, additional PROCESS analysis was carried out to examine the moderating effects of age with Model 8.

2.3.4 Research Ethics

This research project was developed in accordance with the principles contained within Massey University's Code of Ethical Conduct for Research, Teaching and Evaluations involving Human Participants. The ethical issues raised by this research and the associated procedures were considered as low risk and a low risk ethics notification was issued by Massey University.

3. Results

3.1 Descriptive Statistics

Participants on average reported a Subjective Environment score of 2.76 (SD = .67), a Physical Activity score of 2.40 (SD = .93), a Social Connection score of 2.31 (SD = .70) and a Well-being score of 3.03 (SD = .68). See Table 1.

Table 1

Descriptive statistics for Subjective Environment, Physical Activity, Social Connection and Well-being (N = 88)

	Minimum	Maximum	Mean	Std. Dev.
Subj.Env.	.20	3.80	2.76	.67
Phys.Act.	.00	4.00	2.40	.93
Soc.Conn.	.33	3.70	2.31	.70
Well-being	1.07	4.00	3.03	.68

The 65+ age group scored lower on average than the Under 65 group for all variables. The Under 65 age group participants on average reported a Subjective Environment score of 2.84 (SD = .67), a Physical Activity score of 2.60 (SD = .89), a Social Connection score of 2.37 (SD = .72) and a Well-being score of 3.06 (SD = .58). The 65+ age group participants on average reported a Subjective Environment score of 2.71 (SD = .70), a Physical Activity score of 2.19 (SD = .99), a Social Connection score of 2.29 (SD = .70) and a Well-being score of 3.05 (SD = .77). See Table 2.

Table 2

Descriptive statistics for Subjective Environment, Physical Activity, Social Connection and Well-being, by age group (Under 65 and 65+)

Age Group		N	Minimum	Maximum	Mean	Std. Deviation
Under 65	Subj.Env.	41	1.20	3.80	2.84	.69
	Phys.Act.	41	.52	4.00	2.60	.99
	Soc.Conn.	41	.33	3.70	2.37	.72
	Well-being	41	1.56	4.00	3.06	.53
65+	Subj.Env.	42	.20	3.80	2.71	.70
	Phys.Act.	42	.00	3.81	2.19	.99
	Soc.Conn.	42	.50	3.40	2.29	.70
	Well-being	40	1.07	4.00	3.05	.73

The number of male and female participants was approximately equally distributed in this sample, with Female N = 45 and Male N = 40. See Table 3.

Table 3

Frequencies statistics for gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	45	51.1	52.3	52.3
	Male	40	45.5	46.5	98.8
	Other	1	1.1	1.2	100.0
	Total	86	97.7	100.0	
Missing		2	2.3		
Total		88	100.0		

The distribution was not equal by age group (Under 65 and 65+), with the 65+ age group Female N = 15 and Male N = 26, and the Under 65 age group Female N = 29 and Male N = 12. See Table 4.

Table 4

Frequencies statistics for gender, by age group

		Frequency	Percent	Valid Percent	Cumulative Percent
Under 65	Female	29	70.7	70.7	70.7
	Male	12	29.3	29.3	100.0
	Total	41	100.0	100.0	
65+	Female	15	35.7	35.7	35.7
	Male	26	61.9	61.9	97.6
	Other	1	2.4	2.4	100.0
	Total	42	100.0	100.0	

Females scored higher on average than males for all variables. Female participants on average reported an Subjective Environment score of 2.82 (SD = .76), a Physical Activity score of 2.59 (SD = .89), a Social Connection score of 2.37 (SD = .79) and a Well-being score of 3.06 (SD = .65).

Male participants on average reported a Subjective Environment score of 2.76 (SD = .52), a Physical Activity score of 2.23 (SD = .98), a Social Connection score of 2.29 (SD = .58) and a Well-being score of 2.97 (SD = .66). See Table 5.

Table 5

Descriptive statistics for Subjective Environment, Physical Activity, Social Connection and Well-being, by gender

Gender		N	Minimum	Maximum	Mean	Std. Deviation
Female	Subj.Env.	45	.20	3.08	2.82	.77
	Phys.Act.	45	.38	4.00	2.59	.81
	Soc.Conn.	45	.33	3.70	2.36	.73
	Well-being	45	1.56	4.00	3.14	.63
Male	Subj.Env.	40	1.20	3.60	2.76	.53
	Phys.Act.	40	.00	3.67	2.23	.87
	Soc.Conn.	40	.83	3.27	2.29	.54
	Well-being	38	1.07	4.00	2.97	.75

By age group, this pattern also generally held true. For both age groups, females scored higher on average than males for all variables, except for Subjective Environment, where Under 65 females scored lower than males. See Table 6.

Table 6

Descriptive statistics for Subjective Environment, Physical Activity, Social Connection and Well-being, by age group and gender

Age Group	Gender		N	Minimum	Maximum	Mean	Std. Dev.
Under 65	Female	Subj.Env.	29	1.20	3.80	2.83	.71
		Phys.Act.	29	.90	4.00	2.71	.80
		Soc.Conn.	29	.33	3.70	2.38	.78
		Well-being	29	1.56	4.00	3.11	.60
	Male	Subj.Env.	12	1.60	3.60	2.85	.58
		Phys.Act.	12	.52	3.67	2.35	1.07
		Soc.Conn.	12	1.47	3.27	2.35	.58
		Well-being	12	2.26	4.00	2.96	.55
65+	Female	Subj.Env.	15	.20	3.80	2.83	.90
		Phys.Act.	15	.38	3.81	2.37	1.06
		Soc.Conn.	15	.50	3.40	2.37	.84
		Well-being	15	1.78	4.00	3.28	.70
	Male	Subj.Env.	26	1.20	3.60	2.70	.52
		Phys.Act.	26	.00	3.67	2.11	.96
		Soc.Conn.	26	.83	3.20	2.28	.62
		Well-being	24	1.07	3.85	2.97	.75

3.2 Correlations

For all participants, the variables Subjective Environment, Physical Activity, Social Connection, and Well-being were strongly positively correlated with each other, at $p < .001$. See Table 7.

Table 7

Pearson's r correlations between key variables

	Subj.Env.	Phys.Act.	Soc.Conn.	Well-being
Subj.Env.	-			
Phys.Act.	.48***	-		
Soc.Conn.	.84***	.47***	-	
Well-being	.49***	.43***	.42***	-

* $p < .05$; ** $p < .01$; *** $p < .001$

When the results were examined by age group, all the correlations did not hold for the Under 65 age group. For the +65 age group, the variables Subjective Environment, Physical Activity, Social Connection, and Well-being were all strongly positively correlated with each other, at $p < .001$. See Table 8.

Table 8

Correlations between all variables used in research, by age group

Age Group		Subj.Env.	Phys.Act.	Soc.Conn.	Well-being
Under 65	Subj.Env.	-			
	Phys.Act.	.29	-		
	Soc.Conn.	.87***	.37*	-	
	Well-being	.14	.18	.16	-
65+	Subj.Env.	-			
	Phys.Act.	.64***	-		
	Soc.Conn.	.83***	.58***	-	
	Well-being	.73***	.63***	.56***	-

* $p < .05$; ** $p < .01$; *** $p < .001$

3.3 Mean Differences

3.3.1 Mean Differences by Gender

There were no significant differences between genders (Female/Male) for Subjective Environment, Physical Activity, Social Connection or Well-being.

3.3.2 COVID Effect

Given the onset of COVID during the research period it was additionally hypothesised that the perception of the residential neighbourhood environment had the potential to be directly affected. If true, this could have implications for the role of the environment in times of crisis more generally. Examples could include the death of a loved one, experiencing negative health (e.g. cancer), experiencing mental health (e.g. depression). The data did not show a significant difference in people's perception of their residential neighbourhood as a result of COVID.

3.3.3 Mean Differences by Environment - Socio-Economic Status (SES)

3.3.3a One-way ANOVA for SES groups

A one-way between subjects ANOVA was conducted to compare the effect of SES on Subjective Environment, Physical Activity, Social Connection and Well-being for the SES groups (1 - Low, 5 - Medium, and 10 - High). There was a significant difference between the SES groups (1 - Low, 5 - Medium, and 10 - High) for all four dependent variables. There was a significant effect of SES on Subjective Environment at the $p < .00$ level for the 3 SES groups [$F(2, 85) = 16.75, p = .00$]. There was a significant effect of SES on Physical Activity at the $p < .01$ level for the 3 SES groups [$F(2, 85) = 5.98, p = .00$]. There was a significant effect of SES on Social Connection at the $p < .001$ level for the 3 SES groups [$F(2, 85) = 9.61, p = .00$]. There was a significant effect of SES on Well-being at the $p < .001$ level for the 3 SES groups [$F(2, 83) = 6.15, p = .00$].

3.3.3b One-way ANOVA for SES groups by age group

Further analysis was conducted to examine the effect of SES on Subjective Environment, Physical Activity, Social Connection and Well-being by age group. For those aged 65+ there was a significant difference between the SES groups (1 - Low, 5 - Medium, and 10 - High) on all four dependent variables as determined by one-way ANOVA.

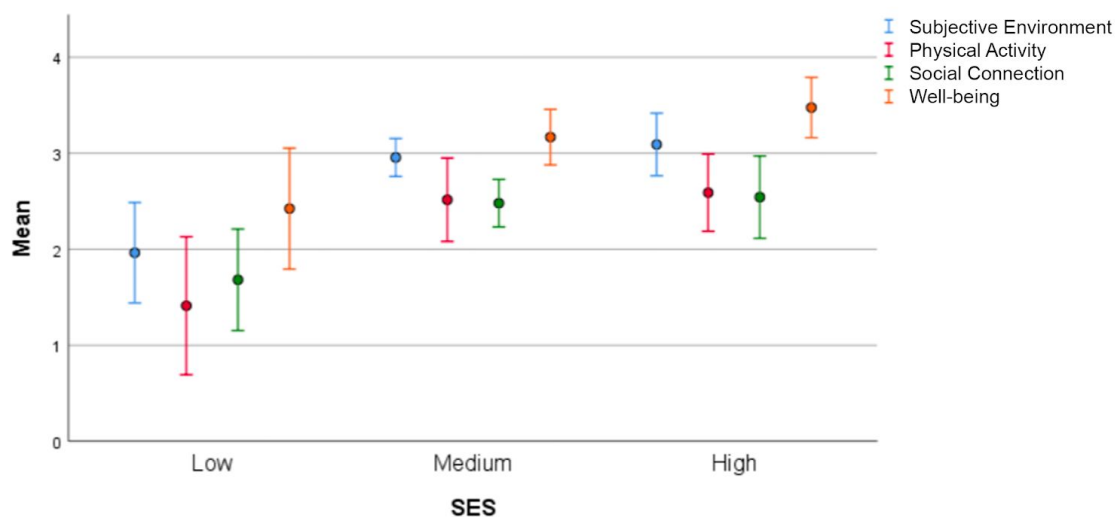
There was a significant effect of SES on Subjective Environment at the $p < .001$ level for the 3 SES groups [$F(2, 39) = 13.48, p = .00$]. There was a significant effect of SES on Physical Activity at the $p < .01$ level for the 3 SES groups [$F(2, 39) = 8.31, p = .00$]. There was a significant effect of SES on Social Connection at the $p < .05$ level for the 3 SES groups [$F(2, 39) = 5.25, p = .01$]. There was a significant effect of SES on Well-being at the $p < .01$ level for the 3 SES groups [$F(2, 37) = 7.25, p = .00$]. For the Under 65 group, only Subjective Environment showed a significant difference [$F(2, 38) = 4.48, p = .02$].

3.3.3c Post Hoc Tests for SES groups by age group

For the 65+ age group, multiple comparisons using Tukey HSD tests showed that the significant differences in SES for all dependent variables (Subjective Environment, Physical Activity, Social Connection and Well-being) were between the low SES and medium or high SES groups. See Figure 4.

Figure 4

Mean Subjective Environment, Physical Activity, Social Connection and Well-being for SES groups Low, Medium and High, for those aged 65+



Those aged 65+ living in low SES areas reported lower Subjective Environment ($M = 2.06$, $SD = .75$) when compared to those in medium ($M = 2.96$, $SD = .40$) or higher ($M = 3.09$, $SD = .49$) SES areas. Those aged 65+ living in low SES areas reported lower Physical Activity ($M = 1.39$, $SD = .98$) when compared to those in medium ($M = 2.52$, $SD = .87$) or higher ($M = 2.59$, $SD = .60$) SES areas. Those aged 65+ living in low SES areas reported lower Social Connection ($M = 1.82$, $SD = .80$) when compared to those in medium ($M = 2.48$, $SD = .50$) or higher ($M = 2.54$, $SD = .64$) SES areas. Those aged 65+ living in low SES areas reported lower Well-being ($M = 2.42$, $SD = .94$) when compared to those in medium ($M = 3.17$, $SD = .58$) or higher ($M = 3.48$, $SD = .47$) SES areas.

There are no significant differences between the medium or high SES groups. In the 65+ age group low SES is consistently related to lower Subjective Environment, Physical Activity, Social Connection and Well-being when compared to medium or higher SES.

For the Under 65 age group, multiple comparisons using Tukey HSD tests showed the same pattern of differences for Subjective Environment only. Those aged Under 65 living in lower SES areas reported lower Subjective Environment ($M = 2.40$, $SD = .73$) when compared to those in medium ($M = 2.97$, $SD = .58$) or higher ($M = 3.11$, $SD = .53$) SES areas.

3.3.4 Mean Differences by Environment - OPERAT

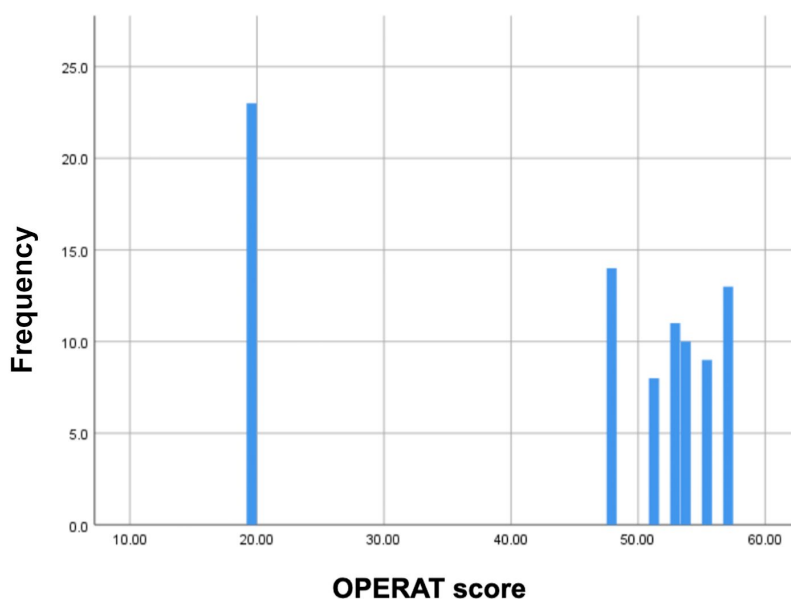
One observed OPERAT score was recorded for each of the 7 populations sampled. Six observed OPERAT scores clustered between 47.52 and 56.98, with one OPERAT score at 19.78 (Area 3238). NOTE: A lower OPERAT score indicates a higher quality neighbourhood.

The major factors associated with the low OPERAT score for Area 3238 were the domains of Incivilities and Nuisance and Territorial Functioning. The differentiating factors for the high-quality neighbourhood were less traffic, dog fouling and litter, and more external beatification.

The six clustered OPERAT scores were for the low and medium SES suburbs, SES 1 and SES 5. The lowest OPERAT score (19.78) was recorded for the High SES suburb (SES 10). For the purposes of analysis, the seven OPERAT scores were binned into two categories: LowOPERAT and MediumOPERAT. See Figure 5.

Figure 5

Histogram of OPERAT scores (M=44.209, SD=14.899, N=88)

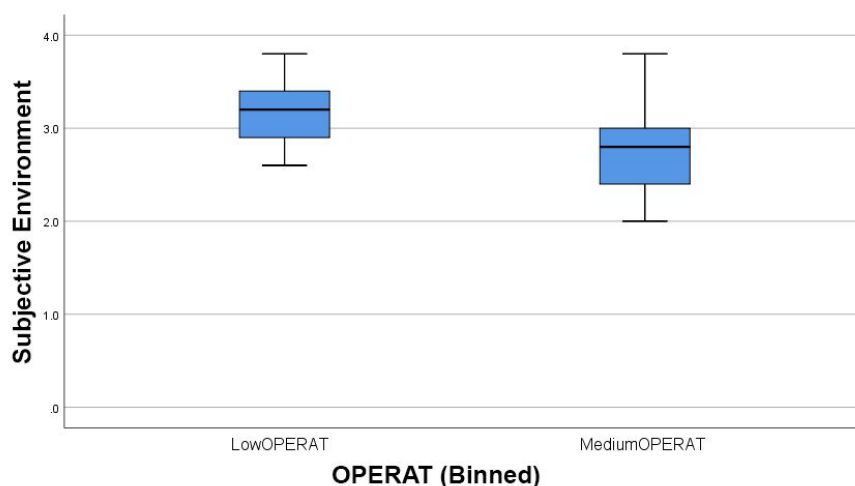


For all participants, there was a significant difference in Subjective Environment between the LowOPERAT and MediumOPERAT groups ($t_{83} = 2.68, p < .05$). People living in a higher quality neighbourhood environment, as measured by OPERAT, reported higher levels of Subjective Environment. For all participants, there was a significant difference in Well-being between LowOPERAT and MediumOPERAT groups ($t_{81} = 2.18, p < .05$). People living in a higher quality neighbourhood environment, as measured by OPERAT, reported higher levels of well-being.

Further analysis, by age group revealed that these results only held true for the 65+ age group. For older participants, aged 65+, there was a significant difference in Subjective Environment between the LowOPERAT and MediumOPERAT groups ($t_{83} = 2.68, p < .05$). People living in a higher quality neighbourhood environment, as measured by OPERAT, reported higher levels of perceived neighbourhood quality. See Figure 6.

Figure 6

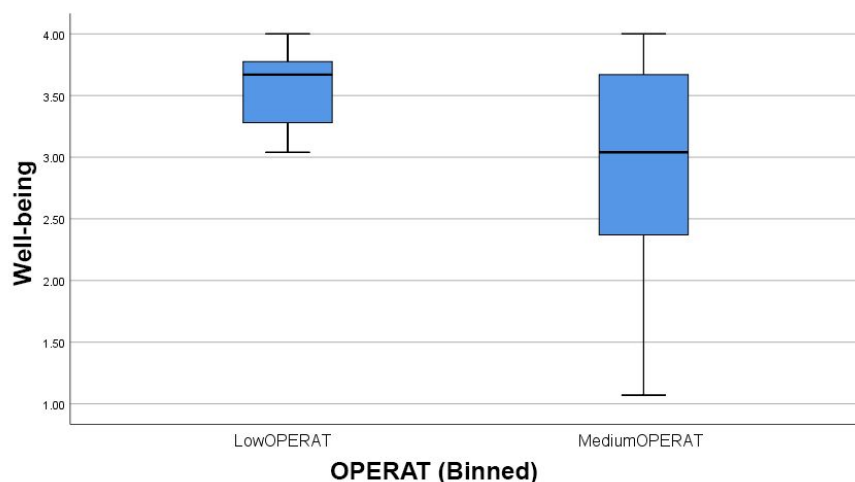
Mean Subjective Environment for binned OPERAT groups, for those Aged 65+



For older participants, aged 65+, there was a significant difference in Well-being between LowOPERAT and MediumOPERAT groups ($t_{81} = 2.18, p < .05$). People living in a higher quality neighbourhood environment, as measured by OPERAT, reported higher levels of well-being. See Figure 7. The results suggest that OPERAT does not affect Subjective Environment, Physical Activity, Social Connection, and Well-being for people aged under 65.

Figure 7

Mean Well-being for binned OPERAT groups, for those Aged 65+



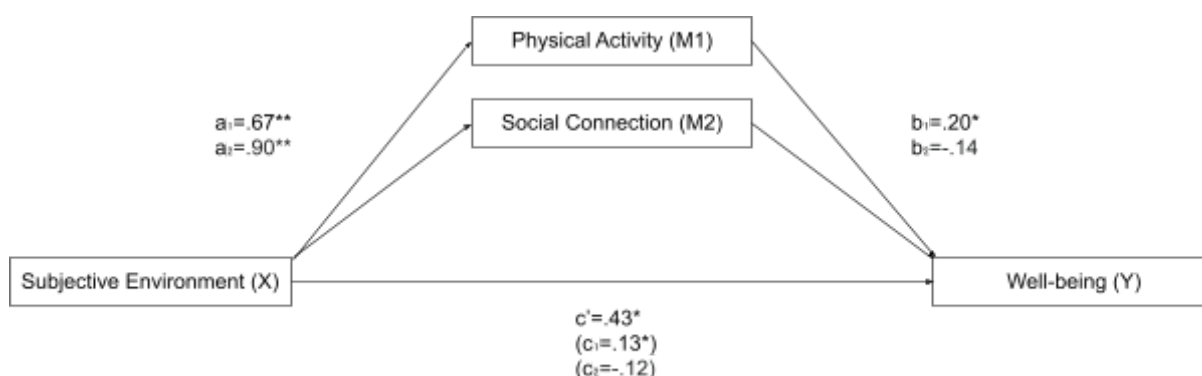
3.4 Hypothesis Testing

3.4.1 Effect of Subjective Environment on Well-being, mediated by Physical Activity and Social Connection

PROCESS was used to investigate the mediating effects of Physical Activity (M1) and Social Connection (M2) on the relationship between Subjective Environment (Y) and Well-being (X). As Figure 8 illustrates, the direct effect of Subjective Environment on Physical Activity is positive and significant ($a_1 = .67$, s.e. = .14, $p < .01$). The direct effect of Physical Activity is positive and significant ($a_1 = .67$, s.e. = .14, $p < .01$). The direct effect of Subjective Environment on Social Connection is positive and significant ($a_2 = .90$, s.e. = .06, $p < .01$). The results suggest that people's subjective experience of their environment positively affects their Physical Activity and Social Connection.

Figure 8

Hypothesised model and statistical mediation indicating the beta coefficients for Subjective Environment (X), Physical Activity (M1), Social Connection (M2) and Well-being (Y) for the total sample ($N = 80$)



As Figure 8 illustrates, the direct effect of Subjective Environment on Well-being is positive and significant ($c' = .43$, s.e. = .19, $p = .02$). The direct effect of Physical Activity on Well-being is positive and significant ($b_1 = .20$, s.e. = .08, $p = .01$). The direct effect of Social Connection on Well-being is not significant. The results suggest that people's subjective experience of their environment positively affects their well-being and the amount of Physical Activity also positively affects their well-being.

The significance of indirect effects was tested using bootstrapping procedures. The indirect effect of Subjective Environment on Well-being via Physical Activity is positive and significant: 95%CI = (.02, .25). The indirect effect of Subjective Environment on Well-being via Social Connection is not significant. Physical Activity mediates the relationship between the Subjective Environment and Well-being. See Table 9.

Table 9

Coefficients for Subjective Environment (X), via Physical Activity (M1) and Social Connection (M2) Mediation with Well-being (Y) as the Outcome for the Total Sample (N = 80)

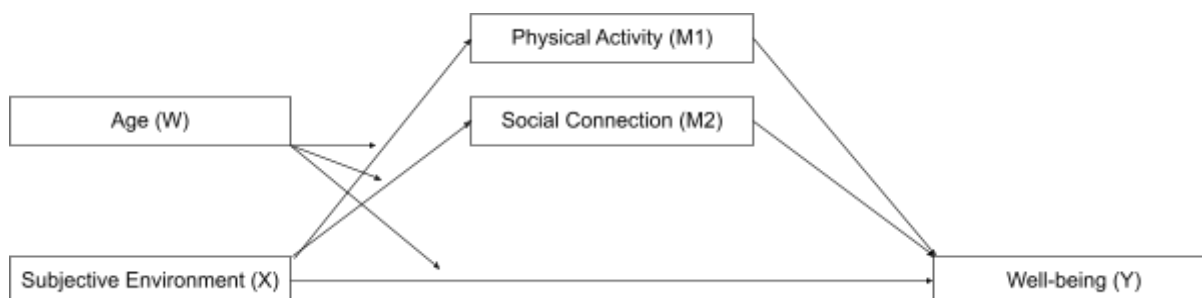
Outcome	Physical Activity (M1)		Social Connection (M2)		Well-being (Y)	
Predictor	<i>Coeff. (SE)</i>	<i>p</i>	<i>Coeff. (SE)</i>	<i>p</i>	<i>Coeff. (SE)</i>	<i>p</i>
Subjective Environment (X)	.67 (.14)	.00	.90 (.06)	.00	.43 (.19)	.03
Physical Activity (M1)					.20 (.08)	.01
Social Connection (M2)					-.14 (.18)	.43
Indirect Effects	β		<i>Boot SE</i>		<i>Boot 95% CI</i>	
Physical Activity (M1)	.13		.06		[.02, .26]	
Social Connection (M2)	-.13		.17		[-.46, .23]	

3.4.2 Effect of Subjective Environment on Well-being, mediated by Physical Activity and Social Connection, moderated by Age

Further analysis was undertaken to examine these effects, moderated by Age. See Figure 9. The interaction between Subjective Environment and Age on Physical Activity is positive and significant ($b = .07$, $s.e. = .04$, $p = .05$). The results show the effect is significant for the 2 older ages groups (50th and 80th percentiles) but not the younger age group (16th percentile). See Table 10. The interaction between Subjective Environment and Age on Social Connection is negative but not significant.

Figure 9

Hypothesised model for Age moderated mediation for Subjective Environment (X), Physical Activity (M1), Social Connection (M2) and Well-being (Y)



The interaction between Subjective Environment, Physical Activity, Social Connection and Age on Well-being is positive and significant ($b = .06$, $s.e. = .03$, $p = .03$). The results show the effect is significant for the 2 older ages groups (50th and 80th percentiles) but not the younger age group (16th percentile). The direct effect of Subjective Environment on Well-being is positive and significant for the older age groups: 50th percentile ($b = .39$, $s.e. = .18$, $p = .03$) and 80th percentiles ($b = .56$, $s.e. = .19$, $p = .00$). The results suggest this effect becomes stronger as people get older. See Table 10.

The indirect effect of Subjective Environment on Well-being via Physical Activity is positive but not significant for any age range. For Subjective Environment, Age moderated mediation of Well-being via Physical Activity is not significant. The indirect effect of Subjective Environment on Well-being via Social Connection is not significant for any age range. For Subjective Environment, Age moderated mediation of Well-being via Social Connection is not significant. The effects of Subjective Environment on Well-being, mediated by Physical Activity and Social Connection, are not moderated by Age. The Upper and Lower confidence interval contains 0 for each mediating variable

Table 10

Bootstrapped Conditional Interaction Effects of Subjective Environment on Physical Activity and Well-being for significant Age Moderation Models

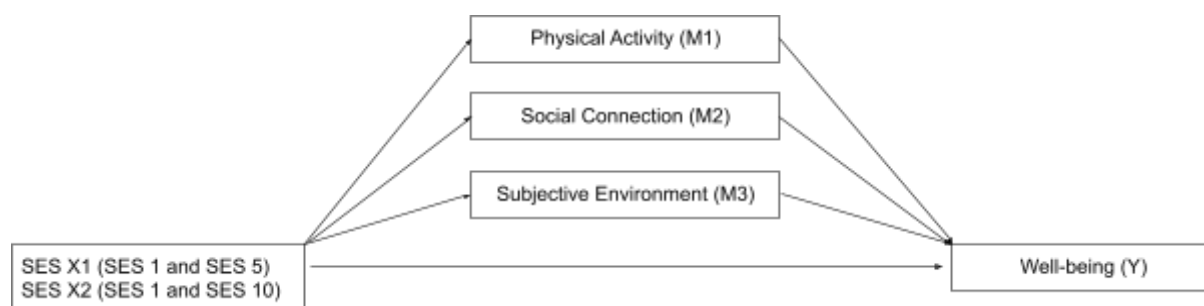
Mediator		Physical Activity (M1)		Well-being (Y)	
	Moderator Percentiles	Coeff. (SE)	Boot 95% CI	Coeff. (SE)	Boot 95% CI
Subj.Env.(X)	Age (W)				
	50th	.65 (.14)	[-.38, .93]	.40 (.18)	[-.03, .76]
	84th	.87 (.18)	[-.52, 1.22]	.57 (.19)	[-.18, .95]

3.4.3 Effect of SES on Well-being, mediated by Physical Activity, Social Connection and Subjective Environment

PROCESS was used to investigate the mediating effects of Physical Activity (M1), Social Connection (M2) and Subjective Environment (M3) on the relationship between SES (Y) and Well-being (X). See Figure 10. For the purposes of this analysis SES was treated as a categorical variable and the differences between SES 1 and SES 5 (X1) and SES 1 and SES 10 (X2) were examined.

Figure 10

Hypothesised model for SES (X1 and X2), Physical Activity (M1), Social Connection (M2), Subjective Environment (M3) and Well-being (Y)



The direct effect of SES on Physical Activity, Social Connection, and Subjective Environment is positive and significant for X1 and for X2. See Table 11. The results suggest SES positively affects Physical Activity, Social Connection and Subjective Environment.

The direct effect of Physical Activity on Well-being is positive and significant ($b = .18$, $s.e. = .08$, $p = .02$). The direct effect of Social Connection on Well-being is not significant. The direct effect of Subjective Environment on Well-being is positive and significant ($b = .41$, $s.e. = .19$, $p = .03$). The results suggest Physical Activity and Subjective Environment positively affect Well-being.

The direct effect of SES on Well-being is not significant for X1 or for X2. The total effect of SES on Well-being, ignoring the mediating variables (Physical Activity, Social Connection, and Subjective Environment), is positive and significant for X1 ($b = .41$, $s.e. = .16$, $p = .02$) and X2 ($b = .63$, $s.e. = .18$, $p < .01$). There is a difference in Well-being for X1 or X2, when mediating variables are not present.

The significance of indirect effects was tested using bootstrapping procedures. The indirect effect of SES on Well-being via Physical Activity is positive and significant for X1: $95\%CI = (.00, .28)$, and X2: $95\%CI = (.01, .30)$. The indirect effect of SES on Well-being via Subjective Environment is positive and significant for X1: $95\%CI = (.00, .66)$, and X2: $95\%CI = (.00, .80)$. The indirect effect of SES on Well-being via Social Connection is not significant for X1 or X2. For both SES X1 and SES X2, mediation has occurred via Physical Activity and Subjective Environment.

Table 11
Coefficients for SES (X1) and SES (X2), via Physical Activity (M1), Social Connection (M2) and Subjective Environment (M3) Mediation with Well-being (Y) as the Outcome for the Total Sample (N = 80)

Outcome	Physical Activity (M1)			Social Connection (M2)			Subjective Environment (M3)			Well-being (Y)		
	Coeff. (SE)	p		Coeff. (SE)	p		Coeff. (SE)	p		Coeff. (SE)	p	
SES (X1)	.61 (.23)	.01		.68 (.16)	.00		.72 (.15)	.00		.07 (.17)	.67	
SES (X2)	.70 (.26)	.01		.71 (.18)	.00		.87 (.17)	.00		.22 (.19)	.27	
Physical Activity (M1)										.18 (.08)	.01	
Social Connection (M2)										-.10 (.19)	.56	
Subjective Environment (M3)										.41 (.19)	.04	
Indirect Effects												
	SES (X1)			SES (X2)								
	β	Boot SE	Boot 95% CI	β	Boot SE	Boot 95% CI	β	Boot SE	Boot 95% CI			
Physical Activity (M1)	.11	.07	[.00, .28]	.13	.08	[.01, .30]						
Social Connection (M2)	-.07	.14	[-.36, .18]	-.07	.14	[-.37, .20]						
Subjective Environment (M3)	.29	.17	[.00, .67]	.35	.20	[.00, .80]						

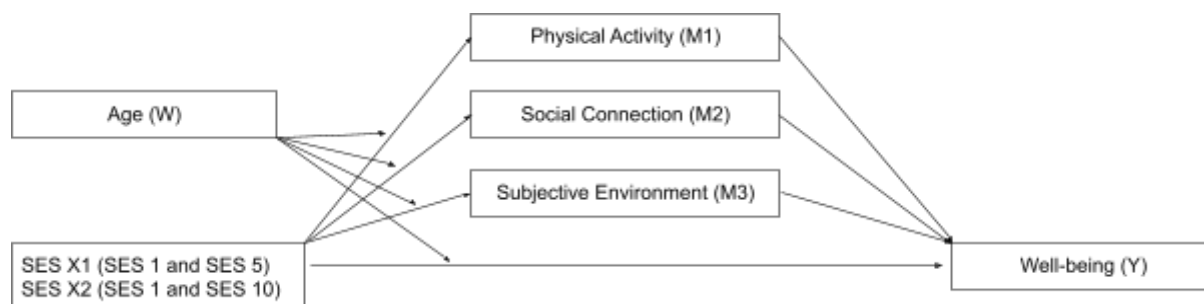
NOTE: SES (X1) compares SES 1 and SES 5. SES (X2) compares SES 1 and SES 10.

3.4.4 Effect of SES on Well-being, mediated by Physical Activity, Social Connection and Subjective Environment, moderated by Age

Further analysis was undertaken to examine these effects, moderated by Age. For the purposes of this analysis SES was treated as a categorical variable and the differences between SES 1 and SES 5 (X1) and SES 1 and SES 10 (X2) were examined. See Figure 11.

Figure 11

Hypothesised model for Age moderated mediation for SES (X1 and X2), Physical Activity (M1), Social Connection (M2), Subjective Environment (M3) and Well-being (Y)



The interactions between SES and Age on Physical Activity, Social Connection, and Subjective Environment are not significant for either X1 or X2. The interactions between SES, Physical Activity, Social Connection, Subjective Environment and Age on Well-being are not significant for either X1 or X2. The direct effect of SES on Well-being is not significant for any age group. See Table 12.

The indirect effects of SES on Well-being via Physical Activity are positive and significant for the older age groups (50th and 80th percentiles) for both X1 and X2. See Table 12. For SES X1 and X2, Age moderated mediation of Well-being via Physical Activity is not significant.

The indirect effect of SES on Well-being via Social Connection is not significant for any age range, for X1 or X2. For SES X1 and SES X2, Age moderated mediation of Well-being via Social Connection is not significant. The indirect effect of SES on Well-being

via Subjective Environment is not significant for any age range, for X1 or X2. For SES X1 and SES X2, Age moderated mediation of Well-being via Subjective Environment is not significant.

The effect of SES on Well-being, mediated by Physical Activity, Social Connection and Subjective Environment, is not moderated by age. The Upper and Lower confidence interval contains 0 for each mediating variable.

Table 12
Indirect effects for SES (X1) and SES (X2), via Physical Activity (M1), with Well-being (Y) as the Outcome for significant Age Moderation Models only

Indirect Effects	Moderator Percentiles	SES (X1)			SES (X2)		
		β	Boot SE	Boot 95% CI	β	Boot SE	Boot 95% CI
Physical Activity (M1)	Age (W)						
	50th	.14	.08	[.00, .32]	.15	.09	[.01, .35]
	84th	.19	.12	[.00, .46]	.19	.12	[.01, .46]

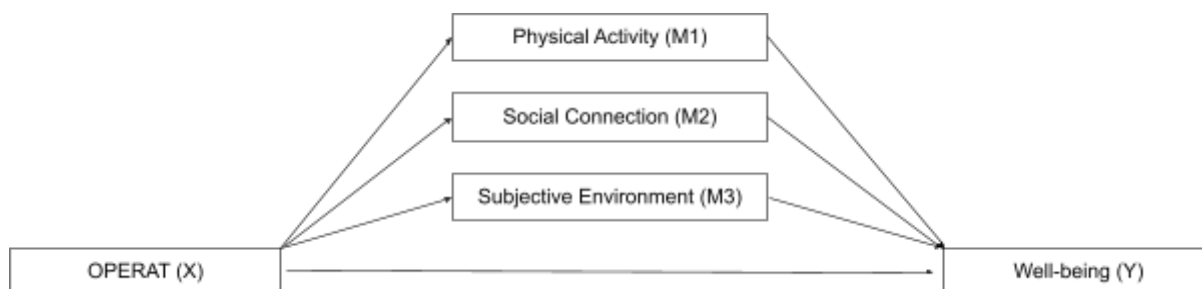
NOTES: SES (X1) compares SES 1 and SES 5. SES (X2) compares SES 1 and SES 10.

3.4.5 Effect of OPERAT on Well-being, mediated by Physical Activity, Social Connection and Subjective Environment

PROCESS was used to investigate the mediating effects of Physical Activity (M1), Social Connection (M2) and Subjective Environment (M3) on the relationship between OPERAT (Y) and Well-being (X). See Figure 12.

Figure 12

Hypothesised model for OPERAT, Physical Activity (M1), Social Connection (M2), Subjective Environment (M3) and Well-being (Y)



The direct effect of OPERAT on Subjective Environment is negative and significant ($b = .01$, $s.e. = .00$, $p = .03$). The direct effects of OPERAT on Physical Activity and Social Connection are not significant. The results suggest that as OPERAT decreases (quality of the residential environment increases), people's subjective experience of their environment increases. See Table 13.

The direct effect of Physical Activity on Well-being is positive and significant ($b = .20$, $s.e. = .08$, $p = .01$). The direct effect of OPERAT on Well-being is not significant. The direct effects of Social Connection and Subjective Environment on Well-being are not significant.

The significance of indirect effects was tested using bootstrapping procedures. The indirect effect of OPERAT on Well-being via Physical Activity is not significant. The indirect effect of OPERAT on Well-being via Social Connection is not significant. The indirect effect of OPERAT on Well-being via Subjective Environment is not significant. Mediation has not occurred.

Table 13
Coefficients for OPERAT (X), via Physical Activity (M1), Social Connection (M2) and Subjective Environment (M3) Mediation with Well-being (Y) as the Outcome for the Total Sample (N = 80)

Outcome	Physical Activity (M1)		Social Connection (M2)		Subjective Environment (M3)		Well-being (Y)
	Coeff. (SE)	p	Coeff. (SE)	p	Coeff. (SE)	p	
OPERAT							
Physical Activity (M1)	-.01 (.01)	.34	-.01 (.01)	.26	-.01 (.01)	.03	-.01 (.00)
Social Connection (M2)							.20 (.08)
Subjective Environment (M3)							-.11 (.18)
							.37 (.19)
Indirect Effects							
	SES (X1)						
	β	Boot SE	Boot 95% CI				
Physical Activity (M1)	.00	.00	[.00, .00]				
Social Connection (M2)	.00	.00	[.00, .01]				
Subjective Environment (M3)	.00	.00	[-.01, .00]				

NOTES: SES (X1) compares SES 1 and SES 5. SES (X2) compares SES 1 and SES 10.

4. Discussion

The purpose of this research was to examine the relationship between environmental factor scores and self-reported well-being, especially for older people, via the mechanisms of physical activity, and social connectedness within the neighbourhood. Overall, it was hypothesised that residential neighbourhood quality would be positively related to well-being, where residential neighbourhood quality could be defined by either a) OPERAT, an objective measurement of the quality of the residential neighbourhood; b) SES, the socio-economic status of a neighbourhood as defined by three measures from the Australian Bureau of Statistics; c) Subjective Environment, residents' perception of the quality of their neighbourhood. It was further hypothesised that the quality of the residential neighbourhood environment may affect physical activity and/or social connection, which in turn would affect well-being.

4.1 The effect of age and gender on Well-being, Physical Activity, Social Connection and Subjective Environment

The results show that those aged 65+ scored lower on average than the Under 65 group for all variables: Well-being, Physical Activity, Social Connection and Subjective Environment. It is worth noting that the lower well-being for the 65+ age group found in this research is at odds with bodies of academic literature that have identified either a 'U-shaped' well-being/age relationship, whereby well-being reaches a minimum at midlife, at approximate age 50, before steadily increasing, before a late life decline, at approximate age 75+) (Horley & Lavery, 1995; Blanchflower, 2020); or relative well-being stability across lifecourse (Diener & Suh, 1997), also known as the 'age well-being paradox', given the increase in risks and losses with older age. The findings of lower physical activity in the older age group are consistent with the literature for age and physical activity results; that is an erosion of physical activity with increasing age for adults (Caspersen, Pereira, & Curran, 2000; Sun & While, 2013) when measured by both subjective and objective criteria. This is of concern given the acknowledged health benefits associated with exercise for older adults (Netz, Wu, Becker, & Tenenbaum, 2005). The lower levels of reported Social Connection for the older age group is consistent with the literature which has found that older people are more susceptible to loneliness and social isolation (World Health Organization, 2002), which

can be explained, in part, by a loss of mobility, reduced transport options and the loss of significant others, including partners and friends. The final variable, which is of primary significance to this study, is Subjective Environment. Less attention has been paid to this construct but there is some evidence that subjective neighbourhood environment scores, independent of objective scores, do predict health outcomes for older people (Badland, Turrell, & Giles-Corti, 2013; Ellaway, Macintyre, & Kearns, 2001; Godhwani, Jivraj, Marshall, & Bécares, 2019; Toma et al., 2015). This study found that Subjective Environment scores were lower on average for the 65+ age group. Given its positive relationship to well-being and health outcomes in general, additional research is required to understand the lifespan trajectory of subjective assessments of the environment and the interaction with objective environment measures.

4.2 The relationships between Well-being, Physical Activity, Social Connection and Subjective Environment

The four variables Well-being, Physical Activity, Social Connection and Subjective Environment were found to be strongly positively related to one another. Further investigation revealed the strength of this correlation was dependent on age. The correlation was stronger and persistent across variables only for the 65+ age group. These findings suggest that as people get older well-being, physical activity, social connection and subjective experience of the environment become increasingly interdependent. Although this level of analysis did not permit causal inference, the literature suggests that higher levels of physical activity (Fox, 1999; Netz, Wu, Becker, & Tenenbaum, 2005) and social connectedness (Lieberman, 2013; Wang, 2016) independently predict improved well-being. What is less well understood is the relationship between social connection and physical activity, and of specific interest to this study, people's subjective experience of their residential neighbourhood environment and levels of physical activity and social connection. Research has found a connection between low levels of physical activity and social connections, alternatively described as isolation (MacDougall, Cooke, Owen, Willson, & Bauman, 1997) and a proposed mechanism for explaining the symbiotic relationship between physical activity and social connections is described by Kok, Coffey, Cohn, Catalin, Vacharkulksemsuk, Algae, & Fredrickson (2013) as a self-sustaining upward-spiral dynamic, whereby more physical activity promotes more social connection and vice versa. Importantly,

the research suggests the inclusion of social factors in policy development and strategies which seek to improve physical activity outcomes. In terms of subjective environment and physical activity, the limited research supports the consideration of measures of perceived environment given the correlation with physical activity, even though objective measures of environment are typically favoured for accuracy and reliability. Boehmer, Hoehner, Wyrwich, Ramirez, & Brownson (2006) found that objective and perceived environments are related to physical activity differently and a systematic review of the built environment and physical activity by Ding & Gebel (2012) recommended more research needs to be done to understand the interaction between the subjective environment, objective environment and physical activity, including how a person's perception reflects reality.

In this research it was hypothesised that the environment in general (measured as SES, Objective and Subjective Environment) could provide a supportive underpinning for social connections, although whether this was via the mechanism of fostering, maintaining or developing social connections was outside the scope of this research. A significant correlation was found between the perceived quality of the environment and social connection. Theoretically this is the least well understood relationship identified in this study. A literature search did not reveal any research directly related to this association. Some evidence comes from Dempsey (2008) who, while researching built environment (objective environment) impacts on social connectedness, found that residents' perceptions of the quality of the neighbourhood positively affected multiple dimensions of social cohesion. Dempsey goes on to state that "increasing residents' perceptions of the attractiveness of the neighbourhood can positively affect social cohesion" (Dempsey, 2008, p. 110) and suggests this may be achieved by adopting initiatives, such as the UK government's *Sustainable Communities Plan: Cleaner, Safer, Greener*.

Overall, the research found that the perception of the environment had a significant positive effect on physical activity, social connection and well-being and physical activity was found to mediate the relationship between the perceived quality of the neighbourhood environment and well-being. These results support the research hypothesis that physical activity mediates the relationship between residential neighbourhood quality and well-being. Furthermore, age significantly moderated the relationships between Subjective Environment and Physical Activity or Well-being in that perception of the environment was related to levels of physical activity and well-being only for older people (50th and 80th percentiles).

Given that the findings indicate that older people's subjective experience of their neighbourhood environment is positively related to physical activity and well-being, interventions aimed at improving the well-being of older people should consider perception of the local environment when designing policy and strategies.

4.3 The relationships between SES, Well-being, Physical Activity, Social Connection and Subjective Environment

The results show that overall SES does have a significant positive relationship with Well-being, Physical Activity, Social Connection and Subjective Environment. As SES increased, Well-being, Physical Activity, Social Connection and Subjective Environment scores all increased. The link between SES and health outcomes, primarily well-being, is well-established (Adler et al., 1994; Pickett, Pearl, 2001). This study found that physical activity, social connection, and perceptions of the environment may help to explain this pathway.

When the effects of SES were examined by age group it was found that the relationship held true for the 65+ age group but was not significant for the younger age group. This implies that the effects of SES are stronger for older people compared to younger. Conversely, this could be conceptualised as youth being a protective factor against the negative effects associated with lower SES. These findings are consistent with established research which has found neighbourhood-level SES, typically measured by census data, was the strongest and most consistent predictor of a variety of health outcomes and functioning for older adults (Yen, Michael & Perdue, 2009).

An important finer-grained distinction was found when the SES groups were compared. The significant differences occurred between the low SES group and the medium and high group but not between the medium SES and high SES group, which suggests the benefits of higher SES taper off as SES improves. So old age and low SES are related to lower levels of well-being, physical activity, social connection and perception of the neighbourhood environment. However, as SES increases from a medium to high level the benefits associated with SES become less pronounced. A similar 'tapering-off' trend can be found in research data in regard to the relationship between mortality. However, the trend for morbidity is more linear. i.e. there is no 'tapering-off' effect (Adlet et al., 1994).

Overall, the results suggest that SES is more strongly related to well-being and perceptions of the local neighbourhood environment at lower levels of SES, which suggests policy interventions at the low socio-economic level would deliver the highest relative return on investment if net well-being is considered as the measure of intervention success. A primary benefit of this approach is that it is straightforward to accurately identify low SES geographic areas, down to the local neighbourhood level, and apply physical/built solutions. Policy interventions to address the social structural factors associated with low SES however require more consideration and longer-term solutions. Phelan, Link, & Tehranifar (2010) recommend this can be achieved by addressing the level of inequality in socio-economic resources themselves and perhaps more importantly in the distribution of health interventions.

4.4 The relationships between OPERAT, Well-being, Physical Activity, Social Connection and Subjective Environment

A higher quality residential environment as assessed by OPERAT, was associated with improved well-being and perceived quality of the residential neighbourhood environment for all participants. The association between the physical environment and well-being across a range of domains is well-established and these results are consistent with existing findings (Evans, 2003; Guite, Clark, & Ackrill, 2006). Prior studies have suggested a range of environmental design features may play a significant role in affecting well-being, including neighbour noise, high-rise living, damp, neighbourhood green spaces and community facilities (Guite, Clark, & Ackrill, 2006; Monahan & Vaux, 1980). This research assessed the relationship between well-being and the total OPERAT score. However, OPERAT consists of 16 factors across four domains. Accordingly, additional analysis and research could be done to identify which of the sixteen factors is most associated with well-being. This would provide useful direction for policy development and built environment interventions.

The objective quality of the residential neighbourhood environment was not found to be associated with Physical Activity or Social Connection for any age group. Further analysis by age group revealed that the relationship between OPERAT, Subjective Environment and Well-being was only associated with the 65+ age group and the quality of the objective neighbourhood environment did not significantly affect Physical Activity, Social Connectedness, Subjective Environment, or Well-being for the Under 65 age group. These

findings support the general argument that the quality of the residential neighbourhood environment becomes increasingly relevant as a determinant of health as people age (Burholt et al., 2016). These findings further suggest that the objective neighbourhood environment should be best viewed as a partial contributor when conceptualising the environment. The subjective experience of the environment and SES, and the factors associated with them, play an equally, if not more significant role in both health outcomes and the possible mechanisms by which health outcomes are achieved as a result of environmental impact. The absence of a relationship between the observed physical environment and self-reported physical activity is of note here. Existing research suggests that there should be a significant relationship between objective environment and physical activity (Pikora, Bull, Jamrozik, Knuiman, Giles-Corti, & Donovan, 2002; Pikora, Giles-Corti, Knuiman, Bull, Jamrozik, & Donovan, 2006), especially for retired people who are more affected by these neighbourhood environmental characteristics (Forsyth, Oakes, Lee, & Schmitz, 2009). However, the results from this research show no evidence of such a relationship, even when examined by age group.

4.5 Strengths, Limitations and Directions for Future Research

4.5.1 The Environment

The environment is related to well-being, and this relationship is stronger for older people. The findings support the position that it is relevant to conceptualise the environment in a multitude of ways. This research conceptualised the environment objectively (natural and physical), subjectively (perceptions of the environment) and socio-economically. The variation between the contributing variables and their relationship with well-being suggest a conceptual model of the environment should include subjective perceptions, social components, and economic factors, not just the objective physical, natural and built environment.

4.5.1a OPERAT

Specific to the objective environment, the use of OPERAT in this research as a single objective measure of the quality of the residential environment is open to criticism. Firstly, OPERAT was developed in Wales, part of the United Kingdom, and as such its application

outside this specific cultural context requires caution. Furthermore, OPERAT was developed for older people using a participatory approach. Older people have specific physical and cognitive (functional) abilities and accordingly their environmental requirements may not translate to other populations. OPERAT identifies environmental variables that are important to older people but does not provide a link to health outcomes (e.g. general health or well-being), nor the mechanisms via which such outcomes may be affected (e.g. physical activity or social connectedness). In this study, OPERAT measurements were carried out by the researcher and only one observed measurement was taken for each area, providing a total of 7 measurements. Ideally, and resources permitting, multiple objective measurements would have been recorded from different observers, such as independent 3rd party observers, and more than one measurement would have been collected from each location. In addition, and consistent with the original OPERAT research and its intended application as an assessment tool, residents of the neighbourhood could have supplied OPERAT scores for their neighbourhood (Burholt, Roberts, & Musselwhite, 2016). This approach would provide useful additional analysis opportunities in terms of comparing residents OPERAT scores with their subjective environment scores and self-reported well-being. Multiple volunteer OPERAT scores for a particular area would permit useful follow-up analysis in terms of OPERAT's reliability, its validity across age groups, and its relationship with other environmental measures, such as perceived quality of the neighbourhood environment and SES.

As mentioned above, a significant factor that could affect the overall OPERAT score would be the time of day at which the data was recorded. During this research project the researcher observed significant traffic differences depending on time of day. The other measure affecting traffic would be weather conditions. The OPERAT scores associated with this research were collected across multiple days but an effort was made to avoid morning and evening rush hours, with the associated increase in traffic levels. And all readings were collected on days with similar weather conditions, which were sunny, with no rain.

4.5.1b Complementary Measures of the Environment

In addition to the above, a strategy to mitigate the validity and reliability issues associated with a single objective environment measure would be to deploy multiple

objective environment measures to build a composite objective environment measurement. A similar strategy was used to construct measures for Subjective Environment, Physical Activity, Social Cohesion, and Well-being. The following tools have all been utilised to collect scores of environment quality, specifically related to residential neighbourhood environments. Importantly, they all reference a link between environmental neighbourhood quality and health, and data collected shows them to be both valid and reliable.

The RESIDE Study commenced in 2003 and is a longitudinal natural experiment including 1,813 people who were building homes in 73 new housing developments across metropolitan Perth, Australia (Knuiman et al., 2014). The study hypothesised certain features of the built environment may be important in the design of neighbourhoods to increase walking for transportation and to meet the health needs of residents. The features collectively contributed to the establishment of "Liveable Neighbourhoods". A recent analysis of the findings suggests that communities built in accordance with these "Liveable Neighbourhoods" features can positively affect health supportive behaviors and well-being outcomes including physical activity, specifically walking, and to create neighbourhoods with a stronger sense of social connection and a feeling of safety (Hooper, et al., 2020).

HABITAT studied physical activity change over five years (2007-2011) in adults aged 40-65 years in Brisbane, Australia (Burton et al., 2009). Items assessing physical activity (general walking, moderate activity, vigorous activity, walking for transport, cycling for transport, recreational activities), sitting time, perceptions of neighbourhood characteristics (traffic, pleasant surroundings, streets, footpaths, crime and safety, distance to recreational and business facilities), social support, social cohesion, activity-related cognitions (attitudes, efficacy, barriers, motivation), health, and sociodemographic characteristics. HABITAT aimed to identify priority "place" and "people" targets for public policy, health policy, and health promotion with the goal of increasing physical activity among middle-aged men and women.

The Residential Environment Assessment Tool (REAT) was designed as a neighbourhood survey instrument, to be completed by an independent observer, to establish links between self-reported general health and the quality of the residential environment (Dunstan et al., 2005). Environmental features associated with negative health identified in the study included physical incivilities and measures of how well the residents maintained

their properties. The amount of green space was not associated with self-reported health. The tool has been used for studies involving common mental health concerns in the community and allows local authorities to target and select interventions to improve the physical condition of their area.

The Neighbourhood Design Characteristics Checklist (NeDeCC) was developed to objectively measure a large range of built environment characteristics and their links with older people's well-being (Burton, Mitchell, & Stride, 2011). The checklist considers Functional place-related well-being, Social place-related well-being and Emotional place-related well-being. Their findings supported associations between well-being and a number of neighbourhood environmental features, including amount of greenery, density, location, street patterns, block size, setback of dwellings, and street topography.

4.5.2 Physical Activity

The research found evidence to support the position that the environment supports physical activity as a pathway by which well-being is affected. The connection between physical activity and well-being is well researched and understood however the environmental underpinnings of this effect, as reported in this research suggest environmental intervention strategies to make physical activity accessible and sustainable could be an effective method to improve well-being. Such a strategy would, in effect, be an indirect promotion of physical activity by providing a suitable environment.

The items used to assess physical activity in this research referenced physical activity within the neighbourhood, and in this sense the levels of physical activity recorded could be assumed to have direct relevance to the quality of the environment. Physical activity that occurred outside of the neighbourhood environment was not recorded. It would be useful in future research to examine the halo effect of increased local physical activity on physical activity in general, such as going to the gym and playing sports, that would typically occur outside of the neighbourhood. This research did not include an item to assess reasons for walking (recreational - health and fitness vs. functional - for transport, to go shopping) or destination. Measuring context-specific behaviour is important to improve predictive capacity for studies measuring environmental correlates of behaviour (Giles-Corti et al., 2006). Examples of walkable destinations that affect levels of physical activity include beaches, parks, bushlands/oval, walking trails, cafés/restaurants, and rivers (Giles-Corti et al., 2006).

Furthermore, given that this research was underpinned by the theoretical concepts of the Capabilities Approach it would be useful to understand the nature and reasons for physical activity, rather than just the amount. This point is closely related to better understanding the objective nature of the environment and the availability of destinations, the most common being the presence of shops. Existing research suggests this is especially relevant for older people. It would also be useful to understand the strength effects of various types of physical activity on well-being, i.e. does functional physical activity have a stronger effect on well-being for older people than physical activity for leisure.

4.5.3 COVID-19

The research was carried out in Australia during the COVID-19 pandemic. Lockdown restrictions meant that the participants in the survey were restricted in their movements. Local travel was however permitted, and in that context, the significance of residential neighbourhood environment could be considered to have greater significance than usual given that travel further afield was either prohibited or discouraged. In addition, physical activity was specifically identified as an activity which was exempt from restrictions, in effect, indirectly endorsed by government regulations. Early research in this area has found that people's level of local physical activity (interest and engagement) increased during the COVID-19 lockdown period (Ding, Del Pozo Cruz, Green, & Bauman, 2020).

4.5.4 Capabilities Approach

This research project was developed with reference to the Capabilities Approach as a theoretical model to explain hypothesised pathways between the environment and well-being. The measures utilised in this research for understanding the subjective perception of the environment, objective measures of the environment (OPERAT) and well-being could be considered consistent with the philosophical intent of the Capabilities Approach. However, further research could be undertaken to understand the functional abilities of participants in greater detail. Choi & Matz-Costa (2018) found that the effects of perceived neighbourhood characteristics on psychological health became greater among older adults with functional limitations. This finding is consistent with other studies which equate disadvantaged neighbourhood environments (e.g. crime, abandoned buildings) to increased levels of vulnerability for older people living with cognitive and physical disabilities

compared to people with good mental and physical functioning (Byrnes, Lichtenberg, & Lysack, 2006). This additional level of analysis is consistent with the recommendation above to better understand how the environment (objective, subjective and socio-economic) affects different older people in different ways.

4.5.5 Methodological issues

The majority of data collected was based on self-reporting, and are thus prone to bias and measurement error. It would be possible to conduct further research, especially in regard to physical activity, using observational data and shared physical activity data that is collected by fitness apps. The sample size was relatively small, especially when analysing differences and effect sizes between groups.

4.6 Conclusion

Intervention at any level should require a metric by which to measure the efficacy of the intervention. Given the importance of well-being as a measure of health, it is worth considering the philosophical definitions and underpinnings of such a construct. The Capability Approach offers insight in this regard, with an emphasis on subjective well-being, achieved via valued functionings. A Capability Approach based concept of health and well-being acknowledges that it is the achievement of desired functionings that defines a person's well-being, rather than a global benchmarking of achievement that is used to measure health and well-being. A supportive environment provides a platform with which to achieve desired functionings, beyond just physical activity, including the importance of the perceived quality of the neighbourhood.

In this research all three measures of the environment showed a positive relationship with well-being, suggesting the environment is a suitable target for intervention. This study supports intervention at the residential neighbourhood environment level to positively affect well-being, especially for older people. Improvements to the residential neighbourhood environment could also be expected to improve physical activity and perceptions of the environment. Beyond the benefits accrued by older people from such environmental enhancements, it would be reasonable to expect that these environmental benefits could be shared across multiple cohorts, including indigenous people, people living with a disability, children, and families.

The original OPERAT development study (Burholt, Roberts, & Musselwhite, 2016) identified factors which were important to older people using a participatory approach which is consistent with the Capability Approach. This is the true value of OPERAT; it provides readily identifiable built environment elements that could be targeted by government intervention. Its applicability could be extended if the principles by which OPERAT was developed were applied to investigate similar, important environmental factors across other populations, for example people with disability and families with young children.

The role of SES as another type of measure of local environment is supported as an important predictor of health outcomes and pathway to health. The Capability Approach based concept of health and well-being admits that additional external factors, beyond the social and physical environments, including gender, socio-economic status (low wages, insecure unemployment), minority group status, can also contribute to lifelong health inequalities which become more apparent in older age. The SES results from this research showed that well-being effects tapered off as SES improved suggesting interventions target lower levels of SES if the intent is to maximise net positive increase in well-being; a cost/benefit approach would focus on the lower to middle SES areas, to deliver relative maximum returns. Applied at a global level, this 'return on investment' effect is compounded given that the majority of ageing population growth is in low- and middle-income countries (World Health Organization, 2019). SES data is sufficiently accurate in most developed countries to allow accurate identification of areas for immediate environmental interventions to positively affect well-being. It is important for developing countries to collect and maintain accurate SES data to readily identify areas for the most effective interventions.

Subject experience of a local neighbourhood and its relationship with SES of the area, as well as built and natural characteristics of the local environment, is the least well understood psychological factor referenced in this research. With the Capability Approach as a theoretical foundation, more research should be undertaken to understand how people's subjective experience of their local neighbourhood environment interacts with SES, and natural and built elements. The objective of such research would be to effectively guide interventions targeting the natural and built environment as well as social policy to affect SES, altering people's subjective experience of the environment and therefore their well-being.

The scale and multi-dimensional composition of the environment (natural, built and socio-economic) suggests environmental intervention requires government support. It is difficult for individuals to control or modify the environment, and the findings suggest that local councils and state and federal government have roles to play in any intervention. The World Health Organization, in promoting a socio-ecological model of health, to positively affect the socio-economic, cultural and environmental factors associated with health, makes it clear that governments, more specifically local governments, play a vital role in delivering such environments, including the built infrastructure and services that contribute to making a community (Marmot, Friel, Bell, Houweling, Taylor, & Commission on Social Determinants of Health, 2008). The efficacy of these government interventions, however, extends beyond the provision of the physical environmental infrastructure. Local governments must have knowledge of the health requirements that are unique to their constituents and social determinants of health should be legislated (Browne, Davern, & Giles-Corti, 2019). Conversely, researchers also have an obligation to familiarise themselves with policy frameworks in order to contribute to evidence-based policy change and the evolving definition and commissioning of healthy liveable neighbourhoods (Lowe, Hooper, Jordan, Bowen, Butterworth, & Giles-Corti, 2019). And, if well-being is the measure by which the efficacy of interventions is measured, then policy and legislation should include a measure of change in well-being pre- and post-intervention to assess efficacy and inform future interventions.

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Appendix 1: Survey



Hello,

My name is Jesse Anderson. I live on the Central Coast and I am completing my Master of Science [Psychology] supervised by Professor Christine Stephens at Massey University, New Zealand. My research project is on the Neighbourhood Environment and Well-being. I am interested in finding out more about how our local neighbourhoods can affect our well-being.

This is an invitation for you to take part in my research.

Why am I receiving this invitation?

Your neighbourhood has been selected to be part of this research project. The research project involves finding out how local people feel about their neighbourhood and how the neighbourhood may affect their well-being. I am also interested in how the local neighbourhood can affect the amount of physical activity and social connections of the people who live there.

I would like to hear from approximately 30 people from your neighbourhood.

What will I be asked to do?

I would like you to complete the enclosed questionnaire and return it to me in the **reply-paid envelope** that is also included (no stamp required). Or, if it is more convenient, you can complete this survey online, at www.centralcoastsurvey.com.au. See the survey booklet for more information.

Your information will be completely anonymous. Your questionnaire answers will not be linked to your name, if you choose to supply it.



What will happen to the information I provide?

All the information I gather will be kept private using a security password on a computer. Any written notes will be kept in a locked cabinet. After the project is finished, I will send everything to Massey University to be held securely until it is disposed of.

I will use the information to write my Master's research project. You will not be named in any reports or presentations of the study results. And, if you are interested you can view a summary of the results after my Master's project is finished.

Your rights as a participant

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any question in the questionnaire
- ask any questions about the research project at any time
- provide information on the understanding that your name will not be used
- be given access to a summary of the research project findings when it is concluded

If you have any questions

Contact the researcher, Jesse Anderson, at Jesse.Anderson.1@uni.massey.ac.nz or the project supervisor, Professor Christine Stephens at C.V.Stephens@massey.ac.nz if you have any questions prior to, or during involvement.

If you are interested in taking part, please complete the questionnaire and return it in the reply-paid envelope (no stamp required) or you can complete the survey online (please see survey for more information).

Thank you for taking the time to think about this invitation. I look forward to hearing from you.

Yours sincerely,



Jesse Anderson

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Prof Craig Johnson, Director, Research Ethics, telephone +64 6 356 9099 x 85271, email humanethics@massey.ac.nz





SURVEY / 1



This is a survey about your neighbourhood and your general well-being.
This survey is being conducted for research purposes only and not for any commercial purpose.

Respondents should be aged 18+. Ideally, this form will be completed by the oldest resident(s) at this address. This survey has been designed to protect your privacy and your responses are anonymous.

Please complete 1 survey, per adult, at this residence. For example, if there are 2 adults living at this residence, you can complete 2 surveys.

If it is more convenient, you can complete this survey online, at www.centralcoastsurvey.com.au
Please use survey code RA2 if you are completing this survey online.

1. Your age range.

Please circle one.

18-19 20-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84 85+

2. Your gender.

Please circle one.

Female Male Other _____

3. Do you identify as Aboriginal or Torres Strait Islander?

Please circle one.

Yes No

4. Do you use a wheelchair or mobility aid (e.g. scooter, walker, walking stick) when you leave the house?

Please circle one.

Yes No

5. In a typical week, on how many days do you do a total of 30 minutes or more of physical activity?

Please circle one.

0 1 2 3 4 5 6 7

SURVEY /2



6. Over the past 12 months, how much have you done the following:

(a) Walked or done any other physical activity in your neighbourhood?

Please tick one.

Never

Rarely

Sometimes

Often

Always

(b) Walked or done any other physical activity with neighbours?

Please tick one.

Never

Rarely

Sometimes

Often

Always

(c) Gone to a neighbourhood park for walks or other physical activities?

Please tick one.

Never

Rarely

Sometimes

Often

Always

7. Circle the picture below that best describes your relationship with the people in your neighbourhood.

[S = Self, PN = People in your Neighbourhood]



8. How strongly do you agree with the following statements:

(a) People around here are willing to help their neighbours.

Please tick one.

Strongly Disagree

Disagree

Undecided

Agree

Strongly Agree

(b) This is a close-knit neighbourhood.

Please tick one.

Strongly Disagree

Disagree

Undecided

Agree

Strongly Agree



Continued 8. How strongly do you agree with the following statements:

(c) People in this neighbourhood can be trusted.

Please tick one.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(d) People in this neighbourhood generally do not get along with each other.

Please tick one.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(e) People in my neighbourhood do not share the same values.

Please tick one.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(f) I generally enjoy living in my neighbourhood.

Please tick one.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(g) During the recent COVID-19 lockdown, I enjoyed living in my neighbourhood.

Please tick one.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(h) I think my neighbourhood is a desirable place to live.

Please tick one.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Continued 8. How strongly do you agree with the following statements:

(i) I feel safe in my neighbourhood during the day.

Please tick one.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(j) I feel safe in my neighbourhood at night.

Please tick one.

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. In general, would you say your physical health is...

Please tick one.

Very Poor	Poor	Acceptable	Good	Very Good
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. In general, would you say your mental health is...

Please tick one.

Very Poor	Poor	Acceptable	Good	Very Good
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. How happy do you feel in general?

Please circle one dot.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0								10
Generally, I am not very happy								Generally, I am very happy



12. In closing, are there any additional comments you would like to make about your neighbourhood, or about your recent experiences of your neighbourhood during the COVID-19 lockdown period?

Thank you for completing this survey.

If you would like to be kept informed about this survey and view the results please add your details below. Please note, the details you provide below will not be associated with your responses above.

Post me an update.

Name

Address

OR

Email me an update.

Email

And finally, thank you for your time and contribution to this piece of research.

SURVEY /6



Appendix 2: SEIFA Indexes - Variables

INDEX OF RELATIVE SOCIO-ECONOMIC DISADVANTAGE

Included Variables

- % Occupied private dwellings with no internet connection
- % Employed people classified as Labourers
- % People aged 15 years and over with no post-school qualifications
- % People with stated annual household equivalised income between \$13,000 and \$20,799 (approx. 2nd and 3rd deciles)
- % Households renting from Government or Community organisation
- % People (in the labour force) unemployed
- % One parent families with dependent offspring only
- % Households paying rent less than \$120 per week (excluding \$0 per week)
- % People aged under 70 who have a long-term health condition or disability and need assistance with core activities
- % Occupied private dwellings with no car
- % People who identified themselves as being of Aboriginal and/or Torres Strait Islander origin
- % Occupied private dwellings requiring one or more extra bedrooms (based on Canadian National Occupancy Standard)
- % People aged 15 years and over who are separated or divorced
- % Employed people classified as Machinery Operators and Drivers
- % People aged 15 years and over who did not go to school
- % Employed people classified as Low Skill Community and Personal Service Workers
- % People who do not speak English well

Variables Dropped

- % Employed people classified as Low Skill Clerical and Administrative Workers
- % Employed people classified as Low Skill Sales Workers
- % Occupied private dwellings with one or no bedrooms
- % People aged 15 years and over who left school at Year 11 or lower

INDEX OF RELATIVE SOCIO-ECONOMIC ADVANTAGE AND DISADVANTAGE

Included Variables

- % People aged 15 years and over with no post-school qualifications
- % Occupied private dwellings with no internet connection
- % People with stated annual household equivalised income between \$13,000 and \$20,799 (approx. 2nd and 3rd deciles)
- % Employed people classified as Labourers
- % Households paying rent less than \$120 per week (excluding \$0 per week)
- % People aged under 70 who have a long-term health condition or disability and need assistance with core activities
- % Employed people classified as Machinery Operators and Drivers
- % People (in the labour force) unemployed
- % One parent families with dependent offspring only
- % Households renting from Government or Community organisation
- % Employed people classified as Low Skill Community and Personal Service Workers
- % Occupied private dwellings requiring one or more extra bedrooms (based on Canadian National Occupancy Standard)
- % Occupied private dwellings with no car
- % Occupied private dwellings with four or more bedrooms
- % People aged 15 years and over at university or other tertiary institution
- % Households paying mortgage greater than \$2,120 per month
- % Households paying rent greater than \$290 per week
- % People aged 15 years and over with an advanced diploma or diploma qualification
- % Employed people classified as Professionals
- % Occupied private dwellings with a broadband internet connection
- % People with stated annual household equivalised income greater than \$52,000 (approx 9th and 10th deciles)

Variables Dropped

- % Employed people classified as Low Skill Sales Workers
- % Households owning dwelling they occupy (without a mortgage)
- % People who do not speak English well
- % Occupied private dwellings with three or more cars
- % Occupied private dwellings with one or more bedrooms spare (based on Canadian National Occupancy Standard)
- % Employed people classified as Managers
- % People aged 15 years and over with degree or higher
- % People aged 15 years and over who left school at Year 11 or lower

INDEX OF ECONOMIC RESOURCES

Included Variables

- % People with stated annual household equivalised income between \$13,000 and \$20,799 (approx. 2nd and 3rd deciles)
- % One parent families with dependent offspring only
- % Occupied private dwellings with no car
- % Households renting from Government or Community organisation
- % Households paying rent less than \$120 per week (excluding \$0 per week)
- % People aged 15 years and over who are unemployed
- % Households who are lone person households
- % Occupied private dwellings requiring one or more extra bedrooms (based on Canadian National Occupancy Standard)
- % Households owning dwelling they occupy (without a mortgage)
- % Dwellings with at least one person who is an owner of an unincorporated enterprise
- % Households paying mortgage greater than \$2,120 per month
- % Households owning dwelling (with a mortgage)
- % Households paying rent greater than \$290 per week
- % People with stated annual household equivalised income greater than \$52,000 (approx 9th and 10th deciles)
- % Occupied private dwellings with four or more bedrooms

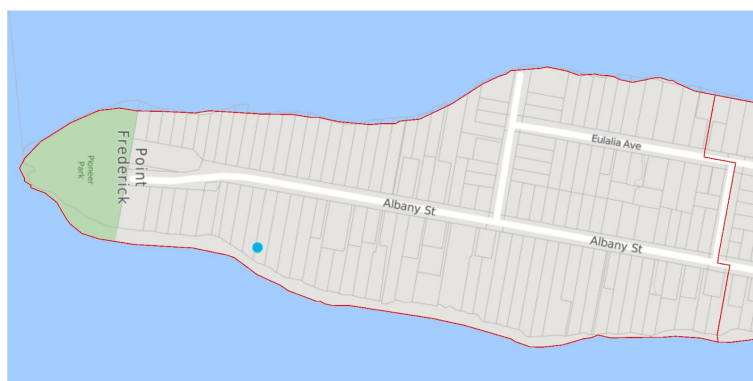
Variables Dropped

- % Occupied private dwellings that are improvised dwellings
- % Households who are group households
- % Occupied private dwellings with four or more cars
- % Occupied private dwellings with one or more bedrooms spare (based on Canadian National Occupancy Standard)
- % Occupied private dwellings with one or no bedrooms

Appendix 3: SA1 Maps for SES High (10), Medium (5) and Low (1)

SES High (10)

SA1:10201103238 Point Fredrick (population 356, households 144)



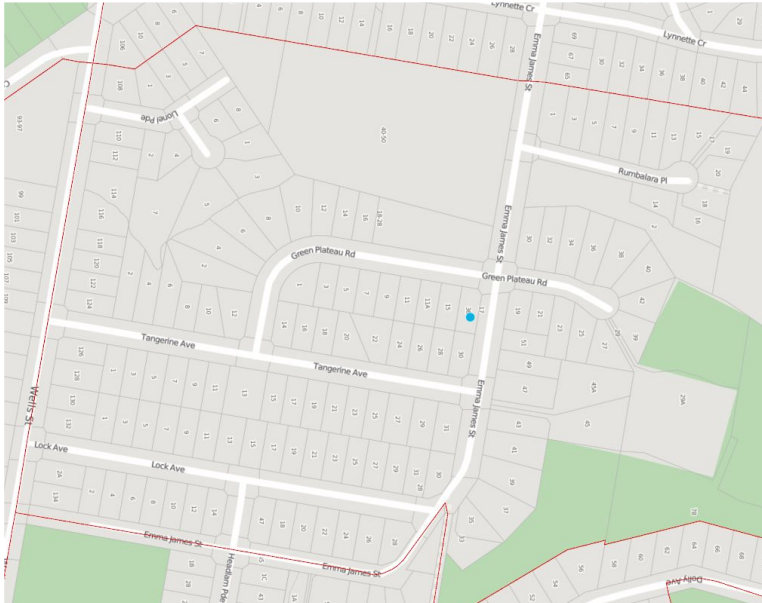
Community Profile

People	356
Male	49.9%
Female	50.1%
Median age	51
Families	110
Average children per family:	
- for families with children	2
- for all families	0.9
All private dwellings	144
Average people per household	2.6
Median weekly household income	\$2,833
Median monthly mortgage repayments	\$2,600
Median weekly rent	\$395
Average motor vehicles per dwelling	2.2

Data retrieved from t.ly/iRgU

Medium SES (5)

SA1:10201103201 Springfield (population 401, households 144)



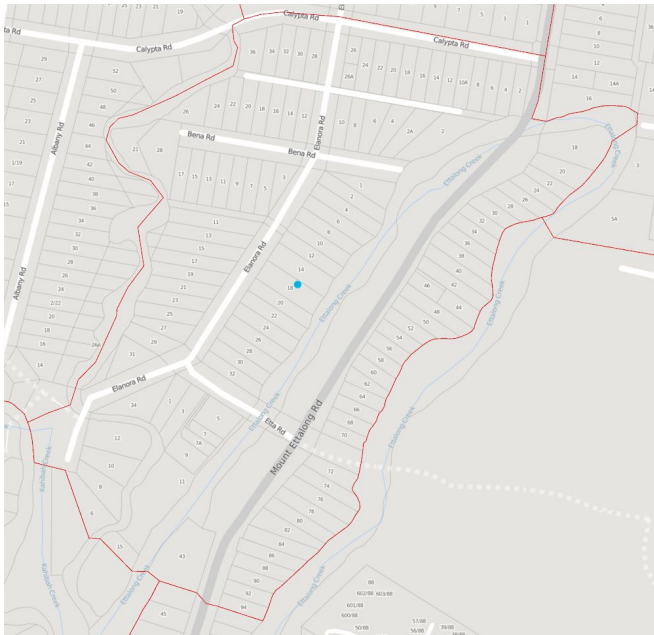
Community Profile

People	401
Male	47.2%
Female	52.8%
Median age	38
Families	115
Average children per family:	
- for families with children	1.9
- for all families	1
All private dwellings	144
Average people per household	2.8
Median weekly household income	\$1,458
Median monthly mortgage repayments	\$1,842
Median weekly rent	\$423
Average motor vehicles per dwelling	1.9

Data retrieved from t.ly/MatG

Medium SES (5)

SA1:10201104012 Umina (population 326, households 136)



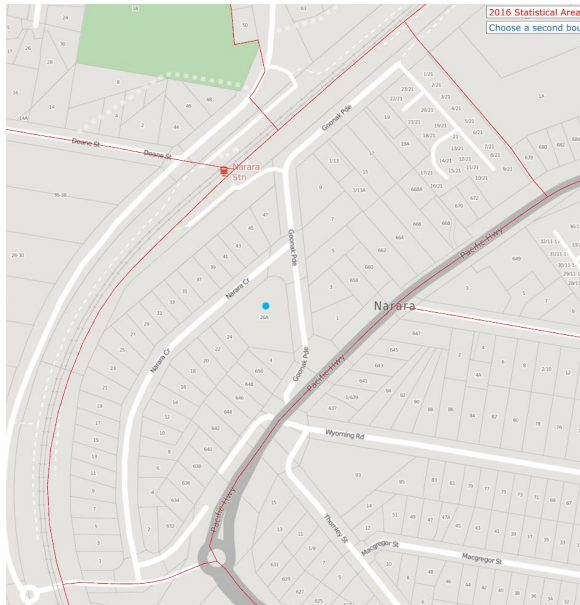
Community Profile

People	326
Male	47.1%
Female	52.9%
Median age	39
Families	85
Average children per family:	
- for families with children	2
- for all families	0.9
All private dwellings	136
Average people per household	2.6
Median weekly household income	\$1,312
Median monthly mortgage repayments	\$1,948
Median weekly rent	\$330
Average motor vehicles per dwelling	1.6

Data retrieved from t.ly/qHj5

Medium SES (5)

SA1:10201104310 Narara (population 201, households 86)



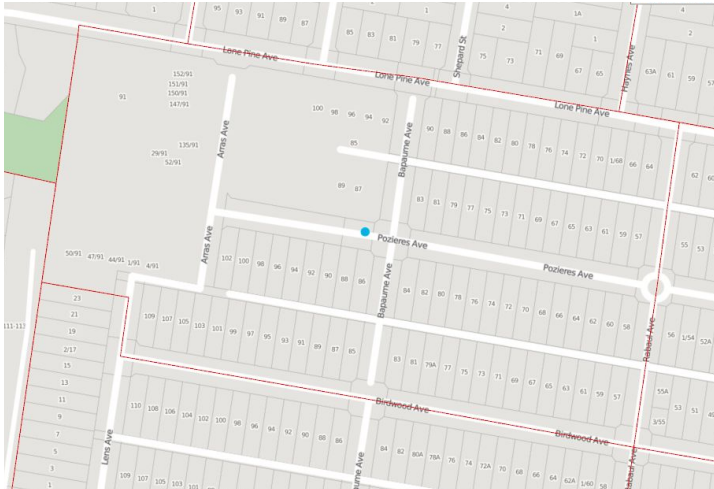
Community Profile

People	201
Male	48.5%
Female	51.5%
Median age	39
Families	59
Average children per family:	
- for families with children	1.6
- for all families	0.6
All private dwellings	86
Average people per household	2.4
Median weekly household income	\$1,437
Median monthly mortgage repayments	\$1,701
Median weekly rent	\$360
Average motor vehicles per dwelling	1.5

Data retrieved from t.ly/lfmS

Low SES (1)

SA1:10201104014 Umina Beach (population 512, households 157)



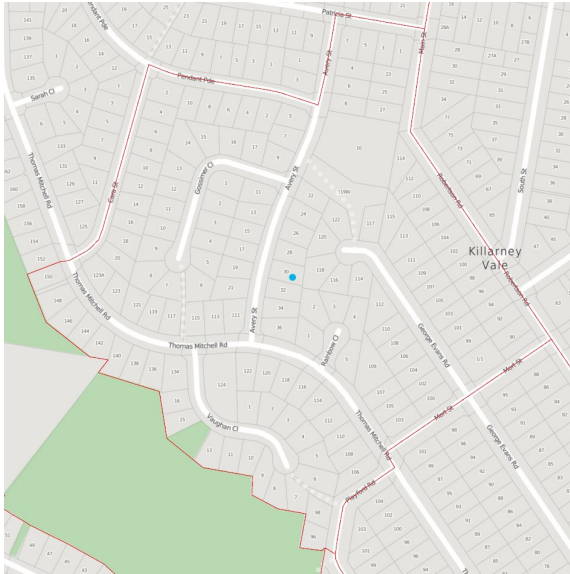
Community Profile

People	512
Male	37.3%
Female	62.7%
Median age	79
Families	62
Average children per family:	
- for families with children	1.5
- for all families	0.4
All private dwellings	157
Average people per household	1.9
Median weekly household income	\$734
Median monthly mortgage repayments	\$1,717
Median weekly rent	\$330
Average motor vehicles per dwelling	1.1

Data retrieved from t.ly/nlw2

Low SES (1)

SA1:10202104445 Killarney Vale (population 393, households 181)



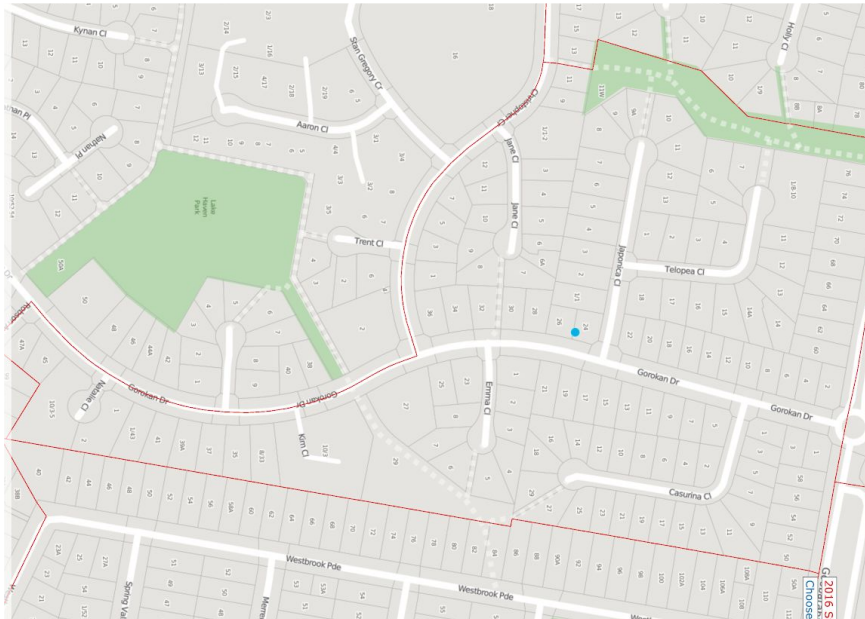
Community Profile

People	393
Male	49.2%
Female	50.8%
Median age	37
Families	95
Average children per family:	
- for families with children	1.8
- for all families	0.9
All private dwellings	181
Average people per household	2.3
Median weekly household income	\$729
Median monthly mortgage repayments	\$1,733
Median weekly rent	\$203
Average motor vehicles per dwelling	1.4

Data retrieved from t.ly/IFPh

Low SES (1)

SA1:10202104815 Lake Haven (population 396, households 204)



Community Profile

People	396
Male	44.6%
Female	55.4%
Median age	50
Families	99
Average children per family:	
- for families with children	1.8
- for all families	0.6
All private dwellings	204
Average people per household	2.2
Median weekly household income	\$740
Median monthly mortgage repayments	\$1,537
Median weekly rent	\$260
Average motor vehicles per dwelling	1.3

Data retrieved from t.ly/UEhJ